

- b** i 1 and 4    ii 2 and 3    iii 3    iv 2

- 8 a**  $\widehat{AOQ} = 180^\circ - \theta$  or  $\pi - \theta$  radians  
**b** [OQ] is a reflection of [OP] in the  $y$ -axis and so Q has coordinates  $(-\cos \theta, \sin \theta)$ .  
**c**  $\cos(180^\circ - \theta) = -\cos \theta$ ,  $\sin(180^\circ - \theta) = \sin \theta$

**9 a**

$\theta^\circ$	$\sin \theta$	$\sin(-\theta)$	$\cos \theta$	$\cos(-\theta)$
0.75	0.682	-0.682	0.732	0.732
1.772	0.980	-0.980	-0.200	-0.200
3.414	-0.269	0.269	-0.963	-0.963
6.25	-0.0331	0.0331	0.999	0.999
-1.17	-0.921	0.921	0.390	0.390

- b**  $\sin(-\theta) = -\sin \theta$ ,  $\cos(-\theta) = \cos \theta$   
**c** i Q has coordinates  $(\cos(-\theta), \sin(-\theta))$  or  $(\cos \theta, -\sin \theta)$  (since it is the reflection of P in the  $x$ -axis).  
 $\therefore \cos(-\theta) = \cos \theta$  and  $\sin(-\theta) = -\sin \theta$ .  
 ii  $\cos(2\pi - \theta) = \cos(-\theta) = \cos \theta$  {from **c i**}

**EXERCISE 8D.1**

- 1 a**  $\cos \theta = \pm \frac{\sqrt{3}}{2}$     **b**  $\cos \theta = \pm \frac{2\sqrt{2}}{3}$     **c**  $\cos \theta = \pm 1$   
**d**  $\cos \theta = 0$   
**2 a**  $\sin \theta = \pm \frac{3}{5}$     **b**  $\sin \theta = \pm \frac{\sqrt{7}}{4}$     **c**  $\sin \theta = 0$   
**d**  $\sin \theta = \pm 1$   
**3 a**  $\sin \theta = \frac{\sqrt{5}}{3}$     **b**  $\cos \theta = -\frac{\sqrt{21}}{5}$     **c**  $\cos \theta = \frac{4}{5}$   
**d**  $\sin \theta = -\frac{12}{13}$   
**4 a**  $-\frac{1}{2\sqrt{2}}$     **b**  $-2\sqrt{6}$     **c**  $\frac{1}{\sqrt{2}}$     **d**  $-\frac{\sqrt{7}}{3}$   
**5 a**  $\sin x = \frac{2}{\sqrt{13}}$ ,  $\cos x = \frac{3}{\sqrt{13}}$   
**b**  $\sin x = \frac{4}{5}$ ,  $\cos x = -\frac{3}{5}$   
**c**  $\sin x = -\sqrt{\frac{5}{14}}$ ,  $\cos x = -\frac{3}{\sqrt{14}}$   
**d**  $\sin x = -\frac{12}{13}$ ,  $\cos x = \frac{5}{13}$   
**6**  $\sin x = \frac{-k}{\sqrt{k^2+1}}$ ,  $\cos x = \frac{-1}{\sqrt{k^2+1}}$

**EXERCISE 8D.2**

- 1 a**  $\theta \approx 1.33$  or  $4.47$     **b**  $\theta \approx 0.592$  or  $5.69$   
**c**  $\theta \approx 0.644$  or  $2.50$     **d**  $\theta = \frac{\pi}{2}$  or  $\frac{3\pi}{2}$   
**e**  $\theta \approx 0.876$  or  $4.02$     **f**  $\theta \approx 0.674$  or  $5.61$   
**g**  $\theta \approx 0.0910$  or  $3.05$     **h**  $\theta \approx 1.52$  or  $4.66$   
**i**  $\theta \approx 1.35$  or  $1.79$   
**2 a**  $\theta \approx 1.82$  or  $4.46$     **b**  $\theta = 0$  or  $\pi$   
**c**  $\theta \approx 1.88$  or  $5.02$     **d**  $\theta \approx 3.58$  or  $5.85$   
**e**  $\theta \approx 1.72$  or  $4.86$     **f**  $\theta \approx 1.69$  or  $4.59$   
**g**  $\theta \approx 1.99$  or  $5.13$     **h**  $\theta \approx 2.19$  or  $4.10$   
**i**  $\theta \approx 3.83$  or  $5.60$

**EXERCISE 8E**

**1**

	a	b	c	d	e
$\sin \theta$	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	$-\frac{1}{\sqrt{2}}$	0	$-\frac{1}{\sqrt{2}}$
$\cos \theta$	$\frac{1}{\sqrt{2}}$	$-\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	-1	$-\frac{1}{\sqrt{2}}$
$\tan \theta$	1	-1	-1	0	1

**2**

	a	b	c	d	e
$\sin \beta$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$
$\cos \beta$	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
$\tan \beta$	$\frac{1}{\sqrt{3}}$	$-\sqrt{3}$	$\frac{1}{\sqrt{3}}$	$-\sqrt{3}$	$-\frac{1}{\sqrt{3}}$

- 3 a**  $\cos 120^\circ = -\frac{1}{2}$ ,  $\sin 120^\circ = \frac{\sqrt{3}}{2}$ ,  $\tan 120^\circ = -\sqrt{3}$   
**b**  $\cos(-45^\circ) = \frac{1}{\sqrt{2}}$ ,  $\sin(-45^\circ) = -\frac{1}{\sqrt{2}}$ ,  $\tan(-45^\circ) = -1$   
**4 a**  $\cos 90^\circ = 0$ ,  $\sin 90^\circ = 1$     **b**  $\tan 90^\circ$  is undefined  
**5 a**  $\frac{3}{4}$     **b**  $\frac{1}{4}$     **c** 3    **d**  $\frac{1}{4}$     **e**  $-\frac{1}{4}$     **f** 1  
**g**  $\sqrt{2}$     **h**  $\frac{1}{2}$     **i**  $\frac{1}{2}$     **j** 2    **k** -1    **l**  $-\sqrt{3}$   
**6 a**  $30^\circ, 150^\circ$     **b**  $60^\circ, 120^\circ$     **c**  $45^\circ, 315^\circ$   
**d**  $120^\circ, 240^\circ$     **e**  $135^\circ, 225^\circ$     **f**  $240^\circ, 300^\circ$   
**7 a**  $\frac{\pi}{4}, \frac{5\pi}{4}$     **b**  $\frac{3\pi}{4}, \frac{7\pi}{4}$     **c**  $\frac{\pi}{3}, \frac{4\pi}{3}$   
**d**  $0, \pi, 2\pi$     **e**  $\frac{\pi}{6}, \frac{7\pi}{6}$     **f**  $\frac{2\pi}{3}, \frac{5\pi}{3}$   
**8 a**  $\frac{\pi}{6}, \frac{11\pi}{6}, \frac{13\pi}{6}, \frac{23\pi}{6}$     **b**  $\frac{7\pi}{6}, \frac{11\pi}{6}, \frac{19\pi}{6}, \frac{23\pi}{6}$     **c**  $\frac{3\pi}{2}, \frac{7\pi}{2}$   
**9 a**  $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$     **b**  $\theta = \frac{\pi}{3}, \frac{2\pi}{3}$     **c**  $\theta = \pi$   
**d**  $\theta = \frac{\pi}{2}$     **e**  $\theta = \frac{3\pi}{4}, \frac{5\pi}{4}$     **f**  $\theta = \frac{\pi}{2}, \frac{3\pi}{2}$   
**g**  $\theta = 0, \pi, 2\pi$     **h**  $\theta = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$   
**i**  $\theta = \frac{5\pi}{6}, \frac{11\pi}{6}$     **j**  $\theta = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$   
**10 a**  $\theta = k\pi, k \in \mathbb{Z}$     **b**  $\theta = \frac{\pi}{2} + k\pi, k \in \mathbb{Z}$

**EXERCISE 8F**

- 1 a**  $y = \sqrt{3}x$     **b**  $y = x$     **c**  $y = -\frac{1}{\sqrt{3}}x$   
**2 a**  $y = \sqrt{3}x + 2$     **b**  $y = -\sqrt{3}x$     **c**  $y = \frac{1}{\sqrt{3}}x - 2$

**REVIEW SET 8A**

- 1 a**  $\frac{2\pi}{3}$     **b**  $\frac{5\pi}{4}$     **c**  $\frac{5\pi}{6}$     **d**  $3\pi$   
**2 a**  $\frac{\pi}{3}$     **b**  $15^\circ$     **c**  $84^\circ$   
**3 a** 0.358    **b** -0.035    **c** 0.259    **d** -0.731  
**4 a** 1, 0    **b** -1, 0  
**6 a**  $\sin\left(\frac{2\pi}{3}\right) = \frac{\sqrt{3}}{2}$ ,  $\cos\left(\frac{2\pi}{3}\right) = -\frac{1}{2}$ ,  $\tan\left(\frac{2\pi}{3}\right) = -\sqrt{3}$   
**b**  $\sin\left(\frac{8\pi}{3}\right) = \frac{\sqrt{3}}{2}$ ,  $\cos\left(\frac{8\pi}{3}\right) = -\frac{1}{2}$ ,  $\tan\left(\frac{8\pi}{3}\right) = -\sqrt{3}$   
**7**  $\frac{1}{\sqrt{15}}$     **8**  $\pm \frac{\sqrt{7}}{4}$     **9 a**  $\frac{\sqrt{3}}{2}$     **b** 0    **c**  $\frac{1}{2}$   
**10 a**  $-\frac{3}{\sqrt{13}}$     **b**  $\frac{2}{\sqrt{13}}$   
**11** perimeter = 12 units, area = 8 units<sup>2</sup>    **12**  $\frac{\sqrt{6}}{\sqrt{11}}$

**REVIEW SET 8B**

- 1 a** (0.766, -0.643)    **b** (-0.956, 0.292)  
**2 a** 1.239<sup>c</sup>    **b** 2.175<sup>c</sup>    **c** -2.478<sup>c</sup>  
**3 a** 171.89°    **b** 83.65°    **c** 24.92°    **d** -302.01°  
**4** 111 cm<sup>2</sup>  
**5** M(cos 73°, sin 73°) ≈ (0.292, 0.956)  
 N(cos 190°, sin 190°) ≈ (-0.985, -0.174)  
 P(cos 307°, sin 307°) ≈ (0.602, -0.799)  
**6** ≈ 103°  
**7 a** 150°, 210°    **b** 45°, 135°    **c** 120°, 300°  
**8 a**  $\theta = \pi$     **b**  $\theta = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$   
**9 a** 133°    **b**  $\frac{14\pi}{15}$     **c** 174°