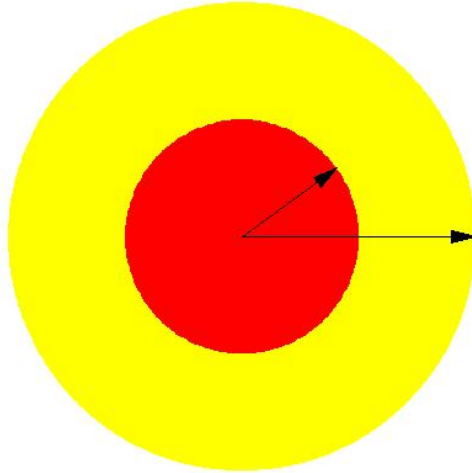


Example 4.1.38 The concentric circles on an archery target are 6 inches apart. The inner circle (red) has a perimeter of 37.7 inches. What is the perimeter of the next largest (yellow) circle?

Begin with a sketch:



The outer (yellow) circle has radius r_2 and perimeter $p_2 = 2\pi r_2$ inches.

The perimeter p_2 is what we want to find.

The inner (red) circle has radius r_1 and perimeter $p_1 = 37.7 = 2\pi r_1$ inches.

Since the circles are six inches apart, $r_2 - r_1 = 6$.

Subtracting the first two equations above, we find:

$$\begin{array}{rcl} p_2 & = & 2\pi r_2 \\ 37.7 & = & 2\pi r_1 \\ \hline p_2 - 37.7 & = & 2\pi(r_2 - r_1) \end{array}$$

Solving this equation for the unknown p_2 , we find:

$$p_2 = 2\pi(r_2 - r_1) + 37.7 = 2\pi(6) + 37.7 \sim 75.3991 \text{ inches.}$$

Example 4.1.47 A radial arm saw has a circular cutting blade with a diameter of 10 inches. It spins at 2000 rpm. If there are 12 cutting teeth per inch on the cutting blade, how many teeth cross the cutting surface each second?

First, we need to find out how many teeth there are on the entire blade. The radius of the blade is half the diameter, so $r = 10/2 = 5$ inches.

The circumference of the blade is given by $p = 2\pi r = 2\pi(5) = 10\pi$.

Since there are 12 teeth per inch, the number of teeth on the blade is

$$(\text{number of teeth on the blade}) = (\text{number of teeth per inch})(\text{circumference of blade}) = (12)(10\pi) = 120\pi \sim 376.991$$

There are 377 cutting teeth total on the blade. One is slightly smaller than the others due to irrational number π !

If there are 2000 rpm (revolutions per minute) that means there are

$$2000 \frac{\text{revolutions}}{\text{minute}} \cdot \left(\frac{1 \text{ minute}}{60 \text{ seconds}} \right) = \frac{100 \text{ revolutions}}{3 \text{ second}}.$$

Note that the quantity in brackets is equal to 1. Multiplying by 1 is how we can change the units in a problem.

The number of teeth crossing the cutting surface each second is given by

$$\frac{100 \text{ revolutions}}{3 \text{ second}} \cdot 120\pi \text{ teeth per revolution} = 4000\pi \frac{\text{teeth}}{\text{second}} \sim 12566.4 \frac{\text{teeth}}{\text{second}}.$$