RADIANS

You need to learn the exact values of the trigonometric ratios of these angles measured in radians:

- $\sin\frac{\pi}{6} = \frac{1}{2}$
- $\cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}$
- $\tan\frac{\pi}{6} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$
- $\sin\frac{\pi}{3} = \frac{\sqrt{3}}{2}$
- $\cos\frac{\pi}{3} = \frac{1}{2}$
- $\tan\frac{\pi}{3} = \sqrt{3}$
- $\sin\frac{\pi}{4} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$
- $\cos\frac{\pi}{4} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$
- $\tan\frac{\pi}{4} = 1$

You can use these rules to find sin, cos or tan of any positive or negative angle measured in radians using the corresponding acute angle made with the x-axis, θ.

- $\sin(\pi - \theta) = \sin\theta$
- $\sin(\pi + \theta) = -\sin\theta$
- $\sin(2\pi - \theta) = -\sin\theta$
- $\cos(\pi - \theta) = -\cos\theta$
- $\cos(\pi + \theta) = -\cos\theta$
- $\cos(2\pi - \theta) = \cos\theta$
- $\tan(\pi - \theta) = -\tan\theta$
- $\tan(\pi + \theta) = \tan\theta$
- $\tan(2\pi - \theta) = -\tan\theta$

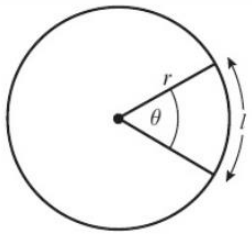
Sketch the following graphs

1) $y = \sin(\theta - \pi)$
2) $y = \tan(2\theta + \pi)$
3) $y = 3\cos(\theta - 2\pi) + 4$

5.2 Arc length

Using radians greatly simplifies the formula for **arc length**.

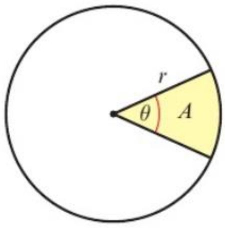
- **To find the arc length l of a sector of a circle use the formula $l = r\theta$, where r is the radius of the circle and θ is the angle, in radians, contained by the sector.**



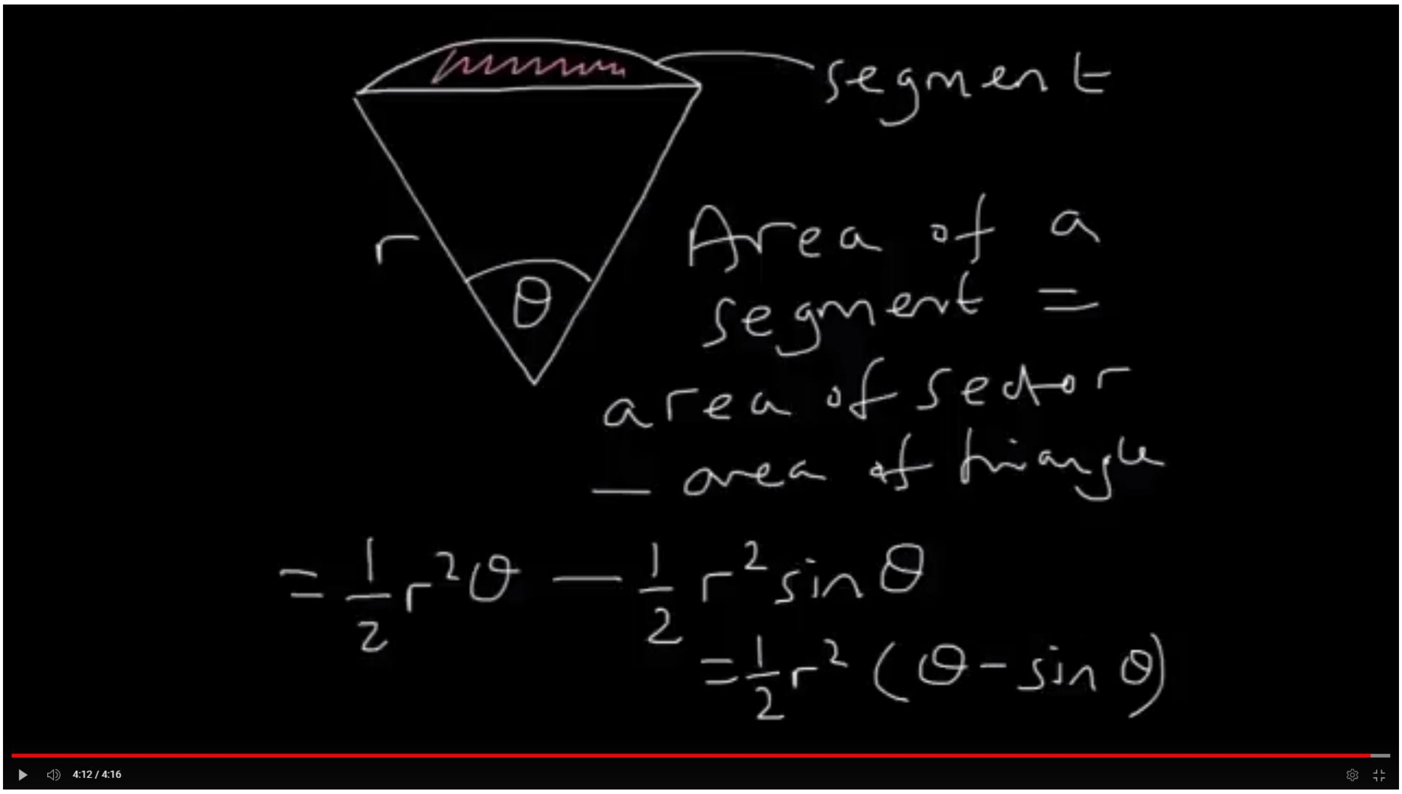
5.3 Areas of sectors and segments

Using radians also greatly simplifies the formula for the area of a **sector**.

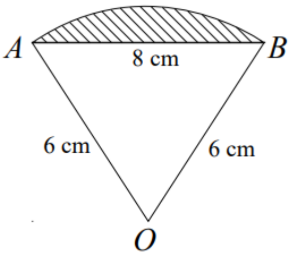
- **To find the area A of a sector of a circle use the formula $A = \frac{1}{2}r^2\theta$, where r is the radius of the circle and θ is the angle, in radians, contained by the sector.**



Notation A sector of a circle is the portion of a circle enclosed by two radii and an arc. The smaller area is known as the **minor** sector and the larger is known as the **major** sector.



1 Sector AOB is a sector of a circle, radius 6cm. The chord AB is 8cm long.



(a) Find the angle AOB in radians, giving your answer to 3 decimal places **(3)**

(b) Calculate the area of the sector AOB **(2)**

(c) Calculate the shaded area. **(3)**

(Total for question 1 is 8 marks)

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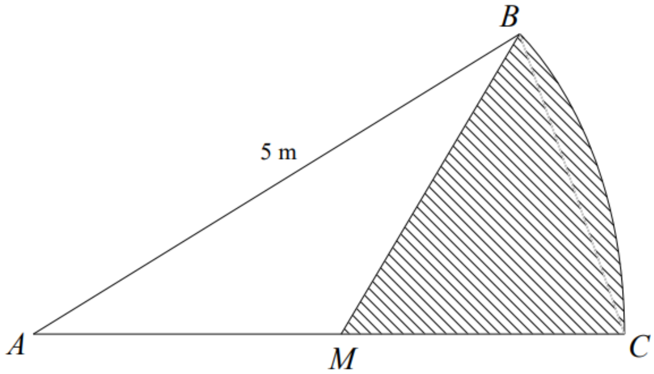
2 Sector *ABC* is a sector of a circle, centre *A* and and radius 5m. Angle *BAC* = 0.5 radians



(a) Find the length of the arc *BC* **(2)**

(b) Calculate the area of the sector *ABC* **(2)**

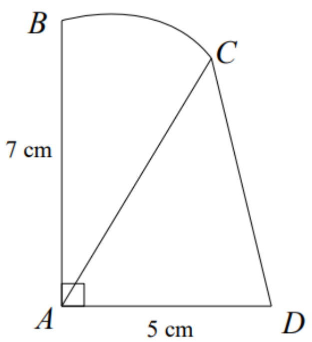
Given that *M* is the midpoint of *AC*

(c) Find the perimeter of the shaded region **(4)**

(d) Find the area of the shaded region **(4)**

(Total for question 2 is 12 marks)

3 Sector *ABC* is a sector of a circle, centre *A* and and radius 7 cm. Angle *BAC* = 0.6 radians



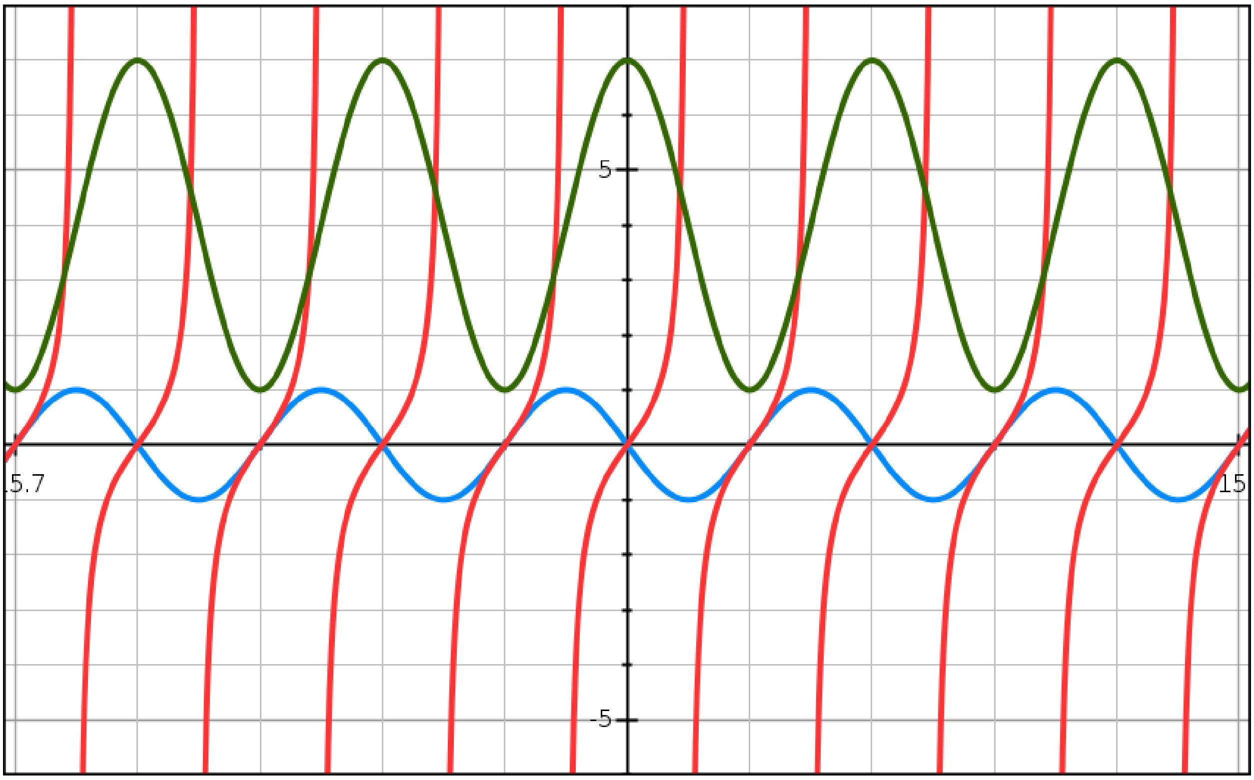
(a) Find the length of the arc *BC* **(2)**

(b) Calculate the area of the sector *ABC* **(2)**

(c) Find the size of angle *CAD*, in radians **(1)**

(d) Find the total area of the shape *ABCD* **(3)**

(Total for question 3 is 8 marks)



Answers (to 3 s.f. where appropriate)

1a) 1.459	b) 26.3	c) 8.38	
2a) 2.5	b) $\frac{25}{4}$	c) 8.05	d) 3.25
3a) 4.2	b) 14.7	c) 0.971	d) 29.1