

Chapter 8

Exercise 8A

- 1 **a** 19.47° 160.53°
b 113.58°
c 74.05°
 254.05°
 434.05°
d 64.62°
 295.38°
 424.62°
 655.38°
- 2 **a** 30°
 150°
b 135°
c 60°
 240°
d 30°
 150°
 390°
 510°
e 150°
 210°
f 135°
 315°
- 3 $(19.47^\circ, 2)$
 $(160.529^\circ, 2)$

Exercise 8B

- 1 **a** 9.736°
 80.264°
 189.736°
 260.264°
b 7.267°
 67.267°
 127.267°
c 17.632°
 72.368°

- d** 273.59°
 356.41°
e 60.964°
 240.964°
f 61.81°
 158.19°
 421.81°
 518.19°

- 2 **a** 30°
 90°
b 70°
 340°
c 0°
 135°
 180°
 315°
 360°
d 85°
 175°
e $3\frac{1}{3}^\circ$
 $103\frac{1}{3}^\circ$
 $123\frac{1}{3}^\circ$
f $22\frac{1}{2}^\circ$
 $202\frac{1}{2}^\circ$

- 3 **a** $p = 4$ $q = 25$
b $(10.5, -1)$ $(219.5, -1)$
- 4 **a** 20.296°
b 5Hours 42minutes, 5.42am
20Hours 18minutes, 8:18pm
- 5 **a** 15.7 hours, day number 170. 19th
june if no leap year. (18th if leap
year)
b days 113 and 227
- 6 Days 11 and 17
[11.13 and 16.87]

Exercise 8C

- 1 a** 56.789°
 123.211°
 236.789°
 39.23°
- b** 140.768°
 219.23°
 320.768°
- c** 270°
- d** 109.47°
 250.53°
- 2 a** 66.87°
 173.13°
 300°
- b** 30°
 150°
 210°
 330°
- c** 90°
 210°
 330°
- 3 a** 0°
 30°
 150°
 180°
 360°
- b** 28.59°
 151.4°
 208.59°
 331.41°
- c** 0°
 48.19°
 60°
 300°
 311.81°
 360°

Exercise 8D

- 1 a** $\frac{\pi}{6}$
 $\frac{5\pi}{6}$
- b** $\frac{3\pi}{4}$
- c** $\frac{\pi}{3}$
 $\frac{4\pi}{3}$
- d** $\frac{\pi}{2}$
 $\frac{5\pi}{2}$
- e** $\frac{5\pi}{6}$
 $\frac{7\pi}{6}$
- f** $\frac{3\pi}{4}$
 $\frac{7\pi}{4}$
- 2 a** $\frac{5\pi}{6}$
 $\frac{11\pi}{6}$
- b** 0.951
 4.092
- c** $\frac{3\pi}{4}$
 $\frac{5\pi}{4}$
- d** 0.927
 4.069
- e** 1.772
 4.511
- f** $\frac{\pi}{2}$
- g** $\frac{\pi}{6}$
 $\frac{11\pi}{6}$
- h** 1.166
 4.307
- 3 a** $\frac{\pi}{12}$
 $\frac{5\pi}{12}$
 $\frac{13\pi}{12}$
 $\frac{17\pi}{12}$

b $\frac{\pi}{9}$

$\frac{4\pi}{9}$

$\frac{7\pi}{9}$

c $\frac{5\pi}{6}$

$\frac{3\pi}{2}$

d $\frac{\pi}{2}$

π

e $\frac{\pi}{4}$

$\frac{7\pi}{12}$

$\frac{11\pi}{12}$

f $\frac{\pi}{2}$ or $\frac{2\pi}{3}$

g $\frac{7\pi}{12}$

$\frac{\pi}{12}$

h 0

$\frac{3\pi}{4}$

π

$\frac{7\pi}{4}$

2π

4 $(\frac{\pi}{6}, 4)$

$(\frac{5\pi}{6}, 4)$

$(\frac{7\pi}{6}, 4)$

$(\frac{11\pi}{6}, 4)$

5 Assuming t is in hours then

5.16, 6.84, 17.16, 18.84

6 Years 4 and 7

[4.37 and 6.63]

7 a 8 am, 8:40am

b days 69 and 275

[69.37, 275.63]

Exercise 8E

1 a $\frac{\pi}{4}$

$\frac{3\pi}{4}$

$\frac{5\pi}{4}$

$\frac{7\pi}{4}$

b 0

$\frac{2\pi}{3}$

π

$\frac{5\pi}{3}$

2π

c $\frac{\pi}{3}$

$\frac{2\pi}{3}$

$\frac{4\pi}{3}$

$\frac{5\pi}{3}$

d 0.886

2.256

4.03

5.397

2 a $\frac{\pi}{3}$

π

$\frac{5\pi}{3}$

b 0

$\frac{\pi}{3}$

$\frac{2\pi}{3}$

π

2π

c π

5.697

0.589

d $\frac{\pi}{6}$

$\frac{5\pi}{6}$

3 $\frac{\pi}{3}$

π

Exercise 8F

- 1 a** 270°
b 48.19°
 120°
 240°
 311.81°
c 70.529°
 120°
d 30°
 150°
 228.59°
 311.41°
- 2 a** 120°
 180°
 240°
b 90°
c 210°
 330°
d 0°
 180°
 360°
e 53.13°
 120°
 240°
 306.87°
f 60°
 131.81°
 228.19°
 300°
g 41.41°
 180°
 318.59°
h 27.36°
 142.01°
 217.99°
 332.64°

- 3 a** 90°
 210°
 270°
 330°
b 0°
 180°
 360°
c 0°
 70.53°
 180°
 289.47°
 360°
 430.53°
 540°
 649.47°
 720°
d 17.46°
 90°
 162.54°
 270°
- 4 a** 0°
 40°
 80°
b 30°
 150°
c 0°
- 5** 270°
 14.48°
 165.52°
- 6 a** $p = 2$
 $q = 2$
b 75.52°
 284.48°
 180°
 360°

Exercise 8G

- 1 a $\frac{\pi}{2}$
 b $\text{ArcCos}\left(\frac{3}{4}\right)$
 $2\pi - \text{ArcCos}\left(\frac{3}{4}\right)$
- 2 a $\frac{\pi}{3}$
 π
 $\frac{5\pi}{3}$
 b $\frac{\pi}{6}$
 $\frac{5\pi}{6}$
 c 0
 $\frac{\pi}{3}$
 π
 $\frac{5\pi}{3}$
 d 0
 π
 $\frac{7\pi}{6}$
 $\frac{11\pi}{6}$
 2π
 e $\frac{\pi}{2}$
 $\frac{4\pi}{3}$
 $\frac{3\pi}{2}$
 $\frac{5\pi}{3}$
 f $\frac{\pi}{3}$
 $\frac{5\pi}{3}$
- 3 note mixup between θ, x in (b)
 a $\frac{\pi}{12}$
 $\frac{5\pi}{12}$
 $\frac{3\pi}{4}$
 $\frac{13\pi}{12}$
 $\frac{17\pi}{12}$
 $\frac{7\pi}{4}$

- b $\frac{\pi}{6}$
 $\frac{\pi}{2}$
 $\frac{5\pi}{6}$
 $\frac{7\pi}{6}$
 $\frac{3\pi}{2}$
 $\frac{11\pi}{6}$

Exercise 8H

- 1 a $\sqrt{65} \cos(x - 29.745)^\circ$
 b $x = 81.416^\circ$
 $x = 338.074^\circ$
- 2 a $k = 2$
 $\alpha = \frac{\pi}{6}$
 b $x = 0$
 $x = \frac{2\pi}{3}$
 $x = 2\pi$
- 3 a $R = 5$
 $\beta = 143.130^\circ$
 b $x = 76.708^\circ$
 $x = 209.552^\circ$
- 4 a $x = 90^\circ$
 $x = 306.87^\circ$
 b $x = 0$
 $x = 263.62^\circ$
 $x = 360^\circ$
 c $x = 19.47^\circ$
 $x = 160.53^\circ$
 d $x = 0^\circ$
 $x = 216.87^\circ$
 $x = 360^\circ$
 e $x = 130.208^\circ$
 $x = 342.412^\circ$
 f $x = 90^\circ$
 $x = 306.87^\circ$
- 5 $\theta = 0.464$
 $\theta = 3.605$

$$6 \quad t = 13.156^\circ$$

$$t = 16.843^\circ$$

- 7 **a** Low 6.89 hours or 6:53am, 18.89 hours or 6:53 pm
High 0.89 hours or 12:53am, 12.89 hours or 12:53pm

- b** time = 9.672 hours = 9:40am, so wait 40 minutes.

Exercise 8I

$$1 \quad \mathbf{a} \quad x = 0$$

$$x = \frac{4\pi}{3}$$

$$x = 2\pi$$

$$\mathbf{b} \quad x = 91.81^\circ$$

$$x = 188.19^\circ$$

$$\mathbf{c} \quad x = 73.435^\circ$$

$$x = 126.565^\circ$$

$$x = 253.435^\circ$$

$$2 \quad \mathbf{a} \quad (\cos x)^2 - (\sin x)^2$$

$$\cos(x + x) = \cos(2x)$$

$$\mathbf{b} \quad x = \frac{\pi}{2}$$

$$x = \frac{3\pi}{2}$$

$$x = \frac{5\pi}{2}$$

$$3 \quad \mathbf{a}$$

$$\sin(2x + x)$$

$$\sin(2x)\cos x + \cos(2x)\sin x$$

$$2\sin x \cos x \cos x + ((\cos x)^2 - (\sin x)^2)\sin x$$

$$\sin x(3(\cos x)^2 - (\sin x)^2)$$

$$\sin x(3 - 4(\sin x)^2)$$

$$\mathbf{b} \quad x = \frac{\pi}{18}$$

$$x = \frac{5\pi}{18}$$

$$x = \frac{13\pi}{18}$$

$$x = \frac{17\pi}{18}$$

$$4 \quad \mathbf{a}$$

$$\sin\left(x + \frac{\pi}{6}\right) = \frac{1}{2}(\cos x + \sqrt{3}\sin x)$$

$$\sin\left(x - \frac{\pi}{2}\right) = -\cos x$$

$$\sin\left(x + \frac{\pi}{6}\right) - \sin\left(x - \frac{\pi}{2}\right) = \frac{1}{2}(3\cos x + \sqrt{3}\sin x)$$

$$\sqrt{3}\cos\left(x - \frac{\pi}{6}\right) = \frac{1}{2}(3\cos x + \sqrt{3}\sin x)$$

$$\mathbf{b} \quad x = 0$$

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

$$5 \quad \mathbf{a}$$

$$2\sin(x - 60)^\circ = 2(\sin x^\circ \cos 60^\circ - \cos x^\circ \sin 60^\circ)$$

$$= \sin x^\circ - \sqrt{3}\cos x^\circ$$

adding $\sin x^\circ$ gives

$$2\sin x^\circ - \sqrt{3}\cos x^\circ$$

$$\mathbf{b} \quad x = 63.1^\circ$$

$$x = 198.686^\circ$$