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°, 2)
(160.529°, 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 $3\frac{1}{3}°$
$103\frac{1}{3}°$
$123\frac{1}{3}°$
f $22\frac{1}{2}°$
$202\frac{1}{2}°$

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

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

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

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

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 $ArcCos\left(\frac{3}{4}\right)$

$2\pi - ArcCos\left(\frac{3}{4}\right)$

π

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 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 $\sqrt{65}\cos(x - 29.745)°$

b $x = 81.416°$

$x = 338.074°$

2 a $k = 2$

$\alpha = \frac{\pi}{6}$

b $x = 0$

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

$x = 2\pi$

3 a $R = 5$

$\beta = 143.130°$

b $x = 76.708°$

$x = 209.552°$

4 a $x = 90°$

$x = 306.87°$

b $x = 0$

$x = 263.62°$

$x = 360°$

c $x = 19.47°$

$x = 160.53°$

d $x = 0°$

$x = 216.87°$

$x = 360°$

e $x = 130.208°$

$x = 342.412°$

f $x = 90°$

$x = 306.87°$

5 $\theta = 0.464$

$\theta = 3.605$

6 $t = 13.156°$

$t = 16.843°$

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 **a** $x = 0$

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

$x = 2\pi$

b $x = 91.81°$

$x = 188.19°$

c $x = 73.435°$

$x = 126.565°$

$x = 253.435°$

2 **a** $(\cos x)^2 - (\sin x)^2$

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

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

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

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

3 **a**

$\sin(2x + x)$

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

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

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

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

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

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

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

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

4 **a**

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

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

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

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

b $x = 0$

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

5 **a**

$2\sin(x - 60)° = 2\left(\sin x°\cos 60° - \cos x°\sin 60°\right)$

$= \sin x° - \sqrt{3}\cos x°$

adding $\sin x°$ gives

$2\sin x° - \sqrt{3}\cos x°$

b $x = 63.1°$

$x = 198.686°$