Chapter 12

Exercise 12A

1 a 18
b 8
c 0
d 13.2
e 13.3333
f –114

2 a 135
b –28.5
c –11.25
d 104
e 18

3 a 2.667
b 0.0121528
c –1.3125
d 38
e 4
f 24.0732
g 4
h 968
i 0.1759

4 a 0.4
b 121.3333
c 130
d –60.6667
e –12.75
f 2.375

5 a 2.6667
b 23.3333
c 0.06944
d 12.6667
e –27.9414
f 7.5
g 13.77778
h 0.27006
i 0.75

6 $\int_{8}^{18} \frac{1}{4}\sqrt{x}\,dx$

$\left[\frac{x^{\frac{3}{2}}}{6}\right]_{8}^{18}$

$\left(\frac{18^{\frac{3}{2}}}{6}\right) - \left(\frac{8^{\frac{3}{2}}}{6}\right)$

$\left(\frac{(2\times 9)^{\frac{3}{2}}}{6}\right) - \left(\frac{(2\times 4)^{\frac{3}{2}}}{6}\right)$

$\left(\frac{27(2)^{\frac{3}{2}}}{6}\right) - \left(\frac{8(2)^{\frac{3}{2}}}{6}\right)$

$2\sqrt{2}\left(\frac{27}{6} - \frac{8}{6}\right)$

$\frac{19\sqrt{2}}{3}$

7 $k = 0.5$
$k = 1$

8 a $p^3 - 2p^2 - \left((-2)^3 - 2(-2)^2\right) - 48$
$= p^3 - 2p^2 - 32$

b i $(4)^3 - 2(4)^2 - 32 = 0$
ii $(p-4)\left(p^2 + 2p + 8\right) = 0$
Second product has no roots, first product gives p=4.

9 –7

10 $t = 2$
$t = -7$

Exercise 12B

1 a 1
b $\frac{5}{2}$
c 4
d $\frac{3\sqrt{3}}{4}$
e $\frac{1}{3}$
f $\sqrt{3} - 1$

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

b $3\sqrt{2}$

c 4

d $\frac{3\sqrt{3}}{4}$

e $\frac{1}{3}$

f $\sqrt{3} - 1$

3 **a** $-3\sqrt{2}\left(1+\sqrt{2}\right)$

b 0

c $\sqrt{2}$

d $\frac{-2\left(2+\sqrt{2}\right)}{3}$

e 0

f 0

4 **a** 0.51

b 4.75

c 0.38

d 0.62

e 6.90

f 7.65

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

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

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

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

7 $\frac{7\pi}{6}$

8 **a**

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

$$= 1 - 2(\sin x)^2$$

$$\Rightarrow (\sin x)^2 = \frac{1}{2}(1 - \cos 2x)$$

b

$$\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \frac{1}{2}(1 - \cos 2x)\,dx = \left[\frac{x}{2} - \frac{1}{4}\sin 2x\right]_{\frac{\pi}{4}}^{\frac{\pi}{3}}$$

$$= \left(\frac{\frac{\pi}{3}}{2} - \frac{1}{4}\sin\left(\frac{2\pi}{3}\right)\right) - \left(\frac{\frac{\pi}{4}}{2} - \frac{1}{4}\sin\left(\frac{2\pi}{4}\right)\right)$$

$$= \frac{1}{24}\left(\pi + 6 - 3\sqrt{3}\right)$$

9 **a** $\cos\frac{\pi}{4}\cos\frac{\pi}{6} + \sin\frac{\pi}{4}\sin\frac{\pi}{6} =$

$\frac{1}{\sqrt{2}}\frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}}\frac{1}{2} = \frac{1}{2\sqrt{2}}\left(\sqrt{3} + 1\right)$

b $\sin\frac{\pi}{4}\cos\frac{\pi}{6} - \cos\frac{\pi}{4}\sin\frac{\pi}{6} =$

$\frac{1}{\sqrt{2}}\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}\frac{1}{2} = \frac{1}{2\sqrt{2}}\left(\sqrt{3} - 1\right)$

c $\int_{-\frac{\pi}{12}}^{\frac{\pi}{12}} \cos x - \sin x\,dx =$

$\left[\cos x + \sin x\right]_{-\frac{\pi}{12}}^{\frac{\pi}{12}} =$

$\cos\frac{\pi}{12} + \sin\frac{\pi}{12} - \left(\cos\left(-\frac{\pi}{12}\right)\right.$

$\left. + \sin\left(-\frac{\pi}{12}\right)\right) =$

$\frac{1}{\sqrt{2}}\left(\sqrt{3} - 1\right) =$

$\frac{1}{2}\left(\sqrt{6} - \sqrt{2}\right)$