

## SPEED MEASUREMENTS

<b>Level</b>	3 (Age group 11 – 14)
<b>Resources Required</b>	Cylinders of different sizes (for example, food cans, soda cans, gas cylinders etc.)
<b>Alternate Options for the Resources</b>	Player or Facilitator can make his/her own cylinder using paper, Papers, Markers, Rulers, Scissors
<b>Strand Covered</b>	Shape and Measurements
<b>Targeted Skills</b>	Practice calculating the surface area of cylinder
<b>Inspired by</b>	Study.com - Heather Jenkins
<b>Time Required</b>	30 minutes to play 20 mins to make their own cylinder
<b>Previous Learning Required</b>	Know how to measure different lengths such as the radius of a circle or height of the cylinder Knowledge of multiplication
<b>Support Required</b>	Medium support

### Rules of the Game:

<b>Goal</b>	Correctly measure the surface area of all cylinders
<b>Rules</b>	<p>Players must create a cylinder with the required surface area. They are allowed a margin of error of up to 1 digit.</p> <p>Cylinders will be created according to the following specifications:</p> <ul style="list-style-type: none"> <li>- Radius: between 1-10</li> <li>- Height: between 5-20</li> </ul> <p>This game is ideal for at least 6 players in groups of 2</p>
<b>Steps</b>	<p>Step 1: Using a sample cylinder, model for the players how to measure the radius of the cylinder's base and its height using a ruler. Then discuss how to find the total surface area of a cylinder using those measurements via the formula: <math>2\pi rh + 2\pi r^2</math></p> <p><math>\pi = 3.14159</math></p> <p>Players must use a <math>\pi</math> value of up to at least three decimal places in their calculation</p> <p>Step 2: the facilitator asks players to create cylinders with a total surface area of 466.5.</p>

Step 3: Players use hypothetical dimensions to come up with the total surface area of 466.5

Step 4: once they arrive at a satisfactory height and radius, players prepare to create their cylinders. They assemble paper scissors and glue/tape. In groups of 2, players start creating their cylinders:

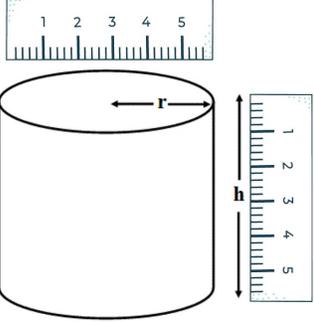
- Players determine the height of the cylinder and draw and cut out a rectangle of that width
- Players fold the rectangle to create a cylinder
- Before taping/gluing the edges, players check one of the two circle openings to make sure that it has the desired radius
- Once the desired radius is achieved, players glue or tape the edges of the paper to create a cylinder



Step 4: players measure the total surface area of their cylinders and report to the group. The group with the most accurate figure wins.

**Images or Illustrations**

How to measure the radius and height of a cylinder:

	 <p>Here, <math>r = 3</math> and <math>h = 5.3</math></p> <p>Therefore, the total surface area is <math>2\pi rh + 2\pi r^2 = (2 * 3.14159 * 3 * 5.3) + (2 * 3.14159 * 3^2) = 156.45</math></p>
<p><b>Variations of the Game</b></p>	<p>The game can be played with different 3 dimensional shapes, for example, cubes or cuboids.</p> <p>Total surface area:</p> <p>Cuboid: <math>2(\text{length} \times \text{width} + \text{width} \times \text{height} + \text{length} \times \text{height})</math></p> <p>Cube: <math>6(\text{side})^2</math></p>