

# Answers

## Exercise 1

- 1  $\sqrt{3}/2, -\sqrt{3}/2, -\sqrt{3}/2, \sqrt{3}/2$ .  
 2  $(-180^\circ, -90^\circ); (30^\circ, 90^\circ); (150^\circ, 180^\circ)$ ; or  $(-\pi, -\pi/2); (\pi/6, \pi/2); (5\pi/6, \pi)$ .  
 3 (a)  $227.7^\circ$  and  $312.3^\circ$ ; (b)  $63.3^\circ$  and  $296.7^\circ$ ; (c)  $110.2^\circ$  and  $290.2^\circ$ ; (d)  $255.2^\circ$ .  
 4 (a) 30, 150; (b) 135, 315.  
 5 48.2, 311.8, 120, 240.  
 6 (a)  $2(\sin^2 \theta \neq 1)$ ; (b)  $\sec^2 \theta (\sin \theta \neq 0)$ .  
 7  $\pi/10, \pi/2, 9\pi/10, 13\pi/10, 17\pi/10, 7\pi/6, 11\pi/6$ .  
 8  $2n\pi/3 + \pi/6, (4n + 1)\pi/2, (n \in \mathbb{Z})$ .  
 9  $\pi/18, 5\pi/18, 13\pi/18, 17\pi/18, 25\pi/18, 29\pi/18$ .  
 10  $n\pi + \pi/4 \pm \beta$ .  
 11  $\pi/4$ .  
 12  $336.3^\circ; 143.7^\circ$ .  
 13  $n\pi \pm \pi/6, n \in \mathbb{Z}$ .  
 14  $2n\pi \pm \pi/6, n \in \mathbb{Z}$ .

## Exercise 2

- 1 (a) 416/425; (b) 87/425; (c) 416/87; (d)  $-304/425$ ; (e)  $-297/425$ ; (f) 304/297.  
 2 (a)  $(1 + \sqrt{3})/2\sqrt{2}$ ; (b)  $(\sqrt{3} - 1)/2\sqrt{2}$ ; (c)  $(1 - \sqrt{3})/(1 + \sqrt{3})$ .  
 3 (a)  $x = 2y^2 - 1$ ; (b)  $(1 - y^2)x = 2y$ .  
 4  $(-1/8), (-31/32)$ .  
 5 0.6, 0.8.  
 6  $-16/63$ .  
 7  $-\frac{1}{4}\pi < \theta < \frac{1}{4}\pi$ .  
 8  $\frac{1}{4}\pi - \frac{1}{2}\alpha$ .  
 9 3 or  $1/3$ .  
 10  $23.2^\circ, 203.2^\circ, 135^\circ, 315^\circ$ .  
 11  $-1.53, -0.35, 1.88$

## Exercise 3

- 1 (a)  $\sqrt{2}, 7\pi/4$ ; (b) 2,  $\pi/6$ ;

(c)  $\sqrt{2}, \frac{1}{4}\pi$ ; (d)  $\sqrt{10}, \tan \gamma = -1/3$  and  $3\pi/2 \leq \gamma \leq 2\pi$ .

- 2 (a)  $45^\circ$ ; (b)  $306.9^\circ$ ; (c)  $97.3^\circ$  and  $230.2^\circ$ .  
 3 (a) Max  $\sqrt{13}, 33.7^\circ$ ; Min  $-\sqrt{13}, 213.7^\circ$ ; (b) Max 18,  $67.4^\circ$ ; Min 8,  $337.4^\circ$ ; (c) Max  $-1/\sqrt{2}, 112.5^\circ, 292.5^\circ$ ; Min  $1/\sqrt{2}, 22.5^\circ, 202.5^\circ$ ; (d) Max 25,  $36.9^\circ, 216.9^\circ$ ; Min 0,  $126.9^\circ, 306.9^\circ$ .  
 4 (a)  $360 n^\circ \pm 80.4^\circ (n \in \mathbb{Z})$ ; (b)  $180 n^\circ$  and  $180 n^\circ + (-1)^n 30^\circ (n \in \mathbb{Z})$ ; (c)  $180 n^\circ$  and  $360 n^\circ \pm 120^\circ (n \in \mathbb{Z})$ ; (d)  $180 n^\circ + 35.3^\circ$  and  $180 n^\circ - 35.3^\circ (n \in \mathbb{Z})$ ; (e)  $180 n^\circ + (-1)^n 90^\circ$  and  $180 n^\circ + (-1)^n 270^\circ$  and  $180 n^\circ + (-1)^n 41.8^\circ (n \in \mathbb{Z})$ .  
 5 (a)  $72^\circ, 144^\circ, 180^\circ, 216^\circ, 288^\circ$ ; (b)  $20^\circ, 90^\circ, 100^\circ, 140^\circ, 220^\circ, 260^\circ, 270^\circ, 340^\circ$ ; (c)  $60^\circ, 105^\circ, 120^\circ, 165^\circ, 180^\circ, 240^\circ, 285^\circ, 300^\circ, 345^\circ$ .  
 6  $\pi/2, 3\pi/2, \pi/8, 5\pi/8, 9\pi/8, 13\pi/8$ .  
 7  $2n\pi \mp 2\pi/3, (n \in \mathbb{Z})$ .  
 8  $\mp 1/\sqrt{3}$ .  
 9 Least value at  $\theta = 143.1^\circ$ ; greatest value at  $\theta = -36.9^\circ$ ; zero at  $\theta = 0^\circ$ .

## Exercise 4

- 1 (a)  $(3/2) - (\theta^2/16)$ , (b)  $-(3\theta/2)$ , (c)  $\frac{1}{2} - \theta^2/24$ .  
 2  $\frac{1}{2} \cos x$ .  
 3 2.  
 4 (a)  $45^\circ$ ; (b)  $60^\circ$ ; (c)  $180^\circ$ ; (d)  $19.5^\circ$ .  
 5  $x = \pm \sqrt{(2/3)}$ .  
 6  $b = 8.26$  cm, area =  $34.95$  cm<sup>2</sup>.  
 7  $A = 35.3^\circ, B = 43.9^\circ, C = 100.8^\circ$ , area =  $58.9$  cm<sup>2</sup>.  
 8 angle  $DAB = 120^\circ$ , angle  $BCD = 60^\circ$ .  
 9  $\frac{3}{5}$ .  
 10  $\frac{1}{3}\sqrt{3}$ .  
 11 48.89 m.

# Index

- amplitude 21
- approximations 28
- arccos 30
- arcsin 29
- arctan 30
- area of a triangle 32
  
- compound-angle identities 13
- cosec  $\theta$ 
  - definition 3
  - graph 8
- cos  $\theta$ 
  - definition 2
  - graph 2
  - small angle approximation 28
- cosine rule 32
- cos<sup>-1</sup>  $x$ 
  - definition 30
  - graph 30
  - principal value 30
- Cos<sup>-1</sup>  $x$  30
- cot  $\theta$  3
  
- degrees 1
- double-angle identities 14
  
- factor formulae 15
  
- half-angle identities 14
  
- inverse trigonometric functions 29
- phase 21
- principal values 29
- Pythagoras' theorem 4
  
- radians 1
  
- sec  $x$  3
- set square angles 4
- sine  $\theta$ 
  - definition 2
  - graph 2
  - small-angle approximation 28
- sine rule 32
- sin<sup>-1</sup>  $x$ 
  - definition 29
  - graph 30
  - principal value 29
- Sin<sup>-1</sup>  $x$  29
  
- tan  $\theta$ 
  - definition 2
  - graph 3
  - small-angle approximation 28
- tan<sup>-1</sup>  $x$ 
  - definition 30
  - graph 31
  - principal value 30
- Tan<sup>-1</sup>  $x$  30