# Answers to practice exercises

## Chapter 1

### Exercise 1 (page 2)

**1.** 19 kg **2.** 16 m **3.** 479 mm
**4.** −66 **5.** £565 **6.** −225
**7.** −2136 **8.** −36 121 **9.** £10 7701
**10.** −4 **11.** 1487 **12.** 5914
**13.** 189 g **14.** −70872 **15.** $15 333
**16.** 89.25 cm
**17.** $d = 64$ mm, $A = 136$ mm, $B = 100$ mm

### Exercise 2 (page 5)

**1.** (a) 168 (b) 868 **2.** (a) £1827 (b) £4158
**3.** (a) 8613 kg (b) 584 kg
**4.** (a) 351 mm (b) 924 mm
**5.** (a) 10 304 (b) −4433 **6.** (a) 48 m (b) 89 m
**7.** (a) 259 (b) 56 **8.** (a) 1648 (b) 1060
**9.** (a) 8067 (b) 3347 **10.** 18 kg

### Exercise 3 (page 6)

**1.** (a) 4 (b) 24 **2.** (a) 12 (b) 360
**3.** (a) 10 (b) 350 **4.** (a) 90 (b) 2700
**5.** (a) 2 (b) 210 **6.** (a) 3 (b) 180
**7.** (a) 5 (b) 210 **8.** (a) 15 (b) 6300
**9.** (a) 14 (b) 420 420 **10.** (a) 14 (b) 53 900

### Exercise 4 (page 8)

**1.** 59 **2.** 14 **3.** 88 **4.** 5 **5.** −33
**6.** 22 **7.** 68 **8.** 5 **9.** 2 **10.** 5
**11.** −1

## Chapter 2

### Exercise 5 (page 11)

**1.** $2\frac{1}{7}$ **2.** $7\frac{2}{5}$ **3.** $\frac{22}{7}$ **4.** $\frac{71}{8}$
**5.** $\frac{4}{11}$ **6.** $\frac{3}{7}, \frac{4}{9}, \frac{1}{2}, \frac{3}{5}, \frac{5}{8}$ **7.** $\frac{8}{25}$ **8.** $\frac{11}{15}$
**9.** $\frac{9}{30}$ **10.** $\frac{9}{10}$ **11.** $\frac{3}{16}$ **12.** $\frac{3}{16}$
**13.** $\frac{43}{7}$ **14.** $1\frac{1}{15}$ **15.** $\frac{4}{27}$ **16.** $8\frac{51}{52}$
**17.** $1\frac{9}{40}$ **18.** $1\frac{16}{21}$ **19.** $\frac{17}{60}$ **20.** $\frac{17}{20}$

### Exercise 6 (page 13)

**1.** $\frac{8}{35}$ **2.** $2\frac{2}{9}$ **3.** $\frac{6}{11}$ **4.** $\frac{5}{12}$ **5.** $\frac{3}{28}$
**6.** $\frac{3}{5}$ **7.** 11 **8.** $\frac{1}{13}$ **9.** $1\frac{1}{2}$ **10.** $\frac{8}{15}$
**11.** $2\frac{2}{5}$ **12.** $\frac{5}{12}$ **13.** $3\frac{3}{4}$ **14.** $\frac{12}{23}$ **15.** 4
**16.** $\frac{3}{4}$ **17.** $\frac{1}{9}$ **18.** 13 **19.** 15 **20.** 400 litres
**21.** (a) £60, $P$£36, $Q$£16 **22.** 2880 litres

### Exercise 7 (page 14)

**1.** $2\frac{1}{18}$ **2.** $-\frac{1}{9}$ **3.** $1\frac{1}{6}$ **4.** $4\frac{3}{4}$ **5.** $\frac{13}{20}$
**6.** $\frac{7}{15}$ **7.** $4\frac{19}{20}$ **8.** 2 **9.** $7\frac{1}{3}$ **10.** $\frac{1}{15}$
**11.** 4 **12.** $2\frac{17}{20}$



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## Chapter 16

### Exercise 62 (page 118)

**1.** (a) 0.1653 (b) 0.4584 (c) 22030
**2.** (a) 5.0988 (b) 0.064037 (c) 40.446
**3.** (a) 4.55848 (b) 2.40444 (c) 8.05124
**4.** (a) 48.04106 (b) 4.07482 (c) −0.08286
**5.** 2.739 **6.** 120.7 m

### Exercise 63 (page 120)

**1.** 2.0601 **2.** (a) 7.389 (b) 0.7408
**3.** $1-2x^2-\frac{8}{3}x^3-2x^4$
**4.** $2x^{1/2}+2x^{5/2}+x^{9/2}+\frac{1}{3}x^{13/2}+\frac{1}{12}x^{17/2}+\frac{1}{60}x^{21/2}$

### Exercise 64 (page 122)

**1.** 3.95, 2.05 **2.** 1.65, −1.30
**3.** (a) 28 cm$^3$ (b) 116 min **4.** (a) 70°C (b) 5 minutes

### Exercise 65 (page 124)

**1.** (a) 0.55547 (b) 0.91374 (c) 8.8941
**2.** (a) 2.2293 (b) −0.33154 (c) 0.13087
**3.** −0.4904 **4.** −0.5822 **5.** 2.197 **6.** 816.2
**7.** 0.8274 **8.** 11.02 **9.** 1.522 **10.** 1.485
**11.** 1.962 **12.** 3 **13.** 4
**14.** 147.9 **15.** 4.901 **16.** 3.095
**17.** $t=e^{b+a\ln D}=e^b e^{a\ln D}=e^b e^{\ln D^a}$ i.e. $t=e^b D^a$
**18.** 500 **19.** $W=PV\ln\left(\frac{U_2}{U_1}\right)$

### Exercise 66 (page 127)

**1.** (a) 150°C (b) 100.5°C **2.** 99.21 kPa
**3.** (a) 29.32 volts (b) $71.31\times10^{-6}$ s
**4.** (a) 1.993 m (b) 2.293 m **5.** (a) 50°C (b) 55.45 s
**6.** 30.37 N **7.** (a) 3.04 A (b) 1.46 s
**8.** 2.45 mol/cm$^3$ **9.** (a) 7.07 A (b) 0.966 s
**10.** £2424

## Chapter 17

### Exercise 67 (page 134)

**1.** (a) Horizontal axis: 1 cm = 4 V (or 1 cm = 5 V), vertical axis: 1 cm = 10 Ω
(b) Horizontal axis: 1 cm = 5 m, vertical axis: 1 cm = 0.1 V
(c) Horizontal axis: 1 cm = 10 N, vertical axis: 1 cm = 0.2 mm
**2.** (a) −1 (b) −8 (c) −1.5 (d) 5 **3.** 14.5
**4.** (a) −1.1 (b) −1.4
**5.** The 1010 rev/min reading should be 1070 rev/min; (a) 1000 rev/min (b) 167 V

### Exercise 68 (page 140)

**1.** Missing values: −0.75, 0.25, 0.75, 2.25, 2.75; Gradient $=\frac{1}{2}$
**2.** (a) 4, −2 (b) −1, 0 (c) −3, −4 (d) 0, 4
**3.** (a) 2, $\frac{1}{2}$ (b) 3, $2\frac{1}{2}$ (c) $\frac{1}{24}$, $\frac{1}{2}$
**4.** (a) 3, −3 (b) −2, 4 (c) 3, 0 (d) 0, 7
**5.** (a) 2, $-\frac{1}{2}$ (b) $-\frac{2}{3}$, $-1\frac{2}{3}$ (c) $\frac{1}{18}$, 2 (d) 10, $-4\frac{2}{3}$
**6.** (a) $\frac{3}{5}$ (b) −4 (c) $-1\frac{5}{6}$
**7.** (a) and (c), (b) and (e)
**8.** (2, 1) **9.** (1.5, 6) **10.** (1, 2)
**11.** (a) 89 cm (b) 11 N (c) 2.4 (d) $l=2.4W+48$
**12.** $P=0.15W+3.5$ **13.** $a=-20, b=412$

### Exercise 69 (page 144)

**1.** (a) 40°C (b) 128 Ω
**2.** (a) 850 rev/min (b) 77.5 V
**3.** (a) 0.25 (b) 12 (c) $F=0.25L+12$
(d) 89.5 N (e) 592 N (f) 212 N
**4.** −0.003, 8.73
**5.** (a) 22.5 m/s (b) 6.43 s (c) $v=0.7t+15.5$
**6.** $m=26.9L-0.63$
**7.** (a) $1.31t$ (b) 22.89% (c) $F=-0.09W+2.21$
**8.** (a) $96\times10^9$ Pa (b) 0.00022 (c) $28.8\times10^6$ Pa

**4.** $t = 122°7'$ and $237°53'$
**5.** $\alpha = 218°41'$ and $321°19'$
**6.** $\theta = 39°44'$ and $219°44'$

### Exercise 88 (page 202)

**1.** 5 **2.** 180° **3.** 30 **4.** 120°
**5.** 1, 120° **6.** 2, 144° **7.** 3, 90° **8.** 5, 720°
**9.** $\frac{7}{2}$, 960° **10.** 6, 360° **11.** 4, 180° **12.** 5 ms
**13.** 40 Hz **14.** 100 μs or 0.1 ms
**15.** 625 Hz **16.** leading **17.** leading

### Exercise 89 (page 203)

**1.** (a) 40 (b) 25 Hz (c) 0.04 s or 40 ms (c) 25 Hz
(d) 0.29 rad (or 16.62°) leading $40\sin 50\pi t$

**2.** (a) 75 cm (b) 6.37 Hz (c) 0.157 s
(d) 0.54 rad (or 30.94°) lagging $75\sin 40t$

**3.** (a) 300 V (b) 100 Hz (c) 0.01 s or 10 ms
(d) 0.412 rad (or 23.61°) lagging $300\sin 200\pi t$

**4.** (a) $v = 120\sin 100\pi t$ volts
(b) $v = 120\sin(100\pi t + 0.43)$ volts

**5.** $i = 20\sin\left(80\pi t - \frac{\pi}{6}\right)$ A or
$i = 20\sin(80\pi t - 0.524)$A

**6.** $3.2\sin(100\pi t + 0.488)$ m

**7.** (a) 5A, 50 Hz, 20 ms, 24.75° lagging
(b) −2.093A (c) 4.363 A (d) 6.375 ms (e) 3.423 ms

## Chapter 23

### Exercise 90 (page 207)

**1.** $C = 83°$, $a = 14.1$ mm, $c = 28.9$ mm,
area $= 189\,\text{mm}^2$

**2.** $A = 52°2'$, $c = 7.568$ cm, $a = 7.152$ cm,
area $= 25.65\,\text{cm}^2$

**3.** $D = 19°48'$, $E = 134°12'$, $e = 36.0$ cm,
area $= 134\,\text{cm}^2$

**4.** $E = 49°0'$, $F = 26°38'$, $f = 15.08$ mm,
area $= 185.6\,\text{mm}^2$

**5.** $J = 44°29'$, $L = 99°31'$, $l = 5.420$ cm,
area $= 6.132\,\text{cm}^2$, or, $J = 135°31'$, $L = 8°29'$,
$l = 0.811$ cm, area $= 0.917\,\text{cm}^2$

**6.** $K = 47°8'$, $J = 97°52'$, $j = 62.2$ mm,
area $= 820.2\,\text{mm}^2$ or $K = 132°52'$, $J = 12°8'$,
$j = 13.19$ mm, area $= 174.0\,\text{mm}^2$

### Exercise 91 (page 209)

**1.** $p = 13.2$ cm, $Q = 47.35°$, $R = 78.65°$,
area $= 77.7\,\text{cm}^2$

**2.** $p = 6.127$ m, $Q = 30.83°$, $R = 44.17°$,
area $= 6.938\,\text{m}^2$

**3.** $X = 83.33°$, $Y = 52.62°$, $Z = 44.05°$,
area $= 27.8\,\text{cm}^2$

**4.** $Z = 29.77°$, $Y = 53.50°$, $Z = 96.73°$,
area $= 355\,\text{mm}^2$

### Exercise 92 (page 210)

**1.** 193 km **2.** (a) 122.6 m (b) 94.80°, 40.66°, 44.54°
**3.** (a) 11.4 m (b) 17.55° **4.** 163.4 m
**5.** $BF = 3.9$ m, $EB = 4.0$ m **6.** 6.35 m, 5.37 m
**7.** 32.48 A, 14.31°

### Exercise 93 (page 212)

**1.** 80.42°, 59.38°, 40.20° **2.** (a) 15.23 m (b) 38.07°
**3.** 40.25 cm, 126.05° **4.** 19.8 cm **5.** 36.2 m
**6.** $x = 9.3$ mm, $y = 142$ mm **7.** 130° **8.** 13.66 mm



## Chapter 24

### Exercise 94 (page 215)

**1.** (5.83, 59.04°) or (5.83, 1.03 rad)
**2.** (6.61, 20.82°) or (6.61, 0.36 rad)
**3.** (4.47, 116.57°) or (4.47, 2.03 rad)
**4.** (6.55, 145.58°) or (6.55, 2.54 rad)
**5.** (7.62, 203.20°) or (7.62, 3.55 rad)
**6.** (4.33, 236.31°) or (4.33, 4.12 rad)
**7.** (5.83, 329.04°) or (5.83, 5.74 rad)
**8.** (15.68, 307.75°) or (15.68, 5.37 rad)

### Exercise 95 (page 217)

**1.** (1.294, 4.830) **2.** (1.917, 3.960)
**3.** (−5.362, 4.500) **4.** (−2.884, 2.154)
**5.** (−9.353, −5.400) **6.** (−2.615, −3.207)
**7.** (0.750, −1.299) **8.** (4.252, −4.233)
**9.** (a) $40\angle 18°$, $40\angle 90°$, $40\angle 162°$, $40\angle 234°$, $40\angle 306°$
(b) (38.04, 12.36), (0, 40), (−38.04, 12.36),
(−23.51, −32.36), (23.51, −32.36)
**10.** 47.0 mm

## Chapter 25

### Exercise 96 (page 221)

**1.** $p = 105°, q = 35°$ **2.** $r = 142°, s = 95°$
**3.** $t = 146°$

### Exercise 97 (page 225)

**1.** (i) rhombus (a) 14 $cm^2$ (b) 16 cm (ii) parallelogram (a) 180 $mm^2$ (b) 80 mm (iii) rectangle (a) 3600 $mm^2$ (b) 300 mm (iv) trapezium (a) 190 $cm^2$ (b) 62.91 cm
**2.** 35.7 $cm^2$ **3.** (a) 80 m (b) 170 m **4.** 27.2 $cm^2$
**5.** 18 cm **6.** 1200 mm
**7.** (a) 29 $cm^2$ (b) 650 $mm^2$ **8.** 560 $m^2$
**9.** 3.4 cm **10.** 6750 $mm^2$ **11.** 43.30 $cm^2$
**12.** 32

### Exercise 98 (page 226)

**1.** 482 $m^2$
**2.** (a) 50.27 $cm^2$ (b) 706.9 $mm^2$ (c) 3183 $mm^2$
**3.** 2513 $mm^2$ **4.** (a) 20.19 mm (b) 63.41 mm
**5.** (a) 53.01 $cm^2$ (b) 129.9 $mm^2$ **6.** 5773 $mm^2$
**7.** 1.89 $m^2$

### Exercise 99 (page 228)

**1.** 1932 $mm^2$ **2.** 1624 $mm^2$ **3.** (a) 0.918 ha (b) 456 m

### Exercise 100 (page 229)

**1.** 80 ha **2.** 80 $m^2$ **3.** 3.14 ha

## Chapter 26

### Exercise 101 (page 231)

**1.** 45.24 cm **2.** 259.5 mm **3.** 2.629 cm **4.** 47.68 cm
**5.** 38.73 cm **6.** 12730 km **7.** 97.13 mm

### Exercise 102 (page 232)

**1.** (a) $\frac{\pi}{6}$ (b) $\frac{5\pi}{12}$ (c) $\frac{5\pi}{4}$
**2.** (a) 0.838 (b) 1.481 (c) 4.054
**3.** (a) 210° (b) 80° (c) 105°
**4.** (a) 0°43′ (b) 154°8′ (c) 414°53′

### Exercise 103 (page 234)

**1.** 113 $cm^2$ **2.** 2376 $mm^2$ **3.** 1790 $mm^2$
**4.** 802 $mm^2$ **5.** 1709 $mm^2$ **6.** 1269 $m^2$
**7.** 1548 $m^2$ **8.** (a) 106.0 cm (b) 783.9 $cm^2$
**9.** 21.46 $m^2$ **10.** 17.80 cm, 74.07 $cm^2$
**11.** (a) 59.86 mm (b) 197.8 mm **12.** 26.2 cm
**13.** 8.67 cm, 54.48 cm **14.** 82.5° **15.** 748
**16.** (a) 0.698 rad (b) 804.2 $m^2$ **17.** 10.47 $m^2$
**18.** (a) 396 $mm^2$ (b) 42.24% **19.** 701.8 mm
**20.** 7.74 mm

### Exercise 104 (page 237)

**1.** (a) 2 (b) (3, −4) **2.** Centre at (3, −2), radius 4
**3.** Circle, centre (0, 1), radius 5
**4.** Circle, centre (0, 0), radius 6

## Chapter 27

### Exercise 105 (page 243)

**1.** 1 $m^3$ **2.** 5 $cm^3$ **3.** 8 $cm^3$
**4.** (a) 3840 $mm^3$ (b) 1792 $mm^2$
**5.** 972 litres **6.** 15 $cm^3$, 135 g **7.** 500 litres
**8.** 4 $m^3$ **9.** (a) 35.3 $cm^3$ (b) 61.3 $cm^2$
**10.** (a) 2400 $cm^3$ (b) 2460 $cm^2$ **11.** 37.04 m
**12.** 1.63 cm **13.** 8796 $cm^3$
**14.** 4.709 cm, 153.9 $cm^2$
**15.** 2.99 cm **16.** 28060 $cm^3$, 1.099 $m^2$
**17.** 8.22 m by 8.22 m **18.** 62.5 min
**19.** 4 cm **20.** 4.08 $m^3$

### Exercise 106 (page 246)

**1.** 201.1 $cm^3$, 159.0 $cm^2$ **2.** 7.68 $cm^3$, 25.81 $cm^2$
**3.** 113.1 $cm^3$, 113.1 $cm^2$ **4.** 5.131 cm **5.** 3 cm
**6.** 2681 $mm^3$ **7.** (a) 268 083 $mm^3$ or 268.083 $cm^3$ (b) 20 106 $mm^2$ or 201.06 $cm^2$
**8.** 8.53 cm
**9.** (a) $512 \times 10^6$ $km^2$ (b) $1.09 \times 10^{12}$ $km^3$ **10.** 664

### Exercise 107 (page 251)

**1.** 5890 $mm^2$ or 58.90 $cm^2$
**2.** (a) 56.55 $cm^3$ (b) 84.82 $cm^2$ **3.** 13.57 kg
**4.** 29.32 $cm^3$ **5.** 393.4 $m^2$
**6.** (i) (a) 670 $cm^3$ (b) 523 $cm^2$ (ii) (a) 180 $cm^3$ (b) 154 $cm^2$ (iii) (a) 56.5 $cm^3$ (b) 84.8 $cm^2$ (iv) (a) 10.4 $cm^3$ (b) 32.0 $cm^2$ (v) (a) 96.0 $cm^3$