



## AFTERSCHOOL EXCHANGE ACTIVITY

---

### BOUNCING OFF THE WALL

#### PREPARATION

**Math Topic:** Equal angles

**Grade Levels:** 3-6

This activity would be most effective if delivered in three (3) separate 30-40 minute periods.

**NCTM Standards:** Geometry, Problem Solving

#### Prerequisites

Before beginning this activity, cut three pieces of white poster/butcher paper in 10-foot-long sheets.

#### Materials Needed

Students will need:

- small rubber balls, like the kind used with Jacks
- lids from a box that holds reams of paper or shoebox lids
- magic markers
- rulers
- a chalkboard or some other way to display information

Group Leader will need:

- copy of the Cyberchase episode "Penguin Tears"
- four large rubber balls, like the ones used in Gym class
- 3 10-foot-long sheets of butcher paper
- tape

#### Academic Goals

Children will:

- use angles in real-world situations
- use visualization and spatial reasoning to solve problems
- use investigation and estimating to solve problems
- make the connection between a sports activity and mathematics

#### Social Goals

Children will:

- have opportunities to work in small groups, as teams
- listen to each other's opinions and reasoning to come up with one final answer

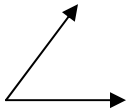
- learn to share information within a group and across groups

## STEPS

### Activity 1:

#### Introductory Activity (30-40 minutes)

1. Watch the entire CYBERCHASE episode "Penguin Tears." Ask the students to pay close attention to when the Cybergang solves problems by looking at angles. Before showing the episode you may want to ask the students if they know what an angle is. If they do not, draw an angle on the board and have the children describe it. They might say it looks like two arrows that begin at the same point. Explain that in math the arrows are called "rays."



2. Discuss briefly how the kids in the show were able to solve different problems. Ask the students if they can explain what "equal angles" means, based on what they learned from the Cyberchase episode. If needed, use an explanation similar to the one used in the "Penguin Tears" episode – the angle going in is the same as the angle going out. Ask the students to identify when the Cybergang used equal angles to solve a situation in the episode.
3. Ask the students to think of the example in the episode when Fluff the penguin, Digit, and the kids are trying to escape from the Tomb of Records. If needed explain that they figure that the angle formed by the path of the object coming in and the wall is the same angle formed between the wall and the outgoing path. In short, angle in = angle out.

#### Learning Activities (30-40 minutes)

1. Explain that now they will watch a short clip from the "Penguin Tears" episode that they watched in the previous session. If you can't show the video clip from the Web, cue the video tape about four minutes into the episode to the scene that begins with Digit saying, "That's your fourth miss." End the clip after about one minute when Digit says, "That's the secret: Aim is the game."
2. Explain to the students that they will now have an opportunity to figure out how to predict the path of a bounce, just as the kids attempted to do in the hockey

scene they just watched. Only in this case, the students will have to predict where the ball will end up.

3. After watching the scene, divide the group into four teams. Give each team a box lid, a small rubber ball, a ruler, and a magic marker. Explain that the lids are the “practice rinks” for the teams to investigate the path of a bounce just like in the Cyberchase episode.
4. To begin, explain to the groups that the lids should be placed upside down so they lay flat against the floor with the edges sticking up. Ask the groups to mark off 10 inches along the bottom inner edge of the box lid. They should draw a dot at one inch, and above the dot label it “1.” They should continue to draw dots every inch and label them “2”, “3”, “4”, “5”, “6”, “7”, “8”, “9”, and “10”. You may want to label a box in advance as an example to show the children.
5. On the opposite inner edge of the shoebox lid, they should again mark off 10 inches along the inner edge of the box lid and draw dots every inch and label them “2”, “3”, “4”, “5”, “6”, “7”, “8”, “9”, and “10”. Draw the numbers so the same numbers are directly across from one another.
6. Each group should roll the ball two times, once starting at the “1” dot and aiming for the “3” dot on the opposite side of the lid. Next, they should start the ball at the “5” dot and aim for the “7” dot on the opposite side.
7. After each roll, one student from each group should record on the board at which dot the ball started, at which dot it hit on the opposite side of the lid, and at which dot it rolled back to on the starting side of the lid.
8. Using the ruler, one student should draw the path of the ball based on the origin number, the bounce number, and the return number. They should draw the path for each of the rolls using the magic marker on the shoe box lid.
9. When every group has completed this activity, ask the students what they discovered about the path of the ball. Did the path of the ball form two equal angles with the bounce side of the lid? If not, what do they think happened? If it did, what do they think made it work? Ask the students how they think equal angles can be used to predict the return path of the ball.
10. Based on what they learned creating their own "practice rinks" ask the students where they think the ball would bounce back to if they started it at "3" and aimed it at "5?" (It would bounce back to "7." Have them explain their reasoning. They may wish to use a ruler and draw the predicted path and then roll the ball to test their prediction.) Continue to ask them to make predictions until you feel the students can easily predict the outcome of the bounce for any number along the number line.

## Activity 2:

### Introductory Activity (15 minutes)

1. Cue the tape about 13 minutes into the episode to the scene where Jackie says, “Whenever Ice stands in a certain spot.” Play the scene for about two minutes, ending with Digit saying, “The angle the path makes going into the wall is the same as the angle the path makes coming away from the wall.”
2. Discuss how the Cybergang used a “practice rink” in the Tomb of Records to test the equal angle theory, just as the students did in the previous exercise. Then, introduce the next activity by discussing how that technique can be used to predict the path of any bounce. You can explain that in the Cyberchase episode the Cybergang was trying to find the target point so the bounce would end at the designated point (i.e. the pole in penguin hockey). Explain that in the next activity the students will identify the starting and target point and with this information they will use equal angles to estimate the point on the wall to bounce the ball.
3. After watching the scene, you will make a space with the butcher paper for the groups to predict their bounces. Ask the students to help you tape one of the 10’ butcher sheets to the wall lengthwise, with the bottom touching the floor. Starting from the bottom of the sheet taped to the wall, tape the other two sheets, lengthwise, to the floor next to each other making one large sheet. The sheets on the floor should be positioned lengthwise from the mid-point of the sheet on the wall. The three sheets of butcher paper make about a 6’ wide and 10’ long strip of paper on the ground.

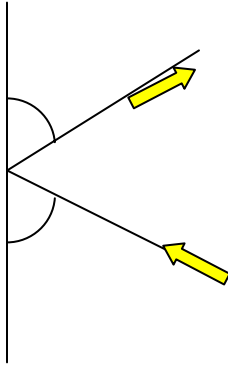
**NOTE:** You can also conduct this activity outdoors against a wall. Or if you do not have butcher paper you can cut out a circle with ‘START’ on it, another labeled ‘BOUNCE POINT’ where the students will hit the wall, and a third labeled, ‘TARGET’ – what they are trying to hit.

4. Ask the students to re-form their groups from the previous session or assign them to new groups, and give each group a rubber Gym ball and a magic marker. Be sure that each group has a different colored magic marker.

### Learning Activities (30-40 minutes)

1. Space the groups equally along the length of the paper. Ask each group to draw one starting circle on the paper on the floor, and an aiming circle on the wall just above the floor - similar to the targets they learned about in the Cyberchase episode.
2. Then, ask each group to estimate the bounce path if they roll it from the ‘Start’ circle and hit the ‘Bounce Point’ on the wall, based on what they learned from the box lid game they played and the Tomb of Records scene they just watched.

3. Ask the groups to draw the predicted path of their ball from the 'Start' circle to the 'Bounce Point' on the wall, and the predicted bounce path. Be sure to ask each group to use its designated magic marker color. Have the students place a target like a chair or a small box – something that will stop the ball as it hits the target – in line with what they think the path of the bounce will be. Also, have one student in each group clearly mark the equal angles formed by the predicted path. When the students mark the equal angles they should look like the below example:



4. Next, one student in each group should roll the ball from the 'Start' circle to the 'Bounce Point', and see if the ball hits the target. If it doesn't hit the target have another student mark in that team's color where the ball ended up.
5. If some of the predictions were not accurate, ask the group to explain why they think the ball traveled a different path than was outlined, taking into account what happened in the "Penguin Tears" episode. For example you can ask the students if the ball missed the target point because the angle the ball made with the wall's 'Bounce Point' was too large or too small to correctly hit the predicted point.
6. Create a new 'start' circle and place it anywhere on the floor and then place a chair or a small box on the floor. Have each team determine the 'Bounce Point' they need to have the ball hit the target. Then have the teams alternate turns and the team to reach 10 hits first wins.
7. Ask the students for examples of games and sports where predicting a bounce could be helpful. If needed, explain that it could be helpful when playing games like pool, hockey, basketball (bounce pass), racquetball, squash, etc. Ask the group if there is a technique they can use that would help them predict the path of a bounce. If needed, explain that just like the Cybergang used icicles to predict the path the key needed to take in the Tomb of Records, and Matt used pool sticks to get the 8 ball in the pocket of the pool table, they can use "angle in = angle out" and use objects, like rulers, to help them visualize the path of the bounce.

**Follow up Activities:**

Have the children visit the Games Central section of the Cyberchase Web site and learn more about how to measure angles with the game "[Star Gazing](#)" or have them watch the For Real clip "[Harry Gets Board](#)" to learn more about angle measurement.

**CREDITS**

This AFTERSCHOOL EXCHANGE activity was developed by Melissa Donohue in connection with the Thirteen series CYBERCHASE.