Erasmus+

ANSWER KEY

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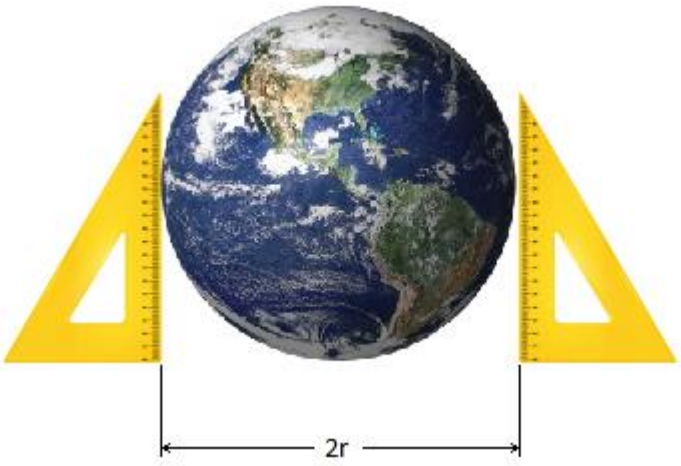
THE DIFFERENT WAYS OF MEASURING THE CIRCUMFERENCE:

To measure the circumference using the specific tools provided, there are at least 4 different ways. Teachers may come up with even more ideas that are not in this document.

OPTION 1: Place vertically two rulers on each side of the ball so you can measure the diameter of the sphere. Mark the distance between the edges of the rulers and then use one of them to measure that distance (the diameter). Now you know the radius of the sphere. The circumference equals Π=2•π•r where r is the radius you measured.



OPTION 2: Use the string to measure how many times the string fits the circumference of the sphere. Then measure that length calculated with a ruler.

OPTION 3: Place the sphere inside the bucket and measure the displacement of the water. The amount of water displaced equals the volume of the sphere. Using the formula:

$V=(\frac{4}{3})\pi r^3$ (where V is the volume and r is the radius)

you measure the radius of the sphere. The circumference equals Π=2•π•r where r is the radius you measured.

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OPTION 4: Place the ball near a wall and the flashlight as far away as possible directing straight at the ball. Use the flash light to project the shadow of the ball on the wall. Measure the shadow's diameter and then calculate the circumference like in option 1.

Not all of the options are equally accurate. The most accurate one is option number 1 because it involves only one, and the simplest measurement (hence, the one with the lowest possible error) and it uses the actual formula to make the calculation.

Option 2 can be valid as well, however, as the string is smaller than the sphere it involves multiple errors. Plus you will also need to measure the length of the string afterwards which includes an additional source of error. However this could potentially be the simplest one that the teachers will go for.

Option 3 is also valid and it only requires one measurement, so least possible error. However it takes two equations to get to the answer so it's more complicated and the error increases too.

Option 4 is the trickiest as there can be many mistakes there. When you flash the light on the sphere depending on where you stand the shadow will be magnified. So the measurement can easily be wrong. In order for this to work, the person holding the flashlight has to stand very far from the sphere and the sphere has to be very close to the projection wall. To explain this make a brief demo by placing the flashlight and the ball in different positions against the wall.

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