Area of a Circle

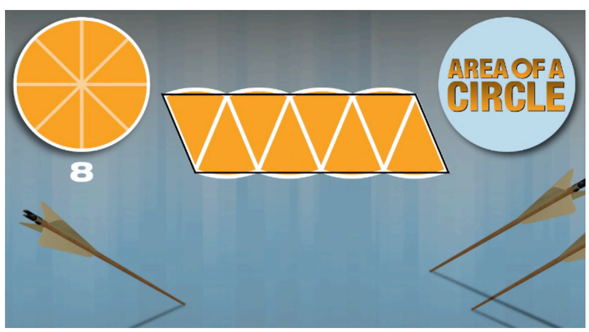
A Closer Look at the Video

After watching the *Area of a Circle* video, make sense of the mathematics by taking a closer look at the problem situation and solutions. Use the questions and comments in bold to help you understand the formula for the area of a circle.

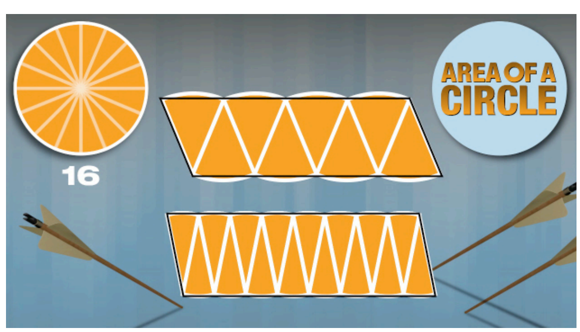
Problem: The radius of the largest circle on an Olympic-size archery target is 61 cm. The radius of the bull's-eye is 6.1 cm. What is the area of the outer circle? What is the area of the bull's-eye?

Before we find the area of these two circles, make sense of the formula used to calculate the area of a circle. The area of a circular region is the area within the circle and the formula to calculate the area is Area = πr^2.

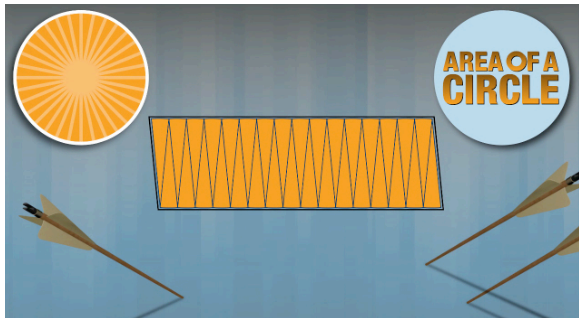
If you slice a circular region into pieces, you can then rearrange those slices into a shape that resembles a parallelogram.



The more slices you have, the closer the shape is to a parallelogram.

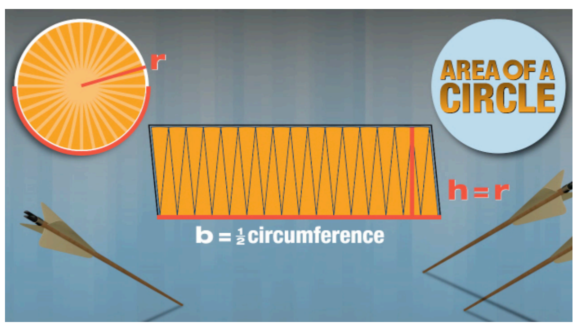


If you had an infinite number of slices, then the circle would form a parallelogram.

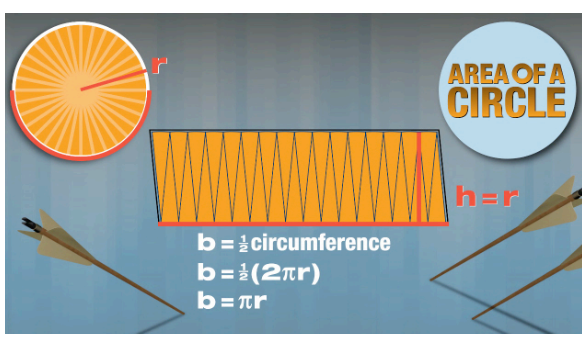


How do you find the area of a parallelogram? The formula used to calculate area of a parallelogram is base times height (Area of a parallelogram = bh).

What is the height of the parallelogram shown above? What is the base of the parallelogram shown above? The height of the parallelogram is equal to the radius of the circle. The base of the parallelogram is one half of the circumference of the circle.

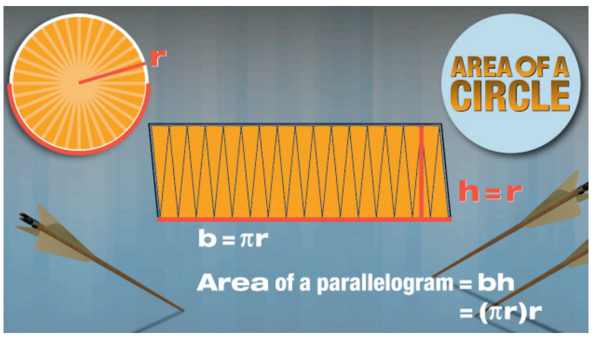


What is one half of the circumference of a circle? The circumference of any circle is π times the diameter (πd) and the diameter of a circle is twice the length of the radius (d = 2r). Therefore, the circumference of any circle is 2πr. The base of the parallelogram is one half of the circumference of the circle, so the base = ½(2πr) or base = πr.



Find the area of the parallelogram shown below. The area of a parallelogram is base times height (A = bh). Since the height of this parallelogram is r and the base is πr, the area is (πr)r or πr^2.

Since the area of the parallelogram is equal to the area of a circle, the area of the circle is equal to (πr)r, or πr^2.



Area of this parallelogram = πr^2

Area of a circle = πr^2

Use this formula to find the area of the outer circle and the area of the bull's-eye of the archery target. The area of a circle is π times the radius squared. The diameter of the outer circle on an Olympic-size archery target is 122 cm and the radius is 61 cm. The diameter of the bull's-eye is 12.2 cm and the radius is 6.1 cm.

Area of the outer circle

$A = \pi r^2$
$= \pi \cdot 61^2$ sq. cm
$= \pi \cdot 3721$ sq. cm
$= 3721\pi$ sq. cm

Substitute 3.14 for π
$\approx 3721 \cdot 3.14$
≈ 11683.94 sq. cm

The area of the outer circle is about 11,684 sq. cm.

Area of the bull's-eye

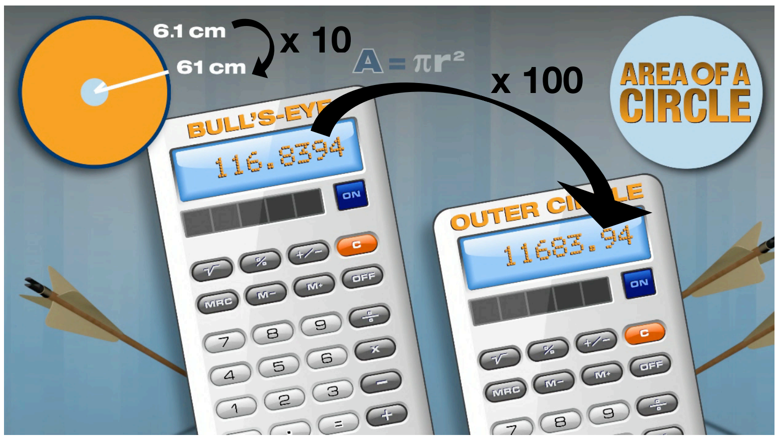
$A = \pi r^2$
$= \pi \cdot 6.1^2$ sq. cm
$= \pi \cdot 37.21$ sq. cm
$= 37.21\pi$ sq. cm

Substitute 3.14 for π
$\approx 37.21 \cdot 3.14$
≈ 116.8394 sq. cm

The area of the bull's-eye is about 116.8 sq. cm.

You can report the area of the outer circle as 3721π sq. cm and the bull's-eye as 37.21π sq. cm, or you can substitute 3.14 for pi and report the areas as approximately 11,684 sq. cm and 116.8 sq. cm. Since the radius of the outer circle was measured to the nearest centimeter, it is more accurate to report the area of the circle to the nearest square centimeter. Likewise, since the radius of the bull's-eye was measured to the nearest one-tenth centimeter it is more accurate to report the area of the bull's-eye to the nearest one-tenth square centimeter.

Compare the radius of the outer circle and the radius of the bull's-eye. Compare the area of the outer circle and the area of the bull's-eye. What do you notice? The area of the outer circle is 100 times larger than the area of the bull's-eye even though the radius of the outer circle is only 10 times the length of the radius of the bull's-eye.



If you would like to further investigate this relationship, watch the *Changing Dimensions: Area* video. For more information on pi and the area of any circle, watch the *What is π?* video.