How long of a rod do I need to
make a rounded rectangle?
Wait… is that a circle?

Technology Integrated Mathematics
Class Notes
Geometry: Circles (Section 8.4)

Here, we will work with circles. We will see how circles are used to make many different shapes as well. First, some definitions.

Definitions: Circle: A **circle** is a closed curve which is the set of all points that are equidistant from a certain point (called its **center**). The **radius** (r) is the measure from the circle itself to the center. The **diameter** (d) of a circle tells us the straight-line distance from one side to the other if we go through the center.

The **circumference** of a circle is its perimeter. In other words, the **circumference** is the measure around the outside of the circle. Imagine yourself to be an ant and you are walking around the whole circle; you walk the circumference (C).

Interestingly, if we take *any* circle and divide its circumference by its diameter, you will *always* get the number π. That motivates the following formula for circumference.

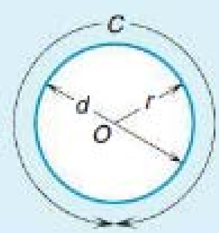
This number π is irrational.
That means its decimal form
neither repeats nor terminates.
It is about 3.14.

Our formulas are pretty straight forward.

Circle Formulas

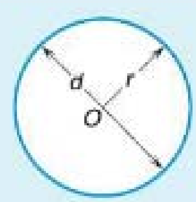
Diameter of a circle, $d = 2r$ or $r = \frac{d}{2}$

Circumference of a circle, $C = \pi d$ or $C = 2\pi r$



Area of a Circle

$A = \pi r^2$ or $A = \frac{\pi d^2}{4} \approx 0.7854d^2$



Pie are squared??
I thought pie are
round?!?

Let's throw ourselves into our examples.

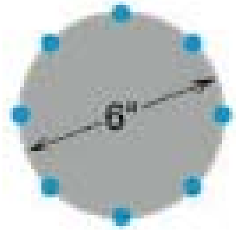
Always use the π button
on the calculator instead
of estimating it as 3.14.

expl 1: If a circle has a radius of 5.2 inches, find its diameter and circumference. Round to the nearest tenth when needed.

expl 2: If a circle has a circumference of 15.2 inches, find its radius. Round to the nearest tenth when needed. Include units.

expl 3: Find the area of a circle that has a circumference of 15.2 inches. Round to the nearest tenth when needed. Include units.

expl 4: We want to equally space eight bolts around the circumference of this circle. How far apart should the bolts be placed? Round to the nearest tenth when needed. Include units.

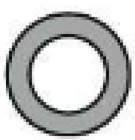


Annulus (Ring):

Plural: annuli or annuluses

Definition: Annulus or Ring: the area between two concentric (having the same center) circles. Washers and the cross sections of pipes are annuli.

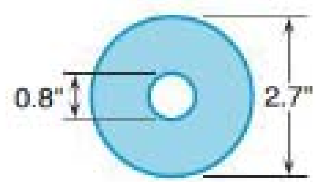
So, how would we find a washer's area? Here is one now. What do you suggest?



Let's suppose that the outer radius is R and the inner radius is r. Label these on the picture.

Can you think of a formula for the **area** of this washer?

expl 5: Find the area of the washer pictured here.



Working with Hexagons:
We will work with shapes that use hexagons with which we have worked before. Recall, the formulas for hexagons given below.

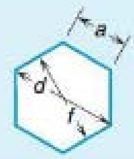
Area of a Regular Hexagon

Area, $A = \dfrac{3a^2\sqrt{3}}{2} \approx 2.598a^2$

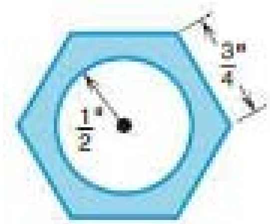
Dimensions of a Regular Hexagon

Distance across the corners, $d = 2a$ or $a = 0.5d$

Distance across the flats, $f \approx 1.732a$ or $a \approx 0.577f$



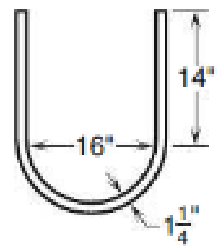
expl 6: Find the area of the cross section of this nut. The units given are in inches. Round to the nearest tenth and include units in your answer.



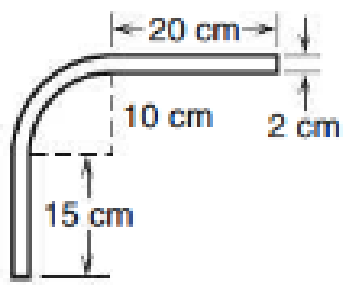
expl 7: We want to mill this hexagon (side length of 0.3 in.) from a circle. What diameter circle do we need?

Rounded Rectangles:

If we bend a straight rod into a rounded rectangle, we need our circles too. This piece of bent steel can be thought of as a half-circle and two straight ends.



If we need to know the length of rod needed to form this shape, we can work with our circle formulas.

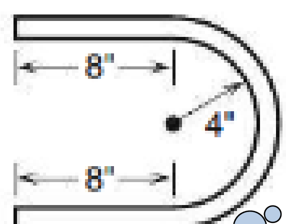


Here, we see a rod bent around a corner. How much of a circle do you see here?

So, we might need to calculate half or a quarter of the circumference of the circle seen in the bend. But what do we use for the radius? The outside or inside dimension? Neither!

Say what?? When a rod is bent, the outside of the curve is stretched *but* the inside is compressed. To get an accurate measure of the radius, we will use the *midway measure*. Let's see this in practice.

expl 8: What length of 1-in. stock should be used to make this shape?



The inside radius is 4 inches. The outside will be 4 + 1 or 5 inches. We will use 4.5 inches for the radius.