

Section 1: Working with radians

Solutions to Exercise level 2

1. (i) $\cos \theta = 0.4$
 Solutions are in the first and fourth quadrants
 $\theta = 1.16$ or $2\pi - 1.16$
 $\theta = 1.2$ or 5.1 radians (1 d.p.)
- (ii) $\tan \theta = -1.2$
 Solutions are in the second and fourth quadrants
 $\theta = \pi - 0.88$ or $2\pi - 0.88$
 $\theta = 2.3$ or 5.4 radians (1 d.p.)
- (iii) $\sin^2 \theta = 1$
 $\sin \theta = \pm 1$
 $\sin \theta = 1 \Rightarrow \theta = \frac{\pi}{2}$
 $\sin \theta = -1 \Rightarrow \theta = \frac{3\pi}{2}$
 $\theta = \frac{\pi}{2}$ or $\frac{3\pi}{2}$
2. (i) $2 \sin x \cos x = \sin x$
 $2 \sin x \cos x - \sin x = 0$
 $\sin x(2 \cos x - 1) = 0$
 $\sin x = 0$ or $\cos x = \frac{1}{2}$
 $\sin x = 0 \Rightarrow x = 0$ or π
 $\cos x = \frac{1}{2} \Rightarrow x = \frac{\pi}{3}$
 $x = 0, \frac{\pi}{3}, \pi$
- (ii) $2 \sin^2 x - \cos x - 1 = 0$
 $2(1 - \cos^2 x) - \cos x - 1 = 0$
 $2 - 2 \cos^2 x - \cos x - 1 = 0$
 $2 \cos^2 x + \cos x - 1 = 0$
 $(2 \cos x - 1)(\cos x + 1) = 0$
 $\cos x = \frac{1}{2}$ or $\cos x = -1$

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$$\cos x = \frac{1}{2} \Rightarrow x = \frac{\pi}{3}$$

$$\cos x = -1 \Rightarrow x = \pi$$

$$x = \frac{\pi}{3} \text{ or } \pi$$

3. (i) $\cos 2x = \frac{\sqrt{3}}{2} = \cos \frac{\pi}{6}$

$$\Rightarrow 2x = -2\pi + \frac{\pi}{6}, -\frac{\pi}{6}, \frac{\pi}{6}, 2\pi - \frac{\pi}{6}$$
$$\Rightarrow x = -\frac{11\pi}{12}, -\frac{\pi}{12}, \frac{\pi}{12}, \frac{11\pi}{12}$$

(ii) $\tan^2 x = \frac{1}{3} \Rightarrow \tan x = \pm \frac{1}{\sqrt{3}}$

$$\Rightarrow x = \frac{\pi}{6} - \pi, -\frac{\pi}{6}, \frac{\pi}{6}, \pi - \frac{\pi}{6}$$
$$\Rightarrow x = -\frac{5\pi}{6}, -\frac{\pi}{6}, \frac{\pi}{6}, \frac{5\pi}{6}$$

(iii) $2\sin^2 x = \sin x + 1$

$$\Rightarrow (2\sin x + 1)(\sin x - 1) = 0$$
$$\Rightarrow \sin x = -\frac{1}{2} \text{ or } \sin x = 1$$
$$\Rightarrow x = -\pi + \frac{\pi}{6}, -\frac{\pi}{6}, \frac{\pi}{2}$$
$$\Rightarrow x = -\frac{5\pi}{6}, -\frac{\pi}{6}, \frac{\pi}{2}$$

(iv) $4 - 5\sin x = 2\cos^2 x$

$$\Rightarrow 2\sin^2 x - 5\sin x + 2 = 0$$
$$\Rightarrow (2\sin x - 1)(\sin x - 2) = 0$$
$$\Rightarrow \sin x = \frac{1}{2} \text{ or } \sin x = 2 \text{ (not valid)}$$
$$\Rightarrow x = \frac{\pi}{6}, \frac{5\pi}{6}$$