



Bowler's Ed

Teacher's Curriculum Guide

Introduction

Welcome! Thank you for introducing the wonderful sport of bowling to your students!

STEM: The United States Bowling Congress (USBC) and Bowling Proprietors' Association of America (BPAA) understand science, technology, engineering, and mathematics (STEM) are not just for professional scientists anymore and regularly are taught in elementary education. Through the unique characteristics of the sport of bowling, we are able to provide a fun and academically sound addition to the Bowler's Ed curriculum, and further increase cross-curricular and academic enrichment.

This addition to the Bowler's Ed Teachers Curriculum was designed to meet the growing needs of STEM instruction in elementary education. In a simple game of bowling, we can witness all types of situations that deal with motion, speed, velocity, acceleration, forces and more! The following teaching tool will cover bowling history, vocabulary and additional activities that can be taught in the classroom/bowling center or to an advanced audience.

Through the instruction of the Bowler's Ed program and continued participation, it allows the educator to use science terminology and literacy devices covered in language arts classes. Students will be met with more cross-curricular learning opportunities compatible with history, geometry and many more activities blending athletics and academics.

Visit www.bowlersed.com for an online version of the Bowler's Ed program and many other resources. In addition, you can also find a list of Specialists who are trained to assist educators with implementing the Bowler's Ed program in your area.

Thanks again for introducing bowling to your students! The program is made available free of charge to educators through the International Bowling Campus.

ORGANIZATION

The Bowler's Ed In-School Bowling program is operated by the International Bowling Campus. We are supported by the United States Bowling Congress (USBC) and the Bowling Proprietors' Association of America (BPAA). Bowler's Ed is a curriculum- and equipment-based physical education program designed to introduce students to the lifetime sport of bowling through an easy-to-follow, fun- and fitness-oriented lesson plan.

MISSION

Provide resources and education that inspire others to provide a safe, positive and fun environment for athletes of all ages and skill levels.

VISION

To encourage all children to experience the enjoyment of organized bowling.

Why Teach Bowling

Bowling is a great sport for everyone!

FOR STUDENTS

- No size or strength limitations for success
- Is a family-oriented activity
- Builds self-confidence and positive self-esteem
- A great team sport
- A great individual sport
- Can be enjoyed in a social or competitive form
- A success-oriented lifetime sport
- Keeping score reinforces math concepts
- Provides enjoyment for children of any age
- Bowling is FUN!

FOR TEACHERS

- The Bowler's Ed program conforms with all six National Association of Sport and Physical Education (NASPE) standards for physical education:
 1. Standard 1: Demonstrates competency in motor skills and movement patterns needed to perform a variety of physical activities
 2. Standard 2: Demonstrates understanding of movement concepts, principles, strategies and tactics as they apply to the learning and performance of physical activities
 3. Standard 3: Participates regularly in physical activity
 4. Standard 4: Achieves and maintains a health-enhancing level of physical fitness
 5. Standard 5: Exhibits responsible personal and social behavior that respects self and others in physical activity settings
 6. Standard 6: Values physical activity for health, enjoyment challenge, self-expression and/or social interaction
- The Bowler's Ed In-School Bowling curriculum is FREE!
- Additional fitness and fun activities are provided
- Academic lessons are included and are great "extra credit" activities
- The Quick Reference Guide makes it easy to teach
- Students are active and on task
- No size limits for success
- All students can participate
- Good for the development of hand-eye coordination
- Large muscle focus in approach, delivery and balance
- Bowling is a great unit for adapted PE programs
- The bowling unit is FUN!

Resources

To receive:

- Additional teaching curriculums
- Referrals to participating bowling centers

Contact:

Bowler's Ed

621 Six Flags Drive
Arlington, TX 76011
800.514.2695 ext. 8426
BowlersEd@bowl.com
BowlersEd.com

For more information on:

- Youth membership
- Youth instruction
- Scholarship opportunities
- High school bowling
- Collegiate bowling
- USA Bowling
- Tournaments

Contact:

United States Bowling Congress

621 Six Flags Drive
Arlington, TX 76011
817-385-8426
ContactUs@bowl.com
BOWL.com/youth

To purchase:

- Official In-School Bowling portable bowling equipment

Contact:

Metro Ltd. Sports

4001 E. State Street
Rockford, IL 61108
815.399.0655
BowlersEdSupply.com

Flaghouse

www.flaghouse.com

SporTime

www.sportime.com



In-School Bowling Fundamentals Quick Reference Guide

Lesson	Setup	Cue Words	Activity	Page
SAFETY <ul style="list-style-type: none"> • Must remain on feet at all times • Must respect foul line • Keep nylon bags off floor • Do not slide on gym floor 	<ul style="list-style-type: none"> • Gym/Multi-purpose Room 	None	<ul style="list-style-type: none"> • Fun and safe bowling 	6
ETIQUETTE <ul style="list-style-type: none"> • Respect bowlers on each side • Be ready for your turn • Encourage your teammates 	<ul style="list-style-type: none"> • Gym/Multi-purpose Room 	None	<ul style="list-style-type: none"> • Fun and safe bowling 	7
FREE PENDULUM SWING <ul style="list-style-type: none"> • Staggered position • “Bowling arm” • “Non-bowling arm” 	<ul style="list-style-type: none"> • Spread students out with enough room to swing their arms. 	PUSH - RELAX	<ul style="list-style-type: none"> • Do PUSH-RELAX motion together. • A natural free swing should result. 	8
HOW TO HOLD THE BALL <ul style="list-style-type: none"> • Two middle fingers and thumb 	<ul style="list-style-type: none"> • Spread students out with enough room to swing their arms 	None	<ul style="list-style-type: none"> • Demonstrate that the two middle fingers and thumb hold the ball. 	9
RELEASE <ul style="list-style-type: none"> • Teach from kneeling position • Use clock for correct position • Focus on relaxed arm swing 	<ul style="list-style-type: none"> • Get students into teams of two and line up facing each other 10-15’ apart. 	None	<ul style="list-style-type: none"> • Roll ball to partner from kneeling position. 	10
FOLLOW THROUGH <ul style="list-style-type: none"> • Teach from kneeling position • Use clock for correct position • Focus on relaxed arm swing 	<ul style="list-style-type: none"> • Get students into teams of two and line up facing each other 10-15’ apart. 	ANSWER THE PHONE	<ul style="list-style-type: none"> • Roll ball using proper follow through 	11
ACCURACY <ul style="list-style-type: none"> • Teach from kneeling position • Use a single pin 	<ul style="list-style-type: none"> • Get students into teams of two and line up facing each other 10-15’ apart. 	None	<ul style="list-style-type: none"> • Smooth roll, like landing an airplane 	12



In-School Bowling Fundamentals Quick Reference Guide

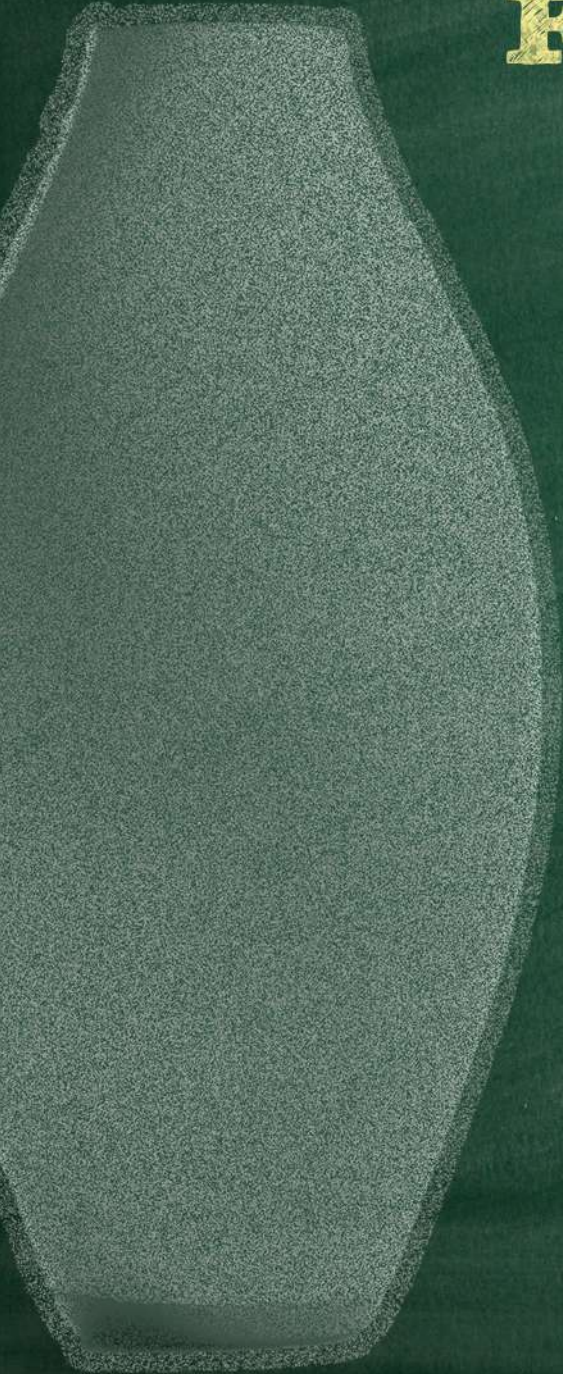
[continued]

Lesson	Setup	Cue Words	Activity	Page
BALANCE <ul style="list-style-type: none"> Staggered feet position "Karate Kid" crane balance 	<ul style="list-style-type: none"> Get students into teams of two and line up facing each other 10-15' apart. 	None	<ul style="list-style-type: none"> Start in staggered position Lean forward and extend both arms out to side. Lift back foot and hold balance. Back toe should be on the floor. Swing bowling arm freely. 	13
ROTATION <ul style="list-style-type: none"> Explain positions Rotate clockwise 	<ul style="list-style-type: none"> Set up bowling lanes Use four pins--1, 2, 3 and 5 pin on each lane 	None	<ul style="list-style-type: none"> Form teams of 3-6 Explain each position Each student gets 2 deliveries practicing balance and rotation 	14
ONE-STEP DELIVERY <ul style="list-style-type: none"> "Toy Story's Woody" Feet together; knees bent "Magic" string = heel up Hold balance and finish 	<ul style="list-style-type: none"> Set up bowling lanes Use four pins--1, 2, 3 and 5 pin on each lane 	BACK -AND - BOWL	<ul style="list-style-type: none"> Each student gets two deliveries using Balance Plus technique. Students bowl and rotate. 	15
ARM SWING <ul style="list-style-type: none"> Bowling arm ready Watch, listen, follow 	<ul style="list-style-type: none"> Spread students out with enough room to swing their arms. 	OUT -DOWN - SWING -AND - RELAX	<ul style="list-style-type: none"> Start arm motion slowly and speed up to develop free, natural arm swing. 	16
TEMPO STEPS <ul style="list-style-type: none"> Staggered position Hands on hips Flex knees and lean forward 	<ul style="list-style-type: none"> Spread students out with enough room to swing their arms. 	SHORT -SHORT - SHORT -BOOOOWL -	<ul style="list-style-type: none"> Do several sets of tempo steps to develop the rhythm of a consistent approach 	17
FOUR-STEP DELIVERY <ul style="list-style-type: none"> Staggered feet position Ball ready for push away 	<ul style="list-style-type: none"> Set up bowling lanes Use all 10 pins 	ONE - TWO -THREE - FOUR -AND A LITTLE MORE	<ul style="list-style-type: none"> Regular bowling rotation and scoring 	18



Bowler's Ed

Fundamentals



Bowling Fundamentals

Rubrics.....	2-6
Safety.....	7
Etiquette.....	8
Free Pendulum Swing.....	9
How to Hold the Ball.....	10
Release.....	11
Clock Template.....	12
Follow Through.....	13
Accuracy.....	14
Balance.....	15
Rotation.....	16
One-Step Delivery.....	17
Arm Swing.....	18
Tempo Steps.....	19
Four-Step Delivery.....	20
The Bowling Center.....	21
Adaptive PE.....	22
Advanced Tips—Strike Pocket.....	23
Advanced Tips—Spare Shooting.....	24

Rubrics

What is a rubric?

A **rubric** is a scoring tool for subjective assessments. It is a set of criteria and standards linked to learning objectives that is used to assess a student's performance. Rubrics allow for standardized evaluation according to specified criteria, making grading simpler.

The rubric is an attempt to delineate consistent assessment criteria. It allows teachers and students alike to assess criteria which are complex and subjective and also provide ground for self-evaluation. It is aimed at accurate and fair assessment, fostering understanding and indicating the way to proceed with subsequent learning/teaching. This integration of performance and feedback is called "ongoing assessment."

Increasingly, instructors who rely on rubrics to evaluate student performance tend to share the rubric with students at the time the assignment is made. In addition to help-ing students understand how the assignment relates to course content, a shared-rubric can increase student authority in classroom.

The following common features of rubrics can be distinguished, according to Bernie Dodge and Nancy Pickett:

- focus on measuring a stated objective (performance, behavior or quality)
- use a range to rate performance
- contain specific performance characteristics arranged in levels indicating the degree to which a standard has been met.

Usage

Rubrics are often used in alternative assessments in education. It is usually in the form of a matrix with a criteria for success. The rubric focuses on stated objectives and should use a scale to rate performance.

The *key advantage* for classroom teachers is that rubrics force clarification of success in the classroom, establishing clear benchmarks for achievement. By sharing scoring rubrics with students, they become aware of the expected standards and thus know what counts as quality work. With rubrics, grading becomes more objective, consistent and defensible. Additionally, rubrics make grading more efficient. Time spent developing a grading rubric will be made up for in ease and speed of actual grading.

According to R. Sabetiashraf, rubrics serve a different role in different phases of assess-ment:

- During the **pre-assessment phase**, rubrics are used to clarify expectations and grading methods with learners. As a result, learners can perform a self-assessment prior to submission of their work.
- During the **assessment phase**, rubrics help evaluators to remain focused on the preset standards of excellence and objectively assess the learner.

- During the **post-assessment phase** learners are given a scored rubric with clear explanation of their grade. They are made aware of their weaknesses and strengths.

Rubrics should be centered more on teaching and learning than scoring. Some of the reasons for using rubrics include:

1. Focus instruction by design.
2. Guide colorful feedback.
3. Objectively characterize desired results.
4. Clearly develop performance standards.
5. Develop self-assessment competence.
6. Involve students and be attentive.

Please review the following grade specific rubrics to assist in teaching age-appropriate Bowling Fundamentals.

Name _____

Date _____

Rubrics K-2	-4- Accomplished	-3- Competent	-2- Developing	-1- Beginning
Approach and Delivery SCORE _____	Demonstrates proper stance by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly ALL of the time.	Demonstrates proper stance by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly MOST of the time.	Demonstrates proper stance by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly SOME of the time.	Does not demonstrate proper stance by using correct finger positioning and bending at the knees and waist. The ball rarely rolls smoothly.
Accuracy and Balance SCORE _____	Consistently stays behind foul line and keeps ball on lane. Regularly knocks down pins.	Usually stays behind foul line and keeps ball on the lane. Frequently knocks down pins.	Occasionally crosses foul line and throws ball off the lane. Occasionally knocks down pins.	Consistently falls down or crosses the foul line and throws the ball off the lane. Rarely knocks down any pins.
Knowledge of the Game SCORE _____	Completely understands the fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.	Usually understands the fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.	Occasionally understands fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.	Consistently does not understand fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.
Safety and Etiquette SCORE _____	Behavior is safe and mannerly on the lanes. Ready to bowl when it is his/her turn and respects priority of bowler to his/her right or left.	Behavior is usually safe and mannerly on the lanes. Ready to bowl when it is his/her turn. Respects priority of bowler to his/her right or left.	Needs occasional reminders to get ready to bowl when it is his/her turn and to respect priority of bowler to his/her right or left.	Needs to be reminded to get ready to bowl each time it is his/her turn and to pay attention to bowler to his/her right or left.
Character Development SCORE _____	Consistently encourages other team members, treats teammates with respect and moves through rotations easily.	Usually encourages other team members, treats teammates with respect and moves through rotations easily.	Needs reminders to encourage other team members, treat teammates with respect and to move through rotation.	Makes fun of other team members, disrespects teammates and does not like to share equipment or take turns.
Effort and Attitude SCORE _____	Follows along on task consistently, plays well with teammates, takes turns with different roles and shows enthusiasm.	Usually stays on task, plays well with teammates, takes turns with different roles and shows enthusiasm.	Needs 2-3 reminders to stay on task and to cooperate with teammates. Shows some enthusiasm.	Not on task at all or rarely. Uncooperative with teammates. Little or no enthusiasm.

Name _____

Date _____

Rubrics 3-5	-4- Accomplished	-3- Competent	-2- Developing	-1- Beginning
Approach and Delivery SCORE _____	Demonstrates proper approach by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly ALL of the time.	Demonstrates proper approach by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly MOST of the time.	Demonstrates proper approach by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly SOME of the time.	Does not demonstrate proper approach by using correct finger positioning and bending at the knees and waist. The ball rarely rolls smoothly.
Accuracy and Balance SCORE _____	Consistently stays behind foul line and keeps ball on lane. Regularly bowls multiple strikes.	Usually stays behind foul line and keeps ball on the lane. Frequently bowls more than one strike.	Occasionally crosses foul line and throws ball off the lane. Rarely bowls a strike.	Consistently falls down or crosses the foul line and throws the ball off the lane. Has never bowled a strike.
Knowledge of the Game SCORE _____	Completely understands the fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.	Usually understands the fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.	Occasionally shows understanding of fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.	Consistently does not show understanding of fundamentals of bowling: approach, release, follow through and concepts of foul line, strikes and spares.
Safety and Etiquette SCORE _____	Behavior is consistently safe and mannerly on the lanes. Ready to bowl when it is his/her turn and respects priority of bowler to his/her right or left.	Behavior is usually safe and mannerly on the lanes. Ready to bowl when it is his/her turn. Respects priority of bowler to his/her right or left.	Needs 2-3 reminders to get ready to bowl when it is his/her turn and to respect priority of bowler to his/her right or left.	Needs to be reminded to get ready to bowl each time it is his/her turn and to pay attention to bowler to his/her right or left.
Character Development SCORE _____	Consistently encourages other team members, treats teammates with respect and moves through rotations easily.	Usually encourages other team members, treats teammates with respect and moves through rotations easily.	Needs reminders to encourage other team members, treat teammates with respect and to move through rotation.	Makes fun of other team members, disrespects teammates and does not like to share equipment or take turns.
Effort and Attitude SCORE _____	Follows along on task consistently, plays well with teammates, takes turns with different roles, shows good leadership and enthusiasm.	Usually stays on task, plays well with teammates, takes turns with different roles, shows good leadership and enthusiasm.	Needs 2-3 reminders to stay on task and to cooperate with teammates. Shows some leadership and enthusiasm.	Not on task at all or rarely. Uncooperative with teammates. Little or no leadership or enthusiasm.

Name _____

Date _____

Rubrics 6-8	-4- Accomplished	-3- Competent	-2- Developing	-1- Beginning
Approach and Delivery SCORE _____	Demonstrates proper approach by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly ALL of the time.	Demonstrates proper approach by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly MOST of the time.	Demonstrates proper approach by using correct finger positioning and bending at the knees and waist. The ball rolls smoothly SOME of the time.	Does not demonstrate proper approach by using correct finger positioning and bending at the knees and waist. The ball rarely rolls smoothly.
Accuracy and Balance SCORE _____	Consistently stays behind foul line and keeps ball on lane. Regularly bowls a strike.	Usually stays behind foul line and keeps ball on the lane. Frequently bowls a strike.	Occasionally crosses foul line and throws ball off the lane. Rarely gets bowls a strike.	Consistently falls down or crosses the foul line and throws the ball off the lane. Has never bowled a strike.
Knowledge of the Game SCORE _____	Completely understands all rules and fundamentals of the game as presented. Can manually score an entire game accurately.	Understands the basic rules and fundamentals of the game as presented and can manually score an entire game almost accurately.	Understands some of the rules and fundamentals of the game as presented. Can manually score spares and strikes.	Does not understand any of the rules or fundamentals presented except that he/she has to knock over some pins. Cannot manually score a spare or strike.
Safety and Etiquette SCORE _____	Behavior is consistently safe and mannerly on the lanes. Ready to bowl when it is their turn and respects priority of bowler to his/her right or left.	Behavior is usually safe and mannerly on the lanes. Ready to bowl when it is his/her turn. Respects priority of bowler to his/her right or left. to his/her right or left.	Needs reminders to get ready to bowl when it is his/her turn and to respect priority of bowler to his/her right or left.	Needs to be reminded to get ready to bowl each time it is his/her turn and to pay attention to bowler to his/her right or left.
Character Development SCORE _____	Consistently encourages other team members, treats teammates with respect and moves through rotations easily.	Usually encourages other team members, treats teammates with respect and moves through rotations easily.	Needs reminders to encourage other team members, treat teammates with respect and to move through rotation.	Makes fun of other team members, disrespects teammates and does not like to share equipment or take turns.
Effort and Attitude SCORE _____	Follows along on task consistently, plays well with teammates and shows enthusiasm.	Usually stays on task, plays well with teammates and shows enthusiasm.	Needs 2-3 reminders to stay on task and to cooperate with teammates. Shows some enthusiasm.	Not on task at all or rarely. Uncooperative with teammates. Little or no enthusiasm.
Bowling Proficiency SCORE _____	Able to bowl a spare when needed most of the time and able to get at least 4 strikes.	Able to bowl a spare some of the time and able to get at least 2 strikes.	Needs help to adjust technique to better hit a strike and able to hit at least 1 strike.	Unable to get a spare due to lack of technique and/or adjustment and did not hit a strike.

Safety

Before you teach bowling in your class, it's important to cover a few basic safety rules:

1. Students should remain on their feet at all times. If a ball or pin ricochets, it could hit them in the face.
2. No one should step beyond the foul line. Whether you are using the official In-School Bowling carpeted lane or another simulation of a lane, ensure that students don't step beyond the foul line. At the bowling center, this is important for two reasons:
 - a. You will receive a score of zero for the frame; and
 - b. The lanes are oiled which helps protect them and reduce the friction caused by the ball rolling down the lane. You could slip and fall if you step onto the oil, or you could track oil onto the approach, causing others to slip and fall.
3. If you are using the In-School Bowling equipment, keep the nylon carrying bags for the balls and pins off the floor. They can be slippery and cause falls.
4. In class, students will learn a four-step approach. They should not "slide" on the fourth step in the gym as they would at the bowling center. When they are bowling at a bowling center, they will wear bowling shoes which are designed to slide on the bowling center approach.
 - You will receive a score of zero for the frame; and
 - The lanes are oiled which helps protect them and reduce the friction caused by the ball rolling down the lane. You could slip and fall if you step onto the oil, or you could track oil onto the approach, causing others to slip and fall.

Reinforcing these safety rules will ensure that your children have a fun and SAFE bowling experience!

Etiquette

When you go bowling, it's important to use good manners.

1. If someone to your left or right is about to bowl, wait until that person is finished before you take your turn. Or, if you are walking up to take your turn at the same time as someone on your left or right, always offer to let the other person go first.
2. Be ready when it is your turn so you don't hold up the game.
3. Be courteous to your teammates and cheer them on.
4. Don't ever tease a bowler who is not doing well. Help to make sure that everyone is having a good time.
5. Keep refreshments in designated areas and away from the lane and approach.

Free Pendulum Swing

Setting: Gym/multi-purpose room. Students should spread out with enough room to swing their arms without bumping into each other (*see diagram below*).

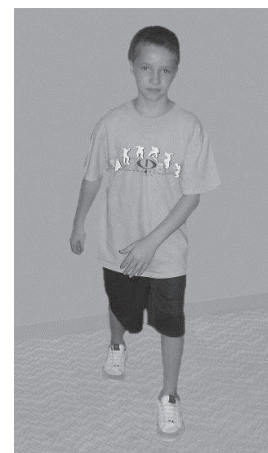
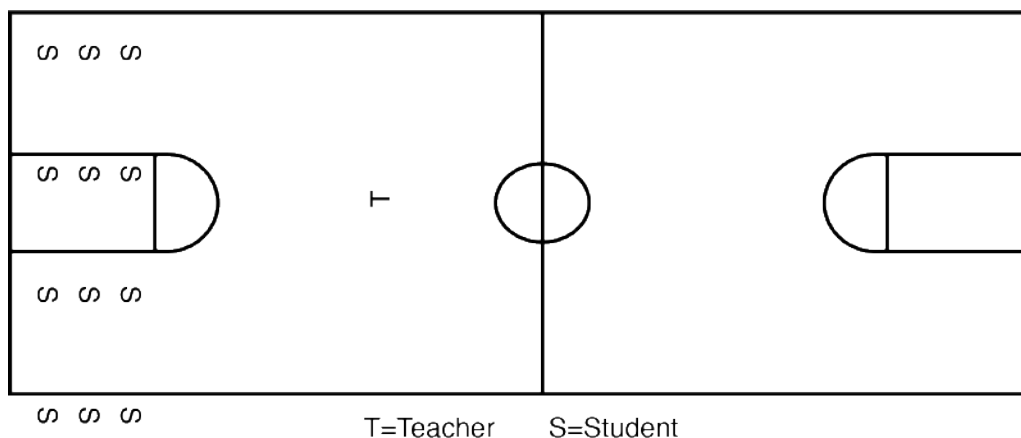
Teaching time: 3-5 minutes

Equipment: None

Cue Words: “Push, Relax”

Instructions:

1. Have students get into a “Staggered” position:
 - Tell them to raise the hand that they will bowl with.
 - Say, “On the same side of your body is a leg. At the end of that leg is a foot. Pick up that foot and step back 6-8 inches.”
2. Once they’re in the staggered position, have them relax their bowling arm at their side.
3. Have them lean forward.
4. Have them place their non-bowling hand on their bowling wrist.
5. Have them push their wrist backwards and let their arm swing freely forward, totally relaxed.
6. Have them practice the drill several times and repeat the cue words, “Push, Relax” to help them develop a rhythm.
 - ★ **Teaching Tip:** Using “generic” language (bowling arm, non-bowling arm) rather than teaching “right” or “left” will ensure that you only have to teach the lesson once, and that left-handers don’t have to reverse the right-handed technique.



How to Hold the Ball

Setting: Gym/multi-purpose room. Students should spread out with enough room to avoid bumping into each other (*see diagram below*).

Teaching time: 3 minutes

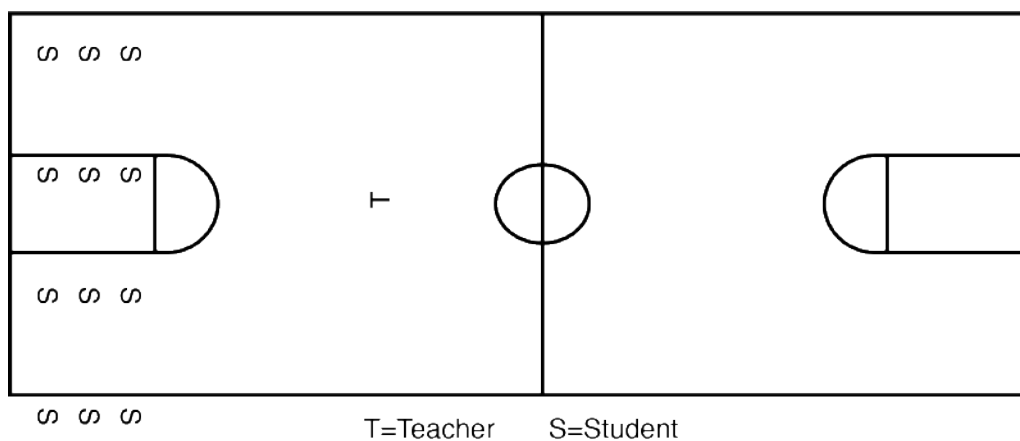
Equipment:

1. (Optional) One glove with the two middle fingers cut off
2. One bowling ball

Cue Words: None

Instructions:

1. Have students raise the hand that they bowl with.
2. Tell them to touch their middle two fingers and their thumb together.
3. If you have a glove available, demonstrate by putting your hand in the glove to help them visualize which fingers they use.
 - ★ **Teaching Tip:** When the students touch their middle two fingers and thumb together, show them that it looks like a bunny rabbit shadow puppet or “hang loose” or “Hook’em Horns” or Spiderman.
4. Using a bowling ball, place your thumb and fingers in the holes to demonstrate how to hold it.
5. If time permits, have each student practice holding the ball.



Release

Setting: Gym/multi-purpose room. Students will get into teams of two and line up in two parallel lines facing each other. They should be 10 to 15 feet apart (see diagram below).

Teaching time: 7-10 minutes

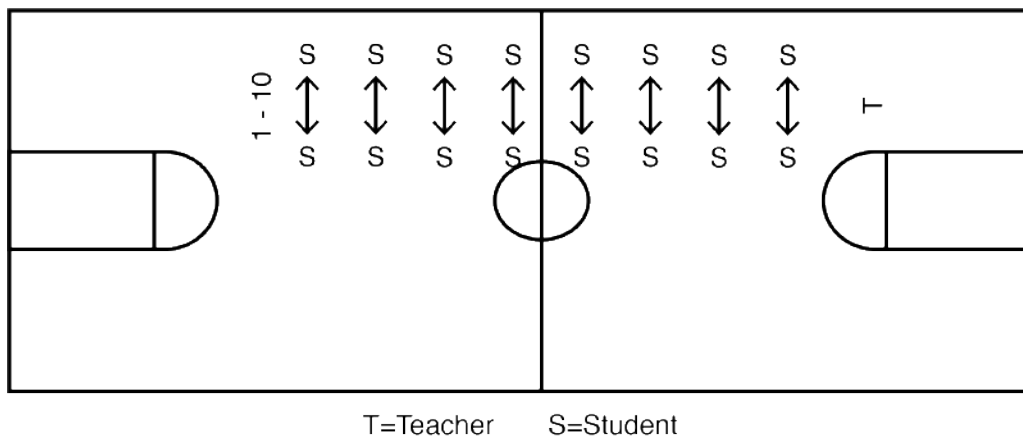
Equipment:

1. A paper clock for each student (see next page for clock pattern)
2. One softball or similar-sized ball for each pair of students

Cue Words: None

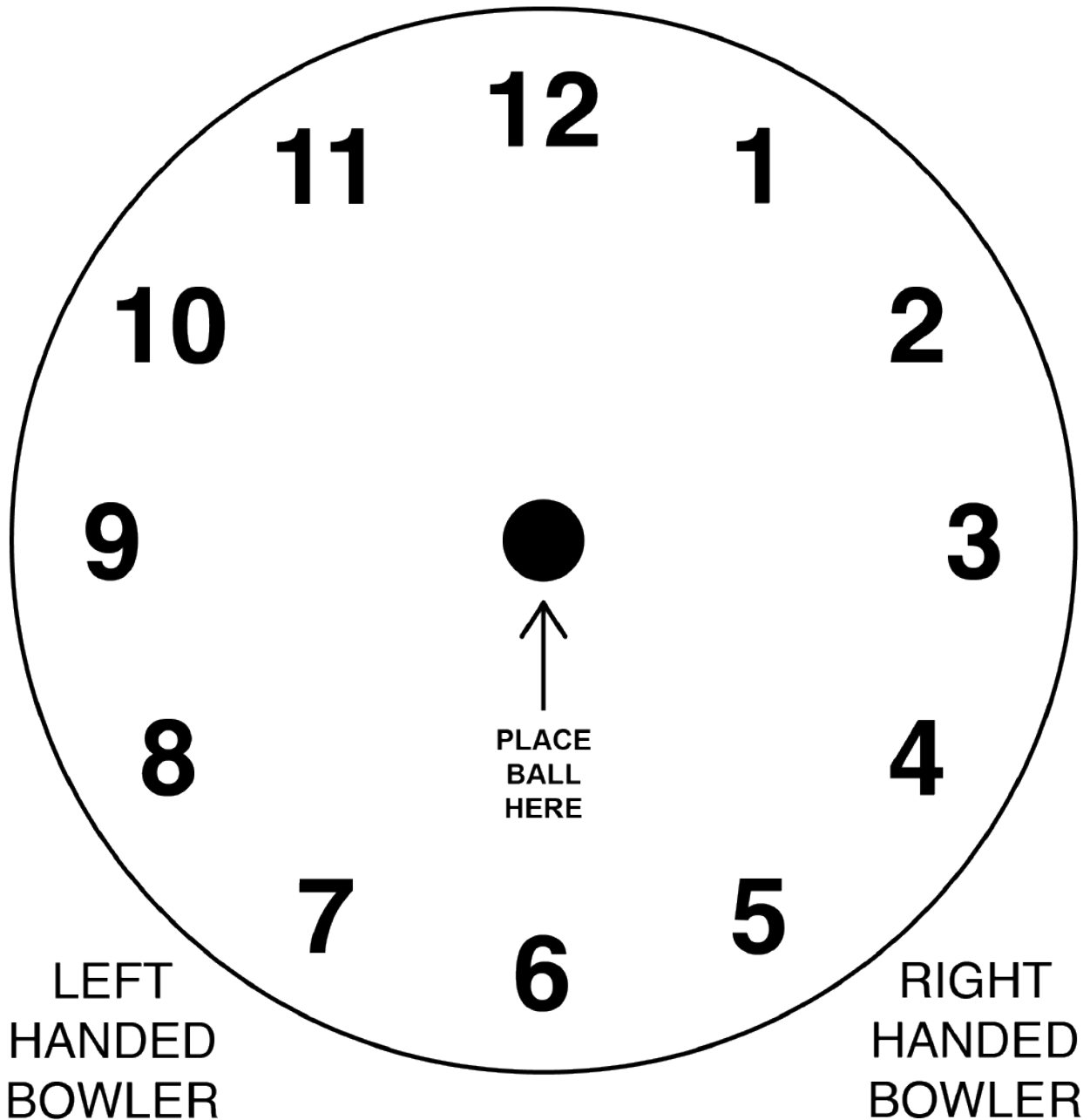
Instructions:

1. Have students pair up and face each other 10 to 15' apart.
2. Ensure that each student has a paper clock.
3. Give each pair of students a softball.
4. Have students get into the "Kneel Down" position (as shown below).
5. Tell students to raise the hand that they will bowl with then say: "On the same side of your body is a leg. On that leg, there is a knee. Touch that knee. Now, kneel down on that knee."
6. Have students place the clock on the floor next to their knee, directly below their bowling hand.
7. Tell students to place their bowling fingers (two middle fingers) on the appropriate numbers—for right-handed bowlers, this will be the 4 and 5 and for left-handed bowlers, this will be the 7 and 8.
8. Have students slide their two fingers under the ball and grip the top of the ball with their thumb.
9. Tell students to raise the ball off the ground, keeping their arm straight.
10. The student will then take two swings and release the ball on the second swing.
11. The partner will return the ball using the same technique.
12. Have each student practice several times.
13. Have them practice releasing the ball smoothly, like an airplane landing on a runway.



CLOCK

To use with Release Lesson, Follow Through Lesson and Accuracy Lesson.



Follow Through

Setting: Gym/multi-purpose room. Students will get into teams of two and line up in two parallel lines facing each other. They should be 10 to 15 feet apart (*see diagram below*).

Teaching time: 10 minutes

Equipment:

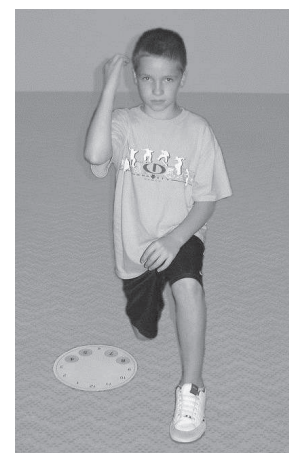
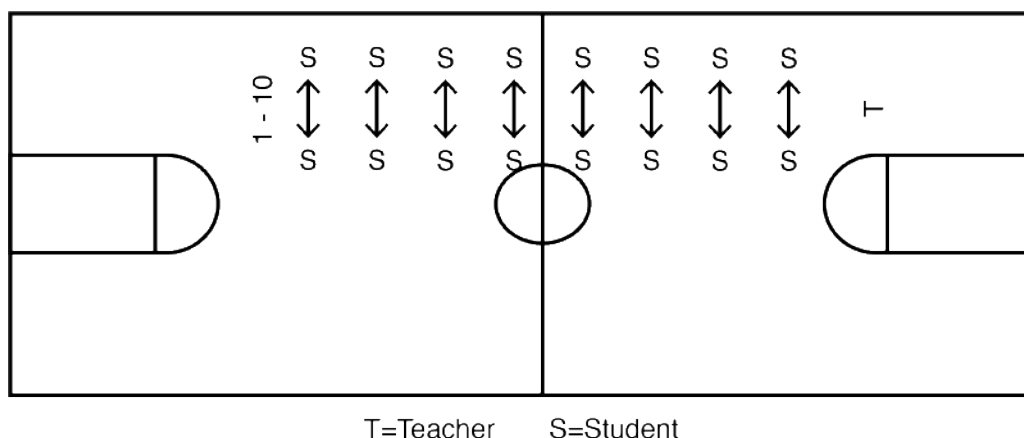
1. A paper clock for each student (see previous page)
2. One softball or similar-sized ball for each pair of students

Cue Words: “Answer the phone.”

Instructions:

1. Have students pair up and face each other 10 to 15’ apart.
2. Give each student a paper clock and each pair of students a softball.
3. Tell students to get into the “Kneel Down” position (see below).
4. To teach the follow through, ask your students what they do when their friends call them on the phone. They will respond, “Answer it.” The follow through is similar to answering the phone; once they release the ball, they should continue the arm swing forward and bring their hand near their ear for the proper follow through.
5. Using the clock and softball as in the Release exercise, each student should take two swings and practice the follow through when the ball is released.
6. Using the cue words “Answer the phone” will help them remember the follow through.

★ **Teaching tip:** Demonstrate the phone call as being a “local” call—hand up to the ear—rather than a “long distance” call—arm extended out.



Accuracy

Setting: Gym/multi-purpose room. Students will get into teams of two and line up in two parallel lines facing each other 10 to 15 feet apart (see diagram on page 11).

Teaching time: 7-10 minutes

Equipment:

1. A paper clock for each student (see previous lesson)
2. One softball or similar-sized ball for each pair of students
3. A bowling pin for each pair of students

Cue Words: None

Instructions:

1. Have students pair up and face each other 10-15' apart.
2. Ensure that each student has a paper clock.
3. Give each pair of students a softball and a bowling pin.
4. Have students get into the "Kneel Down" position (as in previous exercise).
5. Instruct students to place the clock on the floor next to their knee, directly below their bowling hand.
6. The students lined up closest to the wall should place a bowling pin on the center of their clock.
7. Have their partners place their bowling fingers—two middle fingers—on the appropriate numbers for them—for right-handed bowlers, this will be the 4 and 5; for left-handed bowlers, this will be the 7 and 8.
8. Have students slide their two fingers under the ball and grip the top of the ball with their thumb. then raise the ball off the ground, keeping their arm straight.
9. The student will then take two swings and release the ball on the second swing, attempting to knock over the pin.
10. Have each student take 5 deliveries.

★ **Teaching tip:** After the first group of students has taken a couple of deliveries, STOP THE CLASS. At this point, some of the students may have knocked down a pin, but others have not and may be discouraged. To keep those students motivated and excited, show them the difference between the size of a softball and a bowling ball. Point out that if they have not had much luck hitting the pin with a softball, they'll knock them down every time with a bowling ball!

Balance

Setting: Gym/multi-purpose room. Students should spread out with enough room to swing their arms without bumping into each other (*see diagram below*).

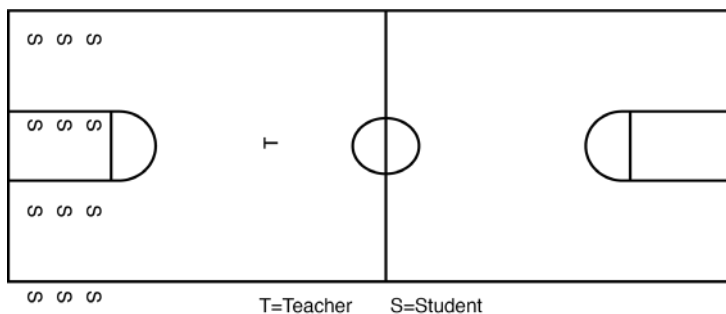
Teaching time: 3-5 minutes

Equipment: None

Cue Words: None

Instructions:

1. Explain the importance of balance. A good way to do this is to use an analogy from the movie *Karate Kid*. In that movie, Daniel wanted to be a master at karate. In order to master karate, he had to have perfect balance. He would practice balance by getting into the “crane” position. Explain that balance is also important to become a good bowler.
2. Have students get into the “Staggered” position:
 - Tell them to raise the hand that they will bowl with.
 - Say, “On the same side of your body is a leg. At the end of that leg is a foot. Pick up that foot and step back 6-8 inches.”
3. Instruct students to lean forward, putting most of their weight on their front foot. Their front knee should be deeply bent.
4. Next have them lean forward and extend both arms out to the side.
5. Have students lift their back toe off the ground and see if they can hold their balance.
6. Then have them rest their back toe on the floor and move it behind their front leg.
7. Next tell students to relax their bowling arm at their side, holding the balance position.
8. Finally have them swing their bowling arm freely, as they did in the Free Pendulum Swing exercise.



Rotation

Setting: Gym/multi-purpose room with bowling lanes set up with only four pins—1, 2, 3 and 5 pin (see diagram below).

Teaching time: 10 minutes

Equipment:

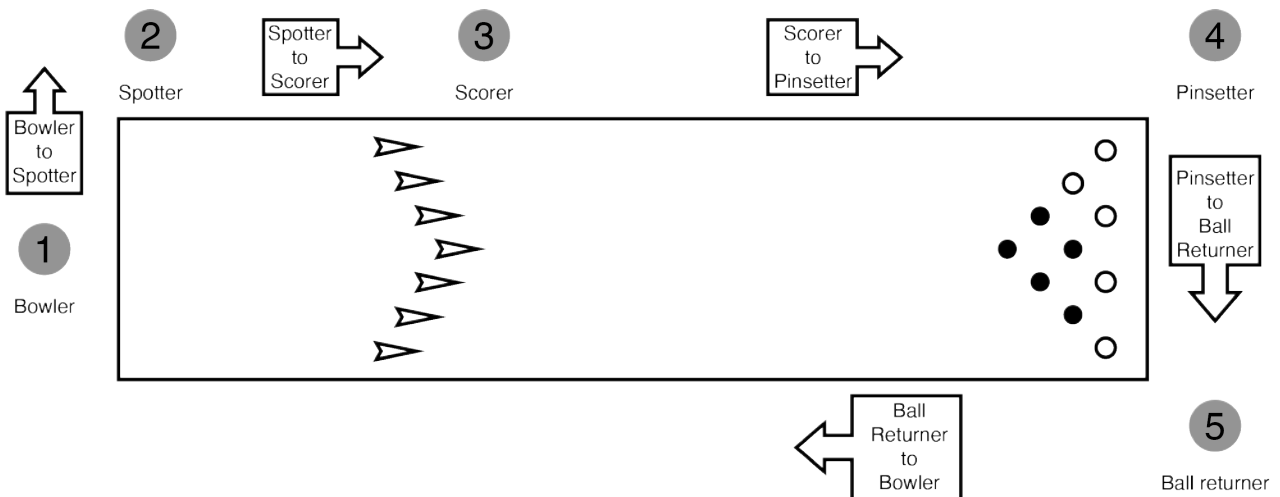
1. Bowling lanes
2. One ball for each lane
3. 4 pins per lane—1, 2, 3 and 5 pin

Note Using 4 pins takes less time to set up after each delivery. If students get proficient at hitting the 1,2, 3 and 5 pins, they will be proficient at hitting all 10 pins.

Cue Words: None

Instructions:

1. Divide students into teams of 5 and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - a. **Bowler:** Takes two deliveries of the ball.
 - b. **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - c. **Scorer:** Keeps count of the number of pins knocked down.
 - d. **Pin setter:** Resets pins after each delivery.
 - e. **Ball returner:** Returns the ball to the bowler.
3. Ensure that everyone understands the positions.
4. Have students go to the lanes and practice Balance and Rotation.
5. The bowler will stand at the foul line in the balance position, take two swings and release the ball.
6. After the bowler has taken two deliveries, each student will rotate in a clockwise fashion (see diagram below).
7. When all students have taken their turn, the entire team should sit down around the lane to signal they have finished.



One-Step Delivery

Setting: Gym/multi-purpose room with bowling lanes be set up with four pins—1, 2, 3 and 5 pin on each lane.

Equipment:

1. Bowling lanes
2. 4 pins per lane—1, 2, 3 and 5 pin
3. One ball for each lane

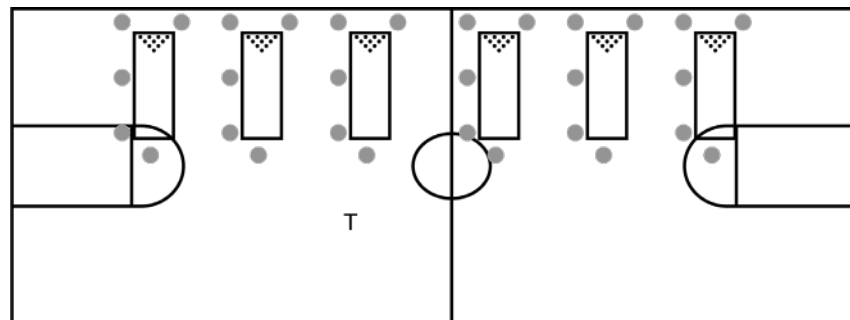
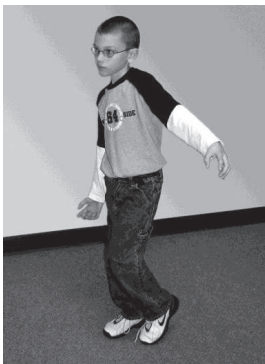
Cue Words: “Back and then booowl”

Instructions:

1. The One Step Delivery is first taught without the ball.
2. Divide students into teams of 5 and assign each team to a lane.
3. Ensure that everyone understands the lane positions.
4. The bowler will get into the Balance position at the foul line:
 - Refer to the movie Toy Story in which one of the main characters, Woody, talks by pulling a string on his back.
 - Have the bowler start with knees flexed and bowling arm relaxed.
 - The non-bowling arm is out to the side and their heel is up. To help students get into this position, have them imagine that they are pulling a string out of their leg. When they pull the string, their heel will raise about 2-3 inches.
 - Have them make a “zip” sound as they are pulling the “string.” After all, there’s no magic if you don’t make the sound!
5. The bowler will then take two swings. The first swing begins with a backward movement of the bowling arm. Students will then say the words, “Back and then booowl” as their arm makes the two swings.

Tip To help with the rhythm of the arm swing, the bowler will start by moving the arm backward—cue word “Back.” As the arm goes forward—cue word “and.” As the arm goes back again—cue word “then.” The ball is released as the bowler steps forward—cue word “booowl.”

6. After the release, the bowlers should check their balance by keeping their back toe on the floor.
7. After two deliveries, each student will rotate in a clockwise fashion.
8. When all students have taken their turn, the entire team should sit down around the lane to signal they have finished.



T=Teacher S=Student

Arm Swing

Setting: Gym/multi-purpose room. Students should spread out with enough room to swing their arms without bumping into each other or they can be in their teams on the lanes with enough room to spread out without bumping (see diagram below).

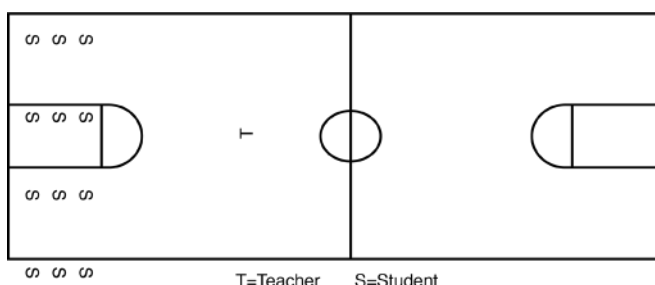
Teaching time: 5 minutes

Equipment: None

Cue Words: “Out, down, swing, and relax”

Instructions:

1. Have students get into a “Staggered” position:
2. Tell them to raise the hand that they will bowl with.
3. Then say: “On the same side of your body is a leg. At the end of that leg is a foot. Pick up that foot and step back 6-8 inches.” Have students place most of their weight on their front foot.
4. Tell students to imagine that they are holding an imaginary ball with both arms between their waist and shoulders.
5. The cue words are “Out, down, swing and relax.”
 - “Out” — bowling arm will extend out in front.
 - “Down” — arm will go down and back.
 - “Swing” — arm will swing forward.
 - “Relax” — arm will go back to its original position.
6. Have students repeat the movements and words several times to develop the rhythm and timing. Ensure that the movements are smooth and relaxed (no robo-bowlers!)



Staggered Stance

...Out...

...Down...

...Swing...

...and...

...Relax...

Temp Steps

Setting: Gym/multi-purpose room. Students should spread out with enough room to swing their arms without bumping into each other or they can be in their teams on the lanes with enough room to spread out without bumping into each other (*see diagram below*).

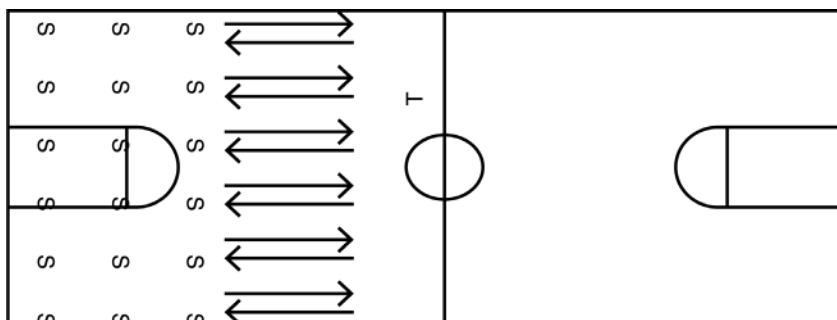
Teaching time: 8-10 minutes

Equipment: None

Cue Words: “Short, short, short, boowl”

Instructions:

1. Have students get into a “Staggered” position.
2. Tell them to raise the hand that they will bowl with.
3. Say: “On the same side of your body is a leg. At the end of that leg is a foot. Pick up that foot and step back 6-8 inches.”
4. Have students place most of their weight on their front foot, put their hands on their hips and look down at their feet.
5. Beginning with their back foot, students should take four short, shuffling steps forward, saying the words “Short, short, short, boowl.”
6. Have students practice this several times to develop a smooth step pattern for bowling.



T=Teacher S=Student



Staggered Stance



...Short...



...Short...



...Short...



...Boooowl...

Four-Step Delivery

Setting: Gym/multi-purpose room with bowling lanes set up with all ten pins on each lane (see diagram below).

Teaching time: 10 minutes

Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane

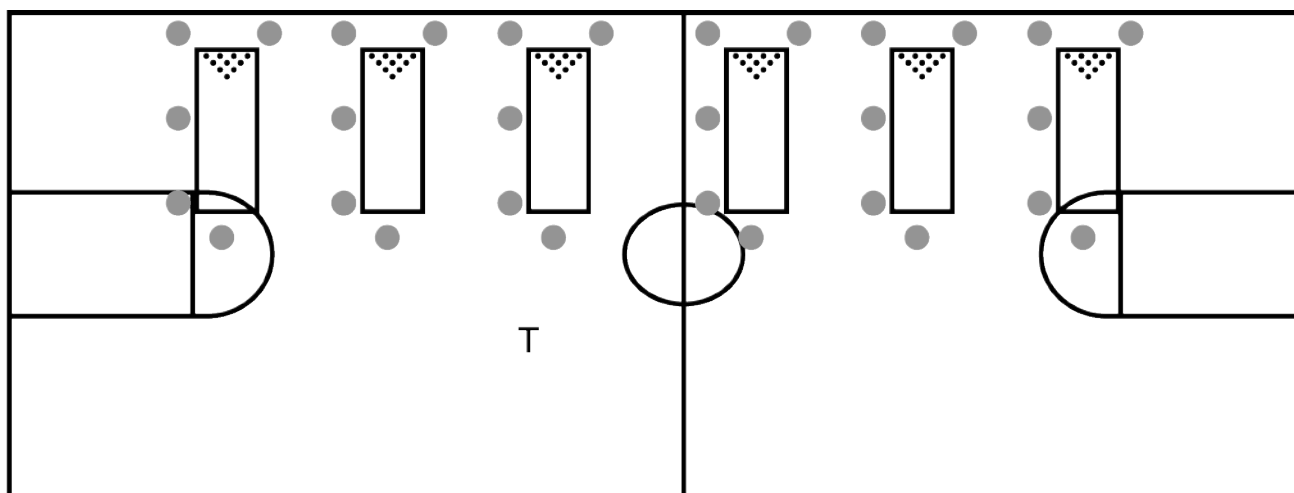
Cue Words: “One, two, three, four and a little bit more.”

Instructions:

1. This lesson combines the Arm Swing and Tempo Steps into the Four-Step Delivery.
2. Divide students into teams of 5 and assign each team to a lane.
3. Ensure that student understands his/her “position” on the lane (refer to page 16 and the Rotation lesson).
4. The bowler will stand about 6” behind the foul line and *facing away from the pins*, will take four and a half steps—cue words “One, two, three, four and a little bit more”—away from the foul line. The “a little bit more” allows for the extra length of the final step. (Note: When bowling at a bowling center, this will accommodate the “slide” on the final step.)
5. The bowler will begin in a staggered stance, holding the ball ready to push away and take a full four-step approach (“short, short, short, boooow!”) along with the arm swing (“out, down, swing, relax”) and release the ball. Each bowler will take two deliveries and then the team will rotate (as learned in Rotation lesson).

Safety Tip Ensure that students do not slide on the final step as their shoes are not designed to slide on the gym floor as bowling shoes slide on the approach at the bowling center.

6. Each team will make one complete rotation for practice and then another rotation for scoring.



T=Teacher S=Student

The Bowling Center

The video segment on the Instructional DVD included in the front of this manual was designed to show students what it's like to be at a real bowling center.

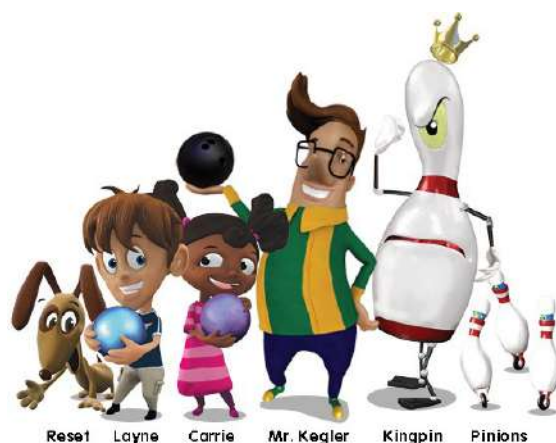
The video explains the control desk, which is where they get their shoes, lane assignments and scoring sheets. It then shows them how to pick the right ball.

The video also covers etiquette, parts of the bowling center and the lane.

Showing this video to your students at the conclusion of your bowling unit is a fun way to introduce them to the bowling center!

Bowlopolis

The bowling center you visit may be a registered Bowlopolis center. In 2008, the Bowling Proprietors' Association of America (BPAA) and the United States Bowling Congress (USBC) introduced an exciting new brand initiative—Bowlopolis. Bowlopolis is an imaginary bowling center where everyone, young and old, look to bowling for happiness, livelihood, identity and love of the sport. It is a place where fun, adventure and play help develop lifetime skills. Meet the characters of Bowlopolis—Layne, Reset, Carrie, Mr. Kegler and Kingpin at www.bowlopolis.com. (You can also locate a participating center in your area.) Bowlopolis bowling centers offer a series of 3-D animated episodes of Bowlopolis adventures on DVD. The DVD's help in educating youth on the finer points of bowling—safety, ball selection, form and sportsmanship.



Adaptive PE

Bowling is a sport that can be enjoyed by students of all ages, skill levels and physical abilities. Listed below are ways that the In-School Bowling curriculum can be modified to accommodate younger students and students with disabilities:

1. Reduce the size of the playing area:
 - Allow students to start at foul line rather than taking a four-step approach.
 - Allow students to sit at the foul line.
 - Allow students to start with the ball at their side rather than waist-high.
2. Adapt the equipment *
 - Lighter balls (3 or 4 pounds)
 - Smaller balls
 - Rubber flex grab balls
 - Handle grip balls
 - Bowling ramps
3. Adapt the activities to suit the students' abilities rather than their disabilities.
4. Begin slowly and gradually introduce new activities.
5. Assign a "buddy" to assist and make the student feel comfortable.
6. Ensure that all students respect each other.
7. Praise success—even small accomplishments!

For more information about Adaptive Physical Education, visit PE Central at www.pecentral.org.

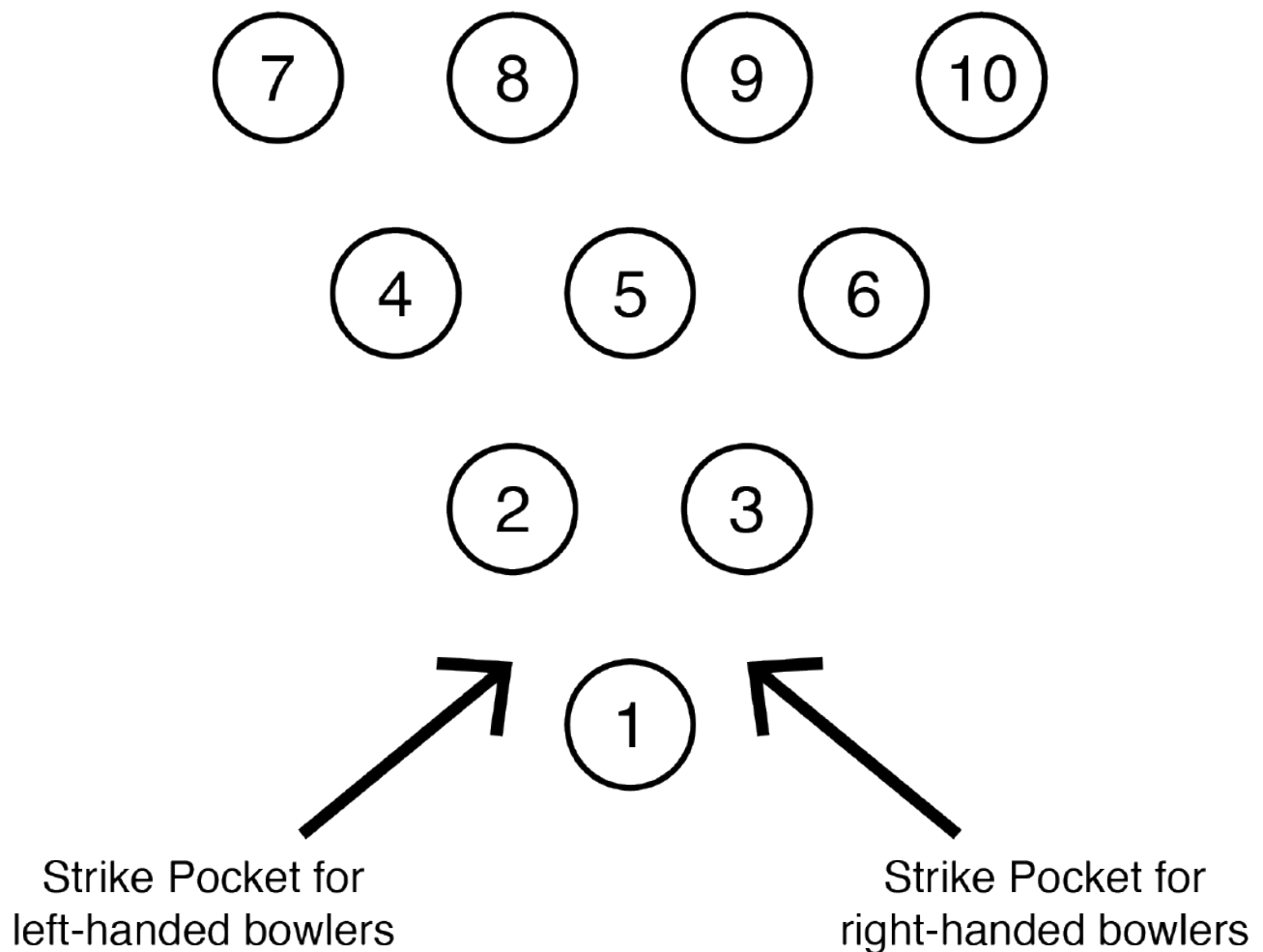
* This equipment is available through most PE resource catalogs.

Advanced Tips - Strike Pocket

The objective of bowling is to knock down as many pins as possible. The easiest way to achieve that is by making as many strikes as possible.

For bowlers to score a strike, they should aim for the strike pocket. The strike pocket is an area on the pin triangle between the number 1 and number 3 pins for a right-handed bowler and between the number 1 and number 2 pins for left-handed bowlers (*see diagram below*).

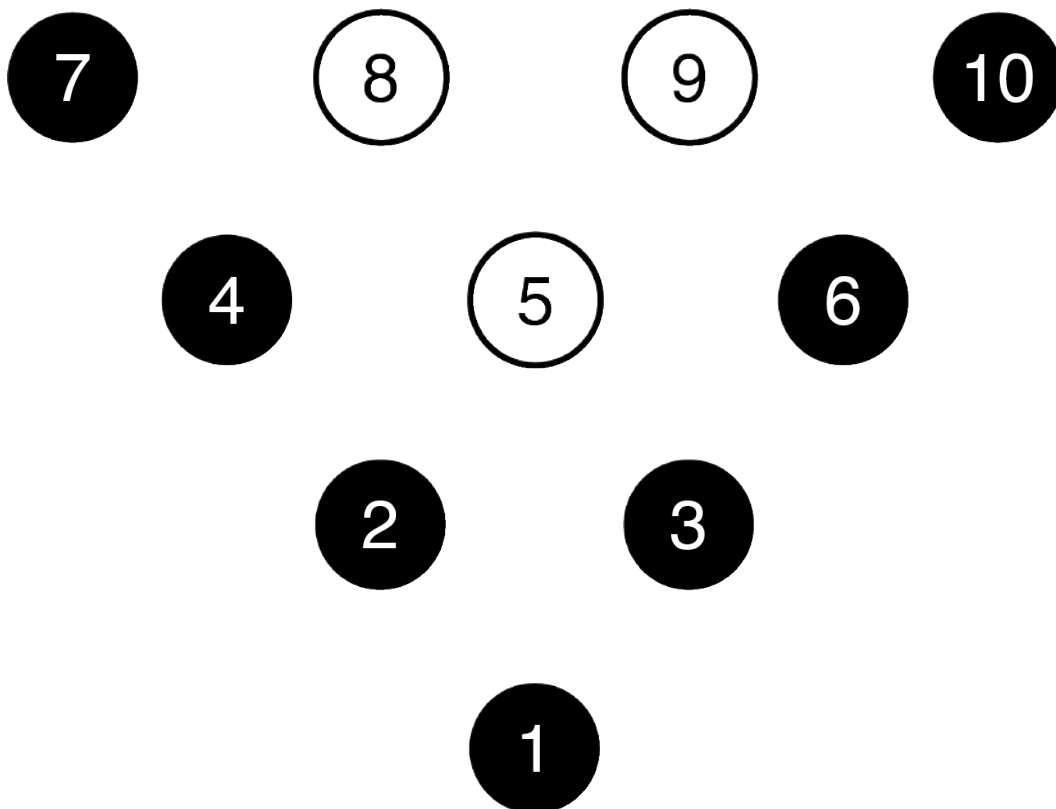
A ball that enters through the strike pocket of the pin triangle at the proper angle and speed will create a domino effect, called pin action, causing pins to bounce off each other as they fall, making more pins fall. Since a hook creates the maximum pin action, bowlers should try to roll a hook ball on their strike shot.



Advanced Tips - Spare Shooting

One method of spare conversion is the use of “key” pins. The ten pins in the pin triangle are numbered—see diagram below. The seven outside pins that form a “V” and point toward the bowler are the key pins. Any spare can be made by simply aiming at one of the seven key pin positions.

While the angle of a shot may change, the line of the ball remains the same, as does the ball speed and the method of ball delivery. In converting spares, it is important to identify the key pin for each spare shot. The first movement should be to the left or right on the approach to realign your starting position with the locator dots. The target area for any spare will be either the second or third arrow from the right side. Slight adjustments may be made to suit the particular delivery of a bowler; however, changes should not be made until a bowler is rolling a consistent ball that is hitting the intended mark.



SCORESHEET



Date: _____

Star Bowler's Name	1	2	3	4	5	6	7	8	9	10
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Date: _____

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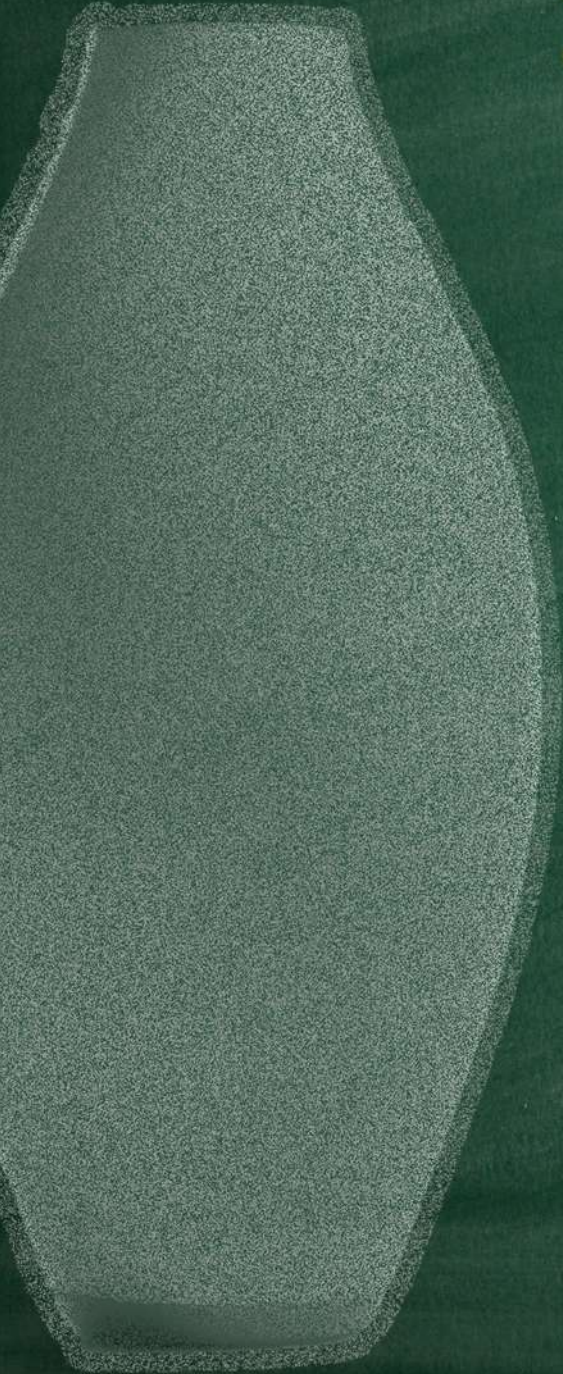
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Star Bowler's Name	1	2	3	4	5	6	7	8	9	10
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Bowler's Ed

Fitness & Fun



Bowling for Fitness & Fun

Bowling is fun and GREAT exercise. The average adult bowler burns 240 calories per hour and uses 134 muscles during the basic four-step approach. Three games of bowling is equivalent to walking 1 mile and bowling is a weight-bearing sport which helps build strong, healthy bones.

In this section, you will find fun activities combining bowling with subjects such as art, history, math and spelling as well as challenging cardio, coordination and balance exercises. These educational activities are separated into grades K-2, 3-5 and 6-8. Look for the symbols on each exercise designating recommended grade levels and refer to the coded matrix on the following page to quickly identify which activities would be most appropriate for the age level you are teaching plus what physical activity and/or subject is emphasized.



	Page	Cardio	Strength Training	Coordination	Balance	Vocabulary	Reading Comprehension	Art	Spelling	Math
K-2	Circuit Bowling	3								
	Bookmark Bowling	9-12								
	Spelling Bee Bowling	13								
	Bingo Bowling	14-15								
3-5	Circuit Bowling	3								
	Cardio Bowling	4								
	Fitness Roll	5								
	Jump Rope	6								
	Relay Bowling	7								
	Bookmark Bowling	9-12								
	Spelling Bee Bowling	13								
	Bingo Bowling	14-15								
	Make That Spare	16								
		Circuit Bowling	3							
6-8	Cardio Bowling	4								
	Fitness Roll	5								
	Jump Rope Bowling	6								
	Relay Bowling	7								
	Speed Bowling	8								
	Bookmark Bowling	9-12								
	Spelling Bee Bowling	13								
	Bingo Bowling	14-15								
	Make That Spare	16								
	Spare Me	17								
Spare Spectacular	18									
Team Bowling for Dollars	19									

Circuit Bowling

K-2

3-5

6-8

Purpose: Incorporates circuit training into the bowling program

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. All ten pins should be placed on each lane. Across from each lane, a “station” should be set up with an additional activity. (Examples: juggling, weight training, jump-roping, balancing, dance moves, or ball handling skills).

Activity time: Varies.

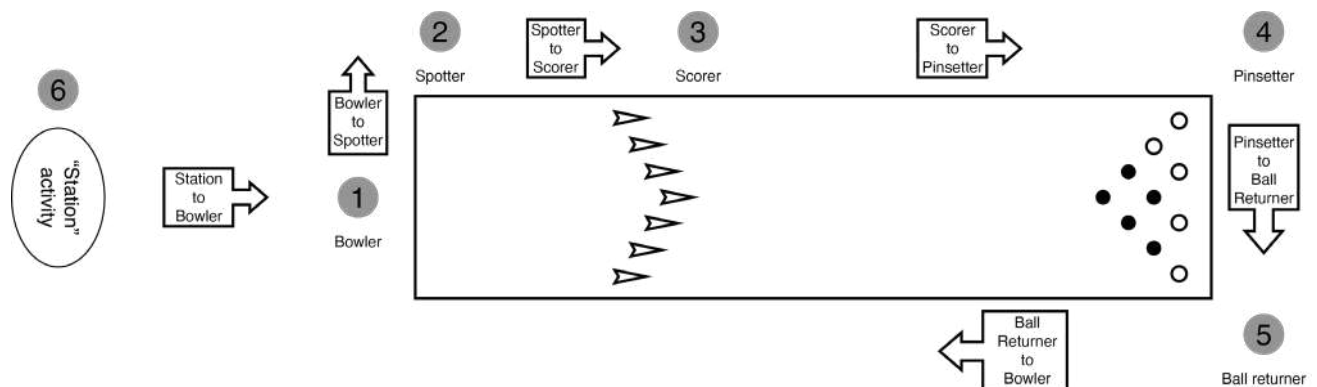
Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane
4. Additional equipment depending on types of station activities chosen



Instructions:

1. Divide students into teams of 5 and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - **Bowler:** Takes two deliveries of the ball.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
3. Ensure that everyone understands the positions.
4. The bowler takes two deliveries.
5. Each student rotates positions on the lane (see diagram below).
6. The ball returner rotates to the “station” activity.
7. The student at the “station” activity then rotates to the bowler.



Cardio Bowling

3-5

6-8

Purpose: Warm-up activity

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. All ten pins should be placed on each lane.

Activity time: This is a timed activity. The total pins knocked down in the allotted time period determines the winner.

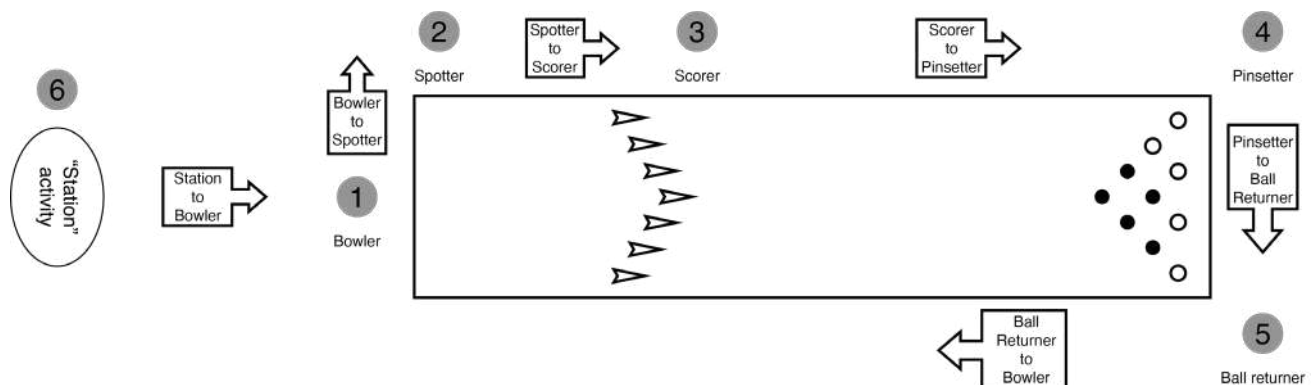
Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane
4. Notepad and pencil for scoring
5. Cone or other marker



Instructions:

1. Divide students into teams of 5 and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - **Bowler:** Takes one delivery of the ball.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
3. Ensure that everyone understands the positions.
4. In this activity, each bowler takes one delivery and then sprints to the next position.
5. As the allotted time expires, have each team add their scores. The team with the highest score is the winner.



Fitness Roll

3-5

6-8

Purpose: Incorporates more fitness into the bowling unit.

Setting: Gymnasium, multi-purpose room or outside covered area. Bowling lanes should be set up along with various fitness activities, such as mats for sit-ups, v-sit, and push-ups; jump ropes; hula hoops; arm circles; jumping jacks; around the world twist; and toe touches.

Activity time: Varies

Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane
4. Three mats (one for sit-ups, one for push-ups, and one for the v-sit)
5. 30 jump ropes
6. 10 hula hoops
7. 6 station cards with the following exercises on them:
 - jumping jacks
 - toe touches
 - around the world waist twist
 - arm circles
 - knee lifts
 - the v-sit
8. Stickers numbered 1-10 to be placed on the bowling pins or a magic marker to mark the pins 1-10.



Instructions:

1. Divide students into teams of 5.
2. Assign each team to a lane.
3. Each student will take two rolls. After the two rolls, the student goes down the lane and looks at the pins that are not knocked down. Each pin has a number on it, and before the student can get back in line to bowl, he/she must go to the correlating number stations and complete the fitness activity at that station. For example, if the bowler did not knock down pins 3, 4, and 8, he/she would go to those stations and do the exercise on the station card before returning to the bowling lane for another turn. Before the student leaves the lane, he/she must reset the pins for the next bowler.
4. Ensure everyone understands the activities by allowing one group to demonstrate.

*Activity submitted by Elaine Harmon
West Gate K-8 - Port St. Lucie, FL*

Jump Rope Bowling

3-5

6-8

Purpose: Incorporates jump roping skills into the bowling program

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. All ten pins should be placed on each lane.

Activity time: Varies

Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane
4. A jump rope for each student



Instructions:

1. Divide students into teams of 5 and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - **Bowler:** Takes two deliveries of the ball.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
3. Ensure that everyone understands the positions.
4. The bowler takes two deliveries.
5. After the two deliveries, the team will complete the designated jump rope skills for that frame.
6. The number of jumps required is dependent upon the number of pins knocked down. (Example: The bowler knocks down 8 pins and leaves 2 standing. The team would jump 12 times--10 for the total number of pins, and 2 for the 2 pins left standing.)
7. The team will then rotate positions until every student has been the bowler (see Rotation on page 9).
8. **Teaching tip:** Have students tie the jump ropes around their waist when they are not in use.

Frame 1 = Basic bounce	Frame 6 = Backwards
Frame 2 = Right leg only	Frame 7 = Teacher’s or students’ choice
Frame 3 = Left leg only	Frame 8 = Wounded duck
Frame 4 = Straddle	Frame 9 = Double unders
Frame 5 = Stride	Frame 10 = Basic at double speed

Relay Bowling

3-5

6-8

Purpose: Students learn accuracy

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. To begin, only the number one (head) pin should be placed on the lane.

Activity time: 5 minutes

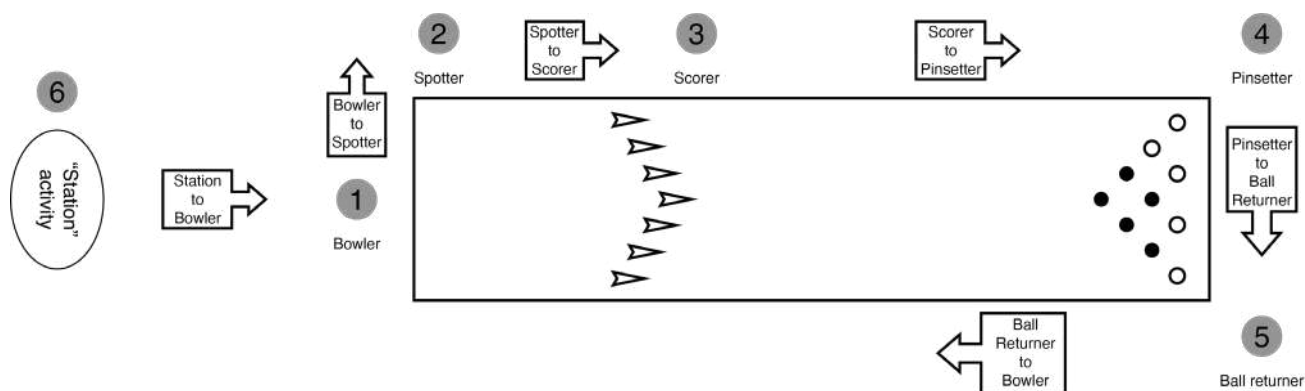
Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane



Instructions:

1. Divide students into teams and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - **Bowler:** Takes two deliveries of the ball.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
3. Ensure that everyone understands the positions.
4. The bowler takes one delivery, attempting to knock down the number one pin.
5. The entire team rotates one position. The next bowler gets one delivery and attempts to knock down the number one AND number two pins.
6. The entire team rotates again. The next bowler gets one delivery and attempts to knock down the number one, number two, AND number three pins.
7. If the bowler is NOT successful at knocking down the pin(s), the team still rotates. The next bowler will attempt to knock down the same combination of pins that was
8. just missed.
9. The game continues until one team knocks over all ten pins in one delivery.



Speed Bowling

Purpose: Students get quite a workout while working in a cooperative environment

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. All ten pins should be placed on the lane.

Activity time: This is a timed activity that should be limited to 5-7 minutes.

Equipment:

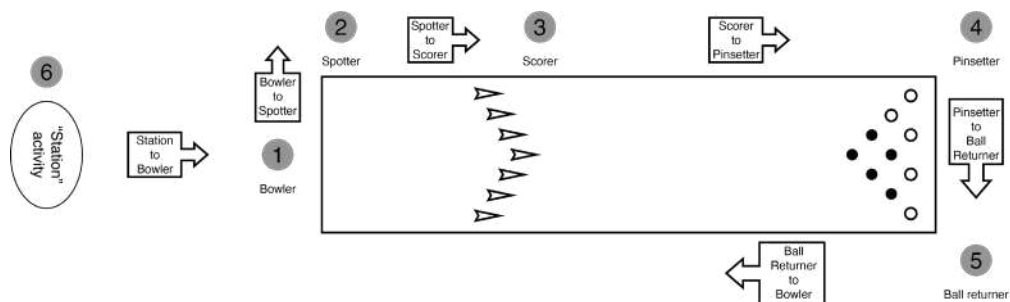
1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane
4. Pencil and pad for scoring



Instructions:

1. Divide students into teams of 5 or more and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - **Bowler:** Takes 2 deliveries of the ball —there can be 3 or more bowlers on the lane.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
3. Ensure that everyone understands the positions.
4. Instruct all bowlers to use the same number of steps in their approach (four, one, or none) and bowl from the balance position at the foul line.
5. The bowler gets two deliveries.
6. Pins are reset after EACH delivery.
7. The ball returner must sprint to the bowler and hand the ball to the bowler for the next delivery. The ball returner must then sprint back to the ball returner position and give the pinsetter a high five.
8. The bowler may not begin the next delivery until the ball returner and pinsetter have concluded the high five.
9. After the bowler has taken two deliveries, the team rotates.
10. The “Speed Bowling Champion” for the day is the team that knocks down the most pins in the time allotted.

Hint: To simplify scoring, have the scorekeepers write down the number of pins knocked down on each delivery and add them up at the end of the time limit.



Bookmark Bowling

K-2

3-5

6-8

Purpose: Kids work cooperatively and learn bowling terminology and pin positions.

Setting: Gymnasium

Activity time: This activity could work in any length PE class for one or more days

Equipment:

1. Bowling Lanes
2. 10 pins for each lane
3. 1 ball for each lane
4. Bookmark Bowling Portfolio (see following page)
5. Bowling Bookmarks for Strikes (see following pages)
6. Bowling Bookmarks for Spares (see following pages)
7. Colored pencils



Instructions:

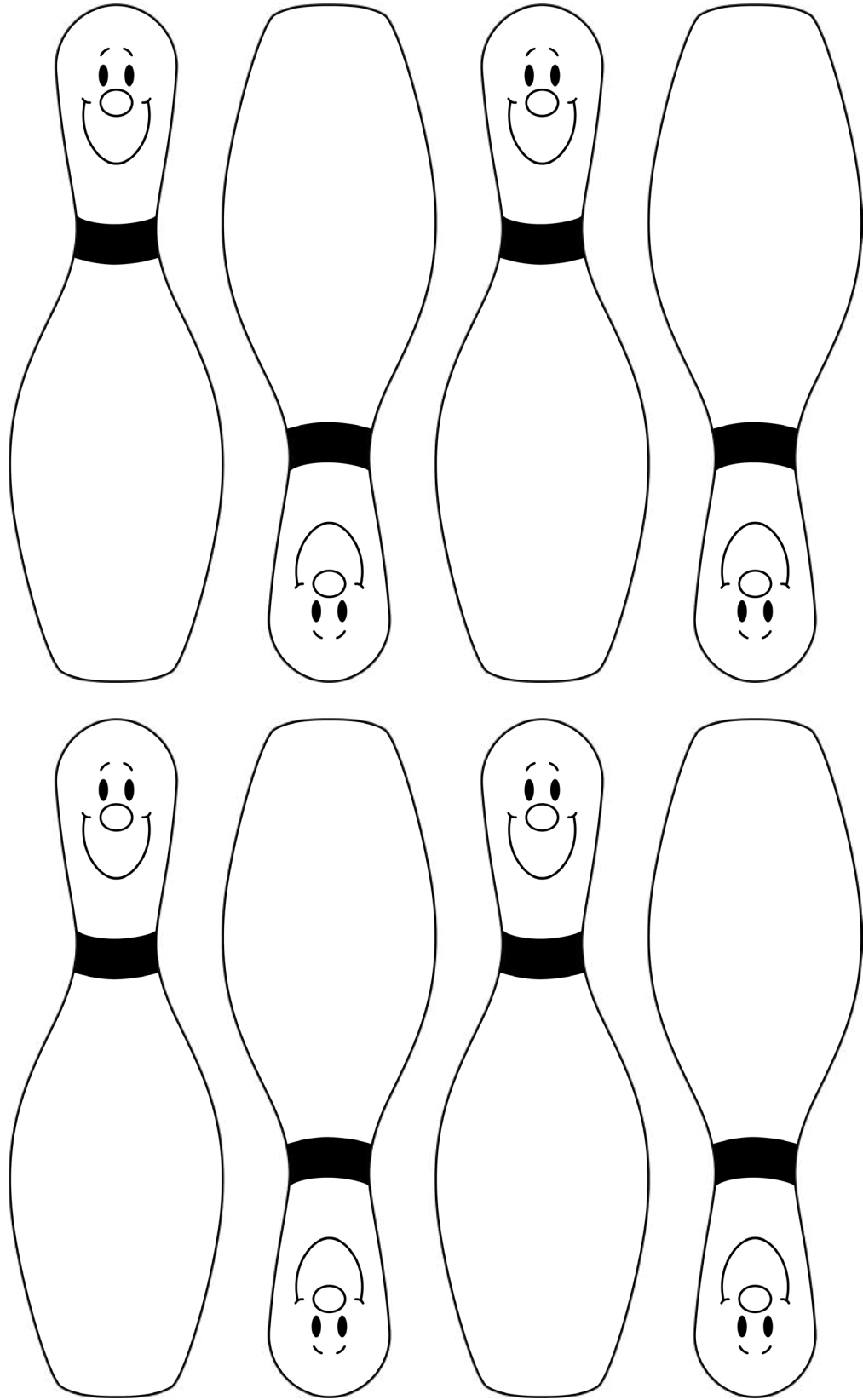
1. Make copies of Bowling Bookmarks for Strikes and Bowling Bookmarks for Spares on colored and/or white paper and cut out with a paper cutter.
2. Make copies of Bookmark Bowling Portfolio page showing numbered pins.
3. Clearly post definitions of a strike and spare. Review with class prior to starting activity.
4. Student will take two deliveries and then rotate. Once student has rotated, he/she can then color in the pins knocked down.
5. Primary students use one color pencil to color in all the pins knocked down each turn. Intermediate students use 2 different color pencils to represent 2 balls.
6. To get a bookmark, students show the teacher their paper after they have bowled a strike or spare. At this point, the teacher can interact with that individual, asking them to explain what the coloring represents and encourage them to use the proper terminology.
7. The bowling portfolio page is kept in the student's PE portfolio at the end of the bowling unit or could be sent home with the student.

Activity submitted by Jennifer Shaw
View Ridge Elementary School – Seattle, WA

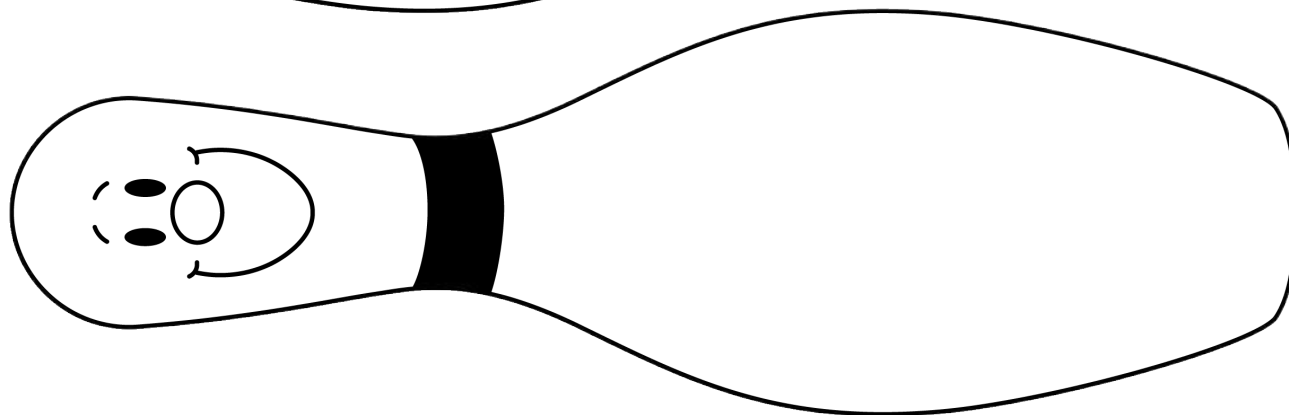
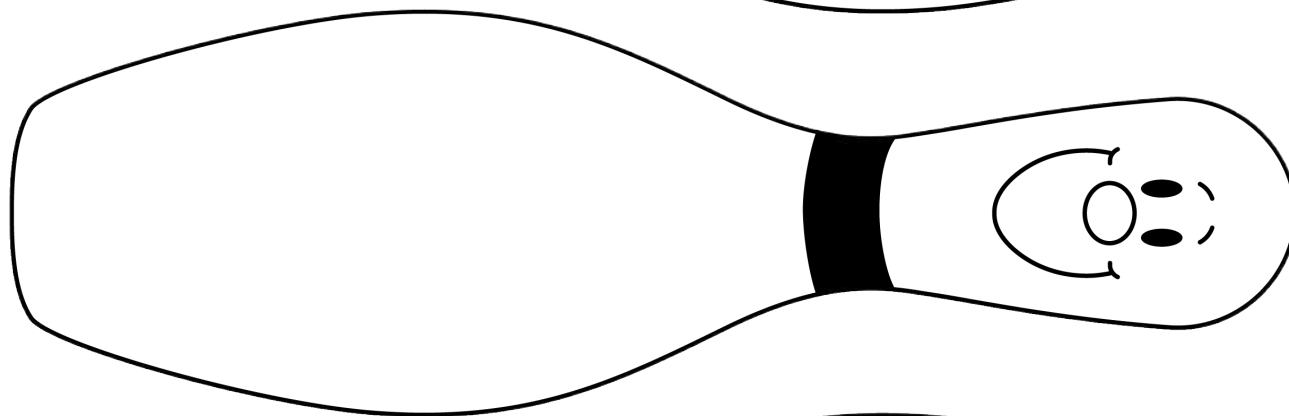
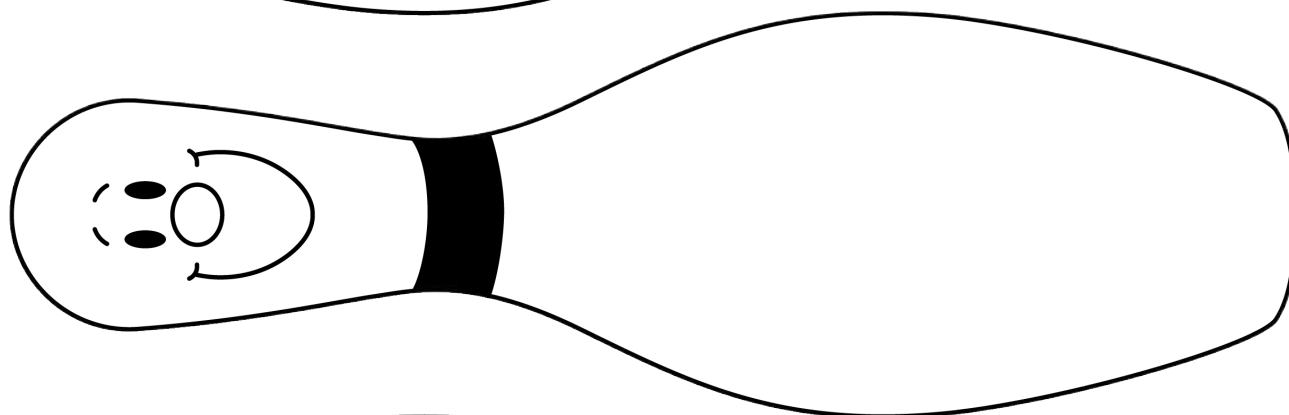
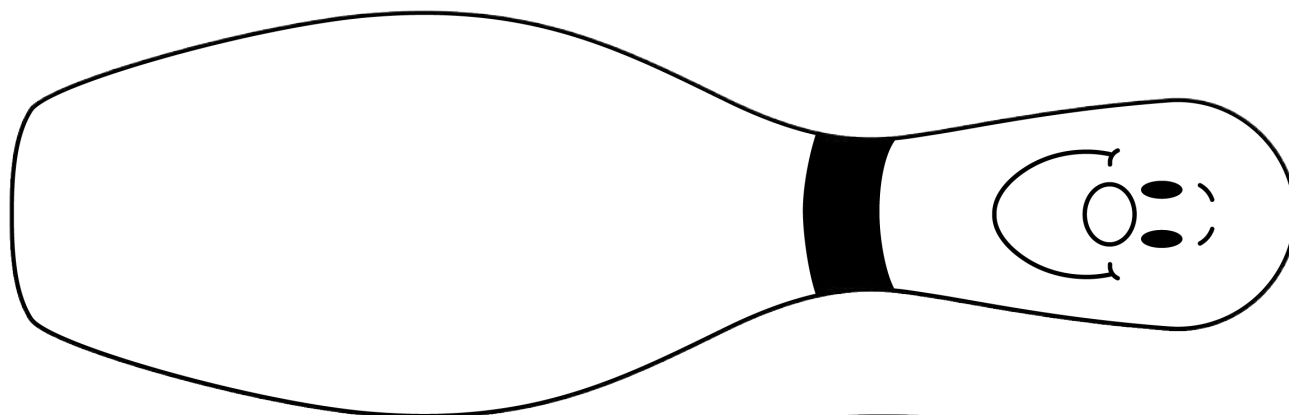
Bookmark Bowling Portfolio

1 2 3 4 5 6 7 8 9 10 11 12

Bowling Bookmarks for Spaces



Bowling Bookmarks for Strikes



Spelling Bee Bowling

K-2

3-5

6-8

Purpose: Incorporates spelling into your bowling program

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. All ten pins should be placed on the lane.

Activity time: Varies

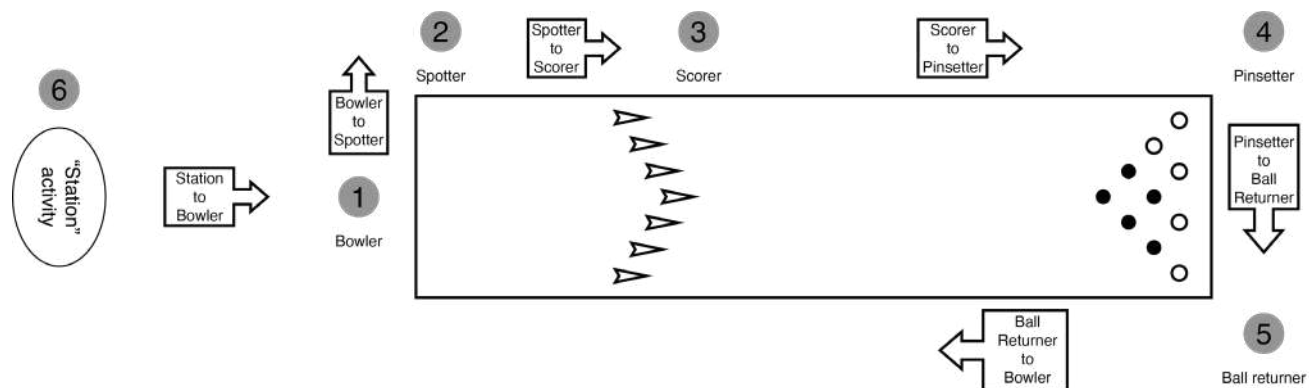


Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane
4. One set of alphabet flash cards for each lane. You should include 3 of each commonly used letter ("e" for example).
5. A list of vocabulary words. Use bowling vocabulary words, names of muscles and bones, spelling words from classroom, etc.

Instructions:

1. Divide students into teams of 5.
2. Assign each team to a lane.
3. Each student will have a "position" on the lane:
 - **Bowler:** Takes 2 deliveries of the ball. For this activity, there can be 3 or more bowlers on the lane.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
4. Choose the vocabulary word.
5. Each lane will have cards with the letters in that vocabulary word.
6. The bowler will take two deliveries. For every strike scored, the team may lay down two letters in the word. For every spare scored, the team may lay down one letter in the word.
7. After the bowler has taken two deliveries, the team will rotate positions.
8. The first team to spell the word wins that round.



Bingo Bowling

K-2

3-5

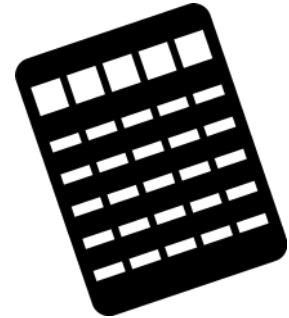
Purpose: Enhances bowling skills and math skills

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. All ten pins should be placed on the lane.

Activity time: Varies; activity lasts until Bingo is scored.

Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. A bingo bowling card for each student (see following page)



Instructions:

1. Divide students into teams of 5 or more and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - **Bowler:** Takes 2 deliveries of the ball. For this activity, there can be 3 or more bowlers on the lane.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
3. Ensure that everyone understands the positions.
4. The bowler will take two deliveries. The team will mark off the correct spaces on the bingo card in an attempt to win Bingo.

Example: The bowler knocks down 6 pins with the first ball and 2 pins with the second ball. The team can mark off a 6 and a 2 or the total of the two deliveries, which is 8.

5. To score a “0,” the bowler must roll the ball on the lane and miss all remaining pins.
6. The first team to get “Bingo” wins.

Bingo Bowling Card

For use with the Bingo Bowling activity on previous page.

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

7	9	10	0	1
1	5	2	8	4
4	10		10	3
0	3	6	8	7
6	10	9	5	2

Name _____

Make That Spare

3-5

6-8

Purpose: Incorporates basic math into the bowling unit

Setting: Gymnasium or multi-purpose room. Bowling lanes should be set up. Three pins should be placed on the lane. This activity is best conducted as a class activity.

Activity time: 5 minutes

Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. One ball for each lane
4. Two dice



Instructions:

1. Divide students into teams and assign each team to a lane.
2. Each student will have a “position” on the lane:
 - **Bowler:** Takes 2 deliveries of the ball. For this activity, there can be 3 or more bowlers on the lane.
 - **Spotter:** Watches the bowler for fouls, helps with technique (follow through, balance, etc.), and assists scorer if necessary.
 - **Scorer:** Keeps count of the number of pins knocked down.
 - **Pin setter:** Resets pins after each delivery.
 - **Ball returner:** Returns the ball to the bowler.
3. A designated player will roll the dice to determine which spare the class will be bowling for. (Example: The player rolls a 5 and a 2. The 5 and 2 pins, along with the 7 pin—the sum of 5 and 2—are set up. The three pins make up the spare that must be converted.)
4. The bowler receives a maximum of two deliveries. If the spare is not made on the first delivery, reset the same spare and let the bowler take a second turn. If the bowler does not make the spare on the second delivery, the students rotate (see Rotation on page 9) and the next student will attempt the same spare.
5. The first team to make the spare in one delivery gets one point.
6. The next spare combination is determined by another roll of the dice.

NOTE:

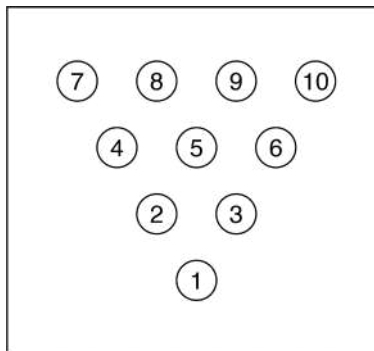
- Any time the total of the two dice is eleven (a 6 and a 5), only those two pins are set up for the spare.
- A roll that produces doubles means that all ten pins must be set up. The bowler must roll a strike! The first team to make the strike in one delivery gets two points.

Spare Me

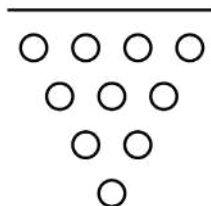
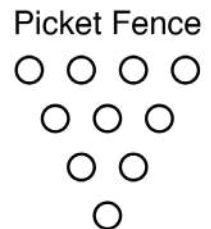
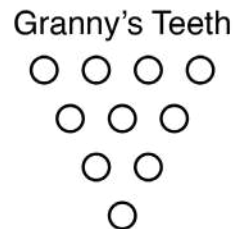
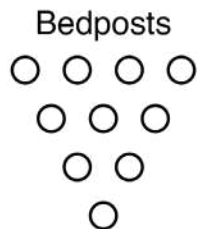
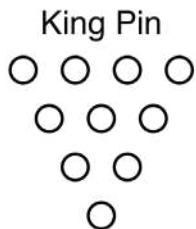
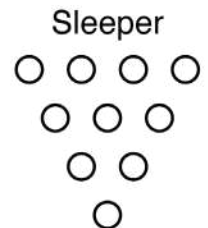
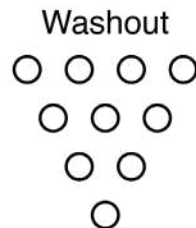
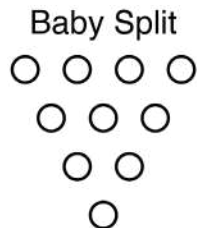
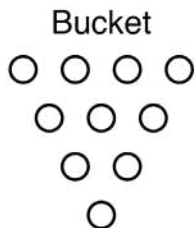
As in any sport or game, bowling has special terminology. Certain groups of pins left standing after the first ball are described by the following terms:

Washout = 1-2-4-10 or 1-3-6-7	Sleeper = 2-8, 3-9, or 1-5
Bucket = 2-4-5-8 or 3-5-6-9	Baby Split = 3-10 or 2-7
Bedposts = 7-10	Picket Fence = 1-2-4-7 or 1-3-6-10
Granny's Teeth = 4-6-7-9-10 or 4-6-7-8-10	King Pin = 5

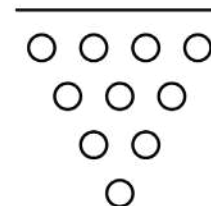
Pin Numbers:



On the sets of pins below, shade in the correct pin(s) that describe that spare.



Shade in and name two spares of your own!



Spare Spectacular!

Purpose: To learn the strategy behind making spares and to practice that strategy

Setting: Gymnasium

Activity time: Two 25 minutes classes or one 50 minute class

Equipment:

1. Bowling lanes
2. 10 pins for each lane
3. 1 ball for each lane
4. Chalk/dry erase board for teacher



Instructions:

1. After a couple of classes to work on their form and “hitting the pocket,” this lesson will set up specific spare situations.
2. Divide the class into teams and assign each team to a lane.
3. All lanes will be directed to set up the same situation (see Possible Spare Situations below). The teacher will ask students for their strategy, and then the teacher will confirm what the “experts” say.
4. On “go” the first student on each lane tries to convert the spare to score a point for the class (the teacher keeps track on the board).
5. Students run down and reset the pins for the next bowler in line.
6. Encourage students to focus and concentrate when it is their turn, but to run down to the pins when their turn is over, so that the spare situation is reset quickly. The faster the pins are set, the more spares your class will get.
7. Allow 2-3 minutes for each spare, then stop the class and set up the next situation.
8. Play music when the students are to be bowling, turn it off again to signal them to stop.
9. Tally up the class score with each spare situation.
10. At the end of the activity, tally the total number of spares they were able to get. Which was their easiest? Which was the most challenging? Can they hit more spares than the other classes? Can they beat this score next time?

Possible Spare Situations

1-2-4-7	1-3-6-10	1-2-4-10	5-9
10 pin	7 pin	1-2-8	2-4-5-8

Activity submitted by Karen Nagle Bagby
Hoover Elementary School – Iowa City, IA

Team Bowling for Dollars

Purpose: To motivate the students to roll strikes and spares

Setting: Gymnasium

Activity time: One class period (30-45 minutes)

Equipment:

1. 6 Bowling lanes
2. 10 pins for each lane
3. 1 ball for each lane
4. Play money
5. Frisbee (to put their money in)
6. 6 Team Bowling for Dollars Task Sheets (see following page)



Instructions:

1. Divide the class into 6 equal teams. Each team should have a Team Bowling for Dollars Task Sheet or you can post them on the walls.
2. Each team begins with \$1.
3. After a bowler rolls 2 balls, the bowler looks at the task sheet to find out which tasks his/her team needs to do. The number of tasks is determined by how many pins are left standing. The bowler becomes the leader and leads his team through the tasks.
4. If the bowler scores a strike or spare, the team is awarded money (\$2 for a strike and \$1 for a spare). If no pins are knocked down, the team has to pay the teacher \$1. The bowler becomes the banker to exchange money with the teacher.
5. At the end of the time period, each team adds up their money. To make it competitive, offer a reward for the team with the most money. Otherwise, just have the winning team go to the other teams and give them “high fives”.

Activity submitted by Joanie Mass
McGilvra Elementary School – Seattle, WA

Team Bowling for Dollars

TASK SHEET

Strike

\$2 for your team

Spare

\$1 for your team

9 pins down

Team jogs 1 lap around your lane

8 pins down

Team jogs 1 lap and gallops 1 lap around your lane

7 pins down

Team jogs 1 lap, gallops 1 lap, and skips 1 lap around your lane

6 pins down

Team jogs 1 lap, gallops 1 lap, skips 1 lap, and jumps 1 lap around your lane

5 pins down

Team jogs 1 lap, gallops 1 lap, skips 1 lap, jumps 1 lap and bear-walks 1 lap around your lane

4 pins down

Team jogs 2 laps, gallops 1 lap, skips 1 lap, jumps 1 lap, and bear-walks 1 lap around your lane

3 pins down

Team jogs 2 laps, gallops 2 laps, skips 1 lap, jumps 1 lap, and bear-walks 1 lap around your lane

2 pins down

Team jogs 2 laps, gallops 2 laps, skips 2 laps, jumps 1 lap, and bear-walks 1 lap around your lane

1 pin down

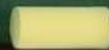
Team jogs 2 laps, gallops 2 laps, skips 2 laps, jumps 2 laps, and bear-walks 1 lap around your lane

Activity submitted by Joanie Mass
McGilvra Elementary School – Seattle, WA



Bowler's Ed

Academics



Academics

Bowling isn't JUST about fun; it's also very educational.

In this section, you will find fun activities centered around bowling to reinforce various subjects including math, language arts, nutrition, art, spelling and more.

These educational activities are again separated by grades K-2, 3-5 and 6-8. Look for the symbols designating recommended grade levels and refer to the coded matrix on the following page to quickly identify which activities would be most appropriate for the age level you are teaching plus what subject(s) is emphasized.



At the end of the section (beginning on page 57) you will find an answer key for many of the activities.

K-2

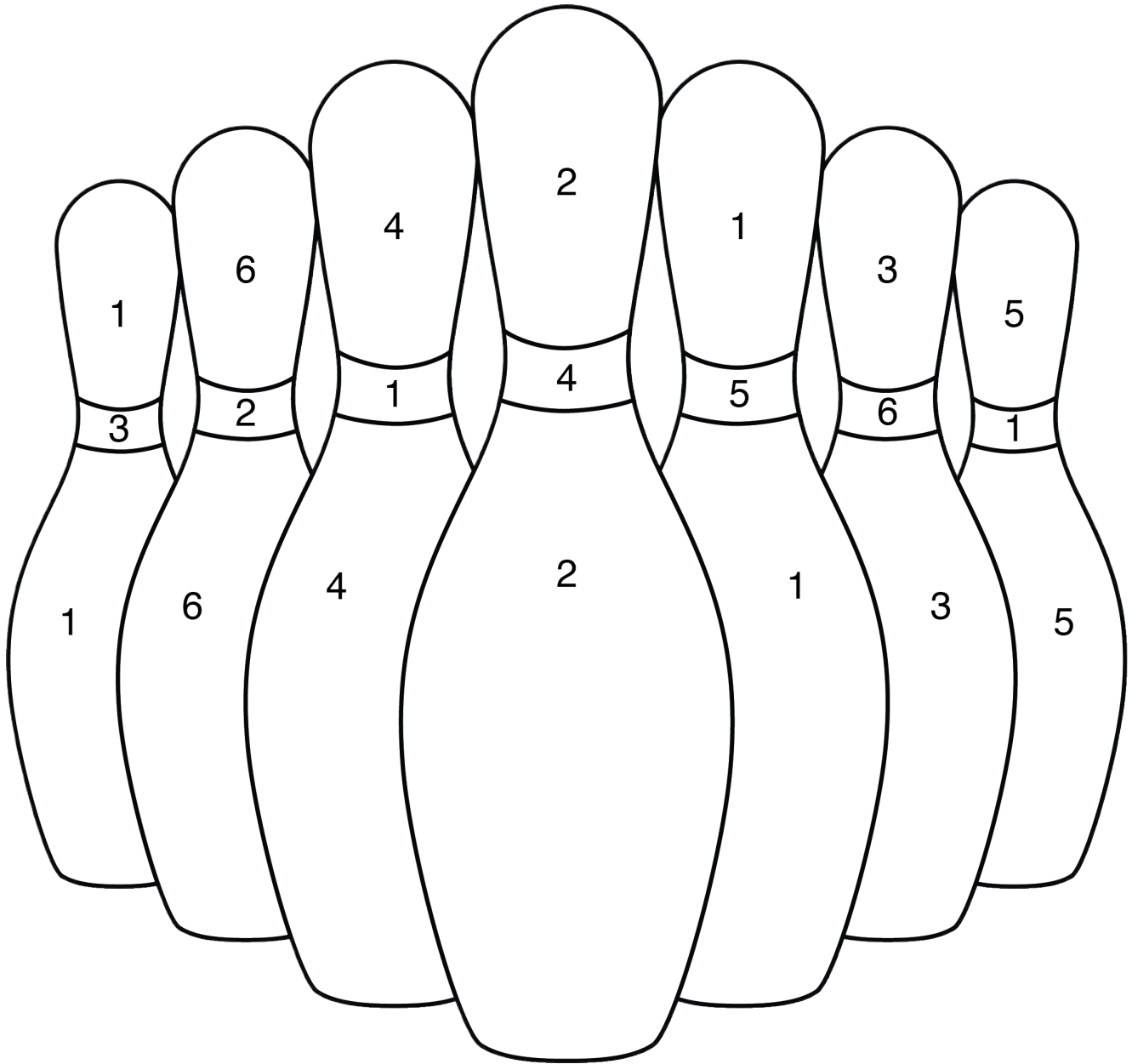
3-5

6-8

Activity	Page	Art	Computer Skill	Geography/Map Skills	Health/Nutrition	History	Language Arts	Math	Physical Education	Poetry	Problem Solving	Reading Comprehension	Spelling	Social Studies
Color by Number	3													
Connect the Dots	4													
Connect the Dots II	5													
Connect the Dots III	6													
Crazy Maze	7													
Criss-Cross Words	8													
Follow That Line	9													
Hidden Words	10													
How Many?	11													
Match That Pin	12													
Action Verbs	13													
Around the World	14													
Bowling Ballads	15													
Bowling Center Tour	16													
Bowling Maze	18													
Bowling Scorecards	19													
Color by Number	21													
Connect the Dots	22													
Daily Health Journal	23													
Fun with Numbers	24													
Health Tips	25													
Heavy Balls	27													
Hidden Words	28													
Keeping Score	29													
Letter Change	32													
Number Search	33													
Power of the Pen	34													
Scrambled Up	35													
Scrambled Up II	36													
Shaded Squares	37													
Test Your Memory	38													
Test Your Memory II	40													
What's Your Score	42													
Word Search	43													
Bowlign A-Z	44													
Bowling Blunders	46													
Comic Strip Fun	47													
Cool New Shoes	48													
Find the Way	49													
Hidden Message	50													
Mystery Location	51													
Name That Bowler	52													
Spare Time	53													
Spare Time II	54													
Through the Ages	55													
Weights & Measures	56													

Color by Number

Using the Color Key below, color the picture.

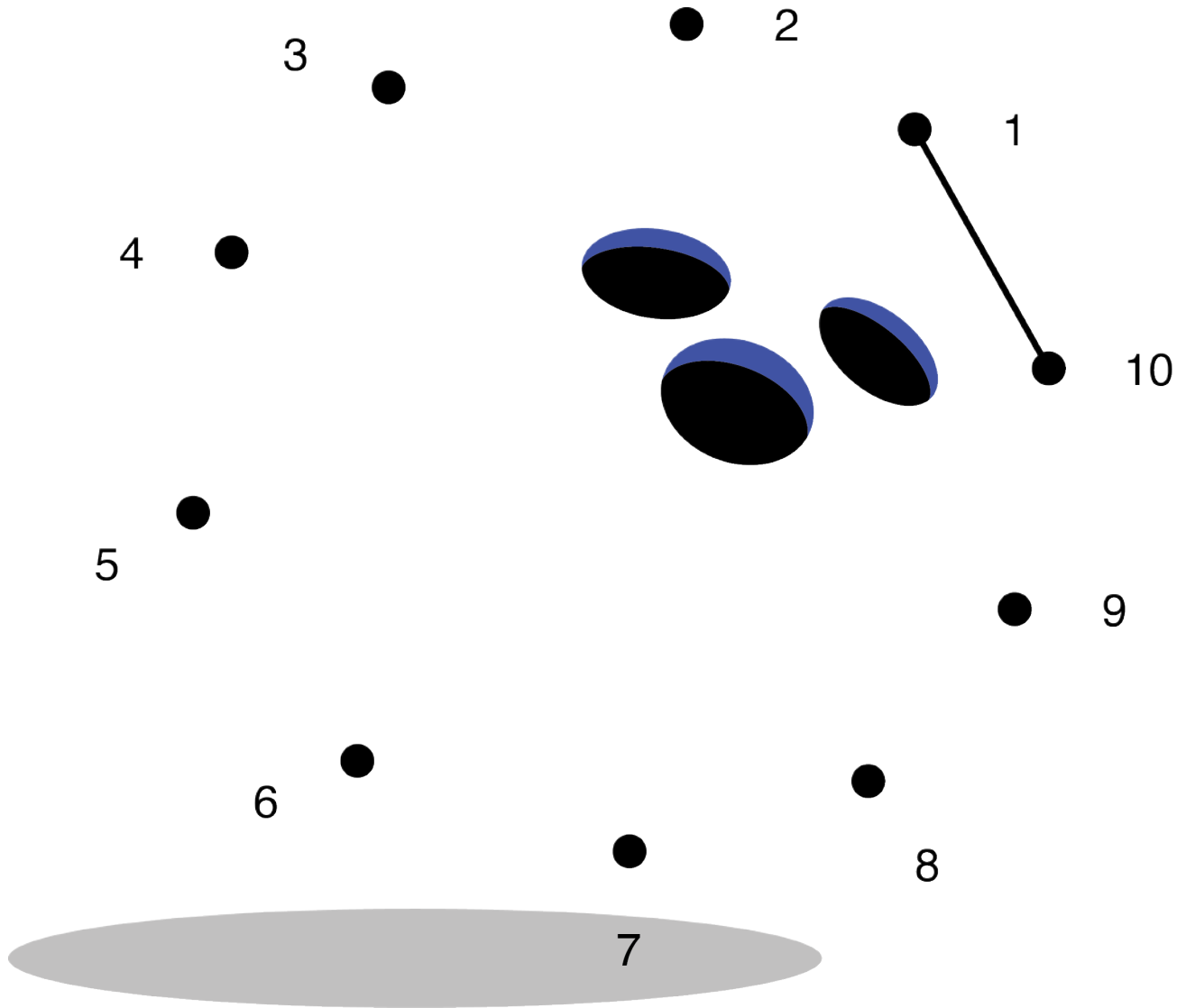


Color Key

- | | |
|------------|------------|
| 1 = blue | 4 = green |
| 2 = red | 5 = brown |
| 3 = yellow | 6 = purple |

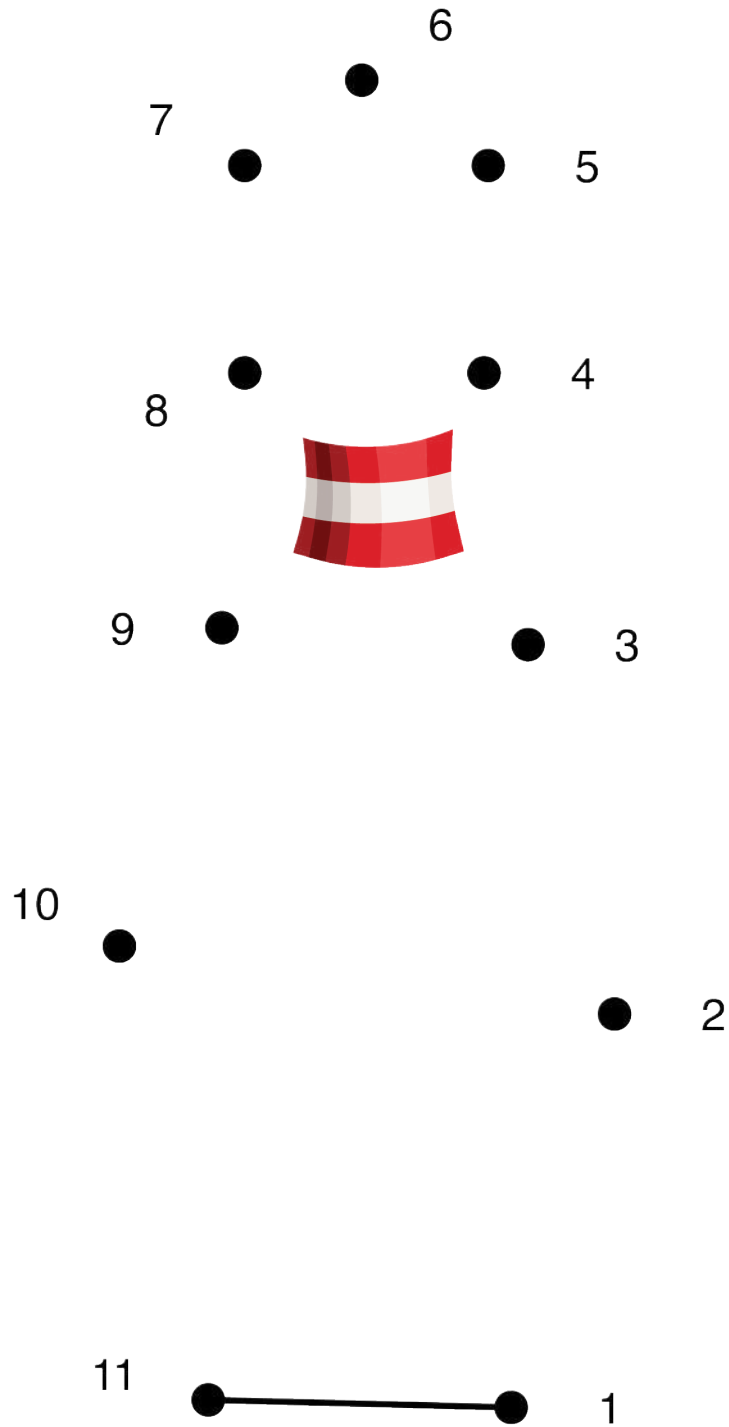
Connect the Dots

Connect the dots to reveal the hidden picture!



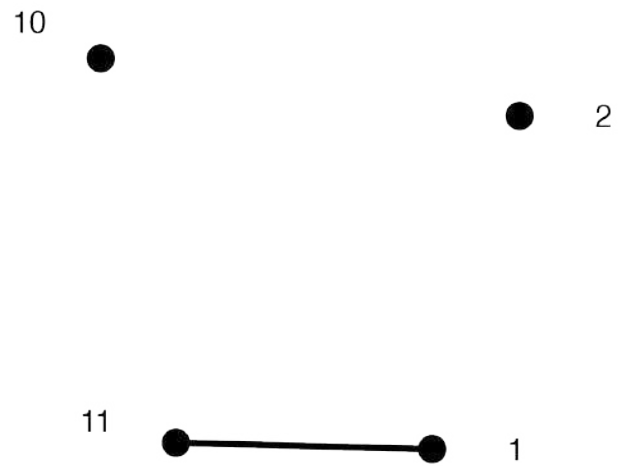
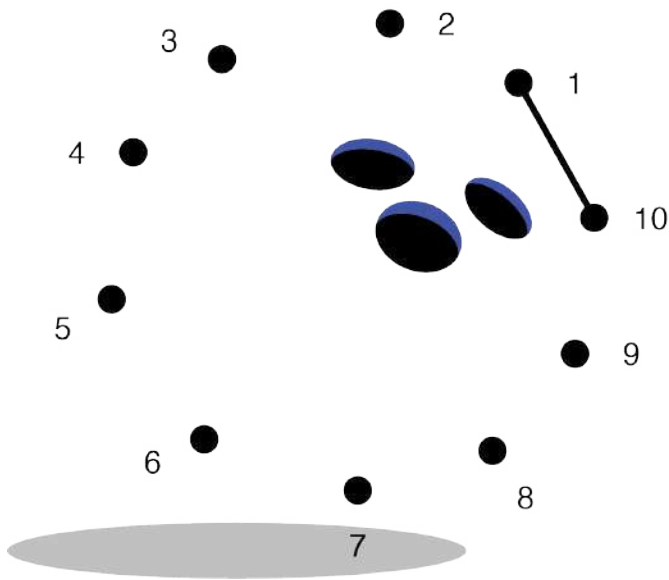
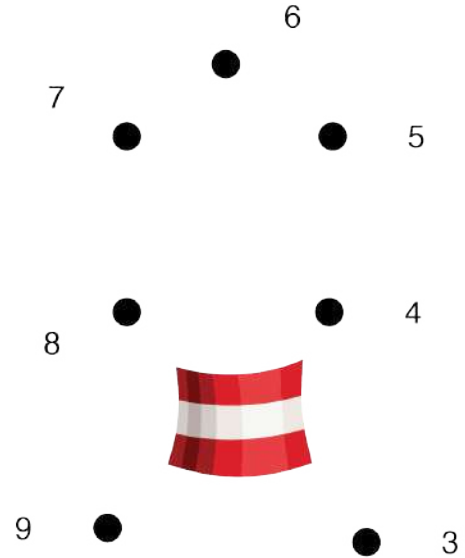
Connect the Dots II

Connect the dots to reveal the hidden picture!



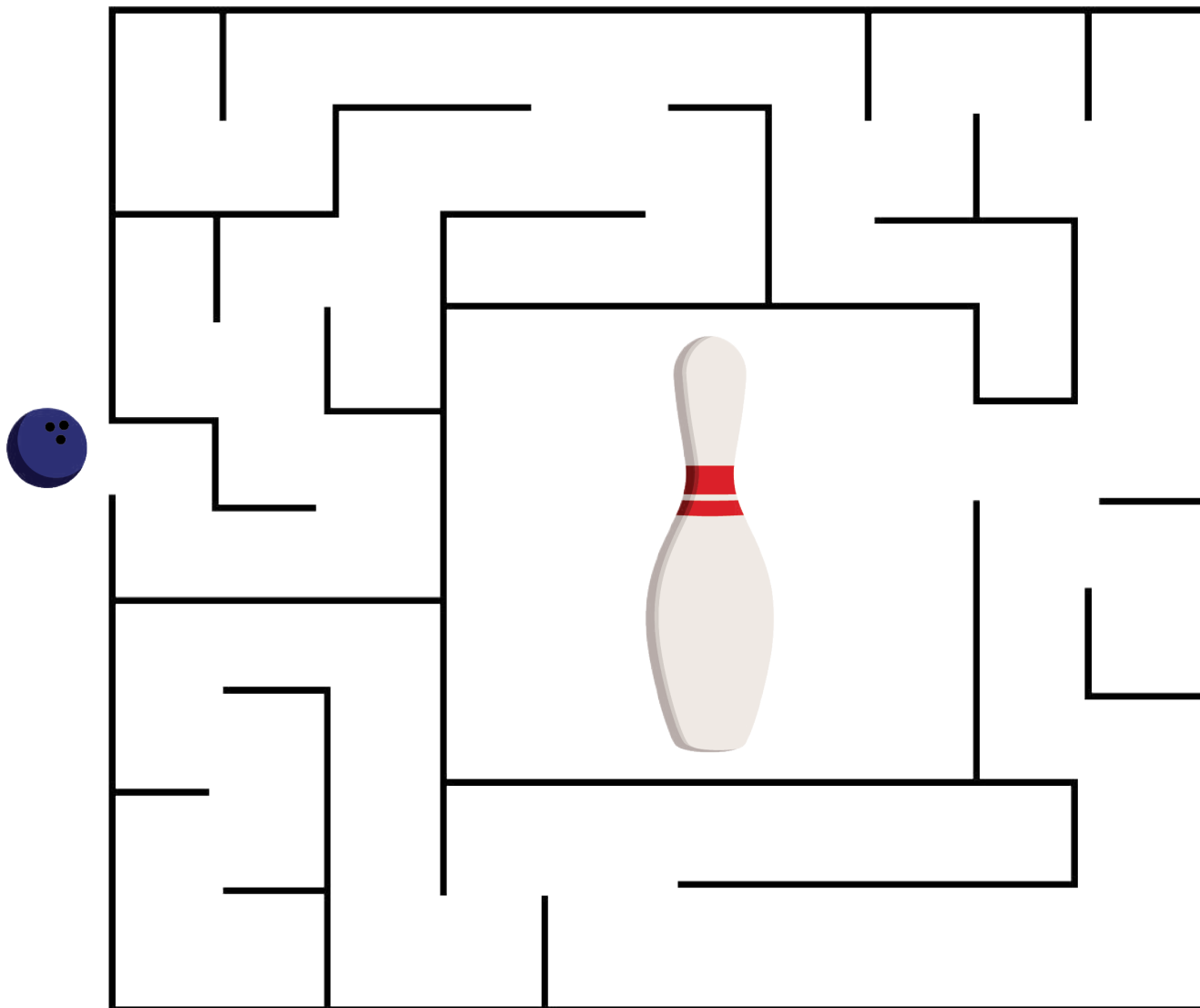
Connect the Dots III

Connect the dots to reveal the hidden picture!



Crazy Maze

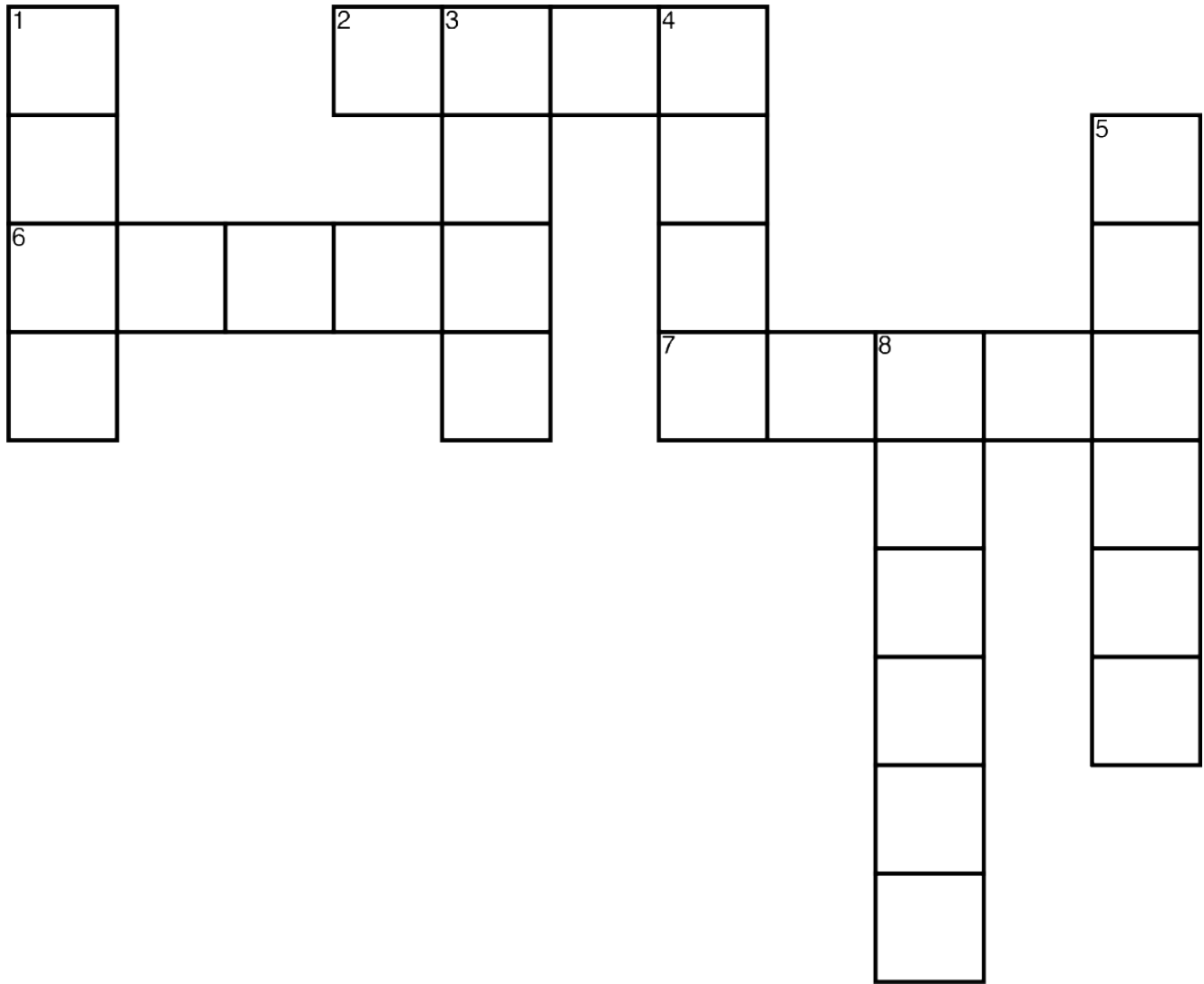
Can you help the ball find its way to the pin?



Criss-Cross Words

K-2

Can you make the words fit into the squares?

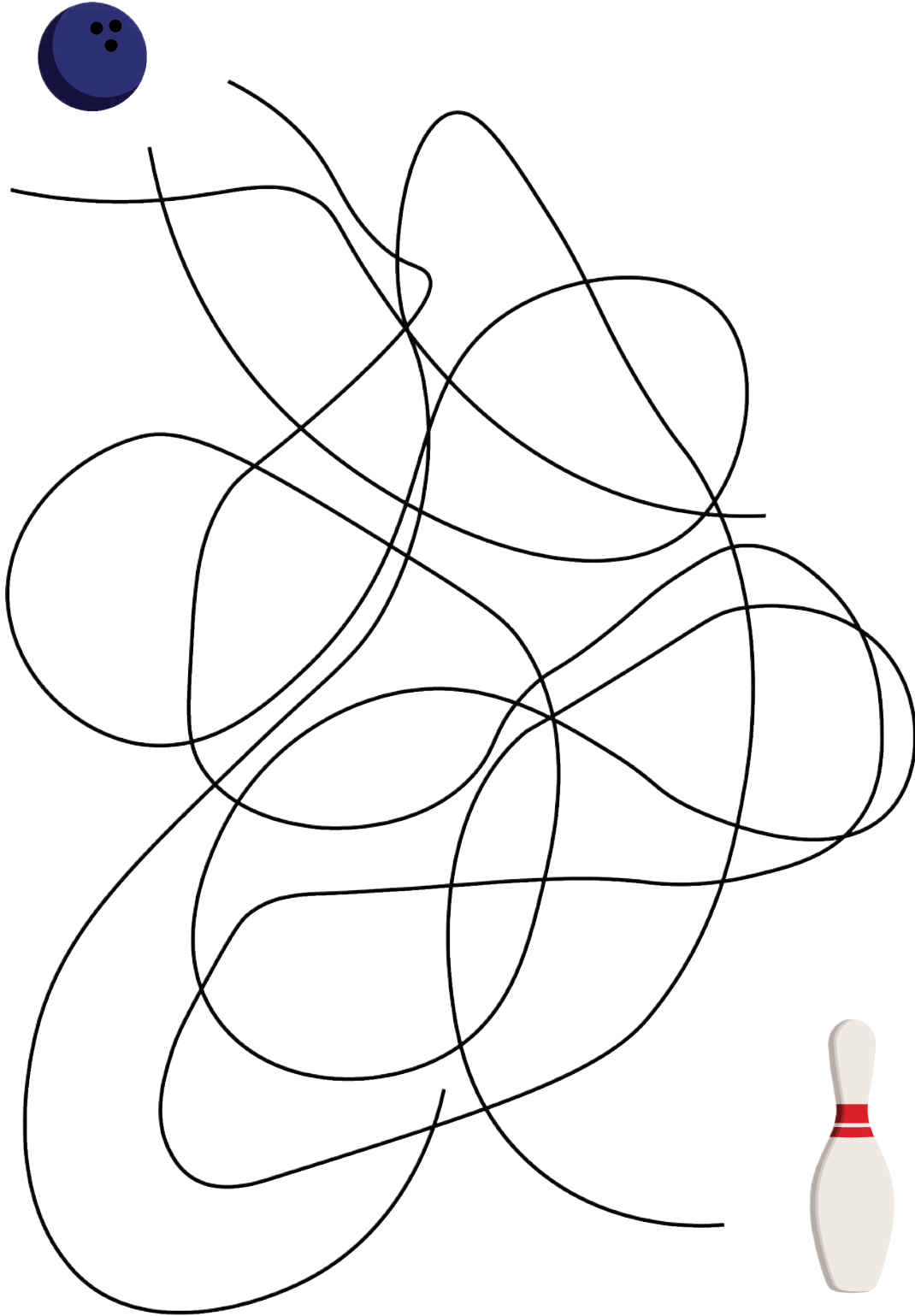


WORD LIST

Open	Strike
Bowl	Lane
Spare	Error
Return	Miss

Follow That Line!

Follow the line that will take the ball to the pin!



Hidden Words

Can you find the hidden words? Remember to look forwards, backwards, up, down, and diagonally.

R	O	R	R	E	B	H	R	U	S
S	K	I	D	O	R	E	U	Y	T
M	I	S	S	E	P	A	O	F	R
B	X	F	E	U	R	E	P	F	I
J	O	N	F	E	Y	B	N	S	K
I	A	G	T	M	D	O	V	R	E
L	R	U	K	M	L	W	L	Y	D
Y	R	I	O	A	A	L	M	M	N
N	U	N	O	S	C	M	L	F	G
I	E	J	H	V	R	G	A	M	H

WORD LIST

Bowl
 Error
 Hook
 Lane
 Miss
 Open
 Return
 Spare
 Strike

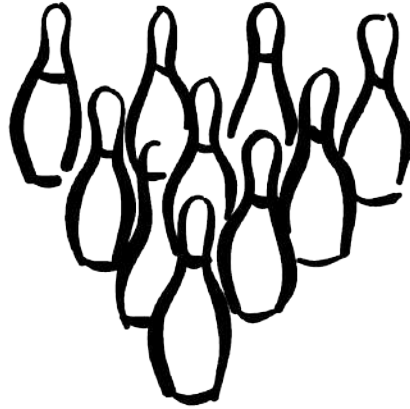
How Many?

Draw a line from the number to the picture that contains the same amount.

Five



Three



Two



Ten

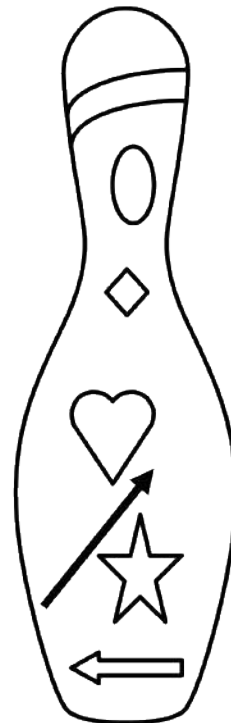
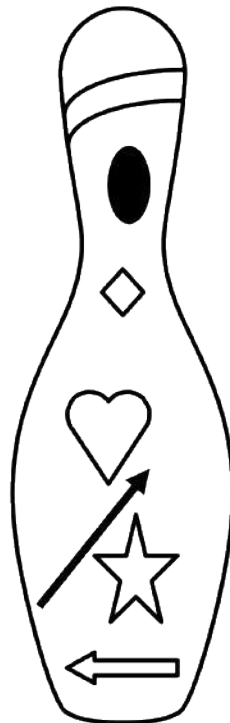
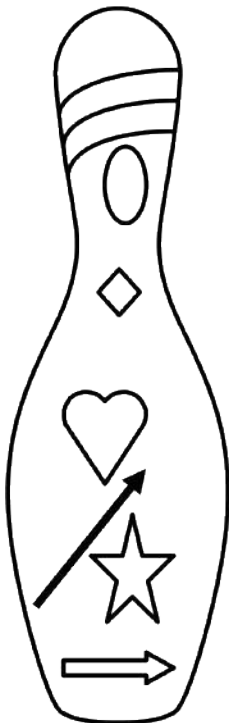
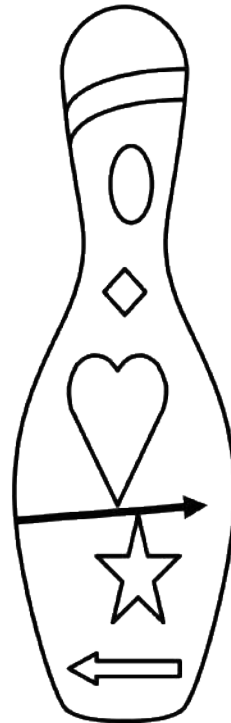
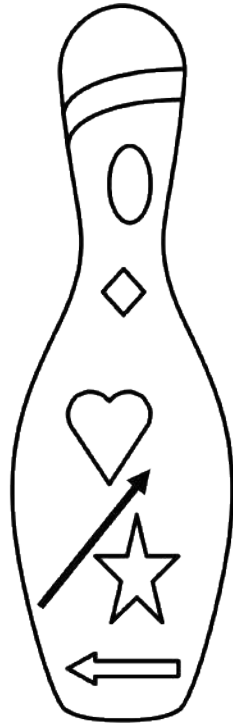


Seven



Match That Pin

Only 2 pins below are identical. Can you find them? Circle the two that are alike.



Action Verbs

Circle the Action Verb(s) in each sentence.

1. Tommy and Alicia went bowling.
2. Allison bought some pizza at the snack bar.
3. Sliding past the foul line, Caitlyn almost slipped on the oil.
4. LeRoy asked his mom if they were going bowling today.
5. Kelly sat and waited patiently for her turn to bowl.
6. Jessica came in first place in the tournament.
7. Michael bowled three strikes in a row—a turkey!
8. “Nice shot!” exclaimed Maricia.
9. Trevor got a spare in the first frame.
10. Bryan said, “Don’t cross the foul line.”
11. The ball glided down the lane—right into the channel!
12. The students told the lady at the control desk their shoe sizes.
13. Suzie found the perfect sized ball.
14. Can you guess the perfect score in bowling?
15. Tony beat Marcus in the tenth frame.

Around the World

3-5

Did you know that there are more than 10,833 bowling centers around the world in over 100 countries? More than 6,000 of them are located in the United States.

Using the Internet, locate a bowling center in another state and answer the following questions:

1. In which city is that bowling center located? _____
2. How many lanes does that bowling center have? _____
3. How far away is the bowling center from where you live? _____ Miles
4. If you drove to that center, traveling 60 miles per hour, how many hours would it take you to get there? (Round up to the next highest hour. You might get stuck in traffic or need to stop and eat a snack.) _____

Now locate a bowling center in a foreign country.

1. In which country is that bowling center located? _____
2. How many lanes does that bowling center have? _____
3. How far away is the bowling center from where you live? _____ miles
4. In what ways is that bowling center the same as the one you found in the United States?

5. In what ways is it different? _____

6. How would you travel to get to that center? _____
7. How long would it take you to get there? _____

Using a map of your city, answer the following questions:

1. Go to www.bowl.com and click on Find a Center.
2. Locate all of the bowling centers in your city.
3. Draw a bowling ball on the map to mark where each bowling center in your city is located.
4. Which bowling center is closest to your home? _____

Bowling Ballads

Ballad is another name for poem. By definition, a *poem* is a piece of literature written in meter. A poet is someone who writes poetry. Can you think of any famous poets?

There are many different types of poems. Two types covered in this lesson are *haiku* and *limericks*.

A *haiku* is a 3-lined poem with the following pattern: the first line contains 5 syllables, the second line contains 7 syllables, and the third line contains 5 syllables. Here are a couple of examples:

Bowling is a fun
Activity for many
Kids of all ages.

A ball with three holes.
Ten pins I must knock down.
A strike is what I seek!

Limericks are humorous, five-lined poems. The first, second, and fifth lines rhyme with each other, and the third and fourth lines rhyme with each other. In addition to rhyming, limericks contain a rhythm. Here is a fun limerick about bowling:

The rhythm sounds like this:

There once was a girl named Moore	da DA da da DA da DA
And bowling was a sport she adored.	da DA da da DA da DA
She once scored a strike	da DA da da DA
And the ball she did spike	da DA da da DA
Which knocked a big hole in the floor!	da DA da da DA da DA

Now, you try it!

1. On a blank sheet of paper, write a haiku and limerick poem about bowling.
2. Go to the Internet and search for different types of poems. Choose your favorite type and write a poem about bowling.

Bowling Center Tour

The size of a bowling center is defined by the number of lanes. While the average center size is 24 lanes, there are centers ranging from just two lanes to over 100 lanes!

When you walk into a bowling center, one of the first things you'll see is the customer service desk, also known as the *control desk* or *control center*. The control desk is the place where you will be assigned a lane, get your bowling shoes and pay for your games. Have you ever wondered why special bowling shoes are required? Bowling shoes have a unique leather sole that allows the bowler to "slide" on the wooden floor when bowling.

After you have received your shoes and lane assignment, you'll need to pick out a ball. Bowling balls are really colorful and range in weight from 6 to 16 pounds. How do you know which ball is right for you? There are two things to consider: First, the weight of the ball should be about 10% of your body's weight. So if you weigh 80 pounds, you should pick an 8 pound ball. Second, the finger holes should fit. To check for proper fit, put your thumb in the thumb hole and extend your middle two fingers out over the finger holes. The middle of the finger holes should line up with middle of your knuckles. Make sure that your thumb fits snugly, but not tight.

The *concourse* area is where spectators sit to watch the bowlers. Most centers allow food and beverage in this area. The *settee* area is the area where the bowlers sit to wait until it is their turn to bowl.

The bowling lane is normally 41 inches wide and 60 feet long from the foul line to the pins. On the lane, you will see locator dots and target arrows to help bowlers aim their shots. Did you know that bowling lanes are oiled daily? This helps protect them and reduce the friction caused by the ball rolling down the lane. The *approach* area is the portion of the lane behind the foul line. This is where the bowler lines up to deliver the ball. The approach must be at least 15 feet long. Along each side of the lane is a channel. A channel is there to catch a ball that rolls off the lane. To prevent your ball from going into the channel, and increase your score, most bowling centers offer *bumper guards*. Bumper guards can really help while you're perfecting your game! The last three feet of the lane is known as the *pin deck*.

The ten pins used in bowling are arranged in a triangular formation, twelve inches apart. The front pin is called the head or *Number 1* pin. Once a ball has been delivered down the lane, it is returned to the bowler by an *automatic ball return*. A *pinsetter* clears the pins that are knocked down after each delivery and resets all 10 pins at the end of the frame.

Bowling Center Tour

[continued]

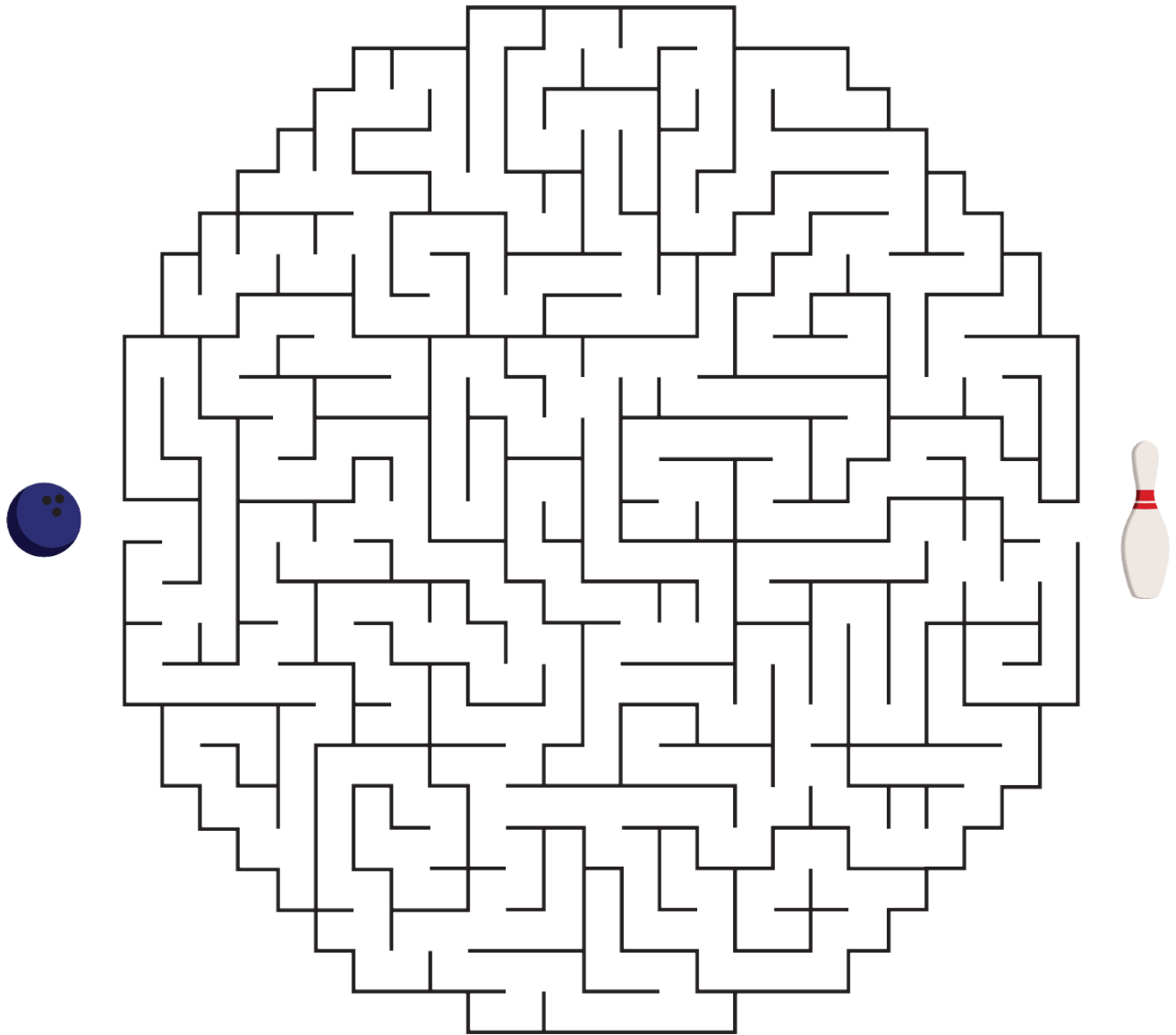
Check what you learned!

1. If you weigh 105 pounds, you should choose a ball that weight _____ pounds.
2. What device prevents your ball from going into the channel? _____
3. The _____ returns the ball to the bowler.
4. Bowlers wait their turn to bowl in the _____ area.
5. Why are special shoes required? _____
6. How is the size of a bowling center determined? _____
7. What is the name of the machine that resets pins? _____
8. Go to the bowling center. Choose a topic and write an essay: a day in the life of a pin (or a bowling ball), or why it would be fun to work in a bowling center.

Bowling Maze

3-5

Help the ball find its way to the pin!



Bowling Scorecards

Name _____

Date _____

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

Bowling Scorecards

Name _____

1	2	3	4	5	6	7	8	9	10			

1	2	3	4	5	6	7	8	9	10			

1	2	3	4	5	6	7	8	9	10			

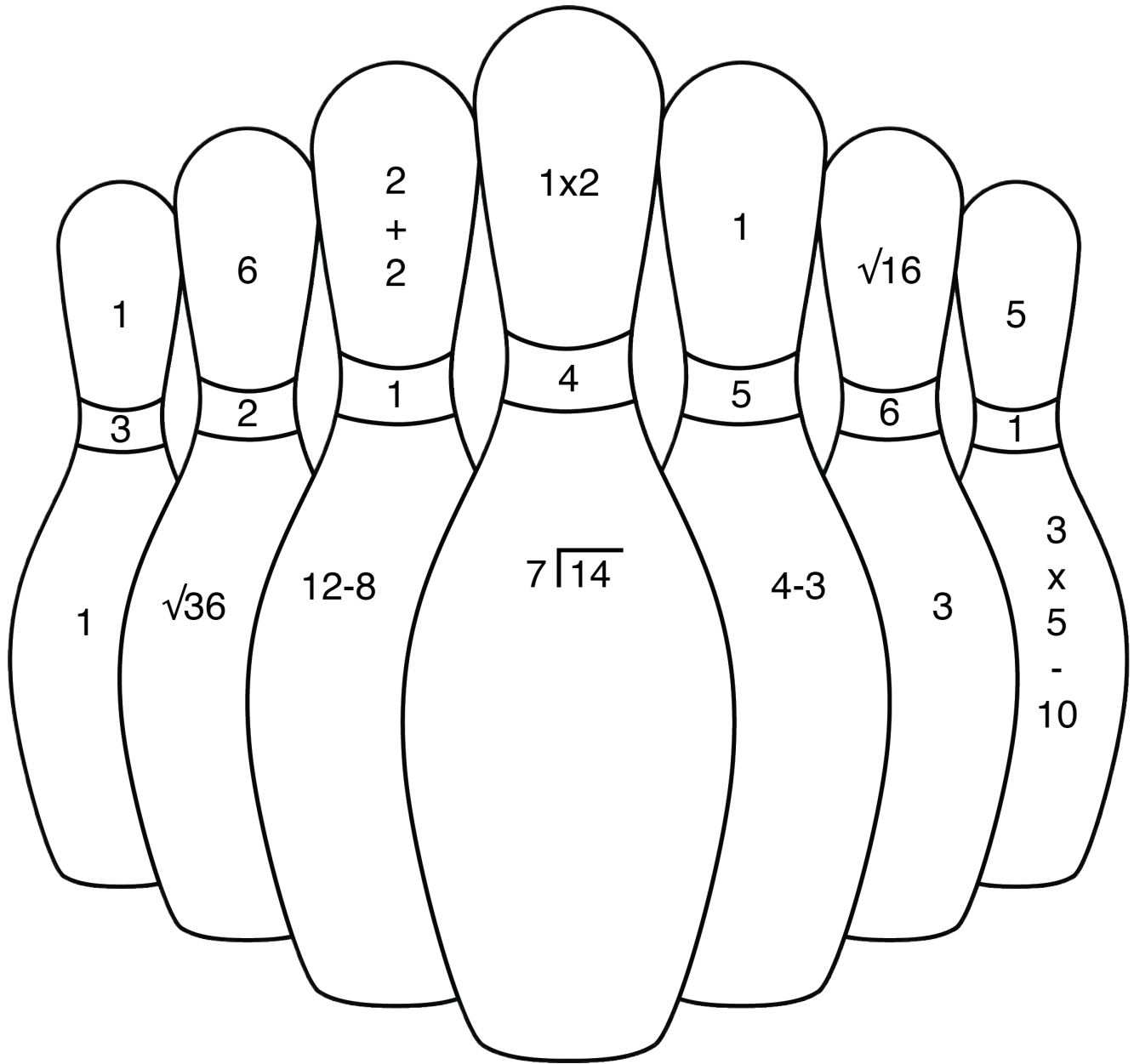
1	2	3	4	5	6	7	8	9	10			

1	2	3	4	5	6	7	8	9	10			

1	2	3	4	5	6	7	8	9	10			

Color by Number

Using the Color Key below, and by solving some equations, color the picture.

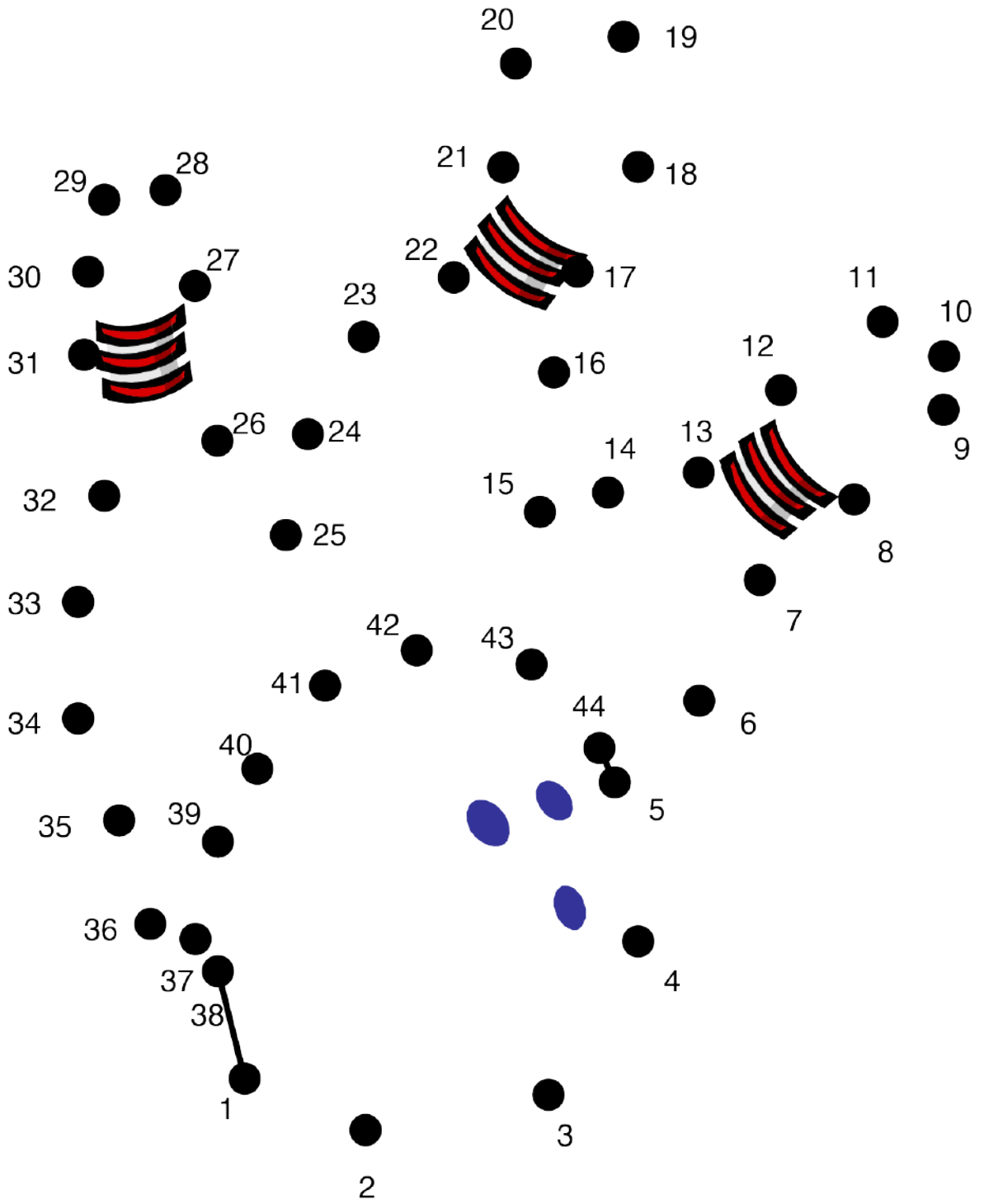


Color Key

- | | |
|------------|------------|
| 1 = blue | 4 = green |
| 2 = red | 5 = brown |
| 3 = yellow | 6 = purple |

Connect the Dots

Connect the dots to reveal the hidden picture!



Daily Health Journal

3-5

Date: _____

Daily goal: _____

Breakfast: _____

Snack: _____

Lunch: _____

Snack: _____

Dinner: _____

Water consumed: _____ ounces

Type of exercise: _____

Duration: _____

Fun with Numbers

Rewrite the underlined word(s) as a numeral.

In 2006-07, there were eighty-three thousand, seven hundred and thirty-one leagues in the United States. (USBC: bowl.com)

Answer: _____

There are ten thousand, eight hundred and thirty-three bowling centers worldwide.

Answer: _____

Today, more than sixty-six million people bowl each year in the United States.

Answer: _____

There are twenty-one million youth bowlers aged seventeen and younger.

Answers: _____

Each year, ten million children celebrate their birthdays in a bowling center.

Answer: _____

There are bowling centers in more than one hundred countries.

Answer: _____

Over five million senior citizens (people aged fifty-five and over) go bowling.

Answers: _____

In 2006-2007, there were two million, six hundred eight thousand, two hundred and seventy-nine sanctioned league bowlers.

Answer: _____

In nineteen ninety-five, the National Bowling Stadium was constructed in Reno, Nevada.

Answer: _____

Health Tips

In order to be a great bowler, it's important to keep in tip-top shape. Getting healthy isn't as hard as it may seem. Here are some tips to make it easy for you:

1. **Drink up!** Your body is made up of 60% water. In order to function properly, every part of your body needs water. Kids should drink 50% of their body weight in ounces of water each day. For example, if you weigh 70 pounds, you should drink 35 ounces of water. To figure out the amount of water you need each day, record your weight here: _____. Now divide that number by 2. The amount of water you should drink daily is _____ ounces. (Remember that 8 ounces = 1 cup).
2. **Get some sleep!** Ever notice that when you're sick you just want to sleep? That's because your body heals itself twice as fast when you're sleeping as when you're awake. To be in tip-top shape, your body needs at least 8 hours of sleep each night.
3. **Get regular exercise!** Bones and muscles stay strong by getting a workout! Bowling is a great form of weight-bearing exercise. Did you know that...
 - The average adult bowler burns 240 calories per hour?
 - Bowlers use 134 muscles during the basic four-step approach?
 - 3 games of bowling = 1 mile of walking?

In addition to weight-bearing exercise (such as bowling), you should stretch regularly to keep your muscles limber and give your heart a workout by getting some cardio-vascular exercise. Try walking, running, skating, riding your bike, or dancing!

4. **You are what you eat!** Your body is an amazing machine and in order to function properly, it needs the proper fuel—just like a car needs the proper fuel to run properly. You wouldn't put watered-down gasoline in a race car and expect it to win the race, would you? Eating the best foods is just like putting the right gas in your car. Here are some simple ways to get started:
 - **Replace sodas and sugary fruit juices with water.** Remember, your body needs a lot of water each day to stay hydrated. Sodas and fruit juices just don't cut it. Did you know that one cup of fruit juice can contain 7 teaspoons of sugar? And a 12-ounce can of orange soda has 12 teaspoons of sugar.
 - **Replace chips and candy with fruits, vegetables and nuts.** Sounds boring doesn't it? Actually, it can be quite fun.
 - Cutting fruits and vegetables into fun shapes.
 - Find as many different colors as possible. The darker the color, the more nutritious the food.
 - Try new things and swap with your buddies. Have each person bring a different type of fruit or vegetable snack and then pass them around so everyone can try something new. Have a contest to see who will try the most new things or who tries the most different colors of food!

Health Tips

[continued]

- **Eat lots of whole grains.** Whole grains, also known as complex carbohydrates, are what give your body energy (like the gasoline in a car)! This includes whole wheat bread, brown rice and whole grain pasta. Experiment with new things you might not have tried before, like barley, quinoa (pronounced “keen-wa”) or millet. You never know what you’ll like until you try it!
- **Eat more beans.** No, you don’t have to eat lima beans if you really don’t like them! Try black-eyed peas, pinto beans, or black beans instead. Or, if you’re feeling adventurous, try things like adzuki beans, lentils, or garbanzo beans (also known as chickpeas).
- **Eat lots of green, leafy vegetables.** Popeye really did get stronger by eating spinach! Green, leafy vegetables are high in antioxidants, which fight off diseases. How cool is that? Try spinach, mixed salad greens, kale, or mustard greens. To make it easier, try putting them in a wrap sandwich, in a salad, or in soup.

LUNCH TIPS

An easy way to start eating healthier is to pack your own lunch. Not only will it be healthier than the school cafeteria, it’ll taste a lot better! Below are some menu ideas for packing your lunch. In addition, there’s a daily journal on the next page. Each day, write down the food you eat, the water you drink, and the exercise you get. It’s an easy way to start making positive changes!

Frito Bandito

- Bean chili
- Baked tortilla chips
- Dairy-free cheese

Put the chili and cheese in a thermos to keep it hot until lunch. Add the tortilla chips on top.

Pocket Power

- Sandwich made with almond or natural peanut butter (one that does not contain partially hydrogenated vegetable oil!) and honey
- Steamed carrots or asparagus
- Sliced apples

Sea and Cee

- Tuna sandwich
- Cucumber slices
- Sliced melon (cantaloupe, honeydew)

Bagel Deluxe

- Half of a bagel with natural peanut butter (no hydrogenated oils), and a face made of raisin eyes, a cashew nose, and an apple smile
- Steamed potatoes and herbs
- Applesauce

Heavy Balls!

List the bowling balls in the order of their weights, starting with the heaviest.

Jake's bowling ball is heavier than Janna's.

Chris's ball weighs more than Brandy's but less than Peter's.

Brandy's ball weighs more than Janna's ball.

Peter's ball weighs less than Jake's ball.

The heaviest ball belongs to: _____.

The next heaviest ball belongs to: _____.

The next heaviest ball belongs to: _____.

The next heaviest ball belongs to: _____.

The lightest ball belongs to: _____.



How many different words can you make out of the letters in

BOWLING?

(We'll give you a couple to get started.)



- 1. **BOW** _____
- 2. **BOWL** _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____
- 8. _____
- 9. _____
- 10. _____
- 11. _____
- 12. _____
- 13. _____
- 14. _____
- 15. _____
- 16. _____
- 17. _____
- 18. _____
- 19. _____
- 20. _____

- 21. _____
- 22. _____
- 23. _____
- 24. _____
- 25. _____
- 26. _____
- 27. _____
- 28. _____
- 29. _____
- 30. _____
- 31. _____
- 32. _____
- 33. _____
- 34. _____
- 35. _____
- 36. _____
- 37. _____
- 38. _____
- 39. _____
- 40. _____

Keeping Score

A game of bowling consists of ten frames. Two ball deliveries are allowed in each frame *except* when a bowler scores a strike. A strike occurs when all ten pins are knocked down in the first delivery. On the scorecard, a strike is marked with an “X.” If all pins are knocked down with two deliveries in the frame, it is called a spare. A spare is marked with a “/” on the scorecard.

Scoring a frame: The number of pins knocked down with the first ball is placed in the upper left corner of the box. The number of pins knocked down with the second ball is placed in the upper right box. The total of the numbers is placed at the bottom of the box. For example, if the bowler knocks down 2 pins with the first ball and 7 pins with the second ball (total of 9 pins knocked down), the scorecard would be marked like this:

1	2	7	Frame 1: $2 + 7 = 9$
	9		

Scoring a Spare: For a spare, you get a score of 10 plus the score of the total pins knocked down in the next delivery. In the example below, the bowler scored a spare in the second frame. The bowler receives a score of ten for that frame plus seven, which is the number of pins knocked down by the first ball in the third frame. The scorecard is marked like this:

1	2	3	Frame 2: 10 points for the spare + 7 for the next ball = 17. Add this to 9 from frame 1 to equal 26.		
2	7	8	/	7	1
9	28	34	Frame 3: $26 + 7 + 1 = 34$		

Scoring a Strike: For a strike, you get a score of 10 plus the score of the total pins knocked down in the next two deliveries. In the example below, the bowler scored a strike in the fourth frame. The bowler receives a score of ten for that frame plus nine, which is the total number of pins knocked down in the next two deliveries (frame 5). The scorecard is marked like this:

1	2	3	4	5	Frame 4: 10 points for the strike + 6 + 3 for the next two balls = 19. Add this to 34 from frame 3 to equal 53.			
2	7	8	/	7	1	X	6	3
9	28	34	53	62	Frame 5: $53 + 6 + 3 = 62$			

The tenth frame: The bowler gets two deliveries on the tenth frame unless a strike or spare is scored. If a strike or spare is scored, the bowler takes three deliveries. All three deliveries are added to the bowler’s final score.

Zero: If no pins are knocked down, the scorecard is marked with a line “—”.

Foul line: If the bowler crosses the foul line, the delivery counts, but the player receives a score of zero for that delivery.

Keeping Score

Now, you try it! Using the blank scorecard below, see if you can correctly keep score for Bowler Ed.

Frame 1:	Ed knocks down 2 pins on the first delivery and 7 pins on the second delivery.
Frame 2:	Ed knocks down 8 pins on the first delivery and scores a SPARE on the second delivery.
Frame 3:	Ed knocks down 7 pins on the first delivery and 1 pin on the second delivery.
Frame 4:	Ed scores a STRIKE!
Frame 5:	Ed knocks down 6 pins on the first delivery and 3 pins on the second delivery.
Frame 6:	Ed scores a STRIKE!
Frame 7:	Ed knocks down 5 pins on the first delivery and scores a SPARE on the second delivery.
Frame 8:	Ed knocks down 8 pins on the first delivery and 1 pin on the second delivery.
Frame 9:	Ed knocks down 6 pins on the first delivery and 2 pins on the second delivery.
Frame 10:	Ed knocks down 7 pins on the first delivery and scores a SPARE on the second delivery. On the third delivery, he knocks down 9 pins.

Spare = / Strike = X

1	2	3	4	5	6	7	8	9	10

More practice! This time, Bowler Ed scored a STRIKE in all ten frames!

Spare = / Strike = X

1	2	3	4	5	6	7	8	9	10

More Scoring Fun!

Mark your answers on the score sheet below:

Frame 1:	Ed knocks down 3 pins on the first delivery and 7 pins on the second delivery.
Frame 2:	Ed knocks down 8 pins on the first delivery and 1 pin on the second delivery.
Frame 3:	Ed scores a STRIKE!
Frame 4:	Ed scores a STRIKE!
Frame 5:	Ed knocks down 4 pins on the first delivery and 5 pins on the second delivery.
Frame 6:	Ed scores another STRIKE! He's really on a roll!
Frame 7:	Ed knocks down 5 pins on the first delivery and scores a SPARE on the second delivery.
Frame 8:	Ed knocks down 6 pins on the first delivery and 4 pins on the second delivery.
Frame 9:	Ed knocks down 6 pins on the first delivery and 2 pins on the second delivery.
Frame 10:	Ed knocks down 7 pins on the first delivery and 2 pins on the second delivery. BONUS QUESTION: Does he get to roll the ball a 3rd time on the 10th frame?

Spare = /

Strike = X

1	2	3	4	5	6	7	8	9	10

Letter Change

3-5

Change each letter to the one that appears BEFORE it in the alphabet to solve the puzzle.



C	P	X	M	J	O	H

J	T

H	S	F	B	U

F	Y	F	S	D	J	T	F

Number Search

You've probably done a word search before, but have you ever done a number search? Find the numbers listed below and circle them. Remember to look across, down, diagonally, forwards and backwards. Can you find all 10 number patterns?

2	1	9	9	3	8
2	1	8	3	0	2
4	5	9	1	8	4
9	7	6	5	0	0
5	0	5	9	0	8
5	9	2	0	4	0

080428

25694

0803

9204

2199

812

4591

9765

955

9652

Congratulations! Now that you have found all 10 hidden numbers, read the numbers that are NOT circled from top to bottom and from left to right to answer to the bowling question at the bottom of the page.

The perfect score in bowling is _____.

Power of the Pen

1. Pretend you own a bowling center. Using PowerPoint, design a one-page flyer advertising kids' birthday parties at your bowling center. Be sure to include:
 - The name, address, and phone number of your bowling center
 - Information about birthday parties
 - The cost of birthday parties
 - What is included in the cost
2. Write a letter persuading someone to take you bowling.
3. Write a narrative essay entitled, "A Day in the Life of a Bowling Ball."

Scrambled Up

Match the letters to the numbers and write the secret message!

- 1 = a
- 2 = b
- 3 = c
- 4 = d
- 5 = e
- 6 = f
- 7 = g
- 8 = h
- 9 = i
- 10 = j
- 11 = k
- 12 = l
- 13 = m
- 14 = n
- 15 = o
- 16 = p
- 17 = q
- 18 = r
- 19 = s
- 20 = t
- 21 = u
- 22 = v
- 23 = w
- 24 = x
- 25 = y
- 26 = z



2 15 23 12 9 14 7

9 19 6 21 14

6 15 18 20 8 5

23 8 15 12 5

6 1 13 9 12 25

!

Scrambled Up II

Unscramble the words to reveal popular bowling terms.

giwolbn lalb _____

eirkts _____

preas _____

netnip _____

nanehlsc _____

louf ienl _____

roachpap _____

yevilred _____

Shaded Squares

3-5

Solve the puzzle by answering all of the questions. The shaded squares reveal the secret word.

Nickname for Abraham Lincoln			
Snap, Crackle, _____			
This bird gives a hoot!			
Not new			
The seed in an avocado or cherry			
It's no fun if this shows up at your picnic!			
You're 10 years old; that is your _____			

The secret word is _____.

Test Your Memory

NOTE TO TEACHER: Print this page and the following page front-to-back.

Study the picture below for 1 minute.
Then, turn the paper over and answer the questions on the reverse.



Test Your Memory

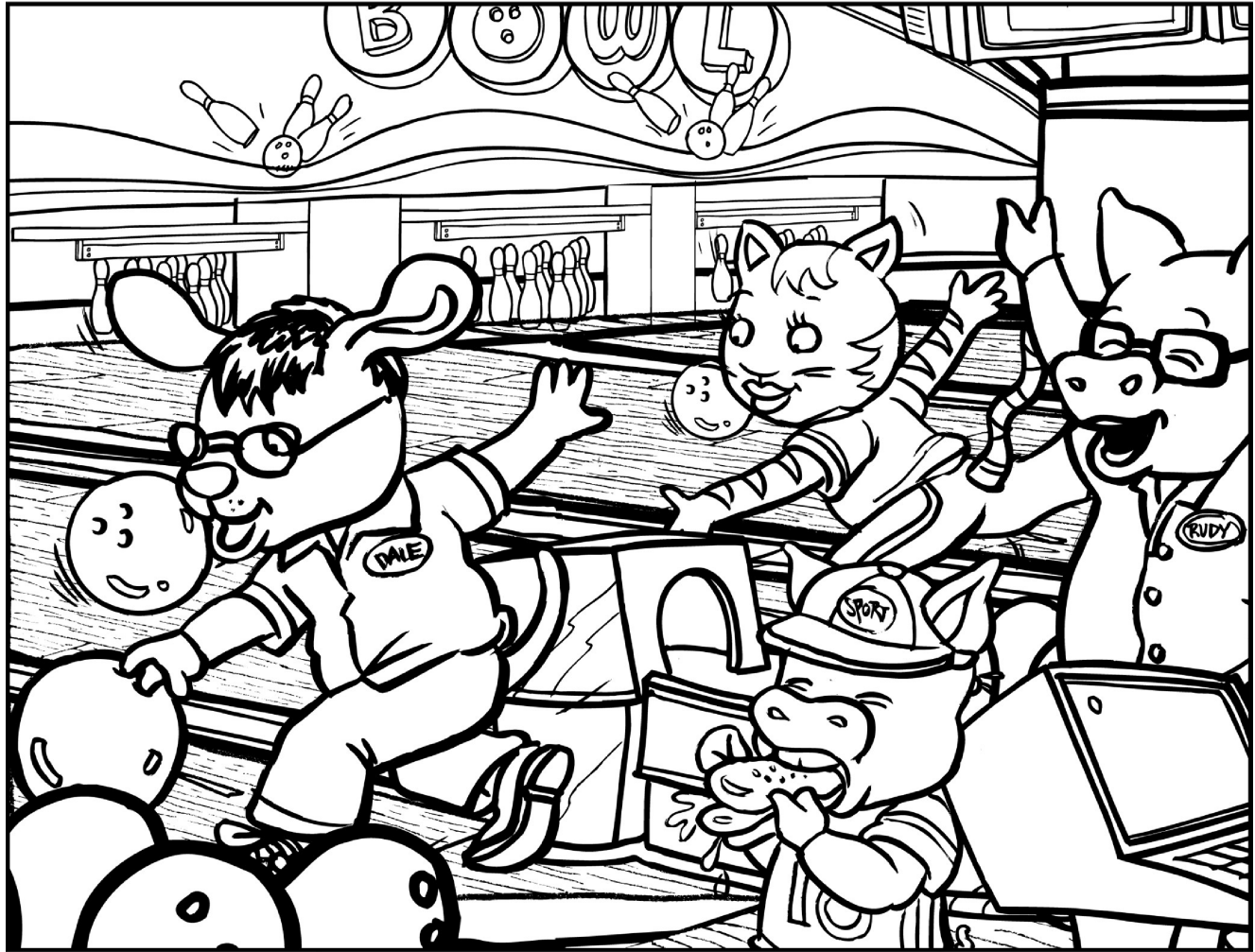
After studying the picture on the reverse for 1 minute, check off all the things you remember seeing. *Caution: There are 5 items listed below that are NOT in the picture!*

- Rudy the pig
- Pizza
- 2 pairs of glasses
- Bowling pins
- A baseball
- Bowling balls
- Bowling lanes
- Sandwich
- French fries
- Scoring computer
- Bowling shirts
- A sign that says "Bowl"
- Dale
- Bowling shoes
- A sign that says "Bowl here"
- An elephant

Test Your Memory II

NOTE TO TEACHER: Print this page and the following page front-to-back.

Study the picture below for 1 minute.
Then, turn the paper over and answer the questions on the reverse.



Test Your Memory II

After studying the picture on the reverse for 1 minute, answer these questions:

How many bowling balls are in the picture? _____

What is Sport eating? _____

What word appears above the bowling lanes? _____

What is the pig's name? _____

How many animals wear glasses? _____

Who is on the lane about to release the ball? _____

What's Your Score?

To complete this worksheet, you'll need your score from two bowling games.

1. Find the **mean** for each game and write it below.

Game #1

Game #2

2. Find the **median** for each game and write it below.

Game #1

Game #2

3. Find the **mode** for each game and write it below.

Game #1

Game #2

4. Write the **range** for each game and write it below.

Game #1

Game #2

5. Draw a **histogram** below representing your score from both games.

Game #1

Game #2

Word Search

Can you find the hidden words? Remember to look in all directions!

R N G F M B N O K H G H J C K E Q L N B S X W
E X M K O R Z C D U K O O H U Z D S Q S S M T
L W P W U U W S T R I K E W P A A I O D I V N
G Z I T U Q L T G D V H J T G N H L S W M P L
E U E J Y W E L Z T D L S K H A E S E N W A I
K R T N A R R U I U D E L I V E R Y G N I T N
U B E Y B S G J G N P J U T W H C D E J A W O
V P Z A W O O D T B E K A X W H Q M I S F L I
O W L D O D Q J A N H C U O C N O S A J P N B
H L B B S I R F R L D R F T L O G N F H L H W
Z L M S W B Y P G T Y Z V G H R P B N R C C X
B Z E G Q U Q L E P K L H O D M O I M M L A C
K O E N H N E P T L B V Z O N D K O D X G O G
Z K W R A H T X A B G I B G E U Q G L E U R E
F X G L O L I M R T V J K F Y K N W F Y L P R
P D T S I I U I R D H E K Q F E E A H C H P R
Q X D K B N N D O K C G P B J C F M L L Y A O
C V D O D D G W W T S R I B Q I P K J X X V R
M A P E R Q E C S L J S S E T Y P P P Q E Y B
O M R D R V N R E L N U F Y K Y A I A G Z E K
B V U G A Z H N C N B P R K X C N B U X K V O
D M M K G R N H D D T B J L P D I R A W D D M
B I F Q O A B O A I D E K T E K B U H K B R E
A A R I H E G I U H E A R C A I X J Q K H B H
F K C C Q M C Z I N T T K X H F F A Q M T Q J

Approach
Bowling Center
Channels
Delivery
Error
Foul Line
Gutter Ball
Hook

Inside
Jason Couch
Kegler
Lane
Miss
Norm Duke
Open
Pin Deck

Quick Eight
Return
Strike
Target Arrows
Under
Wood
YABA
Zero in

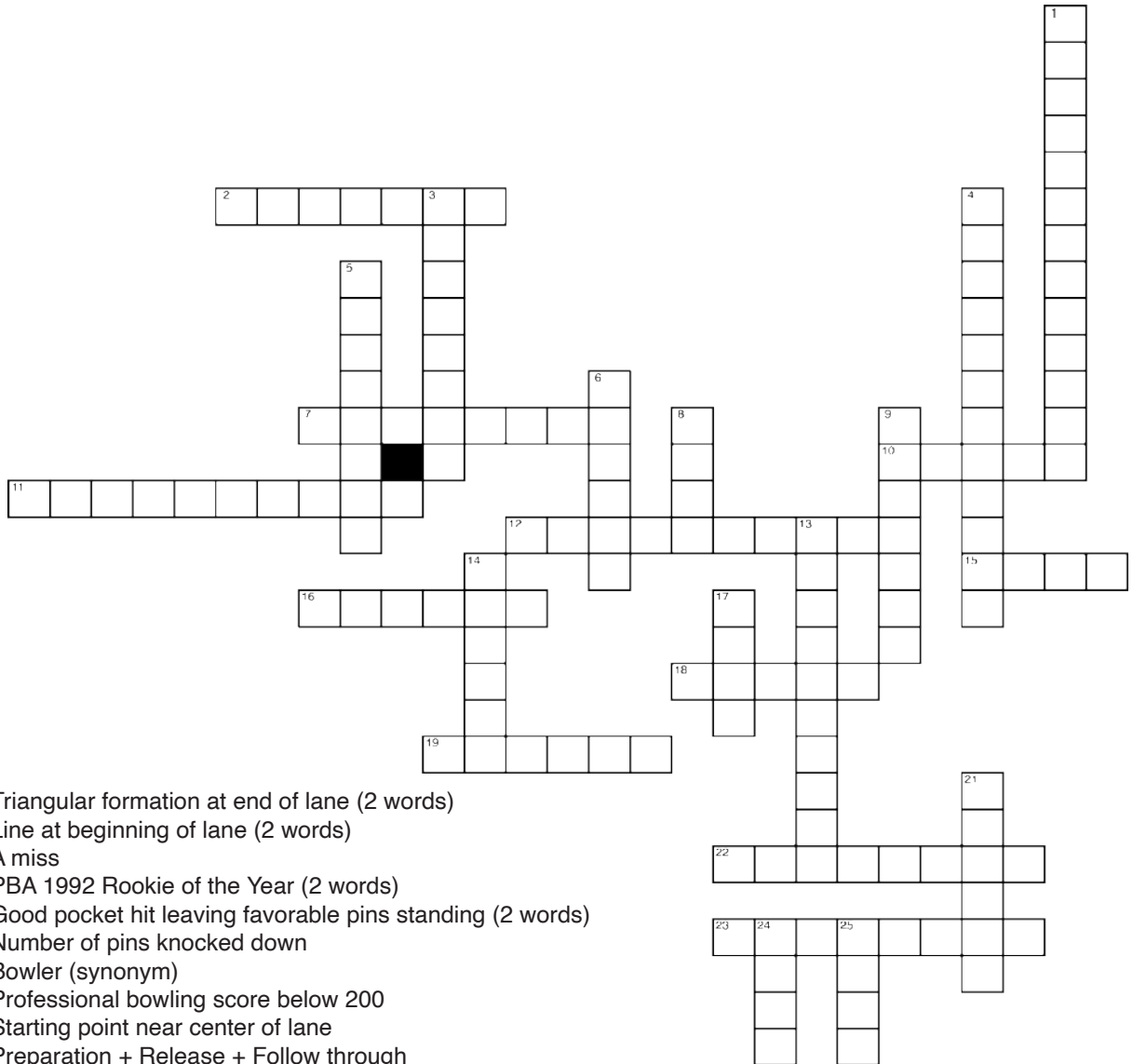
Bowling A-Z Criss-Cross

Below are bowling vocabulary words using the letters A-Z. Use these vocabulary words to solve the criss-cross puzzle on the next page.

Approach	The part of the lane from the very back of the ball return area to the foul line. Most approaches are 16 feet long.
Bowling Center	The public location where bowling takes place.
Channels	U-shaped tracks, also known as gutters, that run down both sides of the lane. Used for catching a ball that rolls off the lane before hitting the pins.
Delivery	Preparation + release + follow through. Each bowler gets two deliveries per frame, unless a strike is scored.
Error	A miss.
Foul Line	A line that designates the end of the approach and the beginning of the bowling portion of the lane. Bowlers are required to stay behind the foul line.
Gutter Ball	A ball that goes into the gutter, or channel.
Hook	A ball that breaks to the left (for right-handers) and to the right (for left-handers).
Inside	A starting point near the center of the lane, usually referring to the point of release.
Jason Couch	A professional PBA bowler who was awarded PBA Rookie of the Year in 1992.
Kegler	Synonym for bowler.
Lane	Playing surface. The lane is 42 inches wide and nearly 63 feet long.
Miss	A missed spare.
Norm Duke	A professional PBA bowler. Norm was the youngest person to win the PBA Tour Title in 1983; he was just under 19 years old.
Open	A frame that leaves pins standing after both balls have been delivered.
Pin Deck	The place at the end of the bowling lane where the pins stand in a triangle formation.
Quick Eight	A good pocket hit which leaves standing the 4-7 pins for right-handers and the 6-10 pins for left-handers.
Return	The track on which balls roll from the pit to the ball rack.
Strike	Knocking down all 10 pins on the first delivery of the frame.
Target Arrows	Seven arrows, located 15-17 feet from the foul line, used for lining up an accurate delivery.
Under	A professional bowling score below 200.
Venting	Drilling a small hole (not a finger hole) to relieve suction on the thumb hole.
Wood	In scoring, the number of pins knocked down.
X	The symbol for a strike
YABA	Young American Bowling Alliance; a non-profit organization for young bowlers. The YABA merged with the USBC (United States Bowling Congress) in 2006.
Zero in	Find the right strike spot on a lane.

Bowling A-Z Criss-Cross

[continued]



Across

- 2 Triangular formation at end of lane (2 words)
 7 Line at beginning of lane (2 words)
 10 A miss
 11 PBA 1992 Rookie of the Year (2 words)
 12 Good pocket hit leaving favorable pins standing (2 words)
 15 Number of pins knocked down
 16 Bowler (synonym)
 18 Professional bowling score below 200
 19 Starting point near center of lane
 22 Preparation + Release + Follow through
 23 1983 PBA Tour title winner; youngest ever (2 words)

Down

- 1 Public location where you can bowl (2 words)
 3 U-shaped tracks, aka gutters, on both sides of lane
 4 Seven arrows used for lining up delivery (2 words)
 5 Part of lane from back of ball return to foul line
 6 Find the right strike spot on a lane (2 words)
 8 A ball that break left or right
 9 Drilling a small hole to relieve suction on the thumb hole
 13 A ball that goes into the gutter or channel (2 words)
 14 The track on which balls rolls from the pit to the ball rack
 17 Playing surface
 21 Knocking down all 10 pins on the first delivery
 24 A frame that leaves pins standing after both balls have been delivered
 25 A missed spare

Bowling Blunders

The sport of bowling can be traced back to articles found in the tomb of an Egyptian child buried in 5200 B.C.! The primitive equipment included nine pieces of stone at which a stone “ball” was rolled, the ball having to first roll through an archway made of three pieces of marble.

Bowling at pins is believed to have originated in ancient Germany in the early 17th century. At that time it was not a sport but a religious ceremony.

The first indoor bowling lanes were used in 1455 and designed by a creative Englishman. In the 1500s, Sir Francis Drake another English citizen insisted on finishing his final frame before taking action against the Spanish Armada which was attacking from the English channel. He is credited with introducing the game of bowling to many cultures as he circumnavigated the globe.

The first record of bowling being played in America was by Dutch settlers in 1626 on Manhattan Island. In 1842, Connecticut outlawed the game of ninepin bowling as a result of heavy gambling on the games. Several bowling supporters changed the number of pins to ten, rearranged them into a triangle shape, and continued to encourage people to participate in the sport. (This allowed them to play legally, since there were ten pins instead of *nine*!)

The American Bowling Congress standardized the rules of bowling in 1895; and the first tournament for professionals and amateurs was held in 1901. Women’s bowling became official in 1916 with the Women’s International Bowling Congress. The WIBC, as it was known, held its first women’s tournament in 1917. In 1982, the Young American Bowlers Alliance (YABA) was founded to promote bowling to children and teens.

Several important advances were made in the sport of bowling in the early 1900s for many centuries bowling balls were made out of hard wood. Then, in 1905, they began manufacturing them out of rubber. Today’s balls are made of urethane and a reactive resin. Finger holes did not gain acceptability until 1889-99, and in the early 1930s, the three-hole ball gained popularity and in 1936, a pinspotter was invented and before mechanical devices were used to reset the pins, young children sat at the end of the lane and cleared or reset the pins after each bowl. In the 1940s, the development of automatic pinsetters dramatically changed the face of bowling. Until the 1970s, all scoring was done manually on a score sheet provided by the bowling alley. Today, automatic scoring systems not only keep score, they provide a source of entertainment and instruction for bowlers. Bumper guards and cosmic bowling are two more revelations that make the sport of bowling entertaining for people of all ages and skill levels.

Activity:

Correct the spelling, grammatical, and punctuation errors in the story.

Comic Strip Fun

6-8

Design a comic strip superhero who is a bowler by day, superhero by night. What is your superhero's name? What kinds of super powers does he or she have? Will the whole world be saved, or is there a particular issue to be addressed?

In the spaces below, create a comic strip featuring your superhero in action.

Title: _____

Cool New Shoes

6-8

You've just gone bowling and discovered that the rental shoes....well, they weren't as cool as they could be! In the space below, draw a picture of the ultimate cool bowling shoes.

In the box below it, design an advertisement for Bowler's Journal International magazine. Include a picture of your new shoe design and write ad copy that will entice everyone to buy your shoes. Be sure to point out the features and benefits that make them cool.

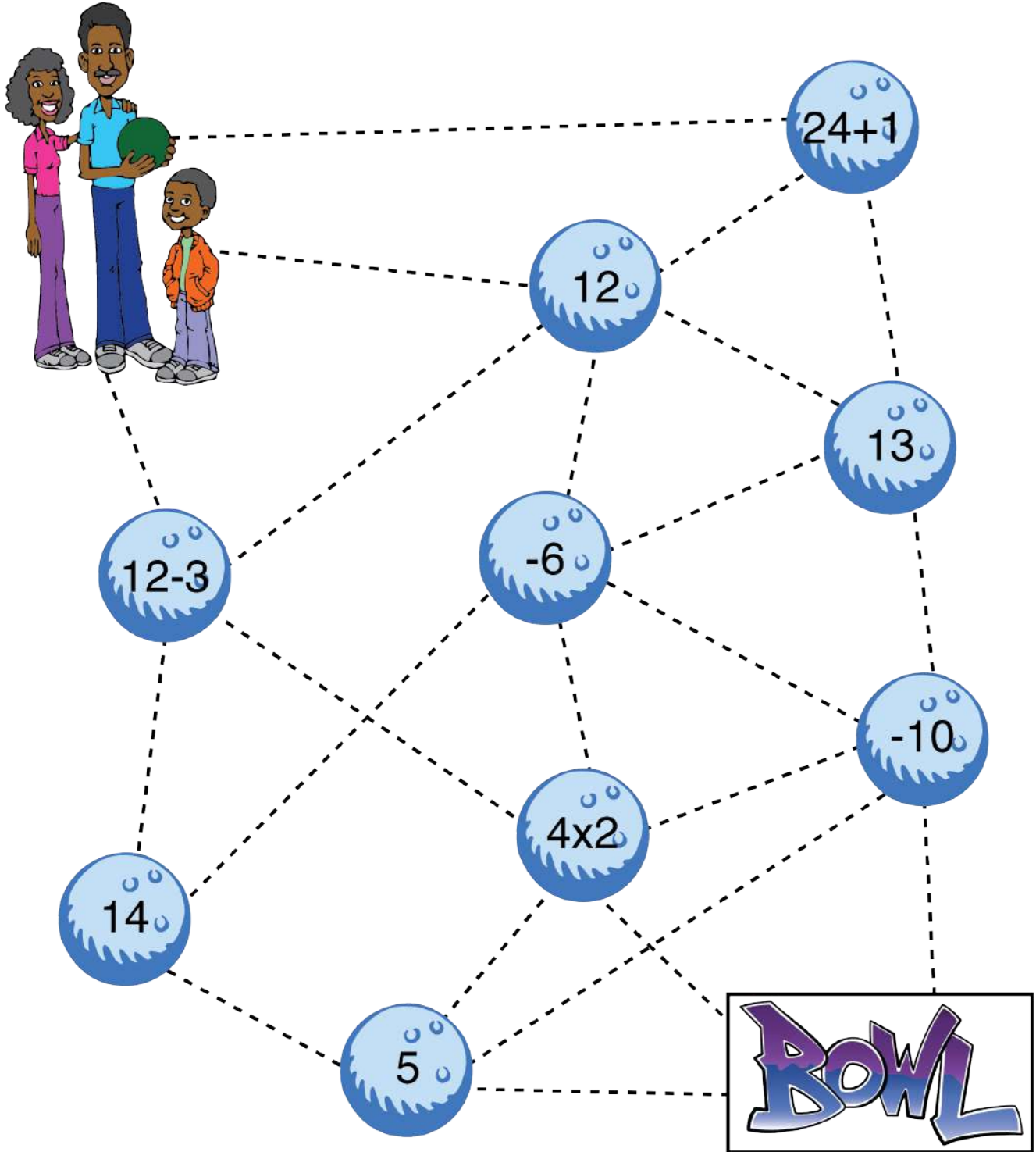
Bowling Shoe Design

Advertisement

Find the Way

6-8

The Thomas family wants to go bowling. Problem is, they're not sure which direction to take to get to the bowling center. Can you help them? Follow the lines, adding the numbers along the path. When you get to the exact sum of 50, they'll arrive at the bowling center. (Hint: don't cross lines!)



Hidden Message

Follow the directions below. When you are finished, read the remaining words from top to bottom and left to right to reveal the hidden message. Write the hidden message on the lines below.

HOCKEY	TORNADO	THE	SPAGHETTI
PERFECT	TACO	12	SCORE
NORTH	IN	CLOUDY	CAMPER
DOG	WASHINGTON	BOWLING	GOOD
HURRICANE	285	BEAUTIFUL	DIVERSITY
HAMBURGER	IS	PIZZA	HAPPY
TOMMY	DARK	300	WEST

- Cross off all numbers that don't satisfy this equation: $150 \times 2 = \underline{\hspace{2cm}}$
- Cross off all words that refers to direction.
- Cross off all words that are weather conditions.
- Cross off all words with 6 letters.
- Cross off all words that are names of food.
- Cross off all words that start with the letter D.
- Cross off all proper nouns.
- Cross off all adjectives.

MYSTERY MESSAGE:

Mystery Location

The Jones family is attending a bowling tournament. Read the clues to find out where the tournament is located.



- It's not located in the state whose capitol is Indianapolis.
- It's not in the smallest of the 50 states.
- It's not in the largest of the 50 states.
- It's not in the state directly above California.
- It's not in the state known for cheese.
- It's not in the Lone Star state.
- It's not in the 50th state added.
- It's not in the home of the Broncos, Nuggets, or Avalanche
- It's not in the state known for maple syrup.
- It's not in the Bluegrass state.

Vermont	Indiana	Rhode Island
Wisconsin	Michigan	Hawaii
Colorado	Kentucky	Alaska
Texas	Oregon	

The bowling tournament is located in _____.

Name That Bowler

6-8

The following are names of professional bowlers who bowl on the PBA tour. Draw a line from the bowler's first name to his last name. (HINT: Log onto www.pba.com to get a list of pro bowlers.)

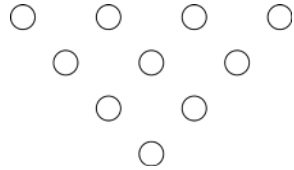
FIRST	LAST
Dick	Jaros
Norm	Anthony
Patrick	Rash
Earl	Duke
Mike	Williams Jr.
Jason	Angelo
Johnny	Weber
Tommy	Barnes
Sean	De Vaney
Danny	Bohn
Parker	Allen
Pete	Petraglia
Chris	Jones
Steve	Wiseman
Brad	Weber
Walter Ray	Couch

Spare Time

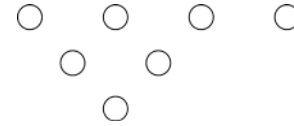
6-8

For each set of bowling pins, write how many have been knocked down. Then, rewrite each number as a *reduced fraction* and as a *decimal*. Remember, there are ten pins to start.

1. _____



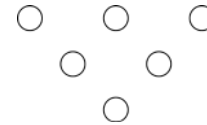
2. _____



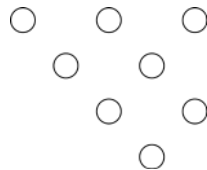
3. _____



4. _____



5. _____



6. _____



7. _____



8. _____



9. _____



10. _____

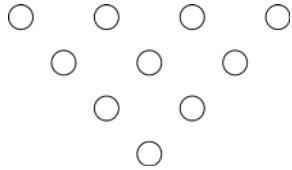


Spare Time II

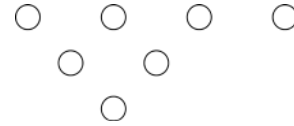
6-8

For each set of bowling pins, write how many have been knocked down. Then, rewrite each number as a *percent* and as a *ratio of pins knocked down to pins left*. Remember, there are ten pins to start.

1. _____



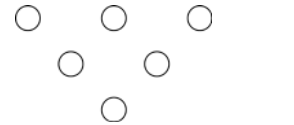
2. _____



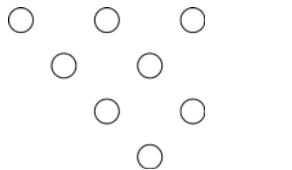
3. _____



4. _____



5. _____



6. _____



7. _____



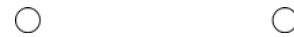
8. _____



9. _____



10. _____



Through the Ages

The sport of bowling can be traced back to articles found in the tomb of an Egyptian child buried in 5200 B.C.! The primitive equipment included nine pieces of stone at which a stone “ball” was rolled, the ball having to first roll through an archway made of three pieces of marble. Bowling at pins is believed to have originated in Germany in the early 17th century. At that time, it was not a sport, but a religious ceremony.

The first indoor bowling lanes were used in 1455 and designed by a creative Englishman. In the 1500s, Sir Francis Drake, another English citizen and famous sailor, insisted on finishing his final frame before taking action against the Spanish Armada which was attacking from the English channel. He is credited with introducing the game of bowling to many cultures as he circumnavigated the globe.

The first record of bowling being played in America was by Dutch settlers in 1626 on Manhattan Island. In 1842, Connecticut outlawed the game of ninepin bowling as a result of heavy gambling on the games. Several bowling supporters changed the number of pins to ten, rearranged them into a triangle shape, and continued to encourage people to participate in the sport. (This allowed them to play legally, since there were ten pins instead of nine!) The American Bowling Congress standardized the rules of bowling in 1895, and the first tournament for professionals and amateurs was held in 1901. Women’s bowling became official in 1916 with the Women’s International Bowling Congress. The WIBC, as it was known, held its first women’s tournament in 1917. In 1982, the Young American Bowlers Alliance (YABA) was founded to promote bowling to children and teens. In 2005, the ABC, WIBC, and YABA merged to form the United States Bowling Congress (USBC).

Several important advances were made in the sport of bowling in the early 1900s. For many centuries, bowling balls were made out of hard wood. Then, in 1905, they began manufacturing them out of rubber. Today’s balls are made of urethane and a reactive resin. Finger holes did not gain acceptability until 1889-99, and in the early 1930s, the three-hole ball gained popularity. In 1936, a pinspotter was invented. Before mechanical devices were used to reset the pins, young children sat at the end of the lane and cleared or reset the pins after each bowl. In the 1940s, the development of automatic pinsetters dramatically changed the face of bowling. Until the 1970s, all scoring was done manually on a score sheet provided by the bowling alley. Today, automatic scoring systems not only keep score, they provide a source of entertainment and instruction for bowlers. Bumper guards and cosmic bowling are two more revelations that make the sport of bowling entertaining for people of all ages and skill levels.

Activities:

1. Draw a “timeline” of the events mentioned in this story.
2. What other major historical events happened during those times?
3. Find each location on a map and mark it by drawing a bowling ball on or near that location.
4. Were there any words or terms in the story that you didn’t understand? Look up the definitions in a dictionary or on the Internet.

Weight & Measures

1. Bowling pins range from 3 pounds 6 ounces up to 3 pounds 10 ounces. Convert each of these to ounces. (Remember, 16 ounces = 1 pound).

3 pounds 6 ounces = _____ ounces

3 pounds 10 ounces = _____ ounces

2. Balls weigh anywhere from 6 pounds to 16 pounds. Convert each of these to ounces.

6 pounds = _____ ounces

10 pounds = _____ ounces

16 pounds = _____ ounces

3. The circumference of a bowling ball is approximately 27 inches. What is the diameter? (Remember, $c = \pi \cdot d$)

The diameter is _____ inches.

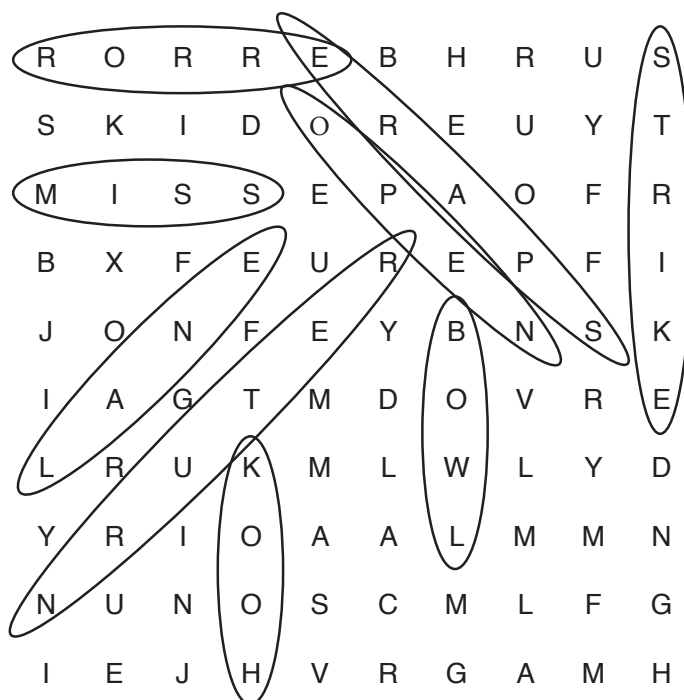
4. Now, take your answer from question 3 (the diameter) and figure the radius. (Remember, $r = 1/2d$).

The radius is _____ inches.

FOLLOW THAT LINE
PAGE 9



HIDDEN WORDS
PAGE 10



HOW MANY
PAGE 11

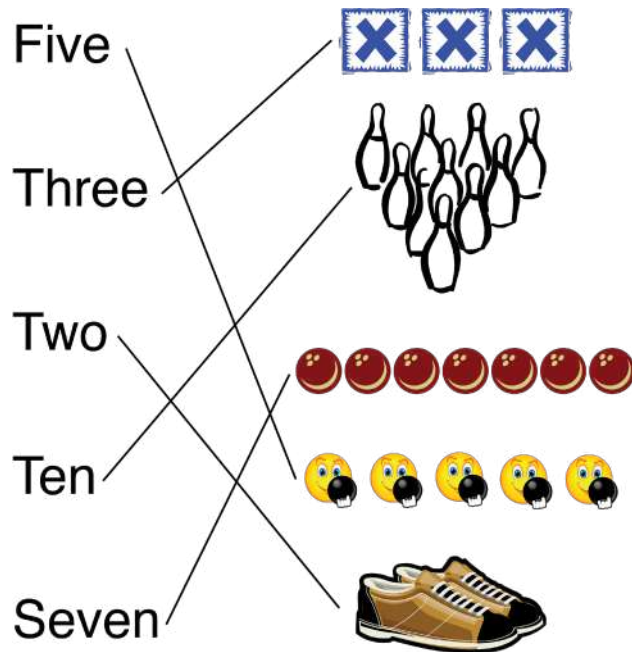
Five

Three

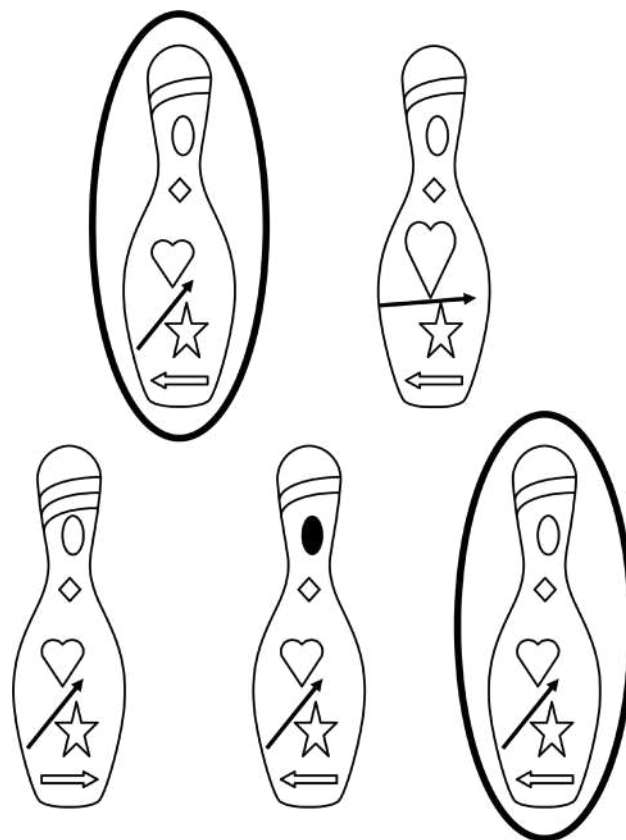
Two

Ten

Seven



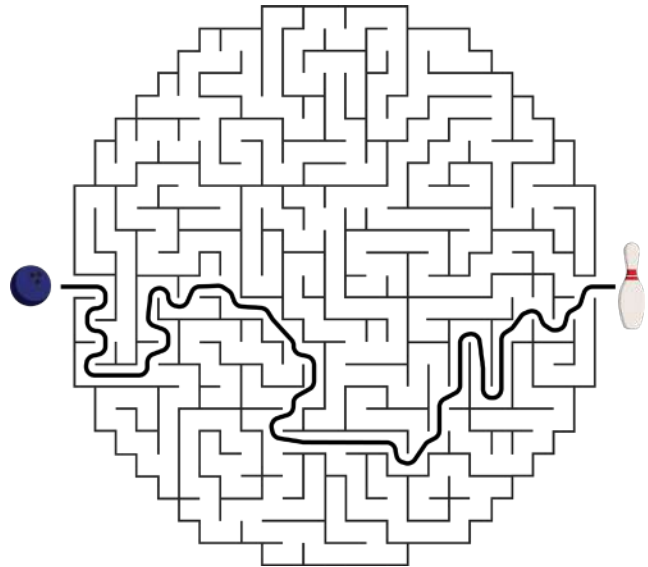
MATCH THAT PIN
PAGE 12



ACTION VERBS
PAGE 13

1. WENT
2. BOUGHT
3. SLIDING, SLIPPED
4. ASKED, GOING
5. SAT, WAITED
6. CAME
7. BOWLED
8. EXCLAIMED
9. GOT
10. SAID, CROSS
11. GLIDED
12. TOLD
13. FOUND
14. GUESS
15. BEAT

BOWLING MAZE
PAGE 18

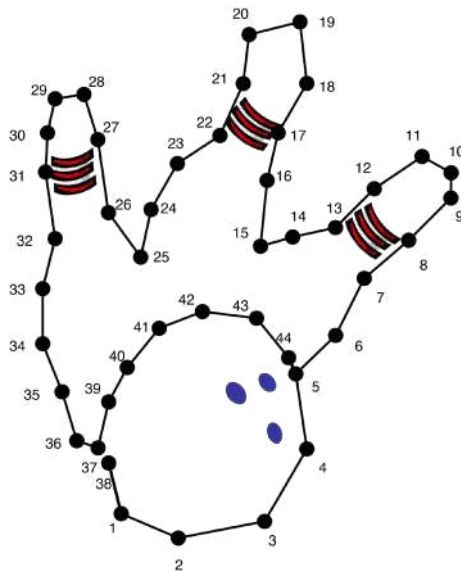


BOWLING CENTER TOUR
PAGE 16

Check what you learned!

1. If you weigh 105 pounds, you should choose a ball that weights 10 or 11 pounds.
2. What device prevents your ball from going into the channel? Bumper guard
3. The automatic ball return returns the ball to the bowler.
4. Bowlers wait their turn to bowl in the settee area.
5. Why are special shoes required? Allows the bowler to slide when releasing the ball
6. How is the size of a bowling center determined? By the number of lanes
7. What is the name of the machine that resets pins? pinsetter
8. **Extra Credit:** Take a tour of the bowling center. Write an essay about one of the following topics: a day in the life of a pin, a day in the life of a bowling ball, or why it would be fun to work in a bowling center.

CONNECT THE DOTS
PAGE 22



FUN WITH NUMBERS
PAGE 24

1. 10,000,000,000
2. 10,833
3. 70,000,000
4. 22,000,000 -- 17
5. 8,000,000
6. 100
7. 5,000,000 -- 55
8. 3,112,037
9. 1995

HEAVY BALLS

PAGE 27

The heaviest ball belongs to: Jake .

The next heaviest ball belongs to: Peter .

The next heaviest ball belongs to: Chris .

The next heaviest ball belongs to: Brandy .

The lightest ball belongs to: Janna .

HIDDEN WORDS

PAGE 28

Our experts found 35 words...

- | | | |
|---------------------|----------------------|-----------------------|
| 1. <u> Bow </u> | 13. <u> glow </u> | 25. <u> nog </u> |
| 2. <u> Bowl </u> | 14. <u> go </u> | 26. <u> now </u> |
| 3. <u> big </u> | 15. <u> gob </u> | 27. <u> oil </u> |
| 4. <u> bingo </u> | 16. <u> in </u> | 28. <u> on </u> |
| 5. <u> bling </u> | 17. <u> lingo </u> | 29. <u> owl </u> |
| 6. <u> blog </u> | 18. <u> lob </u> | 30. <u> wig </u> |
| 7. <u> blow </u> | 19. <u> log </u> | 31. <u> win </u> |
| 8. <u> blown </u> | 20. <u> long </u> | 32. <u> wing </u> |
| 9. <u> boil </u> | 21. <u> low </u> | 33. <u> won </u> |
| 10. <u> bong </u> | 22. <u> nil </u> | 34. <u> gin </u> |
| 11. <u> gib </u> | 23. <u> no </u> | 35. <u> bin </u> |
| 12. <u> glib </u> | 24. <u> nob </u> | 36. <u> </u> |

KEEP SCORE
PAGE 30

Spare = /

Strike = X

1	2	3	4	5	6	7	8	9	10
2 7	8 /	7 1	X	6 3	X	5 /	8 1	6 2	7 / 9
9	26	34	53	62	82	100	109	117	136

Spare = /

Strike = X

1	2	3	4	5	6	7	8	9	10
X	X	X	X	X	X	X	X	X	X
30	60	90	120	150	180	210	240	270	300

MORE SCORING FUN
PAGE 31

Spare = /

Strike = X

1	2	3	4	5	6	7	8	9	10
3 /	8 1	X	X	4 5	X	5 /	6 /	6 2	7 2
18	27	51	70	79	99	115	131	139	148

LETTER CHANGE
PAGE 31

C	P	X	M	J	O	H
B	O	W	L	I	N	G

J	T
I	S

H	S	F	B	U
G	R	E	A	T

F	Y	F	S	D	J	T	F
E	X	E	R	C	I	S	E

NUMBER SEARCH
PAGE 33

2	1	9	9	3	8
2	1	8	3	0	2
4	5	9	1	8	4
9	7	6	5	0	0
5	0	5	9	0	8
5	9	2	0	4	0

SCRAMBLED UP
PAGE 35

B O W L I N G
2 15 23 12 9 14 7

I S F U N
9 19 6 21 14

F O R T H E
6 15 18 20 8 5

W H O L E
23 8 15 12 5

F A M I L Y **!**
6 1 13 9 12 25

SCRAMBLED UP II
PAGE 35

giwolbn lalb Bowling ball

eirkts Strike

preas Spare

netnip Tenpin

nanehlsc Channels

louf ienl Foul line

roachpap Approach

yevilred Delivery

SHADED SQUARES
PAGE 37

Nickname for Abraham Lincon	A	B	E
Snap, crackle, _____	P	O	P
This bird gives a hoot!	O	W	L
Not new	O	L	D
The seed in an avocado or cherry	P	I	T
It's no fun if this shows up at your picnic	A	N	T
You're 13 years old; that is your _____	A	G	E

TEST YOUR MEMORY
PAGE 39

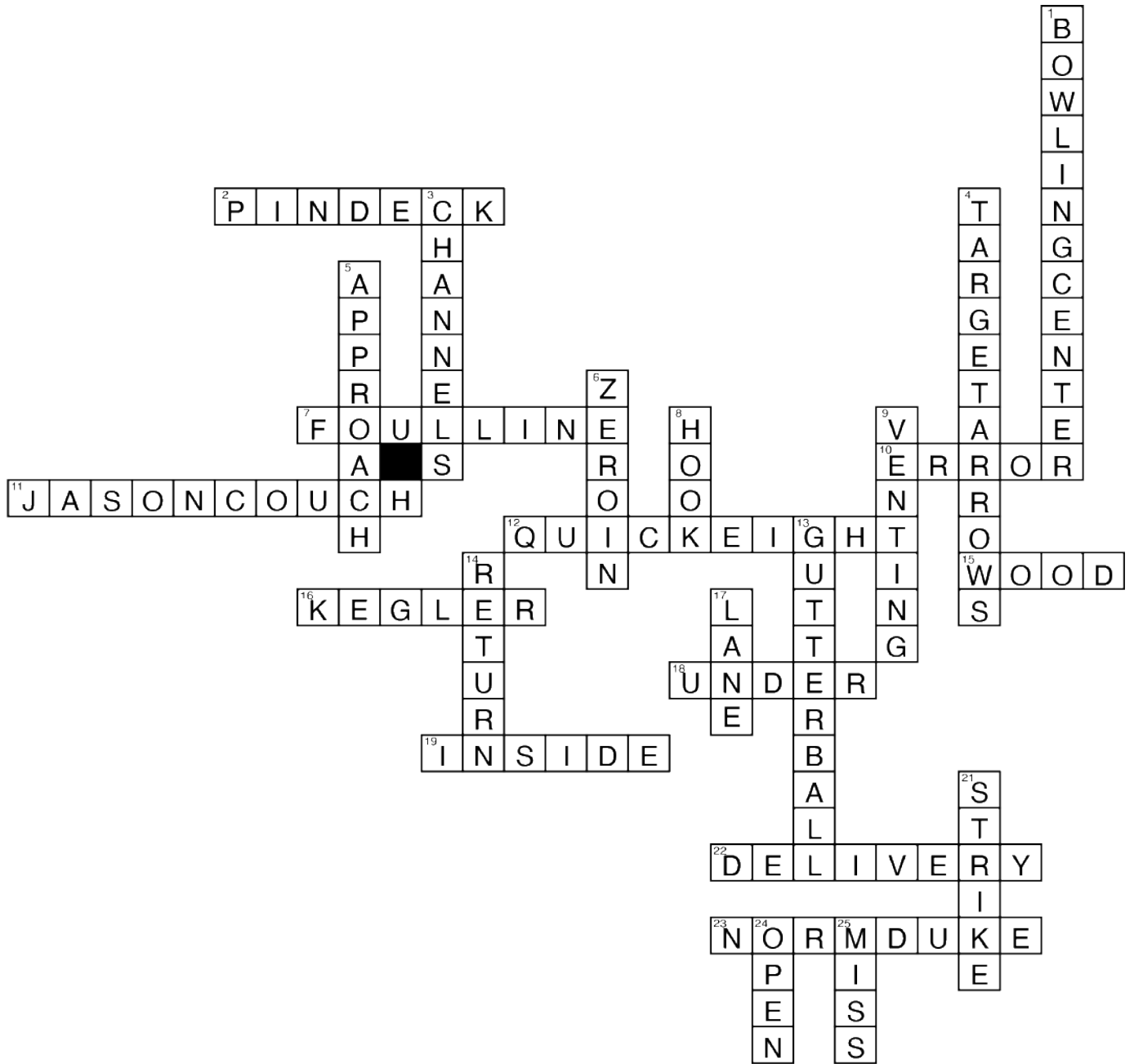
- 4 Rudy the pig
- Pizza
- 4 2 pairs of glasses
- 4 Bowling pins
- A baseball
- 4 Bowling balls
- 4 Bowling lanes
- 4 Sandwich
- French fries
- 4 Scoring computer
- 4 Bowling shirts
- 4 A sign that says "Bowl"
- 4 Dale
- 4 Bowling shoes
- A sign that says "Bowl here"
- An elephant

TEST YOUR MEMORY
PAGE 41

- How many bowling balls are in the picture? 9
- What is Sport eating? SANDWICH
- What word appears above the bowling lanes?
BOWL
- What is the pig's name? RUDY
- How many animals wear glasses? 2
- Who is on the lane about to release the ball?
DALE

WORD SEARCH
PAGE 43

R	N	G	F	M	B	N	O	K	H	G	H	J	C	K	E	Q	L	N	B	S	X	W
E	X	M	K	O	R	Z	C	D	U	K	O	O	H	U	Z	D	S	Q	S	S	M	T
L	W	P	W	U	U	W	S	T	R	I	K	E	W	P	A	A	I	O	D	I	V	N
G	Z	I	T	U	Q	L	T	G	D	V	H	J	T	G	N	H	L	S	W	M	P	L
E	U	E	J	Y	W	E	L	Z	T	D	L	S	K	H	A	E	S	E	N	W	A	I
K	R	T	N	A	R	R	U	I	U	D	E	L	I	V	E	R	Y	G	N	I	T	N
U	B	E	Y	B	S	G	J	G	N	P	J	U	T	W	H	C	D	E	J	A	W	O
V	P	Z	A	W	O	O	D	T	B	E	K	A	X	W	H	Q	M	I	S	F	L	I
O	W	L	D	O	D	Q	J	A	N	H	C	U	O	C	M	O	S	A	P	N	B	
H	L	B	B	S	I	R	F	R	L	D	R	F	T	L	O	G	N	F	H	L	P	W
Z	L	M	S	W	B	Y	P	G	T	Y	Z	V	G	H	R	P	B	N	R	C	C	X
B	Z	E	G	Q	U	Q	L	E	P	K	L	H	O	D	M	O	I	M	M	L	A	C
K	O	E	N	H	N	E	P	T	L	B	V	Z	O	N	D	K	O	D	X	G	O	G
Z	K	W	R	A	H	T	X	A	B	G	I	B	G	E	U	Q	G	L	E	U	R	E
F	X	G	L	O	L	I	M	R	T	V	J	K	F	Y	K	N	W	F	Y	L	P	R
P	D	T	S	I	I	U	I	R	D	H	E	K	Q	F	E	A	H	C	H	P	R	
Q	X	D	K	B	N	N	D	O	K	C	G	P	B	J	C	F	M	L	L	Y	A	O
C	V	D	O	D	D	G	W	W	T	S	R	I	B	Q	I	P	K	J	X	X	V	F
M	A	P	E	R	Q	E	C	S	L	J	S	S	E	T	Y	P	P	P	Q	E	Y	B
O	M	R	D	R	V	N	F	E	L	N	U	F	Y	K	Y	A	I	A	G	Z	E	K
B	V	U	G	A	Z	H	N	C	N	B	P	R	K	X	C	N	B	U	X	K	V	O
D	M	M	K	G	R	N	H	D	D	T	B	J	L	P	D	I	R	A	W	D	D	M
B	I	F	Q	O	A	B	O	A	I	D	E	K	T	E	K	B	U	H	K	B	R	E
A	A	R	I	H	E	G	I	U	H	E	A	E	C	A	I	X	J	Q	K	H	B	H
F	K	C	C	Q	M	C	Z	I	N	T	T	K	X	H	F	F	A	Q	M	T	Q	J



BOWLING BLUNDERS

PAGE 46

The sport of bowling can be traced back to articles found in the tomb of an Egyptian child **bureed** in 5200 B.C.! The primitive equipment included nine pieces of stone at which a stone “ball” was rolled, the ball having to first roll through an archway made of three **peaces** of marble.

Bowling at pins is believed to have originated in ancient Germany in the early 17th century. At that time it was not a sport but a religious ceremony.

The first indoor bowling lanes were used in 1455 and designed by a creative Englishman. In the **1500s**, Sir Francis Drake, another English citizen, insisted on finishing his final frame before taking action against the Spanish Armada which was attacking from the English channel. He is credited with introducing the game of bowling to many cultures as he circumnavigated the globe.

The first record of bowling being played in America was by Dutch settlers in 1626 on Manhattan Island. In 1842, Connecticut **outlawd** the game of **ninepin** bowling as a result of heavy gambling on the games. Several bowling supporters changed the number of pins to ten, rearranged them into a triangle shape, and continued to encourage people to participate in the sport. (This allowed them to play legally, since there were ten pins instead of nine!)

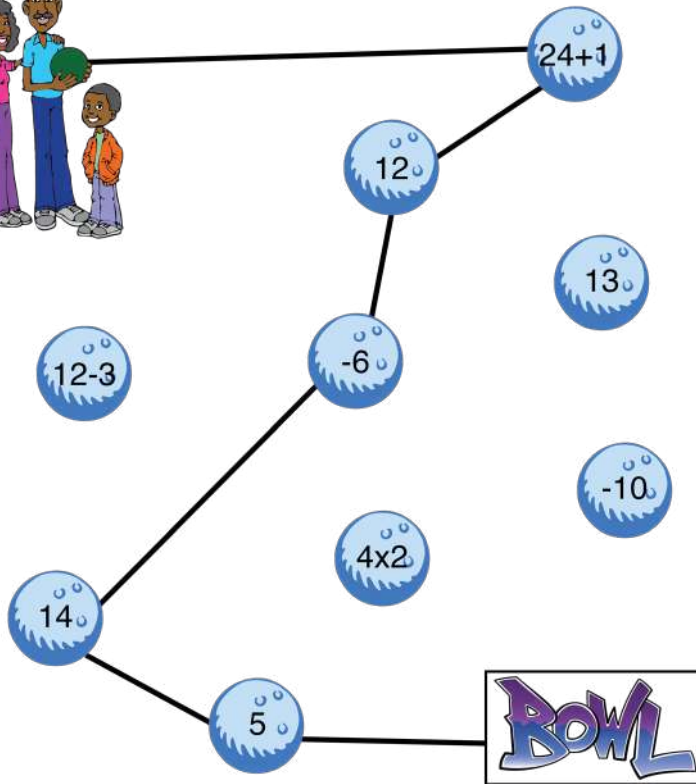
The American Bowling Congress standardized the rules of bowling in 1895; and the first tournament for professionals and amateurs was held in 1901. Women’s bowling became official in 1916 with the Women’s International Bowling Congress. The WIBC, as it was known, held its first women’s tournament in 1917. In 1982, the Young American Bowlers Alliance (YABA) was founded to promote bowling to children and teens.

Several important advances were made in the sport of bowling in the early **1900s** for many centuries bowling balls were made out of hard wood. **Then**, in 1905, they began manufacturing them out of rubber. Today’s balls are made of urethane and a reactive **rezin**. Finger holes did not gain acceptability until 1889-99, **and** in the early **1930s**, the three-hole ball gained popularity and in 1936, a pinspotter was invented **and** before mechanical devices were used to reset the pins, young children sat at the end of the lane and **cleared** or reset the pins after each bowl. In the **1940s**, the development of automatic pinsetters dramatically changed the face of bowling. Until the **1970s**, all scoring was done manually on a score sheet provided by the bowling alley. Today, automatic scoring systems not only keep score, they provide a source of entertainment and instruction for bowlers. Bumper guards and cosmic bowling are two more revelations that make the sport of bowling entertaining for people of all ages and skill levels.

Activity:

Correct the spelling, grammatical, and punctuation errors in the story.

**FIND THE WAY
PAGE 49**



**FIND THE WAY
PAGE 49**

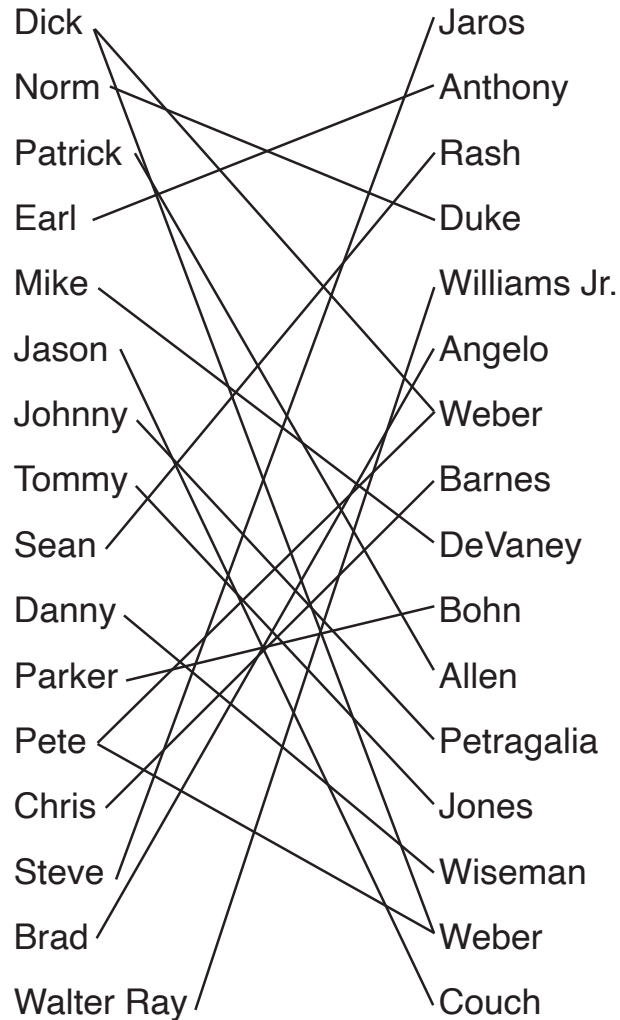
The bowling tournament is located in Michigan.

**FIND THE WAY
PAGE 49**

HOCKEY	TORNADO	THE	SPAGHETTI
PERFECT	TACO	12	SCORE
NORTH	IN	CLOUDY	CAMPER
DOG	WASHINGTON	BOWLING	GOOD
HURRICANE	285	BEAUTIFUL	DIVERSITY
HAMBURGER	IS	PIZZA	HAPPY
TOMMY	DARK	300	WEST

THE PERFECT SCORE IN BOWLING IS 300

NAME THAT BOWLER
PAGE 52



SPARE TIME
PAGE 53

1.	0	0/10	0
2.	3	3/10	.3
3.	7	7/10	.7
4.	4	2/5	.4
5.	2	1/5	.2
6.	6	3/5	.6
7.	4	2/5	.4
8.	5	1/2	.5
9.	9	9/10	.9
10.	8	4/5	.8

SPARE TIME II
PAGE 54

1.	0	0%	0:10
2.	3	30%	3:7
3.	7	70%	7:3
4.	4	40%	4:6
5.	2	20%	2:8
6.	6	60%	6:4
7.	4	40%	4:6
8.	5	50%	5:5
9.	9	90%	9:1
10.	8	80%	8:2

THROUGH THE AGES
PAGE 55

Date	Event
5000 BC	Bowling traced back to tomb of Egyptian child
1455	First indoor bowling lanes were used
1500s	Sir Francis Drake insisted on finishing his final frame before attacking the Spanish Armada
17 th Century	Bowling at pins originated in ancient Germany as a religious ceremony
1626	First record of bowling played in America by Dutch settlers
1842	Conneticut outlawed ninepin bowling and the game was changed to ten pins
1895	The American Bowling Congress standardized the rules of bowling
1889-99	Finger holes gained acceptability
1901	First tournament held for professional and amateurs
1905	Balls started being manufactured out of rubber instead of wood
1916	Women's bowling became official
1917	First women's bowling tournament was held
1930s	Three-hole balls gained popularity
1936	Pinspotters were invented
1940s	Automatic pinsetters dramatically changed the game
1970s	Automatic scoring systems were invented
1982	The YABA was founded to promote bowling to children and teens

THROUGH THE AGES

PAGE 55

Other Historical Events (Note: The historical events listed here are just a sample; your students may list other events that occurred. Answers are not provided for date ranges, since many historical events would have occurred.)

Date	Event
5000 BC	Agriculture begins in Mexico; The original inhabitants of Jerusalem are driven out by the Canaanites (www.din-timelines.com)
1455	Calixtus II was the Pope in Rome (www.thinkworks.com) First block Bible was published in Germany (www.cgi.duke.edu) York won the first battle of the War of the Roses in St. Albans (www.editoreric.com)
1500s	
17 th Century	
1626	Manhattan Island was purchased by the Dutch (www.gesource.ac.uk)
1842	Coal Mines Act passed, prohibiting the employment of women and children in mines (www.gesource.ac.uk) Crazy Horse was born in South Dakota (www.history.eserver.org)
1895	Moving picture projector patented; World's first movie theater opens in Paris (www.history.nickeysurf.com)
1889-99	
1901	Oil discovered in Texas; US Steel Corp organized under JP Morgan (www.history.nickeysurf.com)
1905	Las Vegas, Nevada founded (www.history.nickeysurf.com)
1916	Professional Golfer Association (PGA) formed (www.history.nickeysurf.com)
1917	Walt Disney graduates from Benton High School; Raggedy Ann doll invented (www.history.nickeysurf.com)
1930s	
1936	"Gone With the Wind" by Margaret Mitchell, published; 40 hour work week law approved (federal) (www.history.nickeysurf.com)
1940s	
1970s	
1982	Earl Anthony becomes 1st pro bowler to win more than \$1 million; EPCOT Center opens in Orlando, Florida (www.history.nickeysurf.com)

WEIGHT & MEASURES

PAGE 56

1. Bowling pins range from 3 pounds 6 ounces up to 3 pounds 10 ounces. Convert each of these to ounces. (Remember, 16 ounces = 1 pound).

3 pounds 6 ounces = 54 ounces

3 pounds 10 ounces = 58 ounces

2. Balls weigh anywhere from 6 pounds to 16 pounds. Convert each of these to ounces.

6 pounds = 96 ounces

10 pounds = 160 ounces

16 pounds = 256 ounces

3. The circumference of a bowling ball is approximately 27 inches. What is the diameter?
(Remember, $c = \pi \cdot d$)

The diameter is 8.6 inches.

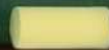
4. Now, take your answer from question 3 (the diameter) and figure the radius. (Remember, $r = 1/2d$).

The radius is 4.3 inches.



Bowler's Ed

Adaptive Needs



Adaptive Needs

Teaching Adapted Bowling Skills For Students With Special Needs.....	2
Poss - I - Bowling.....	3
Adapted Ball Grips.....	4
Wedge For Wheelchair Bowlers and Portable Bumpers.....	5
Ball Pushers or Bowling Sticks and Bowling Ball Holder Ring (Third Arm).....	6
Adapted Communication Methods.....	7
Bowling For The Blind or Visually Impaired.....	8-9
References and Continued Learning Resources.....	10

Teaching Adapted Bowling Skills for Students with Special Needs

The ultimate aim of teaching adapted bowling skills for students with special needs is to train students to adhere to the rules of bowling as much as possible. It is the goal of every adapted physical education teacher, classroom teacher and rehabilitation professional to make bowling a successful experience for students with special needs. Inclusion is the most important aspect of adaptive bowling because bowling is a sport that requires limited movement and a simple scoring system that is easy to administer (M. Weinman, personal communication, March 21, 2012). One way to make this experience possible is to modify the bowling exercises, bowling equipment used and the methods of communication/instructional approaches to address the special needs of these students. These adaptations will help them become successful in bowling. The following ideas are derived from a compilation of several online resources (see references at the end of this paper). These ideas are designed to facilitate the successful occupational and recreational participation of students with special needs in bowling from the perspective of occupational therapy:

Setting: Gym/multi-purpose room. Organized students accordingly.

Equipment:

1. Metal, aluminum or wooden ramp
2. One rubberized bowling ball or standard ball

Cue Words: Assisted, Unassisted, bowl or physical prompt

Instructions: Assisted (wheelchair bowlers)

1. Assisted – Have the “Guide” (APE teacher or staff) assist students by placing the ramp at the foul line. Students will make their request as to where they would like ramp by verbal or non-verbal (sign language) communication.
2. Do not place ramp beyond foul line (This will disqualify the bowler’s roll).
3. Students should adjust the ramp themselves if possible.
4. Students should roll the ball into the ramp themselves.
5. Guides should act as support for ramp as needed.
6. Guides should not look in the direction of the pins.
7. Guides should give verbal or non-verbal cue to students to bowl.



Instructions: Unassisted (ambulatory bowlers)

1. Unassisted - Students should place the ramp at the foul line.
2. Do not place ramp beyond foul line (This will disqualify the bowler’s roll)
3. Students should adjust the ramp themselves if possible
4. Students roll the ball down the ramp making sure the ram does not pass the foul line (This will disqualify the bowler’s roll).



Poss - I - Bowling

Purpose: Students learn to bowl without using a conventional three fingered bowling ball or grip

Setting: Gym/multi-purpose room. Organized students accordingly.

Equipment:

1. Pass-I-Bowl Device
2. Metal, aluminum or wooden ramp
3. One rubberized bowling ball or standard ball

Cue Words: Bowl

Instructions:

1. Guide should fasten the device to the ramp.
2. Have the "Guide" (APE teacher or staff) assist students by placing the ramp at the foul line. Students will make their request as to where they would like ramp by verbal or nonverbal (sign language) communication.
3. Do not place ramp beyond foul line (This will disqualify the bowler's roll).
4. Students should adjust the ramp themselves if possible.
5. Students should place the ball on the ramp.
6. When the students are ready to bowl, they should press the switch to release the ball.



Adapted Ball Grips

Purpose: Students learn to bowl without using a conventional three-fingered bowling ball or grip

Equipment:

1. Handle-grip bowling ball
2. Coated foam bowling ball

Cue Words: Bowl

Instructions: Handle-Grip Ball (equipped with a spring loaded handle which snaps back into the ball upon release)

1. Have the students raise the hand they bowl with by verbal or physical cues.
2. The students place their bowling hand around the handle-grip of ball to lift it.
3. Have students repeat these steps and practice holding the ball.

Instructions: Coated Foam Ball (pre-drilled for both large and small hands; weighted for easier handling and rolling)

1. Have students raise the hand they bowl with by verbal or physical cues
2. Tell them by verbal or physical cues to touch their middle two fingers and their thumb together.
3. If you have a glove available, demonstrate by putting your hand in the glove to help them visualize which fingers they will use.
4. Using a coated foam bowling ball, place your thumb and finger in the holes to demonstrate how to hold it.
5. Have students repeat these steps and practice holding the ball.

For vision impaired students give them a physical demonstration using their bowling hand.



Wedge for Wheelchair Bowlers

Purpose: Prevents students from sliding while rolling the ball

Setting: Gym/multi-purpose room

Equipment:

1. Wedge cushion

Instructions:

1. Have students or guide place wedge cushion between their non-bowling hand and the side of chair.
2. Place ball in their lap.
3. Student should wheel themselves up to the foul line, keeping their arms over the side of the chair.
4. Students should position themselves directly in front of the lane dots or arrow they wish to target.
5. Students can use pendulum swing to roll the ball away from the wheel of the chair.

In cases where the student is unable to handle the ball using the wedge technique then a ramp should be used.

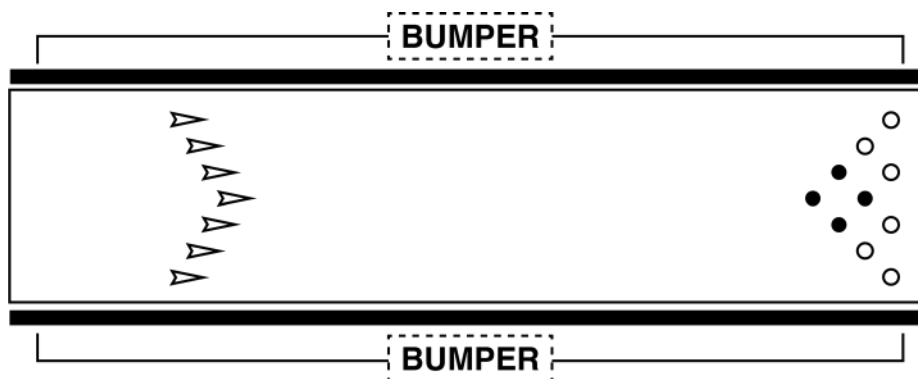
Portable Bumpers

Purpose: Increase the success of the student's bowling experience and build confidence level especially for first-time or young bowlers.

Setting: Gym/multi-purpose room. Organize students accordingly.

Instructions:

1. Place the bumpers or barriers on both sides of the lanes (carpeted or non-carpeted).
2. The teacher should remove the bumpers or barriers once the students become more proficient bowlers.



Ball Pushers or Bowling Sticks

Purpose: Increase control over the force of roll and the angle at which the bowling ball rolls down the lane (National Center on Physical Activity and Disability, 2012).

Setting: Gym/multi-purpose room. Organize students accordingly.

Equipment:

1. Bowling stick (NCPAD, 2012)
2. Adjustable Ball Pusher (NCPAD, 2012)

Instructions:

1. Have the students secure the bowling stick or adjustable ball pusher independently or with assistance from a guide.
2. Students will get positioned at the foul line, secure the ball and push the ball.
3. Students should not pass the foul line with the bowling stick or ball pusher.



Bowling Ball Holder Ring (Third Arm)

Purpose: Used as a third arm to hold the bowling ball by those who have limited or absent grip.

Setting: Gym/multi-purpose room. Organize students accordingly.

Equipment:

1. Bowling ball holder ring (Winnick, 2005)
2. Wheelchair

Instructions:

1. Have the students fasten the holder ring to the wheelchair arm.
2. Grasp a bowling ball while the bowler maneuvers down the approach line.
3. Students will get positioned at the foul line, secure the ball and push the ball into the lane.

Adapted Communication Methods

Purpose: Facilitate comprehension of bowling rules and techniques.

Setting: Gym/multi-purpose room. Organize students accordingly.

Equipment:

1. Picture cards
2. Instructions in large prints or with high contrast

Instructions:

1. Use a combination of methods that will meet the special needs of each student
2. Verbal, visual, or physical prompts
3. Modified large print/high contrast letters or pictures (for the visually-impaired)

Purpose: Facilitate comprehension of bowling rules and techniques.

Setting: Gym/multi-purpose room. Organize students accordingly.

Equipment:

1. Picture cards
2. Instructions in large prints or with high contrast

Instructions:

1. Have guides use picture cards to help students with speech delays to comprehend instructions.
2. Guide will provide instructions in large print or in high contrast to help students discriminate visual inputs.
3. Provide positive reinforcement for successful bowling.

Bowling for the Blind or Visually Impaired

Purpose: Serve as a guide to make sure bowling balls are rolled in a straight line.

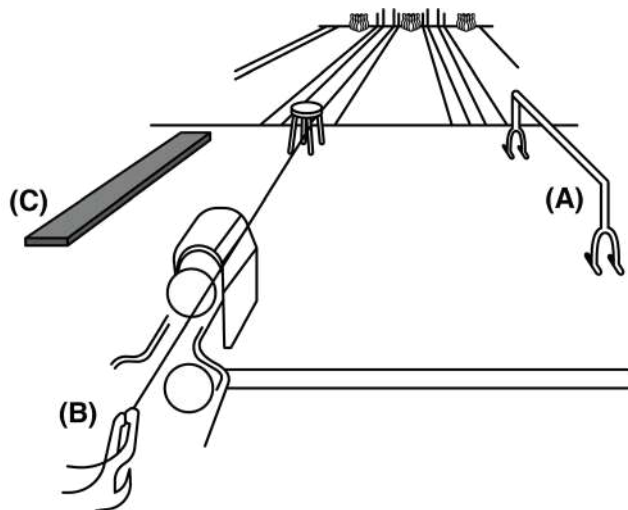
Setting: Gym/multi-purpose room. Organize students accordingly.

Equipment:

1. Commercial bowling rail (NCPAD, 2012)
2. Makeshift rope (NCPAD, 2012)
3. Carpet strips (NCPAD, 2012)
4. Bells

Instructions:

1. Have students hook the elbow of their guiding arms around the rail.
2. Have students adjust the rail position so that it is straight in the middle of the foul line.
3. Put carpet strips on the sides of the carpet to guide ball positions.
4. Use bell that rings after each pin is knocked down successfully.



Bowling for the Deaf of Hearing Impaired

Purpose: Serve as a guide for students who are deaf and hearing impaired to aim the bowling ball successfully at the pins.

Setting: Gym/multi-purpose room. Organize students accordingly.

Equipment:

1. Flashing lights
2. Bright colored pins
3. Ball markers

Instructions:

1. Have the guides signal their turn of each student to bowl.
2. Have the guides use flashing lights to signal turns of students to bowl.
3. Have the guides position students close to them.
4. Have the guides speak slowly, clearly, and close to the students.
5. Have the guides utilize visible markers such as stars, fingernail polish, washable magic markers or even stickers to remind students of appropriate finger placements (Special Olympics, 20014).

Bowling, as a meaningful recreational activity from the perspective of occupational therapy, provides numerous benefits physically, emotionally and spiritually for people for all ages. It is an indoor activity with minimal equipment adaptations and modifications catering to the special needs of students with multiple disabilities. Consumers are urged to probe further and determine on their own which bowling equipment best fits their needs. Consultation with physicians or sports professionals may be warranted to determine the best fit. The bowling equipment suggested above does not mean to endorse any particular vendor. The adaptations and modifications to teaching bowling skills offered here are just guides and may not be applicable for everyone since students with special needs may have a wide range of physical and/or mental disabilities.

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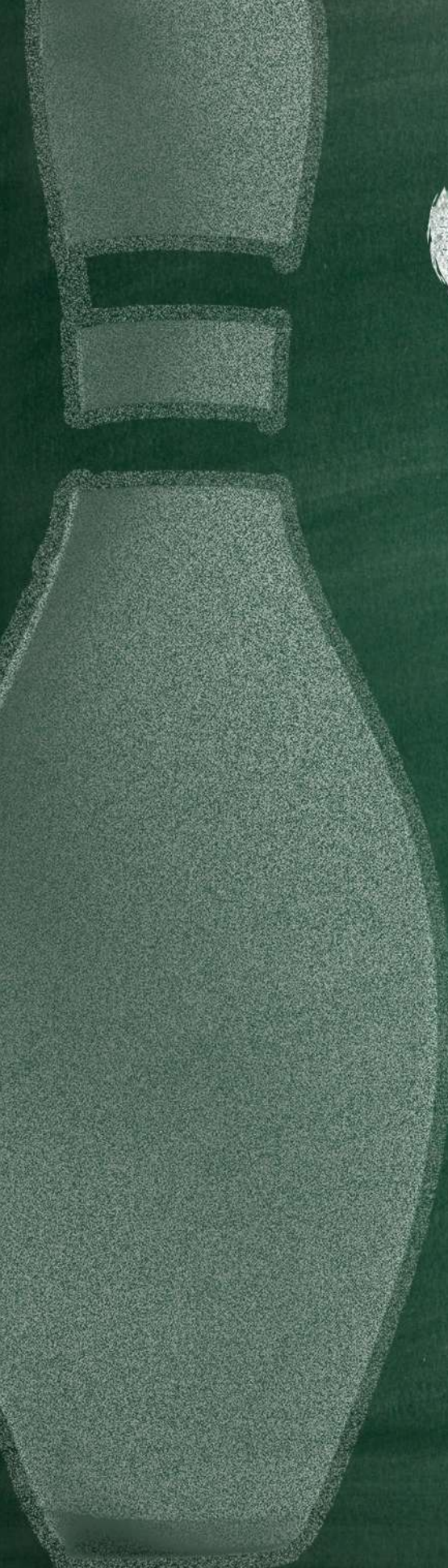
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O. Federico
3/29/12



Bowler's Ed

STEM



Science Technology Engineering and Math (STEM) Bowling

Teaching Objectives and Student Knowledge.....	2
Introduction.....	3
Newton’s Law of Motion.....	4
Forces, Friction and Momentum.....	5-6
Technology, Equipment and Specification.....	7-9
Advanced Learning.....	10-11
Vocabulary.....	12
Activities.....	13-16
References and Continued Learning Resources.....	17

Teaching Objectives and Student Knowledge

Why are bowling lanes oiled with more oil placed at the start of the lane and less at the end? What is the advantage of throwing a “hook” ball? And why do those pins remain standing though the ball hit them? Using an elementary-based physics approach, the student and teacher will benefit through a practical application and learning when participating in the In-School Bowling/ Bowler’s Ed experience.

The United States Bowling Congress (USBC) and Bowling Proprietors’ Association of America (BPAA) understand science, technology, engineering and mathematics (STEM) are not just for professional scientists anymore and regularly are taught in elementary education. Through the unique characteristics of the sport of bowling, we are able to provide a fun and academically sound addition to the Bowler’s Ed curriculum, further increasing cross-curricular opportunities and academic enrichment.

Bowling is enjoyable for players of all skill levels because it is easy to get started and see real results (like bowling a strike), yet most people can play for years without coming close to the elusive perfect game. The dynamics of the bowling ball, the oil, the gutters, etc. exhibit interesting concepts from math and physics that are accessible to anyone with a background in differential equations.

The addition to the Bowler’s Ed Teachers Curriculum was designed to meet the growing needs of STEM instruction in elementary education. In a simple game of bowling, we can witness all types of situations that deal with motion, speed, velocity, acceleration, forces and more! The following teaching tool will cover bowling history, vocabulary and additional activities that can be taught in the classroom/bowling center or to an advanced audience.

Through the instruction of the Bowler’s Ed program and continued participation, it allows the educator to use science terminology and literacy devices covered in language arts classes. Students will be met with more cross-curricular learning opportunities compatible with history, geometry and many more activities blending athletics and academics. Finally, advanced teaching tools can be found at the end of this section to assist with higher-level learning.

Teaching Objectives:

- Inertia effects on objects of varying masses
- Friction is a force that can effect inertia
- Energy of moving objects
- Transference of energy
- Motion of objects during a collision
- Applied force affects collisions

Student Knowledge and Understanding:

- Newton’s Law of Motion
- Force and Acceleration
- Rotational and Circular Motion
- Inertia vs. objects of varying masses
- Friction is a force and its effect on inertia
- Transfer of energy between moving objects
- Motion of objects during a collision
- How applied force effects collisions

Introduction

Bowling looks easy! Especially when USBC Team USA or bowling professionals are seen competing in the bowling center or on television. However, there is a lot more to bowling than simply throwing a ball down a stretch of wood to knock over some pins. Bowling is a precision sport, and to fully appreciate it one must fully understand the bowling environment.

Nothing helps develop understanding and interest in science, technology, engineering and mathematics principles more than application examples a student can relate to. Bowling provides a fun platform to illustrate different principles and explain how changes in technology have made large impacts on a familiar sport.

Before we talk about the science in bowling, we need to understand the vocabulary relating to bowling through a scientific lens. **Motion** is the act of an object moving from one place to another. A **Force** is any pull or push that causes an object to move, stop or change direction. **Friction** is a force that opposes motion when two surfaces rub against each other. **Magnetism** is the force of pushing or pulling between poles of magnets. **Gravitation** is a force that pulls all objects toward one another. **Inertia** is the property of matter that keeps an object moving in a straight line or keeps it at rest.

Objects that have a lot of **mass** also have a lot of **inertia**. Inertia means that objects want to keep on doing what's they're already doing. For instance, it is difficult for us to push a 16-pound bowling ball to get it moving since it is so massive. The 16-pound ball has a lot of inertia. A marble, on the other hand, is not as massive as a bowling ball. If we chose to move a marble, it would not be as hard as the bowling ball. A marble has less inertia since it has less mass. In either case, objects at rest will stay at rest, and objects in motion will stay in motion unless acted upon by an outside force.

Activity #1- Mass & Distance

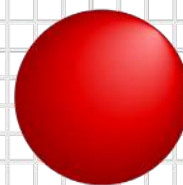
Question: Which of these marbles has more inertia?



A



B



C

Activity on Page 13



Did you know....

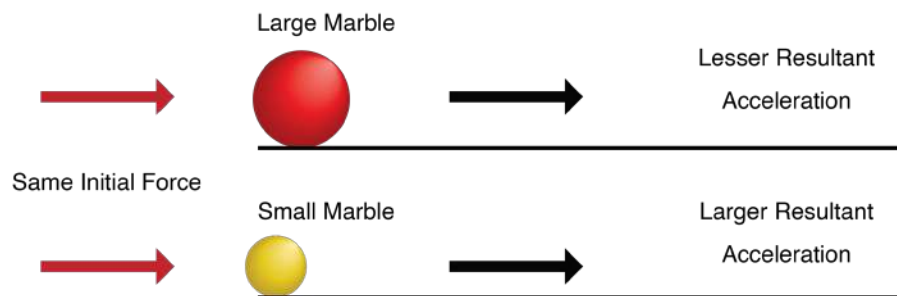
In 1930, British anthropologist Sir Flinders Petrie, along with a team of archaeologists, discovered various primitive bowling balls, bowling pins and other materials in the grave of a protodynastic Egyptian boy dating to 3200 B.C., very shortly before the reign of Narmer, one of the very first Egyptian pharaohs?

Newton's Laws of Motion

Sir Isaac Newton formulated three laws of motion. **Newton's first law** being, an object at rest will remain at rest and an object in motion will continue to move at the same speed and in a straight line unless acted upon by an external force. The most basic example of this is the bowling pins will remain standing and at rest until they are acted upon by the external force of the **unbalanced force** bowling ball knocking them over. Another example is that when the ball is released, it will continue to roll in the same direction until acted upon by a force. Either the ball will hit the pins, or it will roll off the carpet lane (in the case of Bowler's Ed) or into the gutter (in the case of in-center bowling).



Newton's Second Law of Motion states that if the same force is exerted on two objects of different masses there will be a difference in the change of motion of the two objects. The change in motion is called **acceleration**. When a bowler lines up for their four-step approach, the first thing that happens to the ball is that it accelerates away from the bowler. Then the ball stops and accelerates on the back swing. Just like a pendulum, the ball accelerates forward as the bowler releases the ball down the lane toward the pins. Remember, the pins are at rest. When the accelerating ball hits the resting pins, it causes them to become unbalanced forces and they accelerate into each other.



Newton's Third Law of Motion states that for every action force there is an equal and opposite reaction force. When you sit in a chair at the bowling center, the force of you sitting in the chair is equal to the force of the chair supporting you. In a practical on-lane application, when the ball is rolled down the lane, the ball is the action force to the pins. The falling pins become the reaction force.



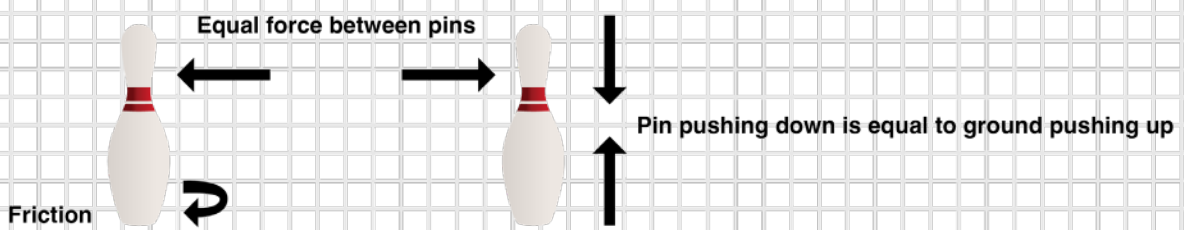
Did you know....

The first nationally televised 300 game by a woman was thrown by Michelle Feldman?

Forces, Friction and Momentum

Forces acting on an object can sometimes balance each other. Forces that are equal in size and opposite in direction are **balanced forces**. An example of a balanced force is two pins standing next to each other. When the forces are equal, the object will remain stopped or continue to move at the same speed and direction. When we see the pins set up at the end of the lane, it seems as if there is no force acting on the pins, but there is. The force of the ground is holding up the pins. The force of gravity is pulling the pins toward the center of the earth. The force of **friction** is helping to keep the pins from sliding off the lanes.

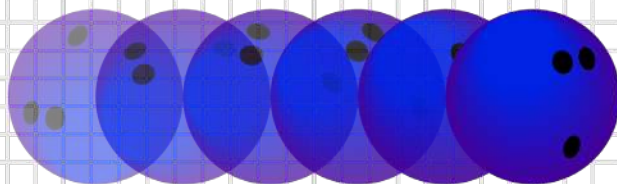
Activity #2- Effects of Friction



Activity on Page 14

When one force is greater than its opposite force, they are **unbalanced forces**. We rely on the unbalanced forces of the rolling ball to knock down the pins. The force of the rolling ball is greater than the forces of the pins, thus knocking them down. Once the pins start to fall, they become unbalanced and can knock each other down. The ball itself cannot hit every pin; therefore, we must rely on unbalanced forces of the falling pins to get a strike.

Activity #3- Speed Calculation



Activity on Page 15

Does it matter how hard we roll the ball? The answer is...YES! If we do not apply enough force on the ball, it won't have the **energy** to knock down the bowling pins. The ball might not even make it to the end of the lane! Remember: energy from our arms is transferred to the ball; this makes the ball move. The ball now has **momentum** moving down the lane. This energy is then transferred to the pins during collision. The energy from the ball causes the pins to fall down. But both the pins and the ball have **inertia**. They will not move unless we apply **force** to them.

Any **mass** that is in motion has momentum. In fact, momentum depends upon mass and speed. Mass is the amount of “stuff” that is moving. Speed is how fast the “stuff” is moving. A 16-pound bowling ball has a lot of momentum, much more than a marble moving at a high speed which has less momentum. What happens when a marble collides with another marble that is at rest? Energy in the moving marble is transferred to the marble at rest and will cause it to move, similar to if you struck it with your finger.

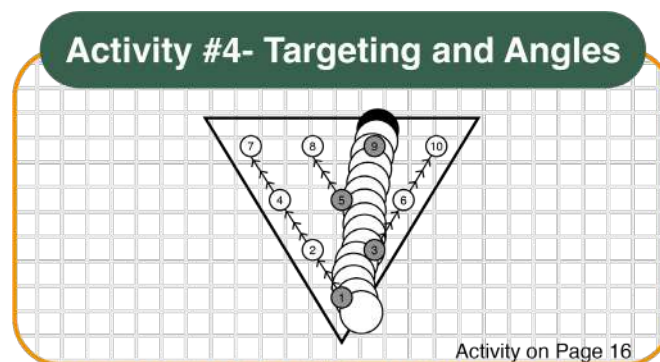
Momentum is a measure of how hard it is for an object to slow down or stop. The conservation of momentum can be illustrated in the basic collision of the ball and pin. When a bowling ball collides with a pin, the momentum lost by the ball is equal to the momentum gained by the pins. An example of this principle is the coefficient of restitution test that USBC conducts on all bowling balls. The coefficient of restitution (COR) of two colliding objects is typically a positive real number between 0.0 and 1.0 representing the ratio of speeds after and before an impact, taken along the line of the impact. The CoR test we run on bowling balls and bowling pins is done on a custom-built device. For our CoR testing, we use a test pin designated only for CoR testing and roll the approval sample ball down a ramp into the pin from a set distance. We use sensors to detect the speed of the ball and the pin (in feet per second) before and after impact.

Momentum is a quantity formed by the mass of an object and its velocity, described in mathematical terms:

$$p \text{ (momentum)} = \text{mass (m)} \text{ times velocity (v)}$$

If we throw the ball as hard as we can, it doesn't mean that all of the pins will fall down. The energy in the ball must be transferred to the pins to get them to move. The bowling pins have inertia. This means they don't want to fall down on their own. They want to keep standing. To get them to fall, we must apply a force. That force comes from the momentum of our bowling ball. To increase our momentum, we have to increase our force. We also have to increase the balls' torque so its spins long and far. With all these things to think about, are we ready to knock them all down every time?

No, not yet! Where we throw the ball is just as important as how hard we throw it. Remember, the bowling pins have inertia. They want to remain standing. If no force is applied, none will fall. Our force must be evenly distributed. This means it has to be spread to every pin. To get a perfect “strike” every time, you have to hit the front pin just the right way. This is what makes bowling so challenging! The figure below shows one way the ball can travel through the pins as the other pins collide into each other. For most strikes, the ball will only contact the 1-pin, 3-pin, 5-pin and 9-pin. The rest of the pins fall because they are contacted by another pin.



Technology, Equipment and Specification

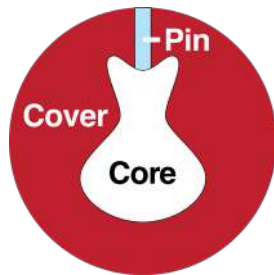
Technology touches areas of everyday life. Bowling is no different and for years also has been changed by technology.

Ball - Early in bowling, the ball was made of a solid piece of very hard wood. After that, hard rubber was the cover of the ball in the early 1900s. Plastic (polyester) coverstocks became popular in the 1960s. The smooth texture and hard surface of this coverstock allowed the ball to skid on the lane. Because of the durability and lower cost of these balls, they are what is primarily used as the “house balls” in most bowling centers. Urethane coverstocks came into bowling in the 1980s. These covers were softer and more porous than the previous plastic covers, allowing the ball to hook more on the lane. In the early 1990s, bowling ball coverstocks changed yet again to what is being primarily used today – Reactive resin. By adding an additional component to the urethane coverstocks, even more texture was created in the cover allowing for even more hook on the lane.

Pin - Bowling pins have also changed slightly over time. The starting point for bowling pins has stayed fairly similar throughout the years. They are then shaped into a bowling pin using a lathe – a wood cutting tool. In the past, the pins were only painted. Pins have a tough life being hit by bowling balls over and over, so instead of just applying a coat of paint, pins today are coated in a layer of plastic.

Lane - If a lane is heavily oiled, a softer ball must be used in order for that all-important curve to take effect. If the lane is lightly oiled, a harder ball must be used to prevent the ball from over-curving. Most significantly, however, it requires a knowledge of the playing conditions, a familiarity with ball-lane interactions, and, above all, a healthy respect for SCIENCE!

BOWLING BALLS



Bowling balls are made up of 2 main components:

1. Coverstock (the exterior material of the ball)
 2. Core (the interior of the ball)
- * Both have evolved over time.



A bowling ball is like a car. The coverstock is what a tire is to a car and the core is like the engine of the bowling ball.

All bowling balls are NOT created equal. Aside from the obvious weight differences, each ball must be custom fitted to your hand in order to provide maximum control and comfort. In addition, the finish of the ball is very important. A very hard ball will not grip the lane as well as a soft ball. This is very important in controlling how much one's ball curves as it makes its way toward the pins. Finally, the core of the bowling ball is not necessarily uniform. Some balls are heavier on one side, further promoting spin and curve. The ball grips the lane, and, if thrown with a spin, will curve much more easily than a hard thrown ball. If a straight throw down the middle is more your style, a hard ball is more in order. It allows for less finesse, but more power. The engine of the bowling ball, or core, is very important because the shape of the core changes the way the ball rolls down the lane.



Did you know....

Each year approximately 310 brand new bowling balls are approved by USBC?

Each bowling ball that is approved for use during USBC competition must meet a set of measurement specifications. Specifications are set limits on certain properties of a bowling ball to ensure that everyone is using a ball that fits within a specified range so someone does not get an unfair advantage.

Every bowling ball is measured for the following:

- Weight
- Hardness of the coverstock
- Circumference (or size of the ball – ten-pin bowling balls are all the same size)
- Roundness (the ball must be round like a sphere instead of oval like an egg)
- Radius of gyration (how hard or easy it is for the ball to rotate about an axis)
- Differential radius of gyration (difference between the highest and lowest radius of gyration)
- Coefficient of restitution (ratio of the speed of the ball and the pin before impact to after impact)
- Coefficient of friction (measure of force between ball and lane surface as ball moves on the lane)
- Surface roughness (measurement of the texture of the ball's coverstock)



Did you know....

USBC takes 38 measurements on each bowling ball submitted for USBC approval?

BOWLING PINS



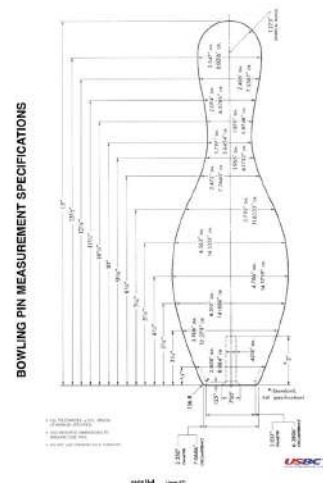
Step 1



Step 2



Step 3



Did you know....

It takes between 7 and 17 pieces of wood to make a wood bowling pin? USBC takes 91 individual measurements on each bowling pin submitted for USBC approval.

A sample number of bowling pins for annual approval are measured for the following:

- Plastic coating thickness
- Radius of gyration
- Center of gravity
- Hardness consistency of the coating (rebound and impact)
- Diameter of the base
- Weight
- Height
- Size of the hole in the base
- Radius of the base
- Diameter at 13 specified distances
- Coefficient of Restitution

BOWLING LANE

Lanes are oiled from the foul line until about two-thirds of the way down the lane. This means the path of the ball is relatively unaffected by its spin until it reaches the lesser oiled third of the lane. Then, depending on its hardness, the spin of the ball imparts a curve upon it. This is why some bowlers throw the ball far from the center, and then it suddenly appears to veer into the pocket, as if by magic.



Did you know....

Over 1,100 miles of bowling lane surface are certified by USBC each bowling season.

Advanced Learning

Professional Bowlers vs. Recreational Bowlers

Top-level bowlers are able to adjust the speed at which they throw the ball, as well as the rate of revolution that is applied to the ball. Characterizing these bowlers by one set of parameters is very difficult since they adjust so well to throw the ball in a manner that makes them the most successful based on the competition they face.

In general, many league bowlers throw the ball at an average speed of 18 miles per hour and an average rate of 275 revolutions per minute.

E.A.R.L., the bowling robot at USBC headquarters used for conducting research projects, can throw the ball as slow as 10 miles per hour at his release point and as quick as 24 miles per hour. Additionally, E.A.R.L. can impart from 0 revolutions per minute at release on the ball up to 900 revolutions per minute. E.A.R.L. has some super-human capabilities. He can throw the ball at any combination within those ranges.

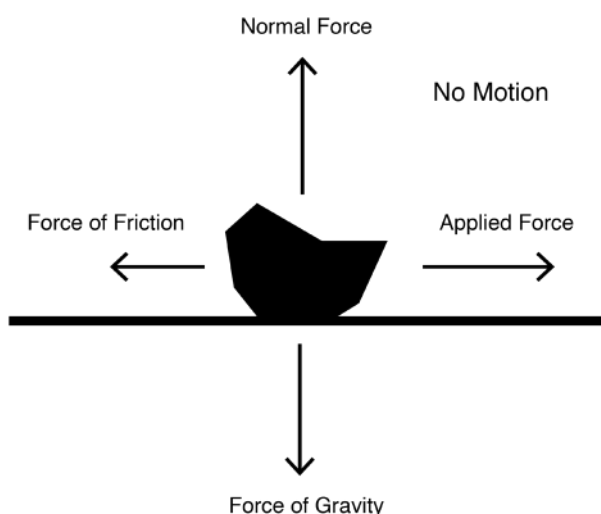


Did you know....

Bowling pins weigh very close to the same, but bowling balls have a maximum weight of 16 pounds with no minimum weight? If a bowling ball that is 16 pounds impacts pins with the same speed as a 12-pound bowling ball, there will be different accelerations of the pins based on which ball is thrown.

Friction

A ball thrown down the lane will slow down over its course. The main cause of this is Friction. The magnitude of the friction between the bowling ball and bowling lane depends on what the surfaces are made of and the amount of oil on the lane, if there is any at all, and the mass of the ball. Some lanes will have no conditioning on it at all, while others will have oil placed to a certain degree on different areas of the lane. As the bowling ball travels down the lane, the friction between the ball and the boards will slow it down. The composition of the oil, and where it is denser on the lane, will have a different effect of the ball as it travels along the lane. The more oil that is laid down, the less friction there is between the ball and the lane surface. The less friction, the harder it is for the bowler to send the ball in a curved path imparted by the spin that the bowler puts on the ball at the instant of release.



Center of Gravity

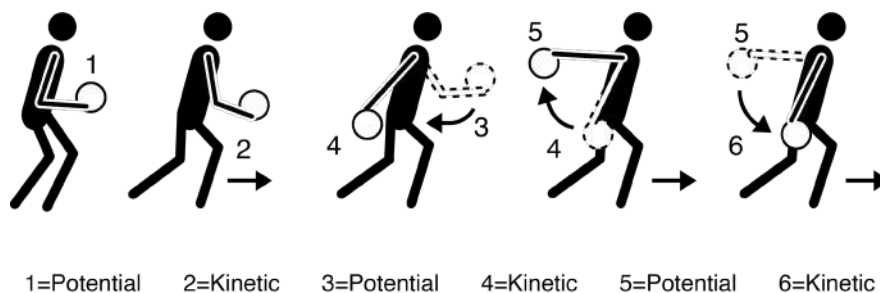
The **Center of Gravity** (CoG) is the point at which gravity can be considered to act. In most cases (with uniform gravity) it is equal to the center of mass. The CoG in bowling is both for the bowling pins and bowling ball. Bowling pins have a low center of gravity due to their shape, which make them more stable. The center of gravity of a bowling ball is not always in the absolute middle of the ball. The vector the center of gravity falls on within the ball is usually indicated by the position of the logo or punch mark on the surface of the ball.

Elastic or Inelastic Collisions

A perfectly **elastic collision** is defined as one in which there is no loss of kinetic energy in the collision. An inelastic collision is one in which part of the kinetic energy is changed to some other form of energy in the collision. After collisions between bowling balls and the pins, you see the pins scatter and bounce when struck by the ball, transferring some of the kinetic energy from the bowling ball to the pins. Therefore, the collision is somewhat elastic. However, both the pins and ball get damaged over time, and come to rest after the collision, so the answer is that the collision is somewhat inelastic.

Energy

There are two basic kinds of energy: 1. Energy of position 2. Energy of motion



Kinetic energy is energy in use or in motion. Anything in motion has kinetic energy. Potential energy is energy that is at rest. All objects have potential energy. When the bowler holds the ball, the ball has potential energy. When the ball is pushed away from the body, the ball has kinetic energy and when the ball stops before the back swing, it has potential energy again. As the bowler begins the backswing, the ball returns to kinetic energy. For a brief second, the ball stops at the end of the backswing, and has potential energy until the bowler swings and rolls it forward down the lane. When the ball hits the pins, it causes the pins, which started out with potential energy, to have kinetic energy.

Vocabulary

Speed	The ability to move your body or parts of your body swiftly.
Static Balance	State of equilibrium, without movement. Stationary.
Torque	A turning, or rotary force.
Velocity	Rate of motion in a particular direction in relation to time. Quickness of motion.
Force	That which alters or tends to alter a body's state of rest or uniform motion in a straight line. The push or pull effect that one body produces on another body.
Inertia	The property of matter that resists an object's change in motion.
Momentum	Measure of how hard it is to slow down or stop an object.
Absorption	Interception of force or energy.
Acceleration	The rate at which velocity changes with respect to time.
Inertia	The tendency of all objects to resist any change in motion.
Moment of Inertia	Resistance to change in rotation.
External Forces	Forces outside of the system that change or alter movement. Examples are air resistance, gravity, and contact with the ground or some other body.
F.I.T.T.	Frequency, Intensity, Time and Type, which are four key ways that activity can be manipulated to create a desired outcome.
Flexibility	The elasticity of muscles and connective tissues, which determines the range of motion of the joints.
Manipulative Skills	A skillful movement done to or with objects such as throwing a bean bag, striking a soccer ball, catching a Frisbee or juggling.
Radius of Gyration (RG)	Measured in inches, distance from the axis of rotation at which the total mass of a body might be concentrated without changing its moment of inertia.
Range of Motion (ROM)	Varying degrees of motion around a joint.
Radius of Rotation	Linear distance from an axis to a point on a rotating body.
Balance	The ability to control or stabilize your equilibrium while moving or staying still.
Balanced Forces	Forces that are equal in size and opposite in direction.
Dynamic Balance	State of the body moving with constant speed and direction with zero acceleration.
Center of Gravity	The imaginary point inside a body of matter where the total weight of the body is thought to be concentrated.
Core	The interior of the bowling ball; the core may consist of the inner core (weight block)
Coverstock	The exterior or outer shell of the bowling ball.
Pin (in bowling ball)	This is used to indicate where the top of the weight block is located in the ball. It is also the axis of the ball with the lowest radius of gyration.

Activites

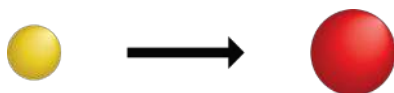
Activity #1 – Mass & Distance

Materials Needed:

Varying size marbles
String or tape
Ruler

Procedure 1: Mass and Distance

- Record the masses of each of the four marbles.
- On paper, measure a distance of 12 inches using your ruler, and draw a line.
- Place a small marble on one end of your line, a larger marble at the other.
- Roll the small marble so that it collides with the larger marble.
-



- Measure with your ruler the distance that the larger marble traveled, after the collision.
- Record your measurement. Do this three times: trail 1, trail 2 and trail 3.
- Repeat experiment with the larger marble striking the smaller. Push larger marble into smaller one.
- Record your measurement. Repeat this three times.

Questions:

1. After the collision, which marble traveled farthest?

The collision involving the large marble striking the small marble will produce the largest distance. This is because the larger marble has more inertia, and strikes the smaller marble with the most force. The larger the force applied to an object, the more energy will be transferred, therefore producing the most distance. The small marble will not move the larger marble as far due to the fact it has less inertia.

2. Why do you think this happened?

Students should relate each of the interactions to inertia, force, and energy. They should understand that if an object has a large mass, it has more inertia, and therefore requires more force to get it to move. Because more force is applied, the object also will have more energy, which can cause motion. Larger things are harder to stop (require more force) than smaller things.

3. Does mass have anything to do with how far the marbles traveled?

a. Yes. The largest mass striking the smallest will result in the most distance. The largest mass has the most energy, and provides the greatest force for the smallest marble.

4. Did the hardness of your throw have a possible effect?

“Hardness of throw” is another way of saying “supply of force”. A hard throw has a lot of force; a gentle lob does not supply much force. The greater the force, the more energy stored within the marble.

5. Complete the sentence:

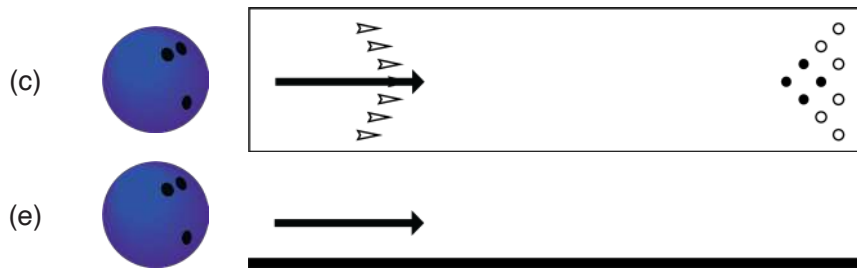
The smaller marble travels farthest when struck with the most massive marble because the most **massive** marble has the greatest **inertia**.

Activity #2 - Effects Of Friction

What makes the bowling ball roll best?

* This is best done as a controlled teacher demonstration

- a. Place the Bowler's Ed carpeted lane down and tape off a similar lane distance alongside.
- b. Make a prediction of how far you think your bowling ball will travel on the gym floor versus the carpeted lane. Do you think the ball will roll easier on the carpet or on the gym surface?
- c. Place a ball on the carpeted lane and push it gently down the laneway from a seated position.
- e. Record the distance traveled.
- f. Place a ball on the gym floor. Push it gently across the marked area of the floor.
 - * Have a student at the other end to stop the ball if it continues rolling.
- g. Record the distance traveled.
- h. Repeat this procedure 3 times for each.



	Distance 1	Distance 2	Distance 3
Carpet			
Gym Floor (not carpet)			

- 1. On which surface did the ball seem to roll the farthest?**
 - a. Gym floor, since it provides the least amount of friction.
- 2. What difference did you notice between the floor and the carpet?**
 - a. The carpet prevents the ball from rolling very far when gently pushed. The carpet is rough, and provides more friction. The gym floor is smooth, and does not have as much frictional force as the carpet.
- 3. Which of the two, carpet or gym floor, provides the least friction?**
 - a. The gym floor, being the smoothest, provides the least amount of friction.
- 4. Why are bowling lanes made of wood and not carpet?**
 - a. The wood allows the ball to roll quickly and farther than a carpeted surface. It would take too much force to roll a ball down a laneway made of carpet, because the ball will eventually stop rolling on a carpeted lane and never even make it to the pins.
- 5. How do you think it would differ if the bowling alley were made of sand? Grass? Ice?**
 - a. Sand and grass would be difficult to roll the balls, in that they have a lot of friction: they are not smooth surfaces. Ice, being smooth and slippery, would be another alternative to the wood: both are smooth and provide little friction. This is why we slip on ice if we try to walk on it - it provides us with little friction.

Activity #3 - Force & Speed

Calculate the speed in which the ball traveled and the amount of force applied.

* Calculations of this nature are for students that have knowledge of how to divide numbers

Trial 1:

From a seated position, use both hands to push the bowling ball gently.

When the ball is released from your hands, start the timer.

When the ball reaches the end of the lane, stop the timer.

Record the time it took for the ball to travel down the laneway.

Trial 2:

Increase your force and push the ball it slightly harder.

Record the time it took for the ball to travel down the laneway.

Trial 3:

You may stand up. Using one hand, you may roll the ball quickly.

Record the time it took for the ball to travel down the laneway.

Switch with your partner and repeat the experiment.

Calculate the average speed for both you and your partner.

Calculate speed by dividing the distance in meters by the time in seconds.

$$\text{Speed} = \text{Distance (m)} \div \text{Time (s)}$$

	Lane Distance	Time Ball Rolled	Partner's Ball Speed (m/s)	Partner #2 Ball Speed (m/s)
Trial 1				
Trial 2				
Trial 3				
Average				

- Determine the length of the laneway with a metric tape measure.
 - Have a partner ready with a stopwatch by the side of the lane.
- 1. On which throw did the ball travel the fastest?**
 - a. Students should respond that the ball thrown quickly traveled the fastest. When they try to roll it fast, it means they are supplying more force. A greater amount of force means they will be providing the ball with more energy. More energy overcomes inertia.
 - 2. On which throw did you apply the most force?**
 - a. The last of the trials, where they threw the ball quickly, supplied the most force.
 - 3. What can you conclude about how hard you throw the ball, and how fast it travels?**
 - a. Students will be able to explain that the harder the ball is rolled, the faster it will travel. This is because they are providing the most force when they try to make it go farthest. The force applied to the ball provides the ball with energy.

Activity #4 - Angles and Collisions

Materials Needed:

Bowler's Ed In-School Bowling Equipment
Gymnastic mats or similar mats for 'bumpers' alongside lane

- a. Roll the ball as straight as you can down the laneway.
- b. Record how many pins you knock down.
Repeat this 2 more times.
- c. Roll the ball slightly to the left of the front pin. Record how many fall.
Repeat this 2 more times.
- d. Roll the ball slightly to the right of the front pin.
- e. Record how many fall.
Repeat this 2 more times.
- f. Roll the ball down the alley so that it bounces off the sides. Observe ball speed after it bounces.
Record how many pins are knocked down.
- g. Repeat this 2 more times.
- h. Find the average number of pins knocked down using each method.
Construct a bar graph of your data.

	Lane Distance	Time Ball Rolled	Partner's Ball Speed (m/s)	Partner #2 Ball Speed (m/s)
Trial 1				
Trial 2				
Trial 3				
Average				

- 1. Which method knocked down the most pins?**
 - a. Students' responses will all vary, due to how hard they roll the ball. In general, the straight forceful throw will knock down the most pins.
- 2. Which method knocked down the least?**
 - a. The throw where they have to bounce the ball off the side-rails will knock down the least amount of pins, due to the fact that the ball loses energy to friction and due to the collisions (energy leaves the ball and it transferred to the rail each time it strikes). In these instances, the ball may not be able to roll the total distance to reach the pins since it loses so much energy, or it simply does not have enough force to knock down the pins when it reaches them.
- 3. What happened to the ball's speed after it bounced each time?**
 - a. The ball's speed will decrease.
- 4. What happened to the ball's energy after it bounced off of the sides?**
 - a. As energy decreases, speed decreases. Some of the ball's energy is transferred to the side-rails each time it strikes them, causing the ball to lose energy, and therefore lose speed.

References and Continued Learning Resources

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Continued Learning:

Sports Science – PBA’s Sean Rash

<http://www.youtube.com/watch?v=gY-8BUnSgf4>

In this video demonstration from ESPN Sport Science you will learn about velocity, acceleration and the force on a bowling ball and body upon release.

Science Chanel How It’s Made – Bowling Ball

<http://www.youtube.com/watch?v=cW4H31DS0QY>

In this video you will learn about the combination of liquids that made up a bowling ball core, bowling ball and manipulation of bowling balls through construction and design.

Science Chanel How It’s Made – Bowling Pin

<http://www.youtube.com/watch?v=Y7ekdqyO-yM>

Learn about the creation of a regulation bowling pin throughout the entire process. Additionally, you will learn about the weight, height, bowling pin dimensions and creation time.

Time Warp – PBA’s Michael Fagan Swing Analyzed

<http://www.youtube.com/watch?v=of92oOD6SqQ>

In this video, PBA star Michael Fagan has his swing, bowling ball rotation speed and how he creates the speed/velocity analyzed on the lane.

**Teacher's
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817-385-8426 | 800-514-2695 ext. 8426
621 Six Flags Drive, Arlington, TX 76011
Fax: 817-385-8262

BowlersEd@bowl.com
www.BowlersEd.com