

Before we begin, are there any questions from last day's work?

Today's Learning Goal(s):

By the end of the class, I will be able to:

- a) calculate the arc length of a circle.
- b) calculate the area of a sector of a circle.

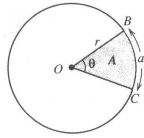
Cake Decorating assignment due today.

Project Renovation assignment past due.

6.9.1: Arc Length and Sector Area

Date: Dec. 17/19

There are problems that often occur in industry that involve arcs and sectors of circles.
Consider the following diagram:



A circle of radius r is drawn, with sector BOC bounded by 2 radii, OB and OC , and an arc BC , of length a .
The area of the sector is A ,
and the sector angle at the centre O is θ , measured in degrees.

We can use the proportional relationship: $\frac{\text{arc length}}{\text{circumference}} = \frac{\text{sector area}}{\text{area of circle}} = \frac{\text{sector angle}}{\text{complete rotation}}$

So, if $\frac{a}{2\pi r} = \frac{A}{\pi r^2} = \frac{\theta}{360^\circ}$

then $\frac{a}{2\pi r} = \frac{\theta}{360^\circ}$ and $\frac{A}{\pi r^2} = \frac{\theta}{360^\circ}$

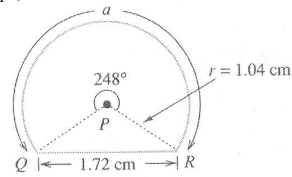
and isolating, [arc length] $a = 2\pi r \left(\frac{\theta}{360^\circ} \right)$ and [sector area] $A = \pi r^2 \left(\frac{\theta}{360^\circ} \right)$

Thus both the arc length, a , and sector area, A , can be calculated once the radius, r , and the sector angle, θ , in degrees, are known.

Ex. 1 A cam for a sewing machine's stitching-control cycle is circular in shape, with a flat side, and has the dimensions shown.

a) Calculate the total perimeter of the cam. (to 3 decimal places)

$$\begin{aligned} P &= 1.72 + a \\ &\approx 1.72 + 4.502 \\ &\approx 6.222 \text{ cm} \end{aligned} \quad \left\{ \begin{aligned} a &= \frac{\theta}{360^\circ} 2\pi r \\ &= \frac{248^\circ}{360^\circ} 2\pi(1.04) \\ &\approx 4.5015 \\ &\approx 4.502 \end{aligned} \right.$$



b) If the cam is 0.36 cm thick and is made from an alloy whose density is 3.8 g/cm^3 , determine the mass of the cam. (to 3 decimal places)

Hint: the cam is a prism, Volume prism = Area base x height, then mass = volume x density

$$A_{\text{cam (Base)}} = A_{\text{sector}} + A_{\text{tri}}$$

$$= \frac{\theta}{360^\circ} \pi r^2 + \frac{bh}{2}$$

$$\approx \left(\frac{248}{360} \right) \pi (1.04)^2 + \frac{(1.72)(0.585)}{2}$$

$$\approx 2.3408 + 0.5031$$

$$\approx 2.8439$$

$$\approx 2.844 \text{ cm}^2$$

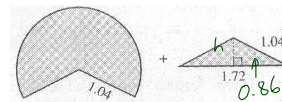
$$\begin{aligned} V_{\text{cam}} &= A_{\text{base}} \times h \\ &\approx 2.844(0.36) \\ &\approx 1.0238 \text{ cm}^3 \end{aligned}$$

$$M = DV$$

$$\approx \left(3.8 \frac{\text{g}}{\text{cm}^3} \right) (1.0238 \text{ cm}^3)$$

$$\approx 3.8905$$

$$\approx 3.891 \text{ g}$$

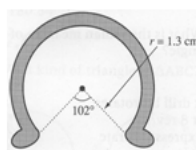


$$\begin{aligned} h^2 &= 1.04^2 - 0.86^2 \\ h &= \sqrt{0.342} \\ &\approx 0.5848 \\ &\approx 0.585 \end{aligned}$$

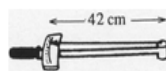
6.9.2 Arc Length and Sector Area

Date: _____

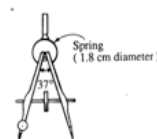
1. A snap-ring retainer clip with dimensions shown is part of a universal joint assembly, and fits snugly around the bearing cap when assembled. What length of the clip is in contact with the bearing cap? (to 2 decimal places)



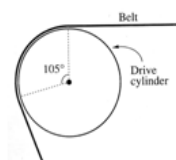
2. The pointer on a torque wrench is 42 cm long, and moves through an angle of 16° . Through what distance does the tip of the pointer move? (to 1 decimal place)



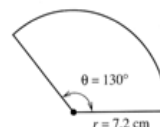
3. Calculate the length of the spring on the bow compasses shown. (to 2 decimal places)



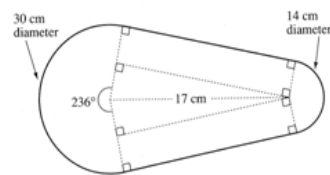
4. The belt on a copier machine is in contact with a drive cylinder over 105° of its surface, as shown. If the length of contact is 5.62 cm, what is the radius of the drive cylinder? (to 2 decimal places)



5. The vent cover on a forced air heating system is in the form of a sector of a circle. Determine the area of sheet metal used to make the vent cover. (to 1 decimal place)



6. The safety shield for a motor pulley drive has the dimensions shown.
- Calculate the perimeter of the shield. (to 1 decimal place)
 - Determine the area of the shield. (to 1 decimal place)

**Answers**

- 5.85 cm
- 11.7 cm
- 5.07 cm
- 3.07 cm
- 58.8 cm²
- 106.9 cm
 - 846.4 cm²