Exercise 1

1 (i) $x = 90°$

(ii) $x = 60°, 300°$

(iii) $x = 14.0°, 194.0°$

(iv) $x = 109.5°, 250.5°$

(v) $x = 135°, 315°$

(vi) $x = 210°, 330°$

2 (i) -1

(ii) $\frac{-2}{\sqrt{3}}$

(iii) $\frac{-2}{\sqrt{3}}$

(iv) $\frac{-2}{\sqrt{3}}$

(v) 0

(vi) $-\sqrt{2}$

3 (i) $B = 60°, C = 30°$

(ii) $\sqrt{3}$

4 (i) $L = 45°, N = 45°$

(ii) $\sqrt{2}, \sqrt{2}, 1$

5 (ii) $14.0°$

6 (i) $0 \leqslant \alpha \leqslant 90°$

(ii) No, for each of the second, third and fourth quadrants a different function is positive.

(iii) No, the graphs of the three functions do not intersect at a single point.

7 (i) $x = 0°, 180°, 360°$

(ii) $x = 45°, 225°$

Exercise 2

1 $\tan^4 A$

2 $\sec^2 \theta$

3 $\tan \theta$

4 $\sin^3 \theta$

5 $x^2 - y^2 = 16$

6 $x^2(b^2 - y^2) = a^2b^2$

7 $x^2(b^2 - y^2) = a^2b^2$

11 $38.2°, 141.8°$

12 $57.7°, 122.3°, 237.7°, 302.3°$

13 $30°, 150°$

14 $30°, 150°$

15 $45°, 166.2°, 225°, 346°$

16 $199°, 341°$

Exercise 3

1 (i) $\frac{\sqrt{3}}{2\sqrt{2}} + \frac{1}{2\sqrt{2}}$

(ii) $-\frac{1}{\sqrt{2}}$

(iii) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

(iv) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$

2 (i) $\frac{1}{\sqrt{2}}(\sin\theta + \cos\theta)$

(ii) $\frac{1}{2}(\sqrt{3}\cos\theta + \sin\theta)$

(iii) $\frac{1}{2}(\sqrt{3}\cos\theta - \sin\theta)$

(iv) $\frac{1}{\sqrt{2}}(\cos 2\theta - \sin 2\theta)$

(v) $\frac{\tan\theta + 1}{1 - \tan\theta}$

(vi) $\frac{\tan\theta - 1}{1 + \tan\theta}$

3 (i) $\sin\theta$

(ii) $\cos 8\phi$

(iii) 0

(iv) $\cos 2\theta$

4 (i) $\theta = 15°$

(ii) $\theta = 157.5°$

(iii) $\theta = 0°$ or $180°$

(iv) $\theta = 111.7°$

(v) $\theta = 165°$

5 (i) $\theta = \frac{\pi}{8}$

(ii) $\theta = 2.79$ radians

6 (i) $\frac{1}{\sqrt{5}}$

(ii) $\sin\beta = \frac{3}{5}, \cos\beta = \frac{4}{5}$

Exercise 4

1 (i) $\theta = 14.5°, 90°, 165.5°, 270°$

(ii) $\theta = 0°, 35.3°, 144.7°, 180°, 215.3°, 324.7°, 360°$

(iii) $\theta = 90°, 210°, 330°$

(iv) $\theta = 30°, 150°, 210°, 330°$

(v) $\theta = 0°, 138.6°, 221.4°, 360°$

Exercise 4

2 (i) $\theta = -\pi, 0, \pi$

(ii) $\theta = -\pi, 0, \pi$

(iii) $\theta = \frac{-2\pi}{3}, 0, \frac{2\pi}{3}$

(iv) $\theta = \frac{-3\pi}{4}, \frac{-\pi}{4}, \frac{\pi}{4}, \frac{3\pi}{4}$

(v) $\theta = \frac{-11\pi}{12}, \frac{-3\pi}{4}, \frac{-7\pi}{12}, \frac{-\pi}{4}, \frac{\pi}{12}, \frac{\pi}{4}, \frac{5\pi}{12}, \frac{3\pi}{4}$

3 $3\sin\theta - 4\sin^3\theta$,

$\theta = 0, \frac{\pi}{4}, \frac{3\pi}{4}, \pi, \frac{5\pi}{4}, \frac{7\pi}{4}, 2\pi$

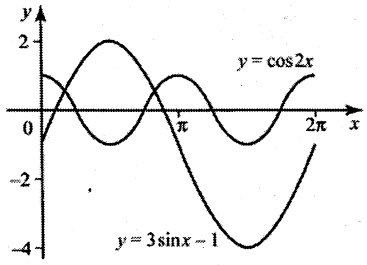
4 $\theta = 51°, 309°$

5 $\cot\theta$

6 $\frac{\tan\theta\,(3 - \tan^2\theta)}{1 - 3\tan^2\theta}$

8 (ii) $\theta = 63.4°$

9 (i)



(iii) $x = \frac{\pi}{6}, \frac{5\pi}{6}$

Exercise 5

1 (i) $\sqrt{2}\cos(\theta - 45°)$

(ii) $29\cos(\theta - 46.4°)$

(iii) $2\cos(\theta - 60°)$

(iv) $3\cos(\theta - 41.8°)$

2 (i) $\sqrt{2}\cos\left(\theta + \frac{\pi}{4}\right)$

(ii) $2\cos\left(\theta + \frac{\pi}{6}\right)$

3 (i) $\sqrt{5}\sin(\theta + 63.4°)$

(ii) $3\sin(\theta + 48.2°)$

4 (i) $\sqrt{2}\sin\left(\theta - \frac{\pi}{4}\right)$

(ii) $3\sin(\theta - 0.49 \text{ rad})$

Exercise 5

5 (i) $2\cos(\theta-(-60°))$

(ii) $4\cos(\theta-(-45°))$

(iii) $2\cos(\theta-30°)$

(iv) $13\cos(\theta-22.6°)$

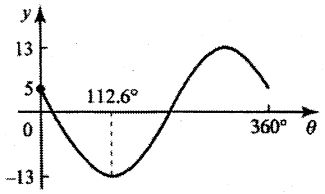
(v) $2\cos(\theta-150°)$

(vi) $2\cos(\theta-135°)$

6 (i) $13\cos(\theta+67.4°)$

(ii) Max 13, min -13

(iii)



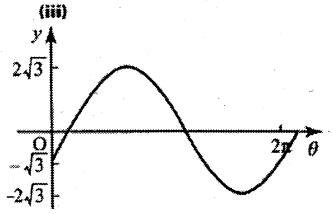
(iv) $\theta=4.7°, 220.5°$

7 (i) $2\sqrt{3}\sin\left(\theta-\frac{\pi}{6}\right)$

(ii) Max $2\sqrt{3}, \theta=\frac{2\pi}{3}$;

min $-2\sqrt{3}, \theta=\frac{5\pi}{3}$

(iii)



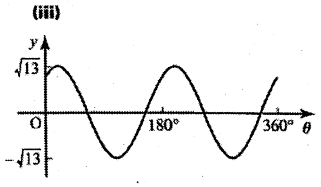
(iv) $\theta=\frac{\pi}{3}, \pi$

8 (i) $\sqrt{13}\sin(2\theta+56.3°)$

(ii) Max $\sqrt{13}, \theta=16.8°$;

min $-\sqrt{13}, \theta=106.8°$

(iii)



(iv) $\theta=53.8°, 159.9°, 233.8°, 339.9°$

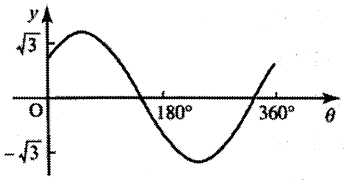
Exercise 5

9 (i) $\sqrt{3}\cos(\theta-54.7°)$

(ii) Max $\sqrt{3}, \theta=54.7°$;

min $-\sqrt{3}, \theta=234.7°$

(iii)



(iv) Max $\frac{1}{3-\sqrt{3}}, \theta=234.7°$;

min $\frac{1}{3+\sqrt{3}}, \theta=54.7°$

10 (ii) $\theta=30.6°, 82.0°$

11 (i) $\cos x\cos\alpha-\sin x\sin\alpha$

(ii) $r=\sqrt{29}, \alpha=68.2°$

(iii) Max $\sqrt{29}$ when $x=291.8°$,

min $-\sqrt{29}$ when $x=111.8°$

(iv) $x=235.7°, 347.9°$

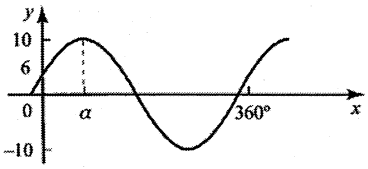
12 (i) 30.96°

(ii) $x=15.7°, 282.4°$

(iii) $x=7.9°, 141.2°, 187.9°, 321.2°$

13 (i) $R=10, \quad \alpha=53.13°$

(ii)



(iii) $x=119.55°, 346.71°$

(iv) $\theta=103.29°, 330.45°$

14 (i) $c=\sqrt{a^2+b^2}$

(ii) $\tan\alpha=\frac{b}{a}$

(iii) $\alpha=36.87°$

(iv) $\theta=103.29°, 330.45°$

Exercise 6

1 $y=1-2x^2$

4 $\frac{56}{65}, -\frac{16}{65}$

5 $x=2y-1$

7 $5\sin(\theta-\alpha)$ where $\tan\alpha=\frac{3}{4}$, 7, -3

8 $\sqrt{2}\sin(2\theta-45°)$, 67.5°

9 $-\pi, 0, \pi$

11 $\cot^2 x$

12 90°, 270°

13 (a) $2-\cos 2\theta$ (b) $2+2\cos 4A$

14 0

15 40.2°