



Triangle Offense with Sphero

Channeling the Chicago Bulls with Math and Robotics

Activity:

Students will review a clip of the Chicago Bulls executing the Triangle Offense. They will pause the footage, determine what type of triangles the team is forming in that play, and program the Sphero robot (using either Scratch or Java script) to execute the triangles used in the play.

Lesson Objective:

After completing this activity, students will be able to

- Identify different types of triangles by angle and length
- Use either block-based coding or java script within the SpheroEdu App
- Replicate the famous triangle offense strategy using Sphero robots

Lesson Standards:

CCSS Math:

[4.G.A.2](#)

Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category and identify right triangles.

NGSS:

GEO-G.CO - 1 Know precise definitions of angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc as these exist within a plane

Skills Needed:

- Google Slide or Microsoft PPT experience
- Beginner block-based coding or Javascript experience
- Understanding of the SpheroEdu App and robot

Materials Needed:

- Access to the Internet
- A protractor or [virtual protractor](#)
- 1-3 Sphero robots
- Access to the [SpheroEdu webpage](#) or [SpheroEdu App](#)



Essential Questions:

1. What properties do lines and angles demonstrate in Geometry?
2. What types of angles exist in Geometry?
3. What are the similarities and differences between the different types of triangles?
4. How does block-based language differ from JavaScript? (if you're having students work in both languages)

Vocabulary (suggestion):

Types of triangles:

By Side

- Equilateral Triangle: Has three equal sides
- Isosceles Triangle: Has two equal sides
- Scalene Triangle: Has no equal sides

By Angle

- Acute Triangle: Has three angles that are all less than 90 degrees
- Right Triangle: Has one angle equal to 90 degrees
- Obtuse triangle: Has one angle greater than 90 degrees
- Equiangular triangle: All three angles are the same (60 degrees)

Coding Vocabulary:

- Block-based coding: **Block-based coding** is very popular in schools as it offers an introduction to coding in a less intimidating way. Instead of traditional **text-based programming**, block-based coding involves dragging "blocks" of instructions. The most popular example of this is **Scratch**, a block-based language created by MIT where users drag blocks of code together (as illustrated in the activity example).
- Java Script: an object-oriented computer programming language commonly used to create interactive effects within web browsers.

Activity Steps and Resources to Share with Students

Step 1: Introduce the Topic

Start the lesson by discussing what has made some of the world's greatest basketball teams so successful.

- Did they find success because of a single talented player?
- Was it that they had the best players in the league?
- Was it because the team worked well together?

From there, provide students with a brief history of the Chicago Bulls of the 90's. Discuss how, although they had one of the best players in the world (Michael Jordan), it was the triangle offense that helped them achieve such great success.

To help, share with students the following videos:

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- [Tex Winter Explaining the Triangle Offense \(Youtube Video\)](#)
 - Tex Winter is known as the innovator of the triangle offense. He was the coach of the Kansas State basketball team from 1952 to 1967. During this time, he perfected his triangle offense strategy which led the team to eight league titles. In 1985, he became the assistant coach of the Chicago Bulls and used this strategy to help the Bulls win the NBA championships in 1991, 1992, 1993, 1996, 1997, and 1998.
- [Dennis Rodman Breaks Down the Chicago Bulls' Triangle Offense \(ESPN+\) \(Youtube Video\)](#)
 - In this 4-minute clip, legendary power forward Dennis Rodman provides commentary on how the team executed the triangle offense showing a few plays from the 1997-1998 season.
- [Triangle Offense in Basketball Explained: New York's Geometry Lesson \(Youtube Video\)](#)
 - A 3-min video (brought to us by the New York Times) discussing the triangle offense, with clips of players in action and lines drawn to show the triangle formations.

Step 2: Review with students the different types of triangles.

- For Beginners New to Triangles:
 - [Types of Triangles Review \(Khan Academy\)](#) - This includes instructional videos, assessments, and ways for students to practice constructing triangles with the information they just learned. The best part—it even tells you what common core standards each step addresses.
- For a Quick Review:
 - [What are the Different Types of Triangles \(Youtube\)](#) - A quick video that uses illustrations to show the types of triangles (and breaks it down by sides and angles).

Step 3: Identify the triangles in the triangle offense

- Students will review a [clip of the triangle offense in action](#)
- Students will take a screen shot of the play in action. (Example below)

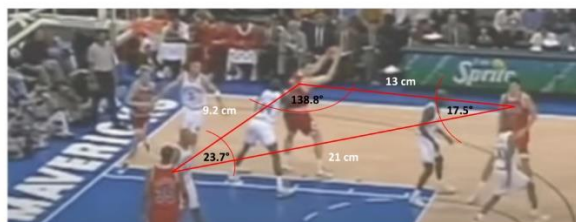


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- Students will then identify the triangles they see in the screen shot. This can be done a number of ways.
 - Using an online platform.
 - If you are a [Microsoft 365](#) school, students can accomplish this using Powerpoint. If you are a [Google for Education](#) school, Google Drawing or Sheets can be a solution. Allow students to use whichever platform they are most comfortable with. To create my drawing, I used Microsoft Powerpoint.
 - Hand drawn.
 - If students have a printer at home and prefer to draw directly on their screen shots, they can print out the image and draw the triangles using markers.
- Students will then measure the angles and sides of the triangles.
 - They can do this by either placing a protractor against their device (or paper if printed out), or by using an online protractor. For this, I downloaded the [Protractor Extension on Google Chrome](#).
 - Students will label the length and angles of the triangles on their doc/paper and have them label what type of triangle they have identified.
 - Within each shot, they should identify a minimum of three triangles.

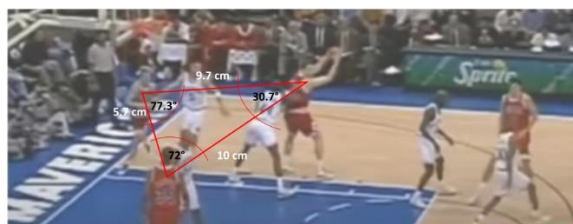
Example Work:

Triangle 1



This is an **obtuse** triangle because one of the angles is more than 90°.
This is a **scalene** triangle because none of the side are the same length.
This is an **obtuse scalene** triangle.

Triangle 3



This is an **acute** triangle because all of the angles are less than 90°.
This is a **scalene** triangle because none of the sides are the same length.
This is a **scalene acute** triangle.

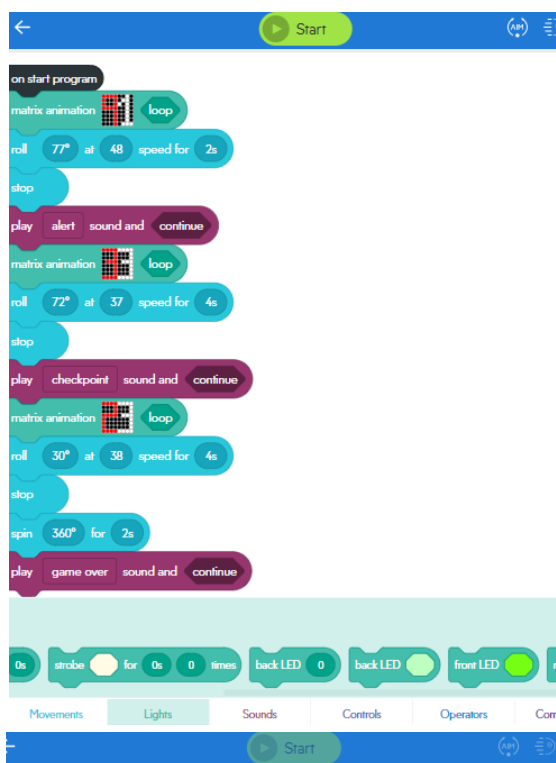
Step 4: Have students create code within Sphero Edu's online platform to create the shape of the triangles.

- Have students log into the [Sphero Edu](#) web platform
- Using either block-based coding or JavaScript (both languages available in the Sphero Edu web platform) have students create the code to execute the play.



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- Encourage students to get creative with their code by adding different actions at each stop of the triangle. For example:
 - Using Sphero Bolt, students can have the LED Matrix display the jersey number of the player holding the ball at each corner of the triangle, as seen in the example code below.
 - Students can have a noise sound once the Sphero has reached each individual corner of the triangle (code also shown below).



JavaScript Code

```

1 async function startProgram() {
2   playMatrixAnimation(0, true);
3   await roll(77, 48, 2);
4   stopRoll();
5   await Sound.EightBit.Alert.play(false);
6   playMatrixAnimation(1, true);
7   await roll(72, 37, 4);
8   stopRoll();
9   await Sound.EightBit.Checkpoint.play(false);
10  playMatrixAnimation(2, true);
11  await roll(30, 38, 4);
12  stopRoll();
13  await spin(360, 2);
14  await Sound.EightBit.GameOver.play(false);
15 }

16 registerMatrixAnimation({
17   frames: [[2, 2, 2, 2, 1, 1, 0, 1], [2, 1, 1, 2, 1, 0, 0, 1],
18   palette: [{ r: 255, g: 255, b: 255 }, { r: 0, g: 0, b: 0 }],
19   fps: 10,
20   transition: MatrixAnimationTransition.None
21 });
22 registerMatrixAnimation({
23   frames: [[2, 2, 2, 2, 0, 0, 0, 0], [1, 1, 1, 2, 1, 1, 1, 0],
24   palette: [{ r: 255, g: 255, b: 255 }, { r: 0, g: 0, b: 0 }],
25   fps: 10,
26   transition: MatrixAnimationTransition.None
27 });
28 registerMatrixAnimation({
29   frames: [[2, 2, 2, 2, 0, 0, 0, 0], [1, 1, 1, 2, 1, 1, 1, 0],
30   palette: [{ r: 255, g: 255, b: 255 }, { r: 0, g: 0, b: 0 }],
31   fps: 10,
32   transition: MatrixAnimationTransition.None
33 });
  
```



And if you'd like to provide additional challenges for your more advanced coders:

- Have students code 3 Spheros to run the play simultaneously
- Include a 4th Sphero to act as the ball being passed from one Sphero to the next
- Have students code multiple Spheros to "pass the ball" down the "court."

Step 5: See it in action!

If students are with you in class, have them run the code until they have their intended results. Allow for enough time for students to trouble shoot their work and finish the activity by having students present their final work to their peers.

Additional idea:

- With students present: Students can dip the Spheros into [washable paint](#) and then run the code on top of large sheets of white paper. Once the paint is dry, students can measure the angles/lines of the triangles the Sphero formed in order to see if the code formed the intended type of triangle.

If you are doing this project remotely with your students, have them send you their labeled images and code. Then, run the code on their behalf to see if it worked. Schedule Google Meet or Skype calls with your students so you can run the code with them live and discuss the results.

For More Information

To learn more about Sphero, check out our courses on [OTIS for educators](#), Teq's online professional development platform. Available Sphero courses include:

- [Sphero Bolt Basics](#)
- [Tech-Infused Learning: Geometry with Sphero](#)
- [Sphero SPRK+ Basics](#)