

## Section 2: Trigonometric equations

## Solutions to Exercise level 2

1. (i)  $\sin 2x = 1$   
 $2x = 90^\circ \text{ or } 450^\circ$   
 $x = 45^\circ \text{ or } 225^\circ$

(ii)  $\cos \frac{1}{2}x = 0.5$   
 $\frac{1}{2}x = 60^\circ$   
 $x = 120^\circ$

As we are going to multiply by 2, we do not need to consider the value of  $\frac{1}{2}x$  in the fourth quadrant.

(iii)  $\tan 3x = \sqrt{3}$   
 $3x = 60^\circ, 240^\circ, 420^\circ, 600^\circ, 780^\circ, 960^\circ$   
 $x = 20^\circ, 80^\circ, 140^\circ, 200^\circ, 260^\circ, 320^\circ$

As we are going to divide by 3, we need to add  $360^\circ$  and  $720^\circ$  to each of the two basic roots

2. (i)  $3 \sin x = 4 \cos x$   
 $\tan x = \frac{4}{3}$   
 $x = 53.1^\circ \text{ or } 180^\circ + 53.1^\circ$   
 $x = 53.1^\circ \text{ or } 233.1^\circ$

Using  $\tan \theta = \frac{\sin \theta}{\cos \theta}$

(ii)  $2 \cos x = -3 \sin x$   
 $\tan x = -\frac{2}{3}$   
 $x = 180^\circ - 33.7^\circ \text{ or } 360^\circ - 33.7^\circ$   
 $x = 146.3^\circ \text{ or } 326.3^\circ$

Using  $\tan \theta = \frac{\sin \theta}{\cos \theta}$

3. (i)  $4 \cos^2 \theta = 3$   
 $\cos^2 \theta = \frac{3}{4}$   
 $\cos \theta = \pm \frac{\sqrt{3}}{2}$   
 $\cos \theta = \frac{\sqrt{3}}{2} \Rightarrow \theta = 30^\circ \text{ or } 330^\circ$   
 $\cos \theta = -\frac{\sqrt{3}}{2} \Rightarrow \theta = 150^\circ \text{ or } 210^\circ$   
 $\theta = 30^\circ, 150^\circ, 210^\circ, 330^\circ$

## Edexcel AS Maths Trigonometry 2 Exercise solutions

(ii)  $2 \cos^2 \theta = \cos \theta$

$$2 \cos^2 \theta - \cos \theta = 0$$

$$\cos \theta (2 \cos \theta - 1) = 0$$

$$\cos \theta = 0 \text{ or } \cos \theta = \frac{1}{2}$$

$$\cos \theta = 0 \Rightarrow \theta = 90^\circ \text{ or } 270^\circ$$

$$\cos \theta = \frac{1}{2} \Rightarrow \theta = 60^\circ \text{ or } 300^\circ$$

$$\theta = 60^\circ, 90^\circ, 270^\circ, 300^\circ$$

(iii)  $4 \sin \theta \cos \theta = \sin \theta$

$$4 \sin \theta \cos \theta - \sin \theta = 0$$

$$\sin \theta (4 \cos \theta - 1) = 0$$

$$\sin \theta = 0 \text{ or } \cos \theta = \frac{1}{4}$$

$$\sin \theta = 0 \Rightarrow \theta = 0^\circ \text{ or } 180^\circ \text{ or } 360^\circ$$

$$\cos \theta = \frac{1}{4} \Rightarrow \theta = 75.5^\circ \text{ or } 284.5^\circ$$

$$\theta = 0^\circ, 75.5^\circ, 180^\circ, 284.5^\circ, 360^\circ$$

(iv)  $\cos^2 \theta - \cos \theta - 2 = 0$

$$(\cos \theta - 2)(\cos \theta + 1) = 0$$

$$\cos \theta = 2 \text{ or } \cos \theta = -1$$

There are no real values of  $\theta$  for which

$$\cos \theta = -1 \Rightarrow \theta = 180^\circ$$

Using  $\sin^2 \theta + \cos^2 \theta = 1$

(v)  $3 \sin^2 \theta + 5 \cos \theta - 1 = 0$

$$3(1 - \cos^2 \theta) + 5 \cos \theta - 1 = 0$$

$$3 - 3 \cos^2 \theta + 5 \cos \theta - 1 = 0$$

$$3 \cos^2 \theta - 5 \cos \theta - 2 = 0$$

$$(3 \cos \theta + 1)(\cos \theta - 2) = 0$$

$$\cos \theta = -\frac{1}{3} \text{ or } \cos \theta = 2$$

There are no real values of  $\theta$  for which  $\cos \theta = 2$

$$\cos \theta = -\frac{1}{3} \Rightarrow \theta = 109.5^\circ \text{ or } 250.5^\circ$$

Using  $\tan \theta = \frac{\sin \theta}{\cos \theta}$

(vi)  $3 \tan \theta - 2 \cos \theta = 0$

$$\frac{3 \sin \theta}{\cos \theta} - 2 \cos \theta = 0$$

$$3 \sin \theta - 2 \cos^2 \theta = 0$$

$$3 \sin \theta - 2(1 - \sin^2 \theta) = 0$$

$$2 \sin^2 \theta + 3 \sin \theta - 2 = 0$$

$$(2 \sin \theta - 1)(\sin \theta + 2) = 0$$

$$\sin \theta = \frac{1}{2} \text{ or } \sin \theta = -2$$

Using  $\sin^2 \theta + \cos^2 \theta = 1$

