6.

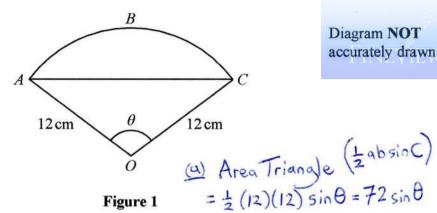


Figure 1 shows a sector *OABCO* of a circle centre *O*.

Given that

- OA = OC = 12 cm
- angle $AOC = \theta$ radians
- area triangle OAC: area segment ABC = 3:1
- (a) show that

$$3\theta - 4\sin\theta = 0 \tag{2}$$

Area Segment (2r20) = Area Sector - Area Triangle

= = 1(12)20 - 72 sin 0

= 72 A - 72 sin 0

(b) Taking 1.2 as a first approximation to θ , apply the Newton-Raphson method once to

$$f(\theta) = 3\theta - 4\sin\theta$$

to find a second approximation to θ

Give your answer to 3 decimal places.

(a) cotd.
$$72 \sin \theta$$
: $72 \sin \theta$: $72 \sin \theta$ = 3:1

$$\Rightarrow \frac{72 \sin \theta}{720 - 72 \sin \theta} = \frac{3}{1} \Rightarrow \frac{\sin \theta}{\theta - \sin \theta} = 3 \qquad (1 \text{ mark})$$

$$\Rightarrow \sin \theta = 3\theta - 3 \sin \theta \Rightarrow 3\theta - 4 \sin \theta = 0 \qquad (1 \text{ mark})$$

(b)
$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad f(\theta) = 3\theta - 4\sin\theta$$

 $f'(\theta) = 3 - 4\cos\theta \quad (Imark)$

$$\theta_1 = 1.2$$
 given $\theta_2 = 1.2 - \frac{f(1.2)}{f'(1.2)} = 1.2 - \frac{3(1.2) - 4\sin(1.2)}{3 - 4\cos(1.2)}$ (mark)