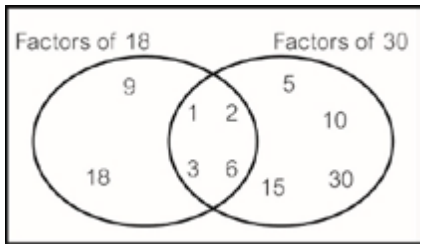
# Unit 1 Answers

## Exercise 1.1

**1** 48

**2 a**



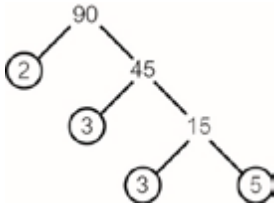

**b** 6

**3 a** Multiples of 9: 9, 18, 27, 36, 45, 54, 63, 72

Multiples of 12: 12, 24, 36, 48, 60, 72, 84, 96

**b** 36

**4 a**




**b** $90 = 2 \times 3 \times 3 \times 5 = 2 \times 3^2 \times 5$

**5 a** $32 = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$

**b** $75 = 3 \times 5 \times 5 = 3 \times 5^2$

**c** $54 = 2 \times 3 \times 3 \times 3 = 2 \times 3^3$

**d** $36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$

**6 a i** $225 = 3 \times 3 \times 5 \times 5 = 3^2 \times 5^2$

**ii** $450 = 2 \times 3 \times 3 \times 5 \times 5 = 2 \times 3^2 \times 5^2$

**b i** $140 = 2 \times 2 \times 5 \times 7 = 2^2 \times 5 \times 7$

**ii** $420 = 2 \times 2 \times 3 \times 5 \times 7 = 2^2 \times 3 \times 5 \times 7$

**7** $20 = 2^2 \times 5$, $27 = 3^3$

**8 a** 12

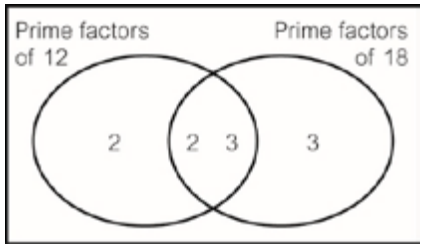
**b** 30

**c** 21

**d** 33

**9** Possible answers are: $36 \times 2 = 72$, $36 \times 3 = 108$, or 108 and $36 \times 4 = 144$, or 36 and $36 \times 5 = 180$ etc.

**10** **a**




**b** $36 = 2^2 \times 3^2$ **c** $2 \times 2 \times 3 \times 3 = 2^2 \times 3^2 = 36$

**11** $21 = 3 \times 7$, $45 = 3 \times 3 \times 5$ LCM $= 3 \times 3 \times 5 \times 7 = 315$.

**12** **a** 72

**b** 198

**c** 84

**d** 150

**13** 9 pm

# Unit 1 Answers

## Exercise 1.2

**1 a** $\frac{1}{5}$

**b** 3

**c** $\frac{5}{3}$

**2 a** 64

**b** 125

**c** 81

**d** 32

**3 a** 64

**b** 243

**c** 10 000 000

**d** 625

**4** $2^2 \times 2^3 = 2^{2+3} = 2^5$

**5 a** $3^6$

**b** $4^4$

**c** $5^6$

**d** $7^6$

**e** $4^{14}$

**f** $3^{10}$

**g** $6^{13}$

**6 a** Students' own answers: any three numbers that are different and add to 15 e.g. 2, 3 and 10

**b** Students' own answers: any two numbers that are the same and one that is different that add to 15 e.g. 2, 2 and 11

**c** 5

**7 a i** $4^2$

**ii** $4^2$

**b** $2^3$

**c** 5

**8 a** $6^6$

**b** $5^4$

**c** 9

**d** $2^5$

**e** $4^6$

**f** $12^4$

**9 a** Students' own answers: any two powers of 3 where the difference in the powers is 2 and they are both greater than 20 e.g. $3^{25} \div 3^{23}$

**b** Students' own answers: any two powers of 3 where the difference in the powers is 2 and they are both smaller than 20 e.g. $3^{19} \div 3^{17}$

**c** $3^4 \div 3^2$

**10** $2^7$ or 128

**11a** $2^8$

**b** $5^4$

**c** $3^6$

**d** $6^8$

**12a** $4^{12}$

**b** $7^{10}$

**c** $3^{18}$

**d** $8^{35}$

**13a** **i** $2^8$ **ii** $3^8$ **iii** $p^8$

**b** $p^a \times p^b = p^{a+b}$

**c** **i** $2^2$ **ii** $3^2$ **iii** $p^2$

**d** $p^a \div p^b = p^{a-b}$

**e** **i** $(2^5)^3 = 2^{15}$ **ii** $(3^5)^3 = 3^{15}$ **iii** $(p^5)^3 = p^{15}$

**f** $(p^a)^b = p^{a \times b}$

**14a** **i** All answers are 1

**ii** All answers are 1

**b** **i** $\frac{9^5}{9^3} = 9^2$, $\frac{9^5}{9^4} = 9^1$, $\frac{9^5}{9^5} = 9^0$

**ii** $9^0 = 1$

**iii** Any number to the power of zero = 1

**15a** $4^7$

**b** $7^4$

**c** $5^4$

**16a** $2^{12}$

**b** $4^6$

**c** $3^5$

# Unit 1 Answers

## Exercise 1.3

**1** $10^2 = 100$, $10^3 = 1000$, $10^4 = 10\,000$, $10^5 = 100\,000$

**2** **a** 45 **b** 2360 **c** 84.3 **d** 14 500
**e** 27 **f** 4.685 **g** 0.35 **h** 0.045

**3**

| | 10 000 | 1000 | 100 | 10 | 1 | | $\frac{1}{10}$ | $\frac{1}{100}$ | $\frac{1}{1000}$ | $\frac{1}{10000}$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| … | $10^4$ | $10^3$ | $10^2$ | 10 | $10^0$ | . | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ | $10^{-4}$ | … | |

**4** **a**

| … | $10^4$ | $10^3$ | $10^2$ | 10 | $10^0$ | . | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ | $10^{-4}$ | … | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kilo | | | | | deci | centi | milli | | | |

**b** 1000
**c** 1 000 000
**d** 1 000 000 000

**5** **a** 4000
**b** 2 400 000
**c** 12 500 000 000

**6** **a** 1 000 000
**b** 1000
**c** 1000
**d** 1000

**7** **a**

| Name of planet | Diameter of planet (km) | Average distance from Sun (km) |
|---|---|---|
| Mercury | 4 900 | 57 900 000 |
| Earth | 12 800 | 150 000 000 |
| Saturn | 120 000 | 1 427 000 000 |

**b** Saturn
**c** Mercury

**8** 110 tonnes

**9** **a** Write all the dimensions in metres

| Name of organism | Length (m) | Width (m) |
|---|---|---|
| dust mite | 0.00 042 | 0.00 025 |
| bacteria | 0.000 002 | 0.0 000 005 |
| virus | 0.0 000 003 | 0.000 000 015 |

**b** dust mite
**c** virus

**10** 0.0 000 001 mm

# Unit 1 Answers

## Exercise 1.4

**1 a** $5^6$

**b** $8^2$

**c** $7^3$

**2 a** 16

**b** 49

**c** 9

**d** 100

**3** Students' own estimations to

**a** 97 ÷ 4 e.g. 100 ÷ 4 = 25

**b** 12.3 × 10.2 e.g. 12 × 10 = 120

**c** 18.6 ÷ 5 e.g. 20 ÷ 5 = 4

**4** 18

**5 a** 40

**b** 36

**c** 1250

**d** 360

**6** 112

**7** Rasheed is correct. Sophie has squared −5 to get −25 instead of +25.

**8** $14 + 4^2$ and $14 + (-4)^2$

$14 - 4^2$ and $14 - (-4)^2$

$25 - 2^2 - 6^2$ and $25 - 2^2 - (-6)^2$

$25 - (-2)^2 + 6^2$ and $25 - 2^2 + (-6)^2$

**9 a** 12

**b** 48

**c** 10

**d** 48

**10a** 47.37

**b** 0.007

**c** 600 000

**11a** 40 × 500 = 20 000

**b** 6000 × 30 = 180 000

**c** 900 ÷ 30 = 30

**d** 50 000 ÷ 200 = 250

**12a** 3

**b** 160

**c** $\frac{1}{2}$

**d** 1800

**13** 43.8 $m^3$

**14a** Students' own answers: any two numbers such that 665 ≤ number < 675

**b** 674

**c** 665

**15a**

| **Planet** | Mercury | Venus | Earth | Mars | Uranus |
|---|---|---|---|---|---|
| **Diameter (km)** | 5 000 | 10 000 | 10 000 | 7 000 | 50 000 |

**b** 45 000 km

**16** 40 000 × £30 = £1 200 000

# Unit 1 Answers

## 1 Check up

### Prime factors

**1** Students own version of factor tree and $72 = 2^3 \times 3^2$

**2** $300 = 2^2 \times 3 \times 5^2$

**3** **a** 45

**b** 160

### Laws of indices

**4** **a** $3^7$ **b** $5^3$ **c** $6^{18}$ **d** $2^4$

**e** $5^7$ **f** $3^8$ **g** $4^0$

**5** 24

**6** **a** 25

**b** 5

**c** 1

**7** **a** $6^6$

**b** $2^3$

**c** $3^6$

**8** A $(2 \times 5)^2$ and C $2^2 \times 5^2$ – both equal 100

**9** 6

**10** $a^x \times a^y = a^{x+y}$

$a^x \div a^y = a^{x-y}$

$(a^x)^y = a^{xy}$

### Powers of 10

**11a**

| Prefix | Power of 10 | Number |
|---|---|---|
| giga | $10^9$ | 1 000 000 000 |
| mega | $10^6$ | 1 000 000 |
| kilo | $10^3$ | 1000 |
| deci | $10^{-1}$ | 0.1 |
| centi | $10^{-2}$ | 0.01 |
| milli | $10^{-3}$ | 0.001 |
| micro | $10^{-6}$ | 0.000 001 |

**b** 0.005 kilograms and 5 grams

5000 kilograms and 5 megagrams

50 000 milligrams and 500 decigrams

**12** $2.4 \div 10^7$, $8.9 \div 10^5$, $4.6 \times 10^4$, $2.1 \times 10^5$

## Significant figures

**13a** 129.3

**b** 0.0004

**c** 700 000

**14a** 40 × 600 = 24 000

**b** 8000 ÷ 20 = 400

**15** £10 × 30 000 = £300 000

# Unit 1 Answers

## 1 Strengthen

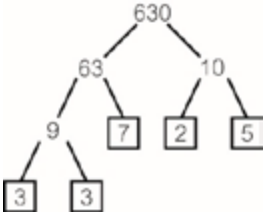
### Prime factors

**1 a** $2 \times 7^4 \times 11^3$

**b** $2^4 \times 3 \times 5^2$

**c** $2 \times 3^3 \times 5^5 \times 7$

**2 a**




**b** $630 = 2 \times 3^2 \times 5 \times 7$

**3 a** $92 = 2^2 \times 23$

**b** $160 = 2^5 \times 5$

**c** $156 = 2^2 \times 3 \times 13$

**d** $195 = 3 \times 5 \times 13$

**e** $441 = 3^2 \times 7^2$

**4 a** 4

**b** 9

**c** 12

**5 a** 135

**b** 108

**c** 675

### Laws of indices

**1**

| $4^0$ | $4^1$ | $4^2$ | $4^3$ | $4^4$ |
|---|---|---|---|---|
| 1 | 4 | 16 | 64 | 256 |

**2 a** $3^7$

**b** $4^4$

**c** $9^9$

**d** $5^{11}$

**3 a** $4^3$

**b** $3^4$

**c** $7^2$

**d** $9^8$

**4 a** $4^6$

**b** $3^{10}$

**c** $6^8$

**d** $8^{30}$

**5** $2^4 \times 2^3 = 2^{4+3}$ $\quad 2^x \times 2^y = 2^{x+y}$ $\quad n^x \times n^y = n^{x+y}$

$2^4 \div 2^3 = 2^{4-3}$ $\quad 2^x \div 2^y = 2^{x-y}$ $\quad n^x \div n^y = n^{x-y}$

$(2^4)^3 = 2^{4\times3}$ $\quad (2^x)^y = 2^{xy}$ $\quad (n^x)^y = n^{xy}$

**6**

| $2^0$ | $2^1$ | $2^2$ | $2^3$ | $2^4$ | $2^5$ | $2^6$ | $2^7$ |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 |

**7 a i** $2^3$ or 8

**ii** 24

**b i** $5^2$ or 25

**ii** 100

**8 a i** 9

**ii** 49

**iii** 49

**b i** 16

**ii** 36

**iii** 4

**9 a** $8^7$

**b** $3^4$

**c** 6

**d** $10^5$

**10a** $2^{11}$

**b** $3^9$

**c** $3^5$

## Powers of 10

**1 a** kilo (k) = $10^3$ = 1000

**b** mega (M) = $10^6$ = 1 000 000

**c** giga (G) = $10^9$ = 1 000 000 000

**2 a** 6 500 000 000 km

**b** 14 000 000 nm

**c** 0.05 mm

**d** 2.2 Mm

**e** 600 000 mm

**3 a** 5 000 J

**b** 21 000 W

**c** 270 000 000 ml

**d** 0.72 mg

**4 a** 6100 kHz

**b** 0.69 μm

## Significant figures

**1** **a** 2 tens

**b** 7 hundredths

**c** 50 thousand

**d** 8 tenths

**2** **a** 300

**b** 40

**c** 2000

**d** 400 000

**e** 0.04

**f** 0.0 006

**3** **a** 64 000

**b** 63.6

**c** 0.83

**d** 0.00 733

**4** **a** 18 000

**b** 28 000

**c** 1 600 000

**d** 50

**e** 40

**f** 50

**5** £600 000

## Enrichment

**1** $7^5 \times 7^{10} = 7^{15}$

$7^9 \div 7^8 = 7^1$

$(7^2)^3 = 7^6$

**2** **a** 672 seconds

**b** 2:11:12 pm

**c** **i** 8 **ii** 7

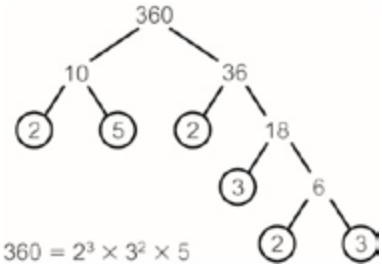
**d** **i** 3200 m or 3.2 km **ii** 2800 m or 2.8 km

# Unit 1 Answers

## 1 Extend

**1** 84

**2**




**3** **a** Yes $(-2)^2 \times (-2)^3 = (-2)^{2+3} = (-2)^5$

**b** Yes $(-3)^5 \div (-3)^2 = (-3)^{5-2} = (-3)^3$

**c** **i** $(-4)^{10}$

**ii** $(-7)^5$

**4** $2^3$ cm

**5** **a** **i** $165 = 3 \times 5 \times 11$

**ii** $180 = 2^2 \times 3^2 \times 5$

**iii** $210 = 2 \times 3 \times 5 \times 7$

**b** 15

**c** 13 860

**6**

| Prefix | Letter | Power | Number |
|---|---|---|---|
| tera | T | $10^{12}$ | 1 000 000 000 000 |
| giga | G | $10^9$ | 1 000 000 000 |
| mega | M | $10^6$ | 1 000 000 |
| kilo | k | $10^3$ | 1000 |
| deci | d | $10^{-1}$ | 0.1 |

| Prefix | Letter | Power | Number |
|---|---|---|---|
| centi | c | $10^{-2}$ | 0.01 |
| milli | m | $10^{-3}$ | 0.001 |
| micro | μ | $10^{-6}$ | 0.000 001 |
| nano | n | $10^{-9}$ | 0.000 000 001 |
| pico | p | $10^{-12}$ | 0.000 000 000 001 |

**7 a** 1000 g

**b** 1 000 000 J

**c** 1 000 000 000 t

**d** 1 000 000 000 000 W

**e** 0.1 l

**8 a** 3.4 cg

**b** 10.19 μm

**c** 8 TJ

**d** 2.5 Mg

**9 a** 230 ds

**b** 9 $l$

**10a** $3^3 \times 3^7 = 3^{10}$

**b** $7^9 \times 7^6 = 7^{15}$

**c** $5^4 \times 2^3 \times 5^6 \times 2^4 = 5^{10} \times 2^7$

**11a** $2^8 \times 3^5$

**b** $2^{11} \times 5^9$

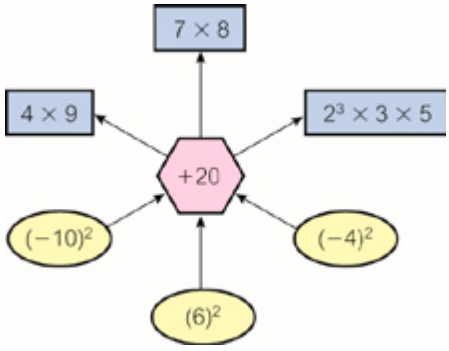
**c** $2^7 \times 3^{24}$

**12a** $\frac{4}{9}$ **b** $\frac{3}{5}$ **c** $\frac{1}{12}$ **d** $\frac{5}{64}$

**13a** −35

**b** 58

**14**




**15a** 7.35

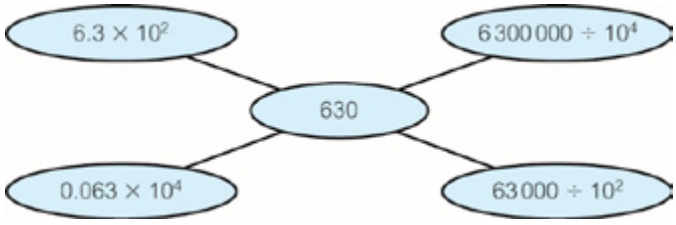
**b** 140

**16a** 16

**b** 5

**c** 36

**17**




**18** 666

**19 a, b**

| Country | Population | Area ($km^2$) | Population density |
|---|---|---|---|
| China | 1 360 000 000 | 9 570 000 | 142 |
| Hong Kong | 7 110 000 | 1 050 | 6771 |
| Iceland | 317 000 | 100 000 | 3 |
| USA | 319 000 000 | 9 160 000 | 35 |
| Vietnam | 93 400 000 | 310 000 | 301 |

**c i** Hong Kong

**ii** Iceland

**20a i** 2 975 000

**ii** 20%

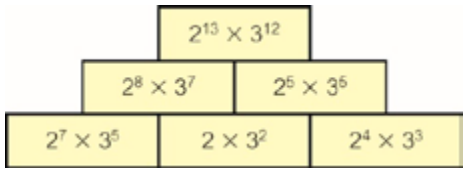
**b i** 2 995 897.5

**ii** 18.8%

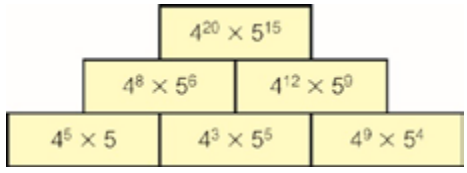
**c** Students' own answer

**21a** $\frac{5}{6}$ **b** $31\frac{1}{2}$ **c** $\frac{25}{288}$ **d** $10\frac{2}{3}$

**22a**




**b**




**c** Students' own answers

**23**

**a** $x^a \times y^b \times x^c \times y^d = x^{a+c} \times y^{b+d}$

**b** $x^a \times y^b \div x^c \times y^d = x^{a-c} \times y^{b-d}$

# Unit 1 Answers

## 1 Unit test

**1 a** $76 = 2^2 \times 19$

**b** $648 = 2^3 \times 3^4$

**2 a** $8^9$

**b** $3^{12}$

**c** $9^{16}$

**d** $7^6$

**e** $12^5$

**f** $6^{18}$

**3 a** $(-3)^7$

**b** $(-8)^{10}$

**4 a i** $144 = 2^4 \times 3^2$

**ii** $180 = 2^2 \times 3^2 \times 5$

**b** 36

**5** 210 seconds

**6 a** 3

**b** 37 800

**7** 250

**8 a** 1 000 000 000 and $10^9$ and G and giga

1 000 000 and $10^6$ and M and mega

1000 and $10^3$ and k and kilo

$10^{-3}$ and 0.001 and milli and m

$10^{-6}$ and 0.000 001 and micro and μ

$10^{-9}$ and 0.000 000 001 and nano and n

**b i** 9 000 000 000 J

**ii** 13 000 W

**iii** 8 500 000 s

**9 a** $5^5 \times 2^7$

**b** $3^6 \times 5^9$

**10a** 49

**b** 87

**11a** 12

**b** 18

**12a** 27 700

**b** 7.982

**c** 0.007

**13a** 54 000

**b** 50

**14** (2000 + 1000 + 400 + 2000 + 800) ÷ 5 = £1240

**15a** $15^5$

**b** $4^2$

**c** $5^6$

**d** $2^2$

**16** **B** $3 \times 4^2$

**17a** 7

**b** $\frac{2}{75}$

**18** **A** and **F**, **B** and **E**, **C** and **D**

# Unit 2 Answers

## Exercise 2.1

**1 a** $8x$

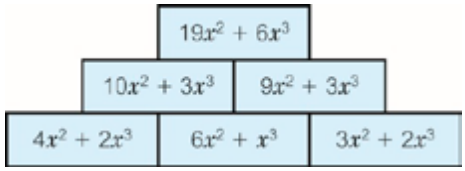
**b** $10y + 11z$

**c** $2t + 3g$

**d** $9j - 7h$

**e** $2x^3 + x^2$

**2**




**3 a** $5x = 35$

**b** $-2a - 6$

**4 a** $10a^2$

**b** $24\text{m}^3$

**5 a** $3x$

**b** $x^3$ and $27x^3$

**c** $28x^3$

**d** 28 000 $\text{cm}^3$

**6 a** $10x^2 + 11y^2$

**b** $6a^3 + 4b^2$

**7 a** and **b**

$5q + 2p^2 - 3q^2 + 6p^2 + 4q + 10q^2 = 9q + 8p^2 + 7q^2$

$5q + 2p^2 - 3q^2 + 12q^2 - 3q - 5p^2 = 2q - 3p^2 + 9q^2$

$6p^2 + 4q + 10q^2 + 12q^2 - 3q - 5p^2 = q + p^2 + 22q^2$

**c** $6q + 3p^2 + 19q^2$

**8 a** $7x + 7$

**b** $2m - 23$

**c** 12

**d** $12 - x$

**e** $8x + 6$

**f** $6x - 17$

**9 a** $8(x + 3)$ or $8x + 24$

**b** $5(x - 2)$ or $5x - 10$

**c** $3x + 34$

**10a** equation

**b** identity

**c** identity

**d** equation

**e** identity

**f** equation

**11a** $2^2 + 2^2 = 4 + 4 = 8$ and $2^3 = 2 \times 2 \times 2 = 8$, so $2^2 + 2^2 \equiv 2^3$

**b** No, when $x = 3$, $3^2 + 3^2 = 9 + 9 = 18$ and $3^3 = 3 \times 3 \times 3 = 27$, so $3^2 + 3^2 \neq 3^3$

# Unit 2 Answers

## Exercise 2.2

**1 a** $3^5$

**b** $5^4$

**c** $4^3$

**d** $2^6$

**e** $x^2$

**2 a** $4x^2$

**b** $20ab$

**c** $2t$

**3 a i** $2^9$ **ii** $3^9$ **iii** $x^9$

**b** When you multiply powers of the same variable together you add the powers.

**c i** $2^2$ **ii** $x^2$

**d** When you divide powers of the same variable together you subtract the powers

**e i** $2^{15}$ **ii** $3^{15}$ **iii** $x^{15}$

**f** When you raise the power of a variable to another power you multiply the powers

**4 a** $x^{16}$

**b** $z^8$

**c** $v^8$

**5 a** $y^6$

**b** $n^9$

**c** $w^6$

**6** $3x^2 \times 5x^3 = 15x^5$

$3x^2 \times 7x^5 = 21x^7$

$3x^2 \times 2x^4 = 6x^6$

$5x^3 \times 7x^5 = 35x^8$

$5x^3 \times 2x^4 = 10x^7$

$7x^5 \times 2x^4 = 14x^9$

**7 a** $3a^5$

**b** $5b^3$

**c** $5n^2$

**d** $6t$

**e** $12p^7$

**f** $10x^3$

**8** Any two expressions that simplify to give $24x^5$

One expression must be a multiplication and the other a division

e.g. $2x \times 12x^4$, $48x^8 \div 2x^3$

**9 a** $\dfrac{5y^5 \times 9y^3}{3y^6} = 15y^2$

**b** $\dfrac{4y^2 \times 12y^7}{6y^5} = 8y^4$

**10a** $16x^4$ **b** $4y^6$ **c** $27z^{12}$

**d** $\dfrac{x^6}{64}$ **e** $\dfrac{y^8}{49}$ **f** $\dfrac{z^{15}}{27}$

**11a** Sometimes true – when $a = 2$ and $b = 2$

**b** Always true $x^a \div x^b \equiv x^{a-b}$

**c** Sometimes true – when $a = 2$ and $b = 2$

**d** Sometimes true – when $c = 0$ and $d = 0$

**e** Always true $(yc)^d \equiv (yd)^c$

**f** Always true $y^d \times y^c \equiv y^{c+d}$

# Unit 2 Answers

## Exercise 2.3

**1** **a** $15ab$

**b** $6m^2$

**c** $-20n^2$

**d** $14a^5$

**e** $-30p^5$

**2** **a** $6x + 10$

**b** $12 - 8y$

**c** $y^2 + 3y$

**d** $2x - 2$

**e** $30 + 3p$

**f** $10s - s^2$

**3** **a** $x^2 + 5x$

**b** $8y + y^2$

**c** $2p^2 - 5p$

**d** $12q - 6q^2$

**4** The HCF is 4 not 2, so fully factorised it is $4(3x - 4)$

**5** **a** **i** $x(3x + 2)$ **ii** $3x^2 + 2x$

**b** **i** $2y(5 + 3y)$ **ii** $10y + 6y^2$

**c** **i** $5z(3z - 7)$ **ii** $15z^2 - 35z$

**6** **a** $x^3 + 4x^2$

**b** $14x^6 - 6x^5$

**c** $5x^4 + 10x^3 + 35x$

**d** $x^4 - 5x^3 + 7x^2$

**7** **a** $7a + 11b$

**b** $14x^3 + 26x$

**c** $18 - 6y + y^3 - 8y^2$

**d** $5t^2 + 10t - 4t^5 + 8t^3$

**8** **a** $x^3 + 4x^2$

**b** $2 \times x \times x + 4 \times x(x + 4) = 2x^2 + 4x^2 + 16x = 6x^2 + 16x$

**9** **a** $x^2$

**b** $p$

**c** $y^2$

**d** $4z$

**e** $5m^3$

**f** $pq$

**10a** $3x(5x^2 - 1)$

**b** $16x(2 + x)$

**c** $3x(5 + 7x)$

**d** $3x(x^2 + 2)$

**e** $y^2(1 - 7y^2)$

**f** $3y^3(y^2 + 5)$

**g** $4y^3(3y - 1)$

**11a** A

**b** C

**c** They are all different

**12a** **i** $4x^3 + x(3x^2 + 7x) = 4x^3 + 3x^3 + 7x^2 = 7x^3 + 7x^2 = 7x^2(x + 1)$

**ii** $2b(b^2 + 3b) - b(b^2 + 8b) = 2b^3 + 6b^2 - b^3 - 8b^2 = b^3 - 2b^2$

$2b^2(b - 1) - b^3 = 2b^3 - 2b^2 - b^3 = b^3 - 2b^2$

**b** $6y(y^3 - 3) - 2y(2y^3 - 11) \equiv 2y(y^3 + 3) - 2y$

**13** Students' own answers.

# Unit 2 Answers

## Exercise 2.4

**1 a** 20

**b** 40

**c** 54

**d** 9

**2 a** $x = 5$

**b** $x = 3$

**c** $x = 6$

**d** $x = -17$

**e** $x = 10$

**3 a** $4x = x + 3$

**b** $x = 1$

**4 a** 23

**b** 35

**c** 24

**d** 35

**5 a, b** A $15a + 5b$ B $18a + 2b$

**c** A 35 B 50

**6** $x = 5$

**7 a** 63

**b** 28

**c** 34

**8 a** $s = 100$ m

**b** $s = 76$ m

**c** $s = 72$ m

**9 a** $24x^2 - 5x^3$

**b i** 19 $cm^3$

**ii** 56 $cm^3$

**iii** 81 $cm^3$

**iv** 64 $cm^3$

**c** when $x = 5$ the difference is negative, which cannot be true for a volume.

**10a** $x = 4$

**b** $y = 2$

**c** $z = 5$

**d** $x = 9$

**11a** $x = 6$

**b** y = 3

**12a** $x = 5$

**b** piece of card is 4 cm by 10 cm and the hole is 2 cm by 8 cm

# Unit 2 Answers

## 2 Check up

### Simplifying and substituting into expressions

**1 a** $10x^2$

**b** $11a^2 - 6b^2$

**c** $11y + 5y^2$

**2 a** $2x + 5 \equiv x + 7 + x - 2$

**b** $2x + 1 = 4x - 3$

**3 a** 11

**b** 12

**c** 20

**d** 6

**4 a** 54

**b** 1

### Index laws

**5 a** $x^5$

**b** $y^{10}$

**c** $z^6$

**6 a** $30x^6$

**b** $2b^2$

**c** $9p^8$

**d** $4p^3$

**e** $\frac{n^6}{25}$

### Expanding and factorising

**7 a** $x^3 + 2x^2$

**b** $6x^2 - 12x^2$

**c** $3x^4 + 2x^3 - x^2$

**8 a** $11x + 5$

**b** $-3x^2 - 4x$

**c** $13x^3 + 22x$

**9** $5x^3 + x^2(3x - 4) = 5x^3 + 3x^3 - 4x^2 = 8x^3 - 4x^2 = 4x^2(2x - 1)$

**10a** $6x(x + 3)$

**b** $2y^3(4 - y)$

**c** $8xy(2 - xy)$

### Solving equations

**11** $x = 4$

**12** $x = 7$

# Unit 2 Answers

## 2 Strengthen

### Simplifying and substituting into expressions

**1 a** $5x^2$

**b** $5t^3$

**c** $9y^4$

**2** $6y$, $-7y$, $3y$, $-y$

$5y^2$, $2y^2$, $-y^2$, $11y^2$

$-12y^3$, $y^3$, $4y^3$

**3 a** $12x + 5x^2$

**b** $3a^2 + 2b^2$

**c** $11p^3 - 10n^2$

**d** $4v^3 + 3v + 4$

**4 a** 43

**b** 5

**c** 12

**d** 45

**5 a** 60

**b** 40

**c** 16

**d** 144

**6 a** 48

**b** 36

**c** 15

**d** 95

### Index laws

**1 a** $x^7$

**b** $y^7$

**c** $z^9$

**2 a** $x^4$

**b** $y^3$

**c** $z^5$

**3 a** $x^6$

**b** $y^8$

**c** $z^{15}$

**4 a** $6x^4$ **b** $20y^7$

**c** $18p^7$ **d** $72q^8$

**e** $2a^4$ **f** $3b$

**g** $b^4$ **h** $2b^6$

**5 a** $25x^6$

**b** $64m^{15}$

**c** $81n^{12}$

**d** $\frac{x^6}{4}$

**e** $\frac{w^{12}}{36}$

## Expanding and factorising

**1 a** $x^3 + 3x^2$

**b** $y^3 - 5y^2$

**c** $2x^4 - 8x^3$

**d** $6y^4 + 12y^3$

**2 a** $8x + 11$

**b** $6a + 10$

**c** $2x^2 + 7x$

**d** $11a - 2a^2$

**3 a** $3x + 2 \equiv x + 5 + 2x - 3$

**b** $5x + 7 = 27$

**c** $8p^2 \equiv 2p \times 4p$

**d** $t + t + t + 8 + 3 \equiv 3t + 11$

**e** $3x - 9 = 2x + 6$

**f** $5(x + 3) \equiv 3x + 2x + 20 - 5$

**4 a** LHS and RHS both simplify to $14x^3 - 3x^2$

**b** LHS and RHS both simplify to $y^3 - 12y^2$

**5 a** $2x^2(1 + 4x)$

**b** $6d(6 - 5d^3)$

**c** $2q^2(3q - 7)$

**d** $9u^2(3u + 4)$

**e** $5b(b - 10)$

**f** $4mn(9 + 2mn)$

## Solving equations

**1 a** $x = 3$

**b** $x = 6$

**c** $x = 2$

**d** $x = 4$

**2 a** $10(2x - 8)$ or $20x - 80$

**b i** 92

**ii** $6x - 10$

**iii** $102 - 6x$

**c** $20x - 80 = 102 - 6x$

**d** $x = 7$

## Enrichment

**1 a** Mean = $6x^2 - 2y^3 + 3z$

**b** When $x = 2$, $y = 1$ and $z = 3$

**i** 11, 72, -28, 69

**ii** 31

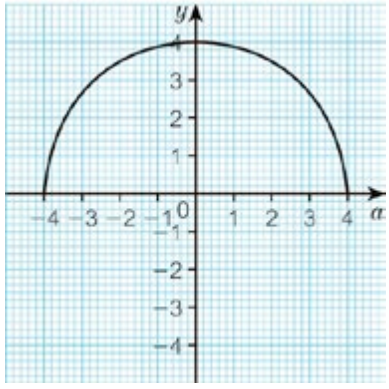
**iii** 31

**iv** 100

**2 a**

| $x$ | −4 | −3 | −2 | −1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|
| $y$ | 0 | 2.65 | 3.46 | 3.87 | 4 | 3.87 | 3.46 | 2.65 | 0 |

**b**




**c** The shape is a parabola.

# Unit 2 Answers

## 2 Extend

**1 a** $v = 5$

**b** $v = 7.5$

**c** $v = 18$

**2 a i** $5(4p^2 + 3pq - 2q^2)$

**ii** $8(3q^2 - pq - 4p^2)$

**b** $14q^2 + 7pq - 12p^2$

**c i** $52p^2 + 23pq - 34q^2$

**ii** $34q^2 - 23pq - 52p^2$

**d** One is the negative of the other

**3 a** A $2(6a + 18)$, B $3(4a + 12)$ or $4(3a + 9)$ or $6(2a + 6)$, C $12(a + 3)$

**b i** C

**ii** Tallest rectangle, as the largest number has been factorised out as the width.

**c i, ii** Students' own answers.

**d** A $12a + 40$, B $8a + 30$ or $6a + 26$, $4a + 24$, C $2a + 30$

**e i** A 2 by 30, B 3 by 20 or 4 by 15 or 6 by 10, C 12 by 5

**ii** A 64, B 46 or 38 or 32, C 34

**4 a** LHS $= 15a^3 + 18a - 12a^3 = 3a^3 + 18a$, RHS $= 3a^3 + 21a$

**b** Make the 7 into a 6

**5 a** $5(ab + 2bc - 5ac)$

**b** $24(2x^2y - 3y^2 + 5x)$

**c** $13(5pt + 3ty - yx - 4xp)$

**6 a** $4y(4y^2 + 5y + 6)$

**b** $2x(6x + 3y - 1)$

**c** $6xy(3x - xy + 5y)$

**d** $6p^2q^3r^3(10r - 35pqr^2 + 9p^3q)$

**7 a** $6xy - 12x^2 + 15x^2y = 3x(2y - 4x + 5xy)$

**b** $6a^3b + 14a^2b - 12a^3b^2 = 2a^2b(3a + 7 - 6ab)$

**8** Find the value of each expression when $x = -2$, $y = -4$ and $z = 3$.

**a** 95

**b** 5

**c** 7

**d** 4

**e** 12

**9** $12x^4 + 2x^3 + 5x^2 - 21x$

**10a** $5a + 6b - c^2 = -34$, $\sqrt{d} + h^2 = 31$, $\frac{g^2 + b^2}{2h} = -9$, $f - 2\sqrt{d + i} = -26$, $\frac{abc}{d} - e^2 = -62$,

$\sqrt[3]{e} + a^2 + \frac{d}{b} = 2$

**b** Any expression that has a value of 60. Students must use at least three of the letters from the table, and their expression must include a power or a root.

**11** Yes, $5xy^2$ will be negative and $y^3$ will be negative, but $z^2$ will be positive, so as long as $z^2$ is large enough, the expression will be positive e.g. when $x = -2$, $y = -1$ and $z = -4$

**12a** $-\frac{5}{16}$

**b** $\frac{9}{16}$

**13a i** $4x + 3$

**ii** $180 - 2(4x + 3)$ or $174 - 8x$

**b** $5(3x - 2) = 180 - 2(4x + 3)$ or $15x - 10 = 174 - 8x$

**c** $x = 8$

**d** ABC and ACB = 35º and BAC = 110º

Total = 180º

**14a i** $9x - 10$

**ii** $360 - 104 - 2(9x - 10)$ or $276 - 18x$

**b** $4(2x - 9) = 360 - 104 - 2(9x - 10)$ or $8x - 36 = 276 - 18x$

**c** $x = 12$

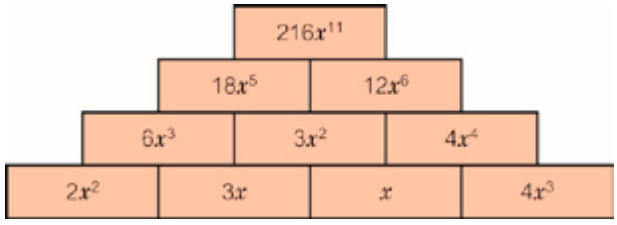
**d** CBA = 104º, BAD and BCD = 98º, ADC = 60º

Total = 360º

**15** Adrian = 3, Beth = 5, Carl = 12, Deeba = 31

**16** 9 or -9

**17**




**18a** $w^{12}$

**b** $z^7$

**c** $d^6$

**d** $3s^8$

**e** $4b^{-1}$ or $\frac{4}{b}$

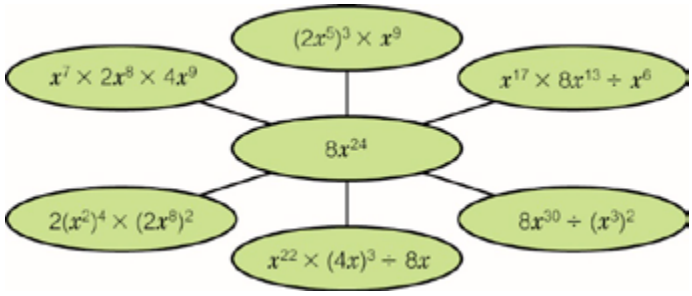
**f** $n^{14}$

**19a** and **b** Students answers for $\frac{\text{A term} \times \text{B term}}{\text{C term}}$

**c** $\dfrac{9y^5 \times 6y^3}{3y^7} = 18y$

**d** $\dfrac{12y^8 \times 8y^9}{2y^5} = 48y^{12}$

**20**




**21 a** $a^x \times a^y \times a^z = a^{x+y+z}$, $\dfrac{a^x}{(a^y)^z} = a^{x-yz}$, $\dfrac{a^x \times a^y}{a^z} = a^{x+y-z}$, $\dfrac{a^x}{a^y \times a^z} = a^{x-y-z}$,

$a^x \times (a^y)^z = a^{x+yz}$, $\dfrac{(a^x)^y}{a^z} = a^{xy-z}$, $(a^x)^y \times a^z = a^{xy+z}$

**b** $a^{xz-y} = \dfrac{(a^x)^z}{a^y}$

# Unit 2 Answers

## 2 Unit test

**1 a** $5y^2$

**b** $5x + x^3$

**c** $7d^3 - 3 + 2d^2$

**2 a** $x^{10}$

**b** $y^{10}$

**c** $z^{10}$

**d** $m^{15}$

**e** $b^7$

**3 a** $p^4 + 2p^2$

**b** $2m^3 - 8m^2$

**c** $6y^4 - 4y^3 + 14y^5$

**d** $24x + 12x^2 - 24x^3$

**4 a** $14p^2 + 13p$

**b** $5v^2 + 6uv - 4v$

**5 a** and **c**

**6** LHS = $3y(5y^2 + 4y) + 2y^2(1 + 3y) = 15y^3 + 12y^2 + 2y^2 + 6y^3 = 21y^3 + 14y^2 = 7y^2(3y + 2)$

**7 a** $7y(y + 4)$

**b** $3x(3 - 7x^2)$

**c** $4w(3w^2 + 5w - 8)$

**8** 40.2 m

**9 a** 20

**b** 41

**10a** 10

**b** 4

**c** 4

**d** 8

**11** $x = 9$

**12a** $x = 7$

**b** 56

**13a** $21y^8$

**b** $5b^8$

**c** $4g^6$

**d** $\frac{q^9}{27}$

**e** $x$

# Unit 3 Answers

## Exercise 3.1

**1 a i** 4 triangles, 1 square **ii** Square-based pyramid

**b i** 2 triangles, 3 rectangles **ii** Triangular prism

**c i** 2 pentagons, 5 rectangles **ii** Pentagonal prism

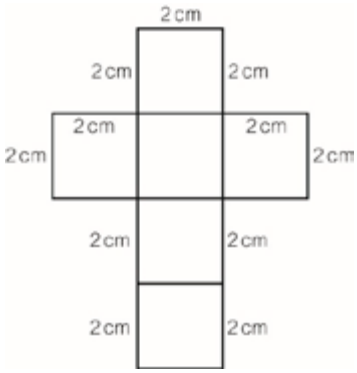
**d i** 6 triangles, 1 hexagon **ii** Hexagonal-based pyramid

**2 a** Cuboid

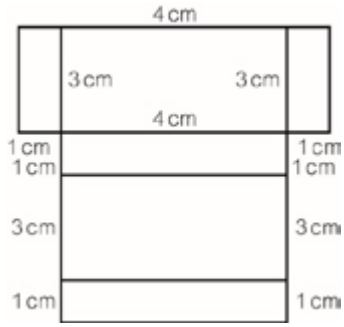
**b** Triangular-based pyramid

**c** Cylinder

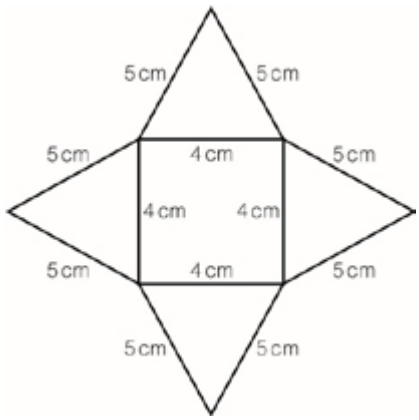
**3 a**



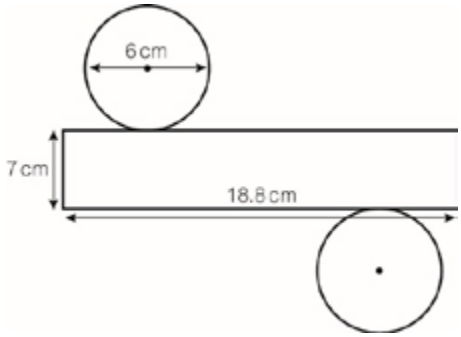

**b**



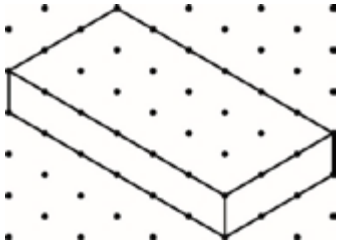

**c**



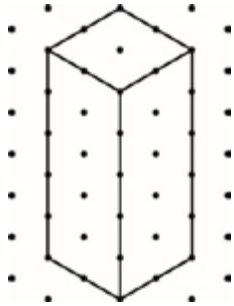

**d**



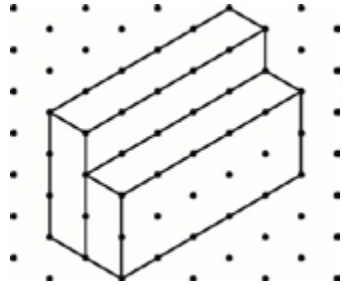
**4 a**



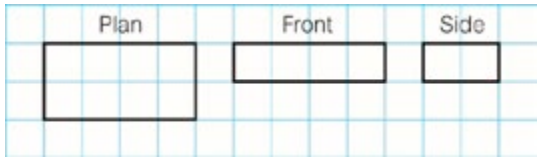
**b**



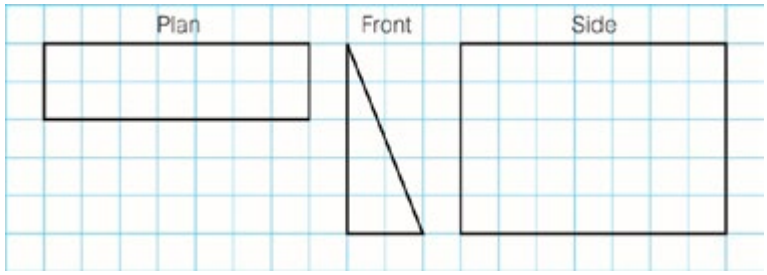
**c**



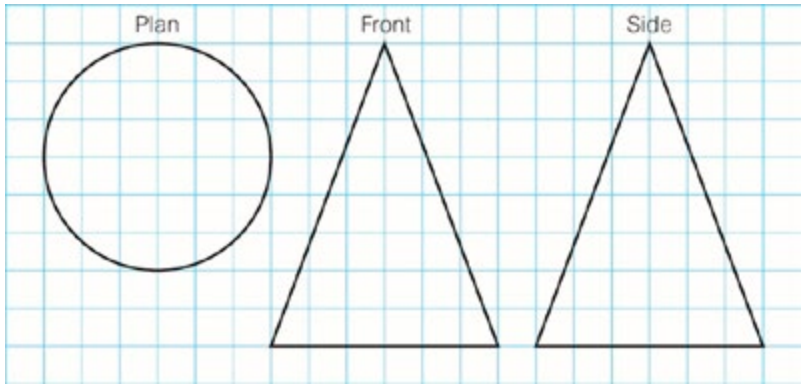
**5 a**




**b**

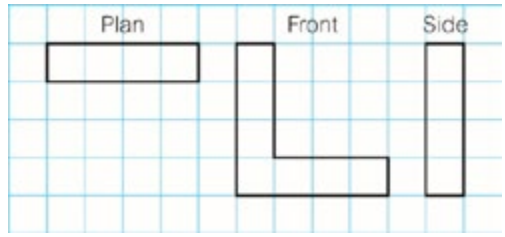



**c**

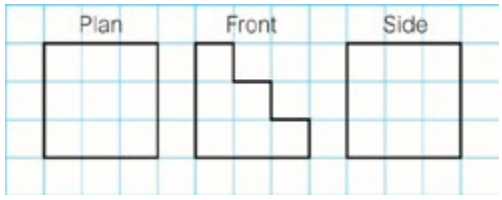


**6 a**

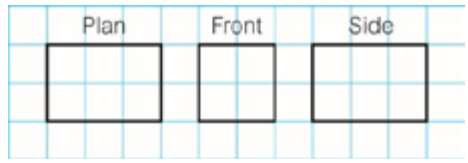

**b**




**c**




**d**




**7**

**8 a** Triangular-based pyramid.

**b** Square-based pyramid.

**c** Cone or cylinder or sphere.

**d** Cuboid or cylinder.

**9** Students' own answers, for example, sketches of cylinder, cuboid, triangular prism, trapezoidal prism.

**10a i** Square

**ii** 2 cuboids

**b i** Square

**ii** 2 cuboids

**c i** Rectangle

**ii** 2 triangular prisms

**d i** Triangle

**ii** Top left part makes a triangular-based pyramid.

# Unit 3 Answers

## Exercise 3.2

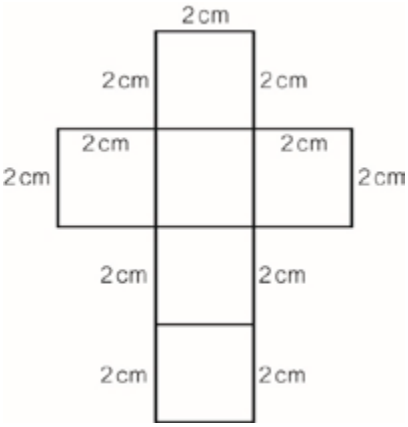
**1 a** 14 cm²

**b** 16 cm² or 1600 mm²

**c** 17.5 cm²

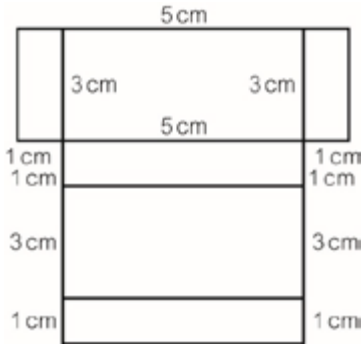
**d** 34 cm²

**2 a i**




**ii** 24 cm²

**b i**

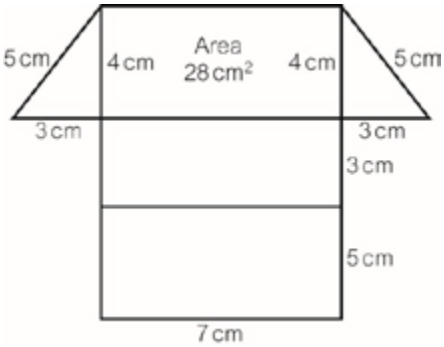



**ii** 46 cm²

**3 a** A, C, E

**b** A triangle, C pentagon, E trapezium.

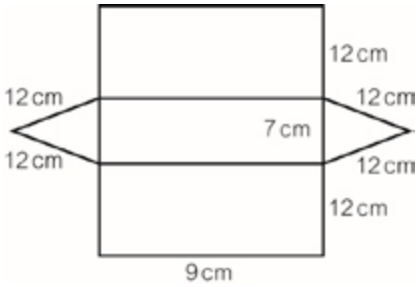
**4 a**




**b** 6 cm², 28 cm², 6 cm², 21 cm², 35 cm²

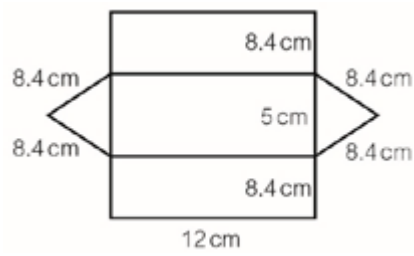
**c** 96 cm²

**5a i**




**ii** 372 $cm^2$

**b i**




**ii** 301.6 $cm^2$

**6** 7.56 $m^2$

**7** 324 $cm^2$

**8** 9.5 cm

# Unit 3 Answers

## Exercise 3.3

**1** **a** 7.5 cm²

**b** 43.75 cm²

**c** 880 mm²

**d** 24 cm²

**e** 3150 $mm^2$

**2** **a** 280 $cm^3$

**b** 140 cm³

**c** 20 cm²

**3** **a** **i** 7 cm²

**ii** 35 cm³

**b** **i** 10.8 cm²

**ii** 162 cm³

**4** **a** 432 cm³

**b** 196 cm³

**5** 8 cm

**6** **a** 33.75 cm²

**b** 201.75 cm²

**7** Any 3D shape with a volume of 36 cm³

**8** **a** 95.25 m²

**b** 1428.75 m³

**c** 1 428 750 *l*

# Unit 3 Answers

## Exercise 3.4

**1 a i** 4.3

**ii** 4.33

**b** 937 cm

**c** 75 mm

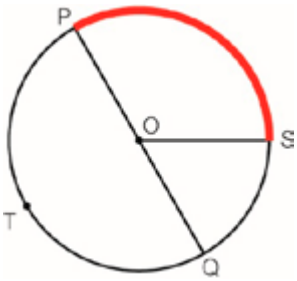
**2 a** 18 cm

**b** 4.5 cm

**c** 11 cm

**d** 2.5 cm

**3 a, b, d , e**




**c** OP or OQ

**f** No, the line does not go through the centre.

**4 a** 6 cm

**b** 8.4 cm

**5 a** 37.7 cm

**b** 13.5 cm

**c** 44.0 cm

**d** 18.2 cm

**6 a** 11.8 mm

**b** 96.4 m

**c** 1087.0 km

**7 a i** 25.1 cm

**ii** ½

**iii** 12.6 cm

**b i** 44.0 cm

**ii** ¼

**iii** 11.0 cm

**8 a i** 3.6 cm

**ii** 8.2 cm

**b i** 14.1 cm

**ii** 23.1 cm

**9** 200.11 m

**10a** 75.4 cm

**b** 37.7 cm

**c** 6.3 cm

**11** Yes, 62.8 cm and 31.4 cm

**12** 15.7 m

**13** 628 lights

**14** 76 mm

**15** 2387 cm

# Unit 3 Answers

## Exercise 3.5

**1 a** 16

**b** 100

**c** 5

**d** 3/2 or 1.5

**2 a** x = 12.6

**b** A = 254.3

**c** p = 4.5

**3 a** 50.3 cm²

**b** 19.6 m²

**c** 153.9 cm²

**d** 18.9 cm²

**4 a** 254.5 cm²

**b** 834.7 cm²

**c** 1134.1 mm²

**d** 16.3 m²

**5 a** 153.9 cm²

**b** 77.0 cm²

**c** 38.5 cm²

**6 a** 190.1 cm²

**b** 17.3 cm²

**c** 27.7 cm²

**7 a** 850.1 cm²

**b** 113.1 cm²

**c** 26.1 cm²

**d** 127.3 cm²

**8** 201.1 cm², 50.3 cm². No, the area is 4 times as large.

**9**

| Pizza diameter | Pizza area | Cost | Area per £1 |
|---|---|---|---|
| 8 inch | **50.3 in²** | £5.99 | **8.4 in²** |
| 10 inch | **78.5 in²** | £7.99 | **9.8 in²** |
| 12 inch | **113.1 in²** | £9.99 | **11.3 in²** |

**10a** 5.1 cm

**b** 4.7 cm

**11a** 32 m², 3.2 m

**b** 28 cm², 3.0 cm

**12a** 2.5 m

**b** 7 m

**c** 49 m²

**13** 10591 m²

**14a** 13.7 cm²

**b** 122.5 cm²

**15** 3376.7 mm²

# Unit 3 Answers

## Exercise 3.6

**1 a i** 31.4 cm

**ii** 78.5 cm$^2$

**b i** 22.0 cm

**ii** 38.5 cm$^2$

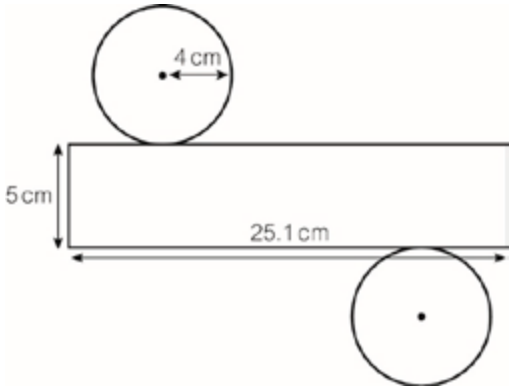
**2 a** 96

**b** 3

**c** 4

**3** 96 cm$^3$

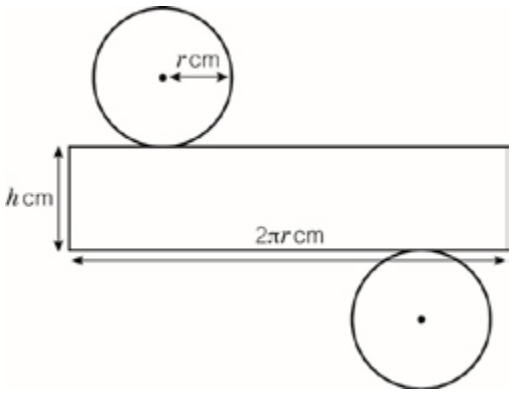
**4 a**




**b** 125.7 cm$^2$, 50.3 cm$^2$, 50.3 cm$^2$

**c** 226.3 cm$^2$

**5 a**




**b** $\pi r^2$, $\pi r^2$, $2\pi rh$

**c** $2\pi r^2 + 2\pi rh$. Total surface area of cylinder = $2\pi r^2 + 2\pi rh$

**6 a** 207.3 cm$^2$

**b** 483.8 cm$^2$

**7 a i** 78.5 cm$^2$ **ii** 706.9 cm$^3$ **b i** 201.1 cm$^2$ **ii** 603.2 cm$^3$ **c i** 7.1 cm$^2$ **ii** 63.6 cm$^3$

**8** **a** Students' own answer, for example, 'The tall thin one because the area of each one is small.' OR 'The shortest one, because the area around the middle is small.'

**b** A 125.7 cm², B 75.4 cm², C 106.8 cm²

**9** Capacity of the saucepan is 4084.1 cm³, which is more than 4 litres, so the claim is correct.

# Unit 3 Answers

## Exercise 3.7

**1 a** 73

**b** 90.1

**c** 11.4

**d** 2.8

**2 a** Students' copy diagram into exercise book.

**b** **a** = 20 mm

**b** = 40 mm

**c** = 45 mm

**3 a** AB

**b** DF

**c** HI

**d** KJ

**4 a** 8.1 cm

**b** 6.7 cm

**c** 8.2 cm

**5** 12.04 m

**6 b, c**

**7 a** 4.4 cm

**b** 11.3 cm

**c** 4.6 cm

**8** h = 7.4 cm

Area = 11.1 cm²

**9** h = 11.6 cm

Area = 34.9 cm²

**10** 6.2m

**11a** 64 cm²

**b** 11.3 cm

**c** 128 cm², double the area.

**d** 450 cm²

**12a** 7.2 cm

**b** **i** 5.8 cm

**ii** 10.8 cm

**iii** 6.1 cm

# Unit 3 Answers

## 3 Check up

**1 a i** 37.7 cm

**ii** 113.1 cm$^2$

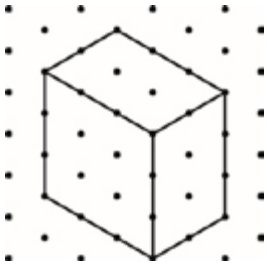
**b i** 34.6 cm

**ii** 95.0 cm$^2$

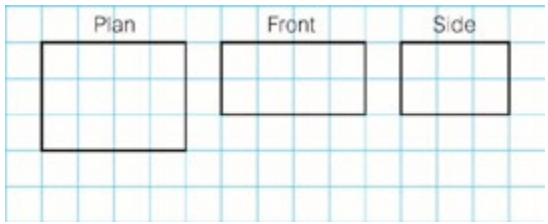
**2 a** 33.2 cm$^2$

**b** 23.7 cm

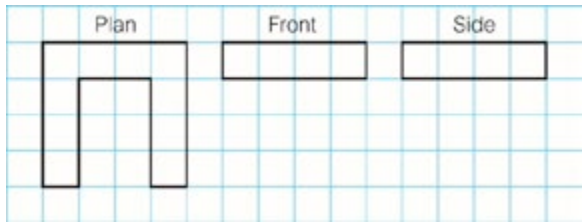
**3**



**4 a**




**b**




**5** Students' own sketch of a cylinder.

**6** Surface area = 510 cm$^2$

Volume = 450 cm$^3$

**7 a** Volume = 115.45 cm$^3$

**b** Surface area = 142.94 cm$^2$

**8 a** 25 cm

**b** 8.5 cm

**10** Students' own answers.

# Unit 3 Answers

## 3 Strengthen

### Circumference and area of circles

**1** **a** r = 5 cm, D = 10 cm

**b** r = 8 cm, D = 16 cm

**2** **a** 3.1

**b** 12.6

**c** 22.0

**d** 31.4

**e** 113.1

**3** **a** 7 cm

**b** C = π × 7

**c** 22.0 cm

**4** **a** **i** Diameter = 2 × radius

**ii** π × diameter = π × 2 × radius

**iii** $\pi d = 2\pi r$

**b** **i** 40.8 cm

**ii** 53.4 cm

**5** **a** 2.5 cm²

**b** π x 2.5²

**c** 19.6 cm²

**6** **a** 36.3 cm²

**b** 66.5 cm²

**7** **a** ½

**b** 78.5 cm²

**c** 39.3 cm²

**d** 31.4 cm

**e** 15.7 cm

**f** 25.7 cm

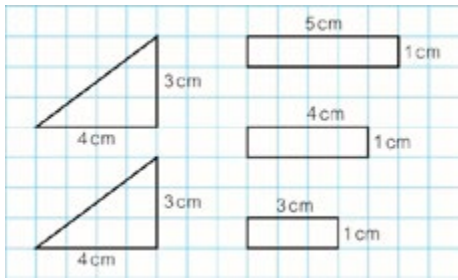
**8** **a** 30.2 cm²

**b** 22.1 cm

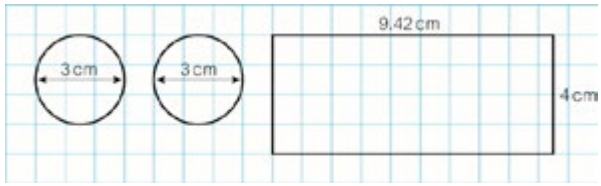
**9** 217.1 cm²

## Working with 3D solids

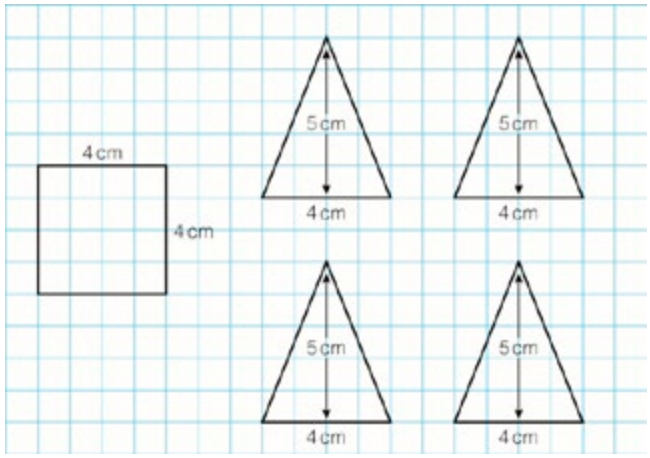
**1 a**



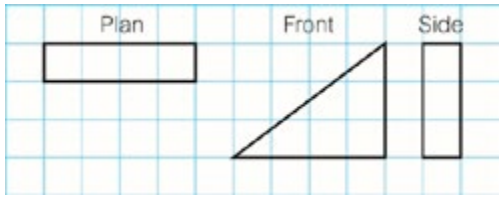

**b**



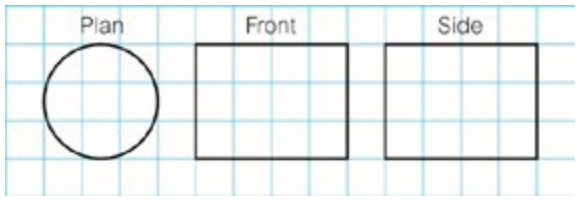

**c**



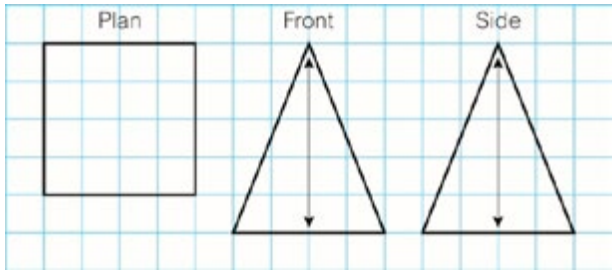
**2 a**




**b**



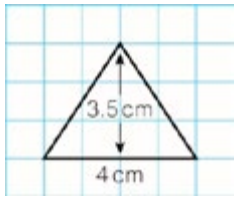

**c**




**3** 216 cm²

**4** 168 cm³

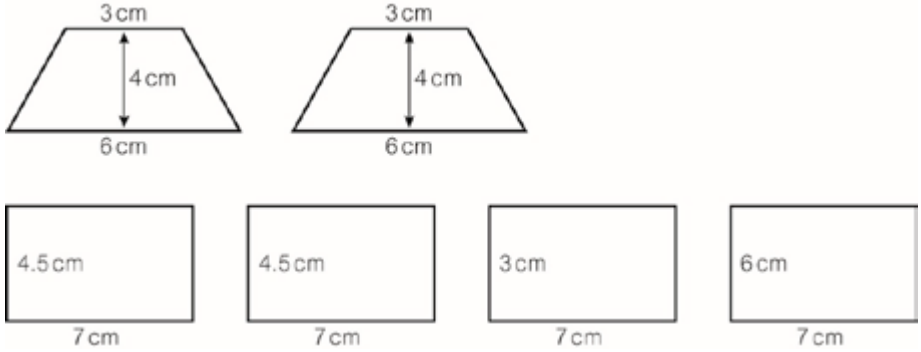
**5 a**




**b** 7 cm²

**c** 21 cm³

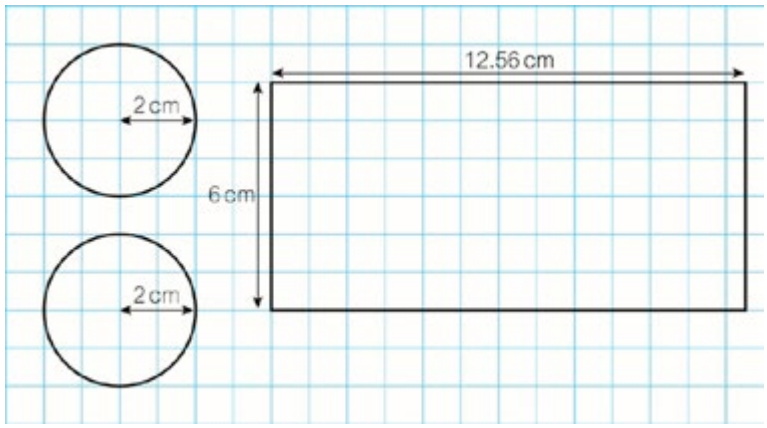
**6 a**




**b** Area of 2 trapezia = 18 cm² each , area of rectangles = 2 rectangles of 31.5 cm², 1 each of 42 cm² and 21 cm²

**c** 162 cm²

**7 a, b**




**c** circular faces = 12.6 cm² each, rectangle = 75.4 cm²

**d** 100.5 cm²

**e** 75.4 cm³

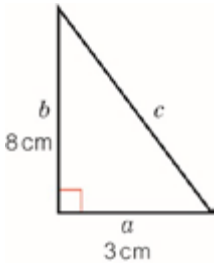
## Pythagoras' Theorem

**1 a** 6.1 cm

**b** 91 mm

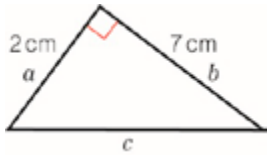
**c** 5.7 cm

**2 a i, ii**



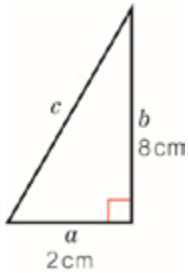

**iii** 8.5 cm

**b i, ii**




**iii** 7.3 cm

**c i, ii**




**iii** 8.2 cm

**3** 7.5 cm, 85.6 mm, 10.8 cm

**4** **a** 11.5 cm²

**b** 60 cm²

**c** 27.7 cm²

## Enrichment

**Method A**

**1** **a** **1** 7 cm

**2** 49 cm²

**3** 6 cm²

**4** 25 cm²

**Method B**

**1** 5 cm

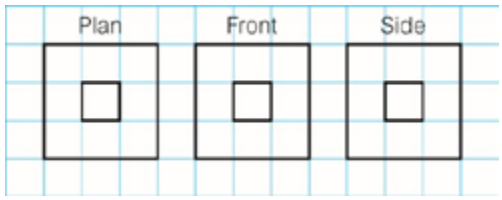
**2** 25 cm²

**b** Students' own answer for example, 'Method B because once I worked out the x the rest of the question was straight forward.' OR 'Method A because I just had to work out the different areas.'

# Unit 3 Answers

## 3 Extend

**1 a**




**2 a** 75.4 cm

**b** 37.7 cm

**3 a** 113.1 cm²

**b** 144 cm²

**c** 78.5 %

**d** 50.3 cm², 64, 78.5%

**4 a** She left π in the answer.

**b** C = 11π cm, A = 30.25π $\text{cm}^2$

**5 a** Students' own answers

**b** C ≈ 7.9 cm

**c** d ≈ 2.5 cm

**d e** Students' own answers

**6** 31.8 cm

**7 a i** 4.6 m

**ii** 21.7 rotations

**b i** 92.6 cm

**ii** 14.7 cm

**8 a** 3 cm

**b** 7.6 cm

**c** 22.8 cm²

**d** 36 cm²

**e** 127.2 cm²

**f** 84 cm³

**9 a** 149 cm

**b** 74.6 km

**10a** $6x = 360^\circ$, so $x = 60^\circ$

**b** $x + 2y = 180^\circ$, so $y = 60^\circ$

**c** Equilateral

**d** 4.3 cm

**e** 10.8 cm²

**f** 64.9 cm²

**11a** 3.8 cm

**b** 4.1 cm

**12a** 9.1 cm

**b** 18.2 $cm^2$

**13a i** 40.8 cm

**ii** 183.8 $cm^2$

**b i** 5.2 cm

**ii** 15.7 $cm^2$

**14 i a** Surface area = 270 $cm^2$, volume = 210 $cm^3$

**b** Surface area = 301.2 $cm^2$, volume = 233.8 $cm^3$

**ii** Shape **b**

**15** 7.2 miles

**16a i** AB = 7.1 cm

**ii** BC = 10 cm

**iii** AC = 7.1 cm

**b** Isosceles

**17a** 4.5 cm

**b** 0.08 cm

**18** 2250 $cm^3$ ; 2010.6 $cm^3$. No it's too small.

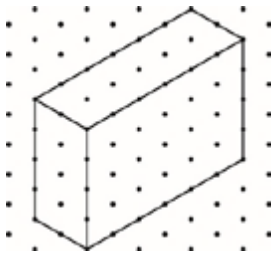
**19a** 9.95 cm

**b** 10.30 cm

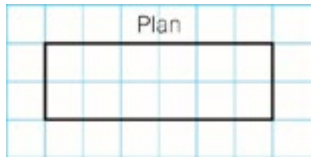
# Unit 3 Answers

## 3 Unit test

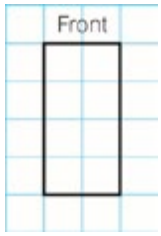
**1 a**



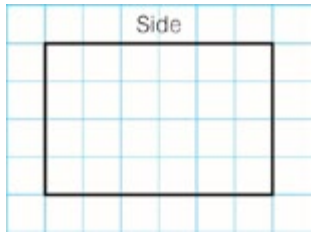
**b**




**c**




**d**




**2 a i** 12.56 cm

**ii** 12.56 cm

**b i** 267.04 mm²

**ii** 5674.50 mm²

**3 a** 22.7 cm²

**b** 19.5 cm

**4 a** D

**b** A

**c** B

**5 a i** 36 cm³

**ii** 84 cm²

**b i** 80 cm³

**ii** 140 cm²

**6 a** 10.8 cm

**b** 7.4 cm

**7 a** 14.32 cm

**b** 6.18 cm

**8** 22.2 cm²

**9** 7.6 cm

**10** 15 cm²

**11a** 70.7 cm³

**b** 103.7 cm²

# Unit 4 Answers

## Exercise 4.1

**1 a** 2040 yen

**b** £1.75

**c** £6

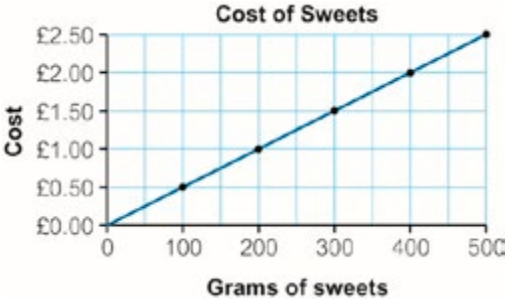
**2 a** 50 p or £0.50

**b** £2.50

**c**

| **Grams of sweets** | 0 | 100 | 200 | 300 | 400 | 500 |
|---|---|---|---|---|---|---|
| **Cost (£)** | 0 | 0.50 | 1 | 1.50 | 2 | 2.50 |

**d**




**3** B and D

**4 a** Yes

**b** ≈ 10 cm

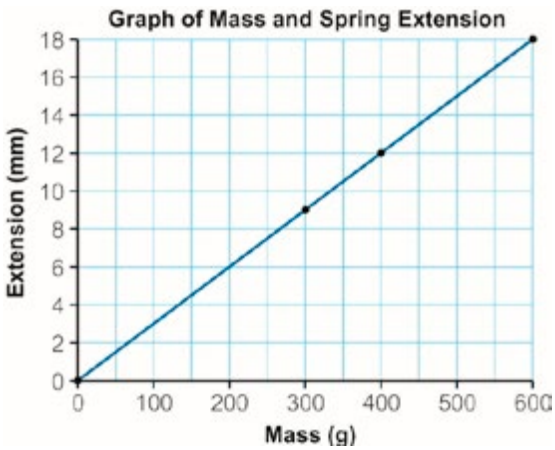
**c** ≈ 7 inches

**d** 6 inches

**e** ≈ 13.25 cm

**f** ≈ 37.5 cm

**5 a**




**b** Yes

**c** No

**6 a i** 77 °F

**ii** 38 °C

**b** 32 °F

**c** 212 °F

**7 a** £32

**b** £8 per hour

**c** 8 hours

**8 a** 1

**b** 3

**c** 4

**d** 2

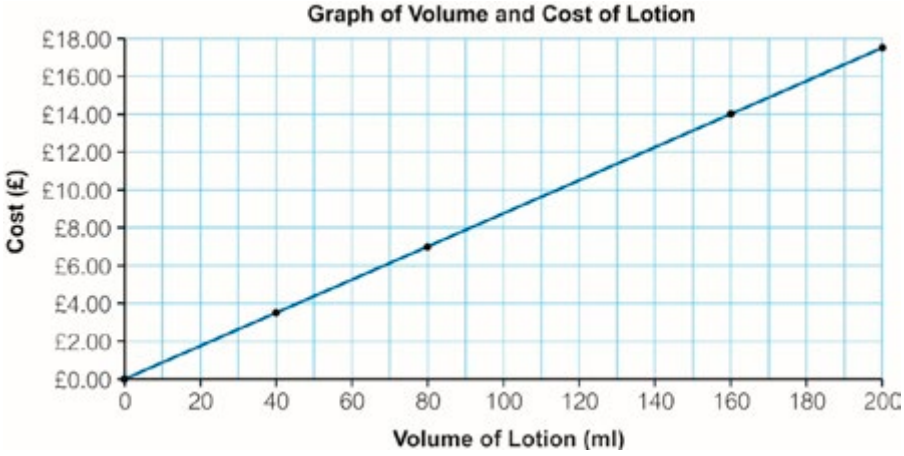
**9 a** Yes

**b** No

**c** No

**d** Yes

**10a**




**b** Yes

# Unit 4 Answers

## Exercise 4.2

**1** A (10, 3)

B (35, 4.2)

C (23, 3)

D (8, 5)

E (46, 0.2)

**2 a i** £14 **ii** £10

**b** Unlimited - pay an infinite amount.

**c** £12

**d** 0 minutes

**e** 150 minutes

**f** Hannah – B, Jeff – A, Matt - A

**3 a** The share price increased.

**b** $11

**c** September 1, November 1

**d** July 1, October 1

**e** $480

**4 a** £300 000

**b** £500 000

**c** 2004, 2008, 2009, 2011, 2012, 2013

**d** 2007

**e i** Income decreased. **ii** Income increased.

**f** It is hard to predict as the graph goes up and down.

**5 a i** House prices increased.

**ii** House prices decreased.

**iii** House prices stayed about the same.

**b** 5%

**c i** 4% **ii** 17%

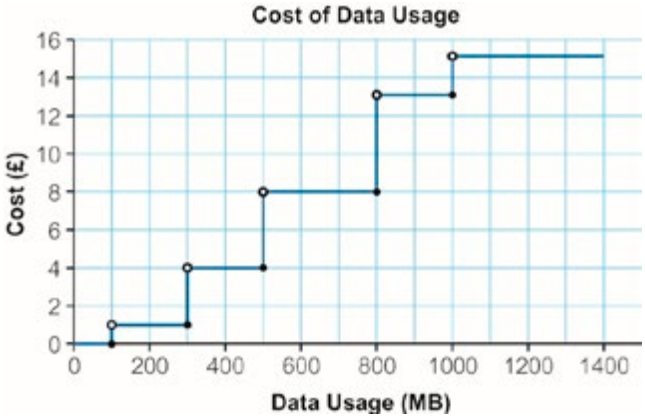
**d i** £81,120 (using 4%) **ii** £64,740 (using 17%) **iii** £95,160 (using 22%)

**6 a** £2

**b** £4

**c** 6-8 hours

**7**



# Unit 4 Answers

## Exercise 4.3

**1** 11.10 am

**2** **a** 0.5 hours

**b** 3 hours

**c** 2.25 hours

**3** **a** 800 m

**b** Stays the same/does not change.

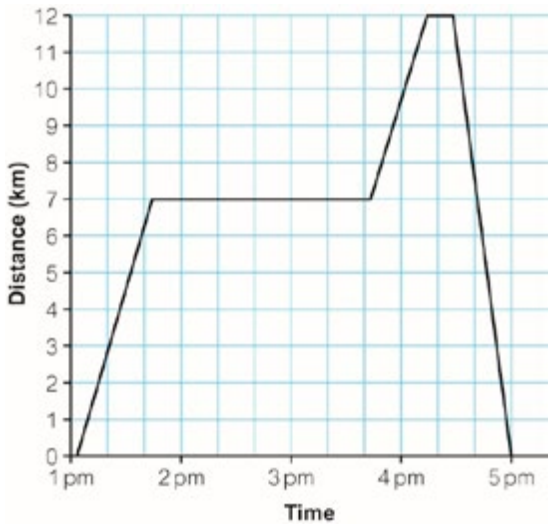
**c** 15 minutes

**d** 10 minutes

**e** 10 minutes

**f** 30 minutes

**4**




**5** **a** 150 km

**b** 2 hours

**c** **i** 0 km/h

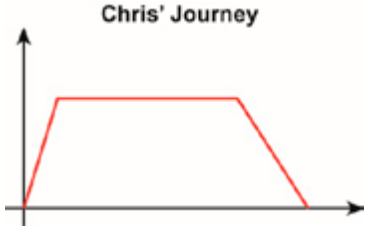
**ii** 50 km/h

**iii** 16.7 km/h

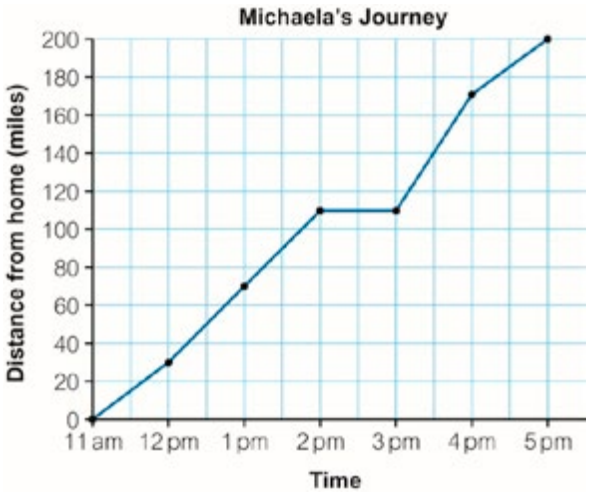
**6** **a** Sania - The time to get to the friends' house is the same as the time to get home.

Karl – The time at the friends' house is not long enough.

**b**



**7 a**




**b** 2 pm – 3 pm

**c** 3 pm – 4 pm

**d i** 36.7 mph **ii** 32.5 mph

**8 a i** 1.5 m/s

**ii** 1.2 m/s

**b** Between 0 and 10 seconds.

**c** 100 m

**d** 1 m/s

**9 a** 600 km

**b** 4:20 pm

**c** 350 km

**d** Train A = 133.3 km/h

Train B = 171.4 km/h

**10a** 42 km

**b** 9.45 am

**c** A $2\frac{3}{4}$ h B $2\frac{1}{4}$ h C $3\frac{1}{4}$ h

**d i** Around 11.22 am **ii** 21.5 km

# Unit 4 Answers

## Exercise 4.4

**1 a** ≈ £2550

**b** ≈ 8.3 years

**c** £2000

**d** ≈ £2100

**2 a i** C

**ii** A

**iii** B

**b** D The runner starts off quickly, stops for a while and then runs quickly to the finish.

E The runner starts off slowly, then runs quickly and then runs slowly again to the finish.

**3 a** A, B and F

**b** E and H

**c** After 5 minutes (part C). The water level rises quickly.

**d** 8 minutes

**e** A - water fills up the bath quickly.

B - water fills up the bath more slowly.

C - person gets in.

D - person sits in bath

E - some water let out of bath.

F - water tops up the level of the bath.

G - person gets out of the bath.

H - the bath begins to empty.

**4 a** ≈ £12 000

**b** 0-2 years

**c** After 3 years

**d** No

**5 a** A

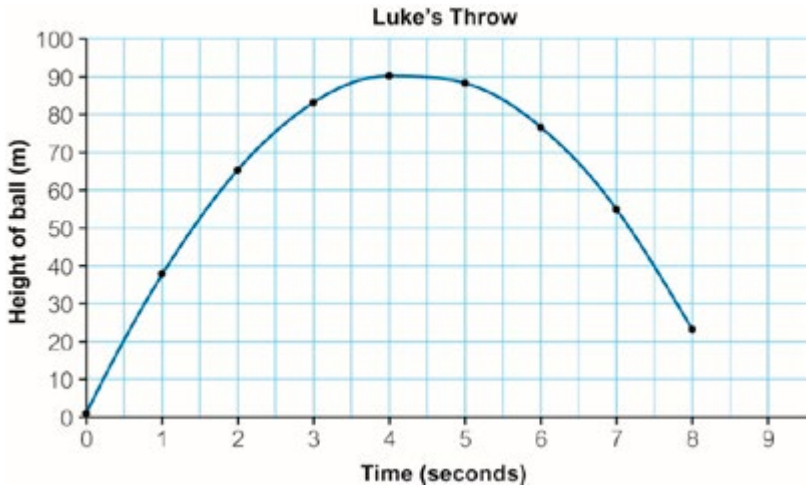
**b** A – 1

B – 2

**6 a** Narrow part

**b** Graph B

**7 a**




**b** No – it is not a linear graph.

**c** Because Luke's arm is 1 m above the ground when he throws the ball.

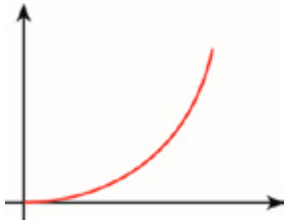
**d** Approximately 1.4 seconds and 7.2 seconds

**e** One is on the way up, the other is on the way down.

**f** ≈ 8.6 seconds

**8 a** 2 A 3 B 4 C

**b**



# Unit 4 Answers

## Exercise 4.5

**1** **a** Saturday

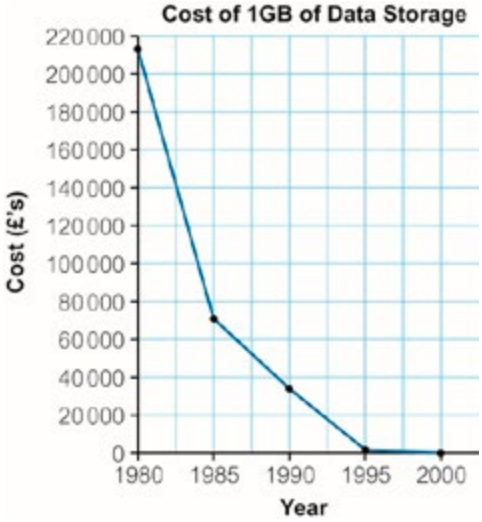
**b** 2

**c** He received more.

**2** No title; no labels or key; percentages add up to more than 100; 34% sector looks bigger than 27% sector.

**3** **a** It does not increase by the same number. You multiply by 10.

**b**




**c** It decreased (rapidly)

**4** **a** The first graph

**b** The second graph.

**c** £750

**d** 7.4%

# Unit 4 Answers

## 4 Check up

### Direct Proportion

**1 a i** 16 km

**ii** 3 miles

**iii** 1.6 km

**iv** 50 miles

**b** It is a straight line graph that goes through (0, 0).

**2 a**


**b** Venue A

**c** Venue B

**d** ≈ 3 hours 15 minutes

**e** Venue B, £80

### Distance-time graphs

**3 a** 45 km

**b** 15 minutes

**c** 1 hour 15 minutes

**d** Between the pizza shop and his brother's house. This is the steepest part of the graph.

**4**

**5 a** 550 km

**b** 3 times

**c** 61.1 km/h

## Real-life graphs

**6 a i** The number of visitors increased.

**ii** The number of visitors decreased.

**b i** ≈ 0.85 million

**ii** ≈ 0.65 million

**7** Vase 1 B

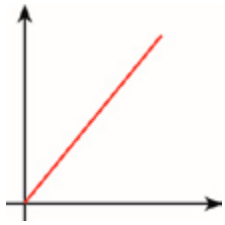
Vase 2 A

# Unit 4 Answers

## 4 Strengthen

### Direct Proportion

**1 b**



**c** Straight line through (0,0) (or the origin)

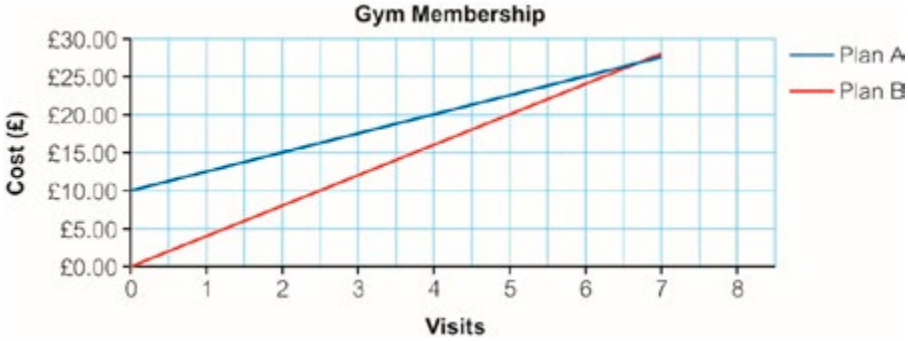
**2** C and D

**3 a** £225

**b** £150

**c** 50 minutes

**4 a-d**




**e** Plan B

**f** Plan A, £10

**g** 7

### Distance-time graphs

**1 a i** C **ii** A **iii** B

**b** 10 minutes

**c** 40 minutes

**d** 1 km

**e** 9 km

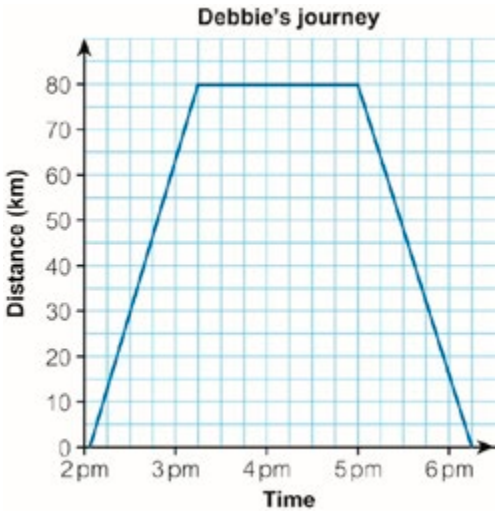
**f** 9 km in 20 minutes

9 km in 40 minutes

**g** On the way there

**h** Fastest

**2 a c**




**3 a** 2 times

**b** 5 miles

**c** 240 miles

**d** 6 minutes

**e** 6.5 hours

**f** 36.9 mph

## Real Life Graphs

**1 a** 5

**b i** £116 000

**ii** £158 000

**c** £4000

**d** 2003

**e** 2007

**2 a** £50

**b** £280

**c** All the values in the table are approximate.

| **Age of bike (years)** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cost (£)** | 280 | 220 | 175 | 145 | 120 | 100 | 80 | 70 | 60 | 55 | 55 |

**d** Between 0 and 1 years

**e** The line is the steepest

**f** No

**3 a** ≈ 52%

**b** ≈ 3%

**c** Between 1995 and 2000

**d** The percentage increased

**e** 65%

**4 a i** Blue line **ii** Red line

**b i** ≈ 16 °C **ii** ≈ 8 °C

**c i** July **ii** February

**d** July

## Enrichment

**1 a** ≈ 340 yuan

**b** ≈ 3740 yuan

**c** ≈ 480 Indian rupees

**d** ≈ 1700 Indian rupees

**e** ≈ 9500 Indian rupees

**f** ≈ £10

# Unit 4 Answers

## 4 Extend

**1 a i** August

**ii** April

**b i** 9°C

**ii** 11.5°C

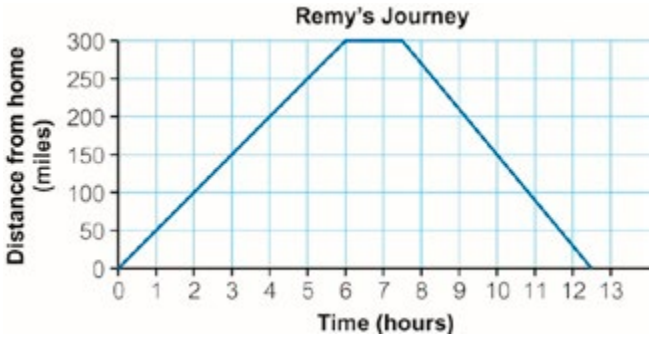
**c i** ≈ 59 mm

**ii** ≈ 122 mm

**2 a** 150 mph

**b** 100 miles

**3 a**




**b** 54.5 mph

**4 a** 921.7 km/h

**b** 866.5 mm/day

**c** 26.2 m/s

**5 a** 8.3 m/s

**b** 0.0 083 km/s

**c** 0.5 km/min

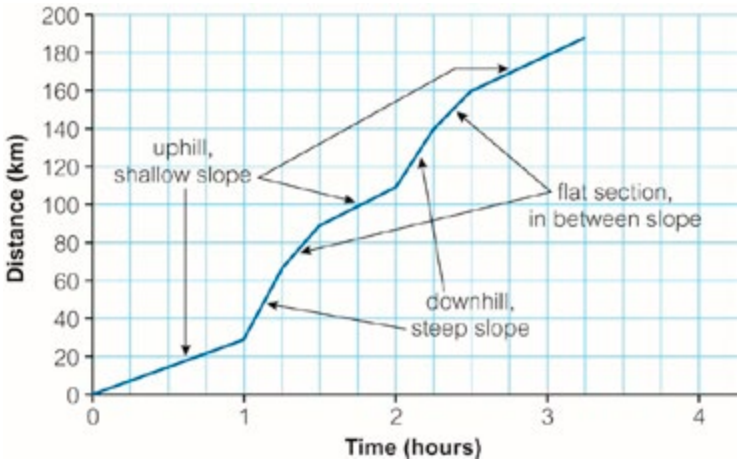
**d** 30 km/h

**6 a** 190 km

**b** 400 m

**c** The first one.

**d** Students' own answer, for example:



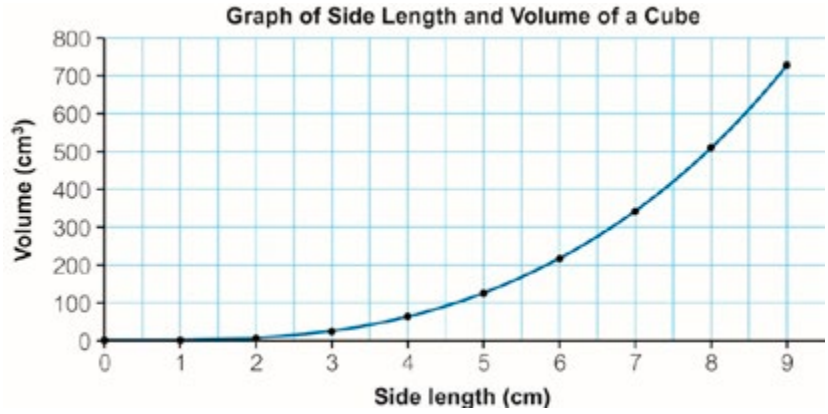

**7 a i** 19 °C **ii** 28 °C

**b i** 56 mm **ii** 65 mm

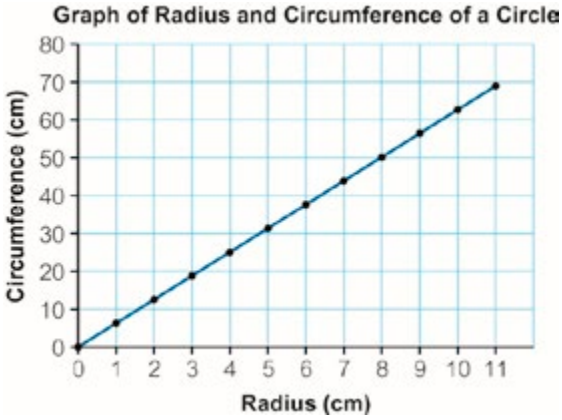
**c** Because the scales are very different

**d** It is warmer but not always wetter in Florida

**8 a i**



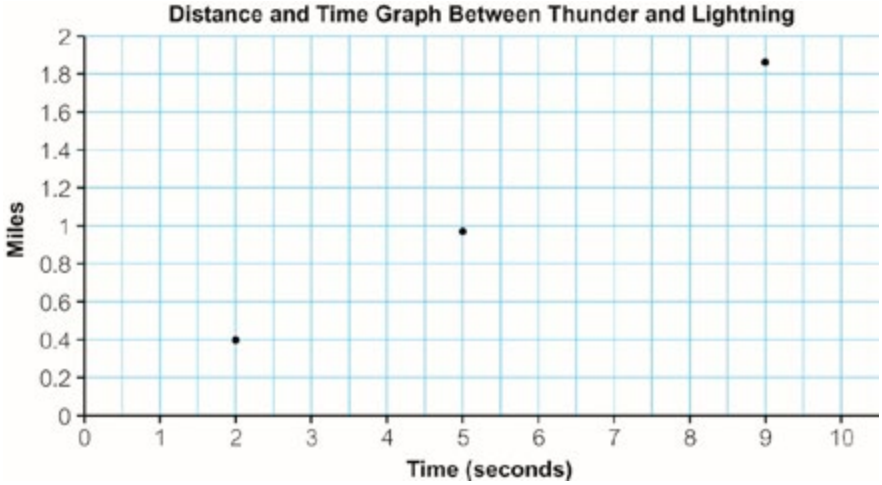

**ii**




**b i** No

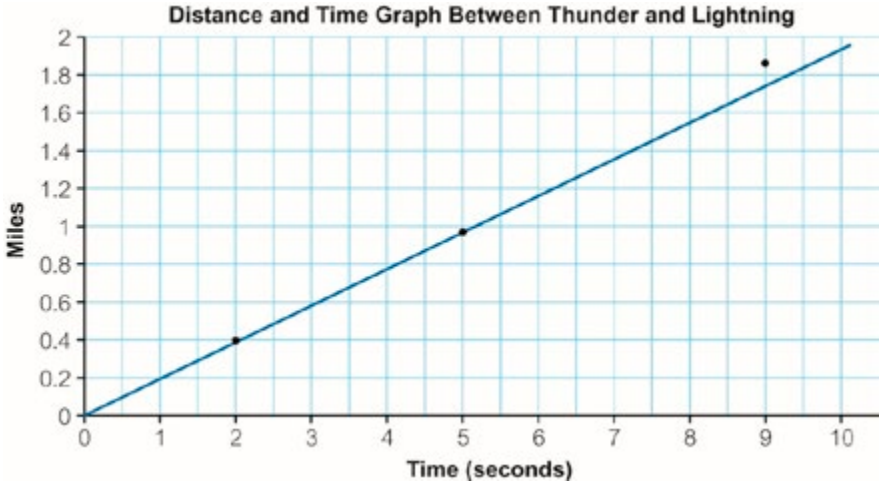
**ii** Yes

**9 a**




**b** No

**c**




**10a i** 30%

**ii** 20%

**b** The percentage of the population aged 0-14 decreased.

**c** 40-64 and 65 +

**d** Older. The percentage of the population ages 40+ is increasing and the percentage ages 0-39 is decreasing.

**11a** Decreases

**b** ≈ 65 N/cm²

**c** No

**d** You cannot put a force on an area of 0 cm²

**e i** They will mark the floor because a lot of force goes through a small area (the heel).

**ii** A sharp knife has a smaller area so the same force will generate a higher pressure.

**iii** They put a large force through a small area - their toes.

**12a** 100 million websites.

**b** Multiply by 10 every square.

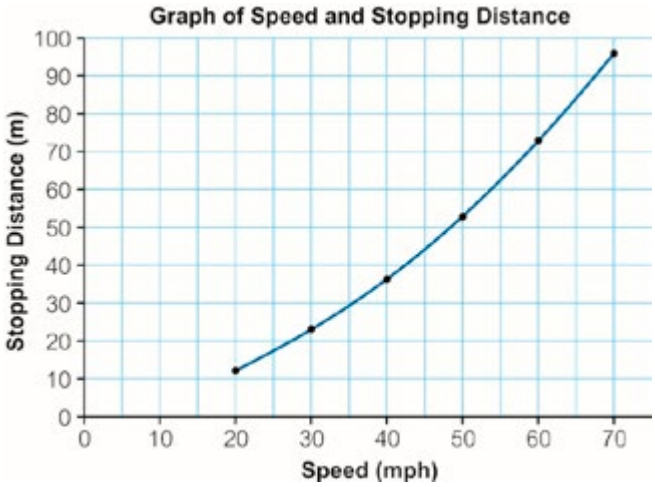
**c** 1992

**d** **i** ≈ 200 million **ii** ≈ 120 million **iii** ≈ 300 000

**e** Students' own answer, for example, 'Left hand graph for (i) and (ii), right-hand graph for (iii).'

**f** Approximately 1 000 000 000

**13a**



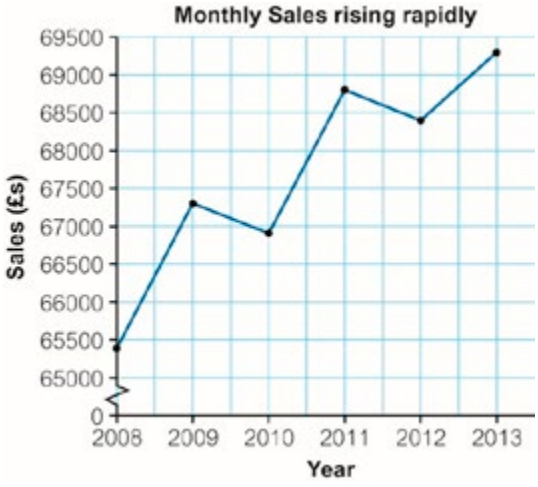

**b** No

**c** Yes

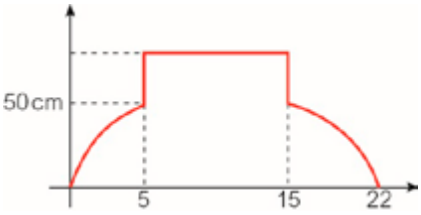
**d** No, Braking distance = (Stopping distance) – (Thinking distance)

Because stopping distance is not in direct proportion, breaking distance will not be in direct proportion.

**14**




**15**



**16a** 1 second

**b** Just before, and just after it hits the ground the first time.

**c** 0 m/s

**d** The maximum height would continue to decrease.

# Unit 4 Answers

## 4 Unit test

**1 a i** 15.5. Accept 15.3 - 15.7

**ii** 17.1. Accept 17.0 - 17.2

**b** March and September

**c** Lerwick

**d** Lerwick

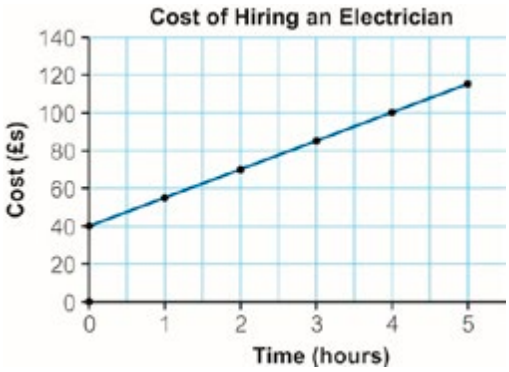
**2 a** 1 hour

**b** First part

**c** 45 km/h

**3** A – iv B – i C – iii D - ii

**4 a**




**b** £40

**c** £15 per hour

**d** No, the graph does not go through the origin.

**5 a** 158. Accept 157 - 159

**b** School A

**c** 2012

**d i** School A - increasing

**ii** School B - decreasing

**6 a i** £25

**ii** £32

**b** 1.6 GB

**7** A and C

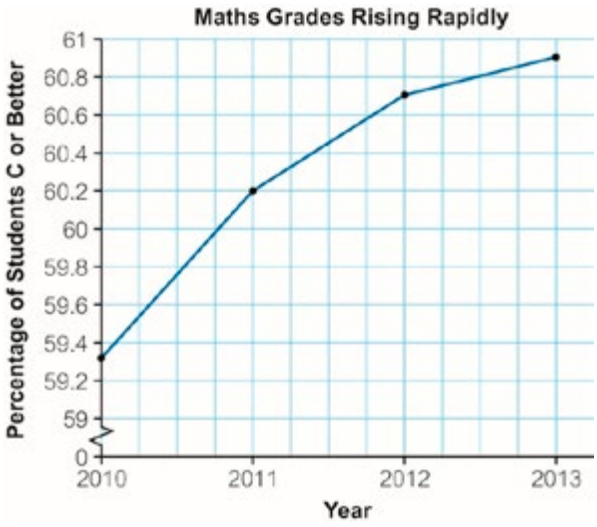
**8 a i** £30 000

**ii** £12 000

**iii** £2000

**b** Increasing

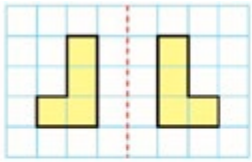
**9**

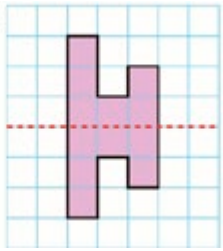


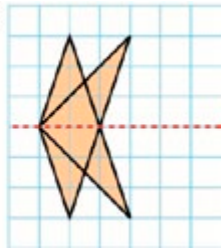
# Unit 5 Answers

## Exercise 5.1

**1**

a 

b 

c 

**2** **a** 1 left, 2 down

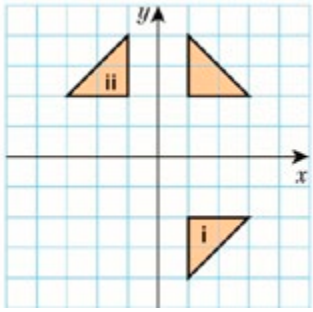
**b** 6 right, 1 up

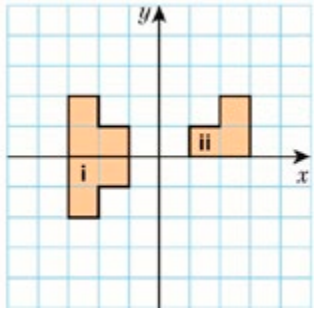
**c** 7 right, 7 down

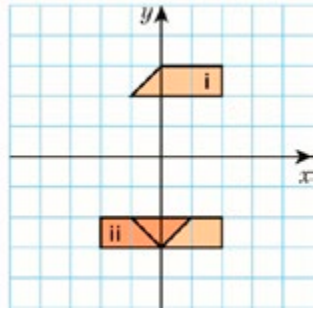
**d** 6 left

**e** 9 left, 3 up

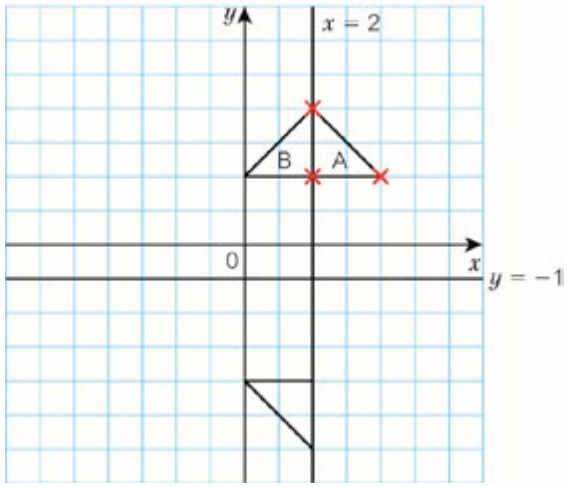
**3**

a 


b 


c 

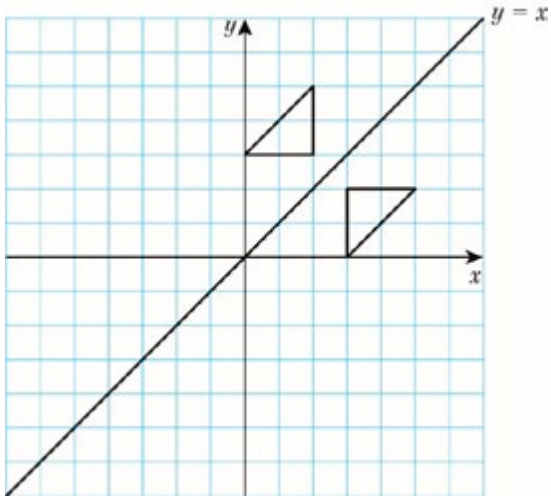

**4**



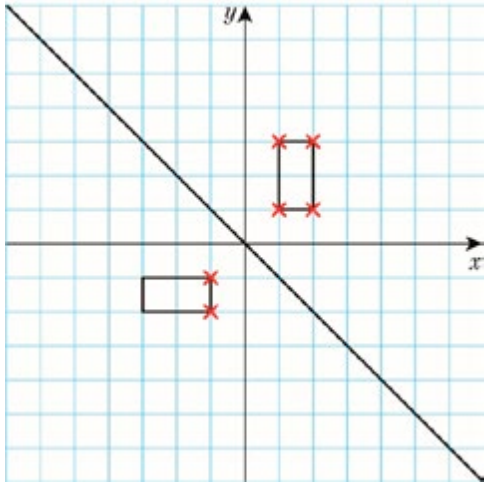

**5** **a** $x = 0$

**b** B is a reflection of T in the line $x = 2$
C is a reflection of T in the line $y = -1$
D is a reflection of T in the line $y = 1$
E is a reflection of T in the line $y = -x$

**6**




**7**




**8** **a** $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$

**b** $\begin{pmatrix} -7 \\ 0 \end{pmatrix}$

**c** $\begin{pmatrix} 0 \\ 5 \end{pmatrix}$

**d** $\begin{pmatrix} -4 \\ 8 \end{pmatrix}$

**e** $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$

**f** $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$

**9** **a** $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$

**b** $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$

**c** $\begin{pmatrix} 7 \\ -7 \end{pmatrix}$

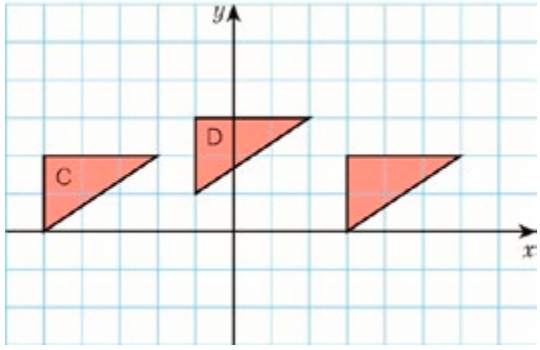
**d** $\begin{pmatrix} -6 \\ 0 \end{pmatrix}$

**e** $\begin{pmatrix} -9 \\ 3 \end{pmatrix}$

**10a** $\begin{pmatrix} -4 \\ -4 \end{pmatrix}$

**b** Reflection in $y = 1$ then $x = 2$

**c-e**




**d** Various answers, such as reflection in $x = 3$, $x = -1$

**f** No

# Unit 5 Answers

## Exercise 5.2

**1** **b** and **c**

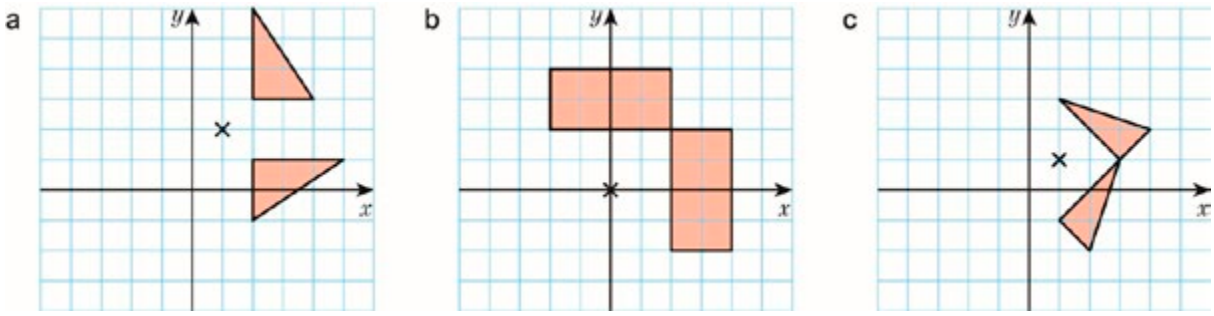
**2** **a** 90° clockwise

**b** 270° clockwise

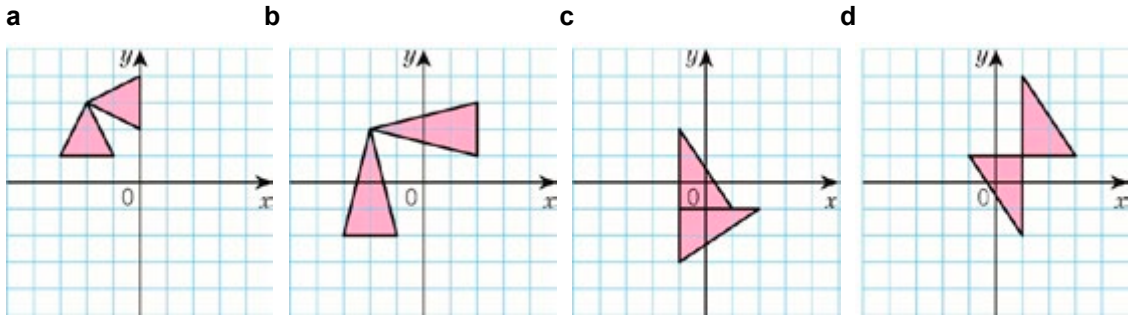
**c** 270° anticlockwise

**d** 180° anticlockwise

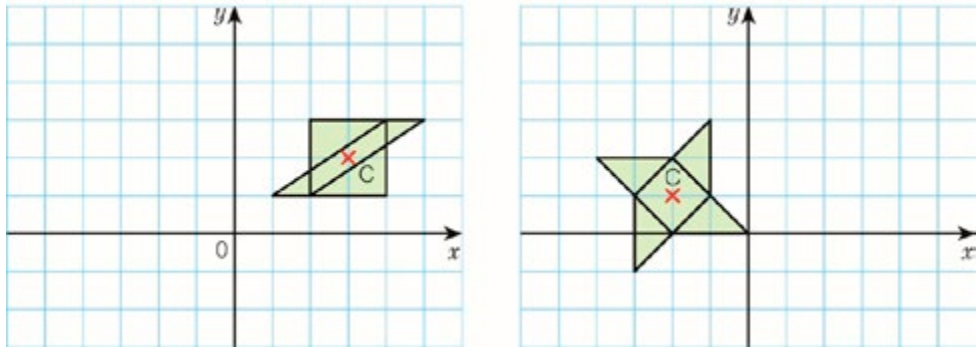
**3**




**4**




**5**



**6 a** Square: 180° about (-2, 3)

**b** Rectangle: 90° clockwise (or 270° anticlockwise) about (4, 5)

**c** Trapezium: 90° anticlockwise (or 270° clockwise) about (6, -4)

**d** Kite: 90° clockwise about the point (-6, -4)

**7**

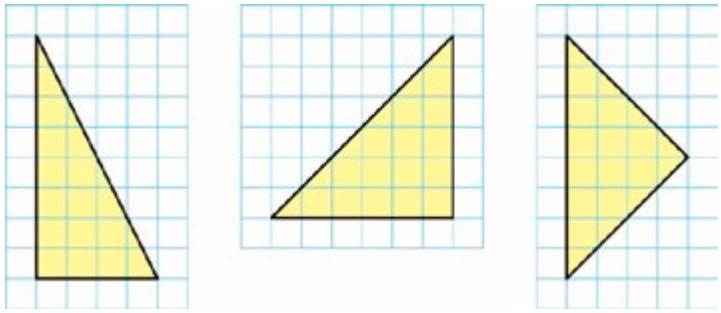
| From | To | Centre of rotation | Angle |
|---|---|---|---|
| A | C | (-2.5, 4.5) | 180° |
| A | F | (2, 8) | 90° anticlockwise / 270° clockwise |
| A | B | (0.5, -0.5) | 90° clockwise / 270° anticlockwise |
| B | C | (2.5, 7.5) | 90° clockwise / 270° anticlockwise |
| B | F | (5, 3) | 180° |
| C | F | (0.5, 0.5) | 90° clockwise / 270° anticlockwise |
| E | H | (0, -2) | 180° |

# Unit 5 Answers

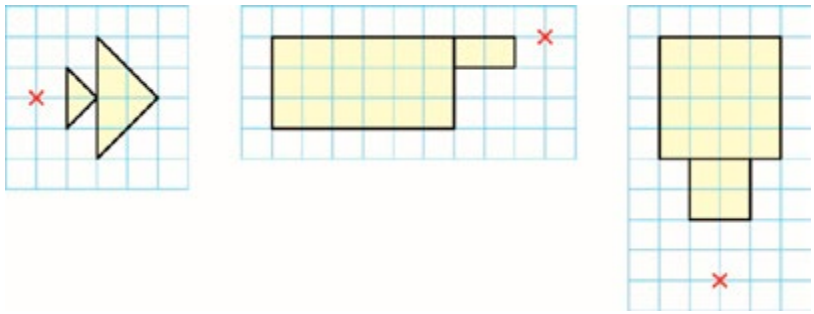
## Exercise 5.3

**1** 3

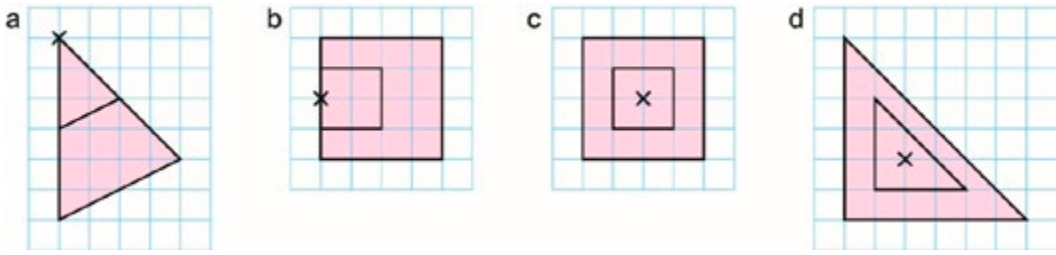
**2** **a** **b** **c**



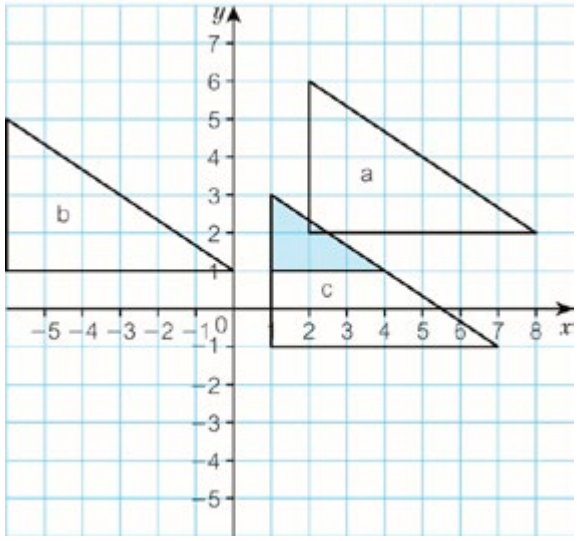
**3** **a** **b** **c**



**4**

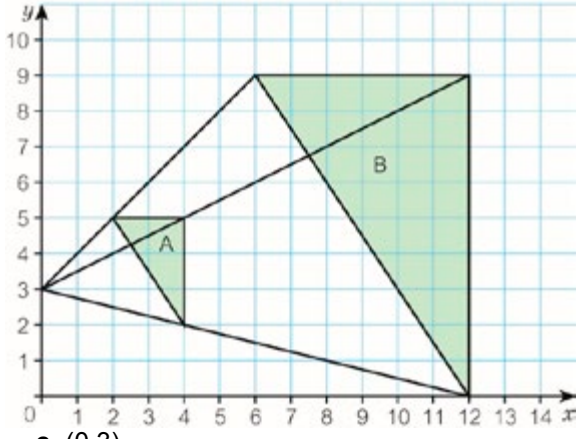


**5**




**6 a** 3

**b**



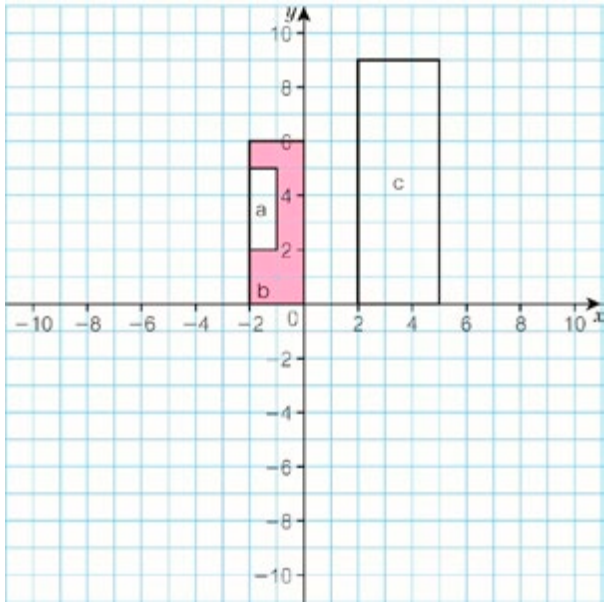

**c** (0,3)

**d** Centre of enlargement at (0,3) with scale factor 3.

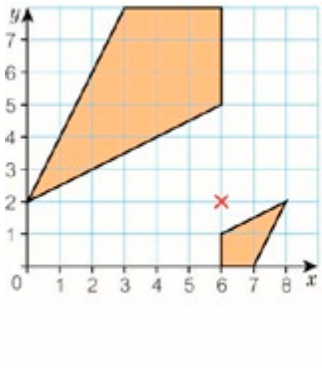
# Unit 5 Answers

## Exercise 5.4

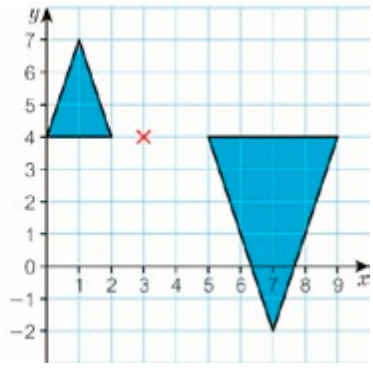
**1**



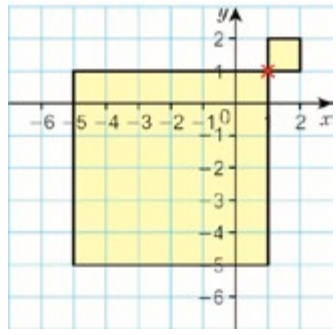

**2 a**



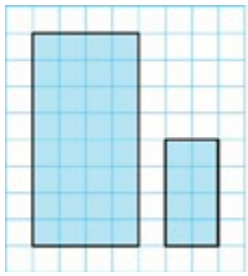

**b**



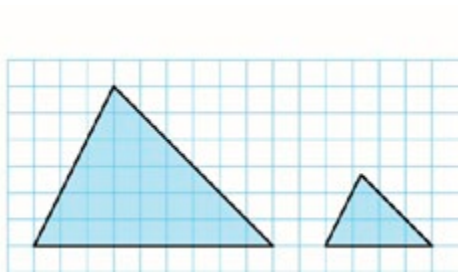

**c**



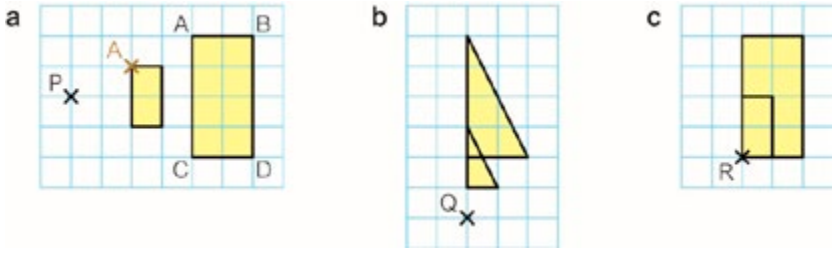

**3 a**



**b**



**4**




**5 a i, ii** Student's own drawings.

**iii** They are congruent.

**b** Enlargement scale factor $\frac{1}{4}$ about the point (0, 1)

# Unit 5 Answers

## Exercise 5.5

**1 a i** Reflecting in $y$ axis (or $x = 0$)

**ii** $\begin{pmatrix} -4 \\ 0 \end{pmatrix}$

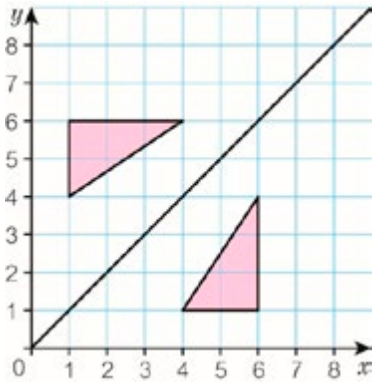
**b i** Reflection in $x$-axis (or $y = 0$)

**ii** $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$

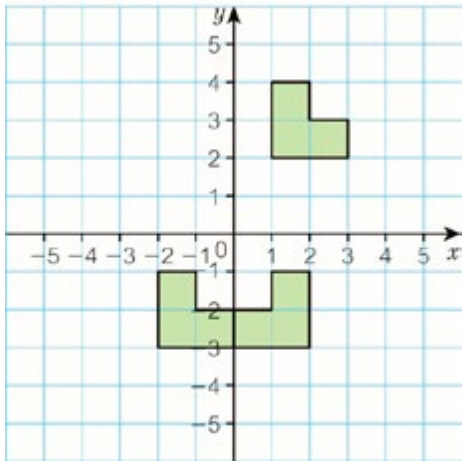
**c i** Reflection in $y = 1$

**ii** $\begin{pmatrix} 0 \\ -4 \end{pmatrix}$

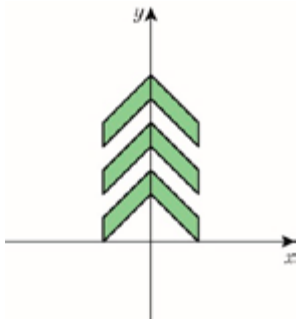
**2**




**3**



**4 a, b**

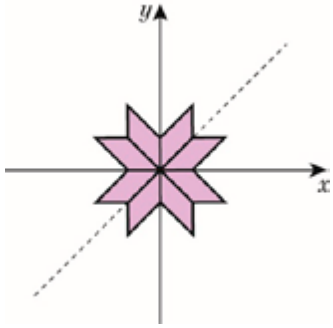



**c** $\begin{pmatrix}0\\2\end{pmatrix}$

**d** Reflection in $x = 0$ (or $y$-axis)

**e** Reflect in line $x = 0$, translate $\begin{pmatrix}0\\2\end{pmatrix}$, translate $\begin{pmatrix}0\\2\end{pmatrix}$

**5 a, b**

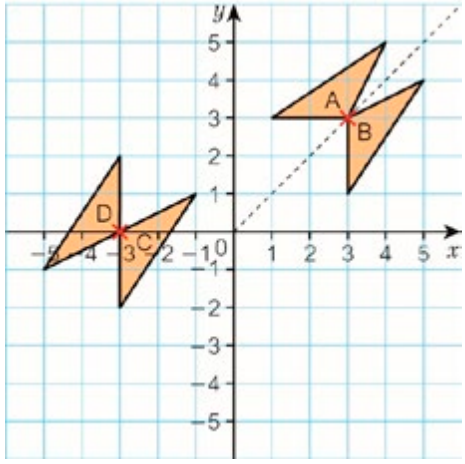



**c** Reflection in the $y$ –axis, reflection in the $x$-axis
OR reflect parallelogram in $y$-axis, then $y = -x$, then $x$-axis, then $y = x$, then $y$-axis, then $y = -x$.

**6 a** $\begin{pmatrix}4\\0\end{pmatrix}$ $\begin{pmatrix}0\\2\end{pmatrix}$ $\begin{pmatrix}3\\0\end{pmatrix}$ $\begin{pmatrix}0\\-6\end{pmatrix}$ $\begin{pmatrix}6\\0\end{pmatrix}$ $\begin{pmatrix}0\\4\end{pmatrix}$

**b** Reflection in $x = 6.5$

**7 a-c**




**d** No

**8 a** 14 cm

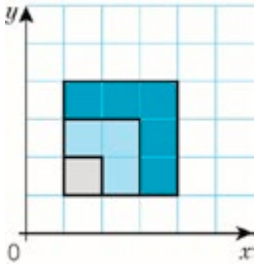
**b** 14 cm

**c** 28 cm

**d** 14 cm

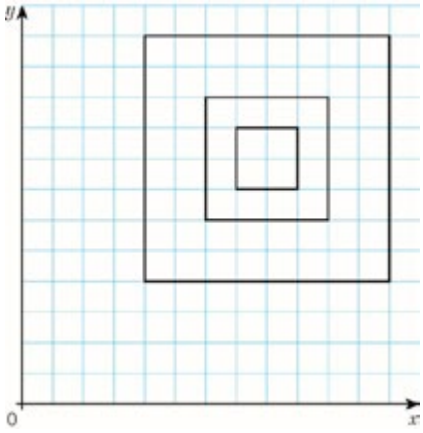
**e** No

**9 a, c**




**c** Enlargement scale factor 3, centre of enlargement (1, 1)

**10a, b**




**c** Day 4

# Unit 5 Answers

## Exercise 5.6

**1 a** Perimeter = 12 cm, Area = 9 $cm^2$

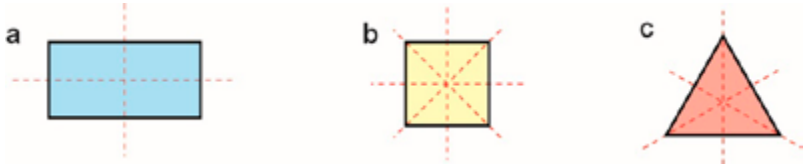
**b** Perimeter = 12 m, Area = 8 $m^2$

**c** Perimeter = 15.4 mm, Area = 10 $mm^2$

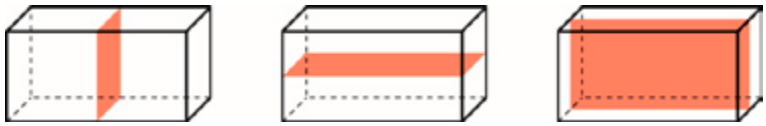
**2 a** Volume = 30 $cm^3$

**b** Volume = 8 $mm^3$

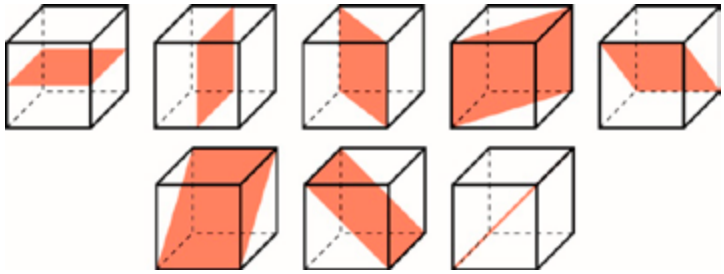
**3**



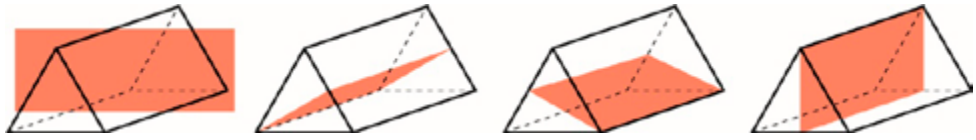

**4 a** 3 planes of symmetry



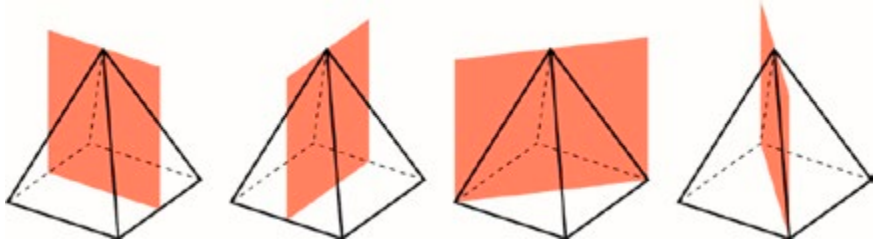
**b** 9 planes of symmetry



**c** 4 planes of symmetry



**d** 4 planes of symmetry



**5 a** 16 cm

**b i** 6 cm and 10 cm

**ii** 32 cm

**c** Lengths of sides: 9 cm and 15 cm
Perimeter = 48 cm

**6 a** 20 cm

**b** 30 cm

**c** 40 cm

**d** 5 cm

**7 a i** 4

**ii** 30.5 cm

**iii** 122 cm

**b i** 2

**ii** 18 cm

**iii** 36 cm

**8 a** 15 $cm^2$

**b** 135 $cm^2$

**9** 140 $cm^2$

**10a** 720 $cm^2$

**b** 1620 $cm^2$

**11** 480 $cm^3$

**12** 80 000 $cm^3$

# Unit 5 Answers

## 5 Check up

### Reflection, rotation and translation

**1 a** 5 right 1 up

**b** 1 left, 4 down

**2** Rotation through 180° about the point (1, -1)

**3 a** Reflection in $x = 1$

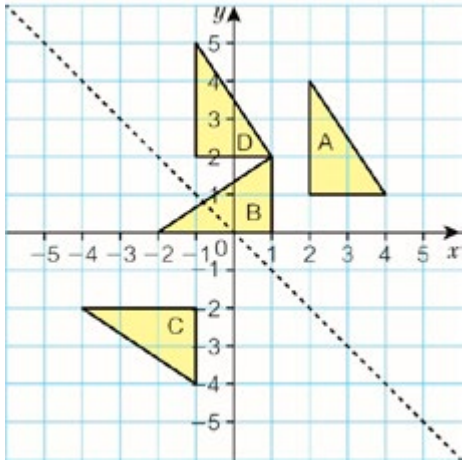
**b** Reflection in $y = -x$

**4 a** 12.5 cm

**b** 12.5 cm

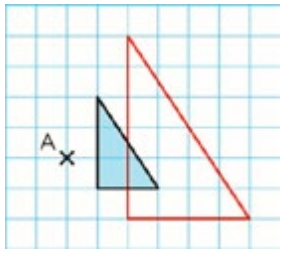
**c** 12.5 cm

**5 a–c**

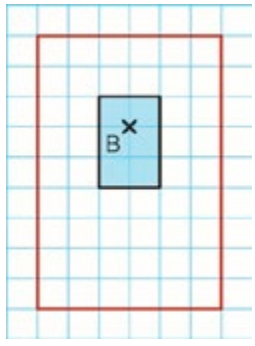



### Enlargement

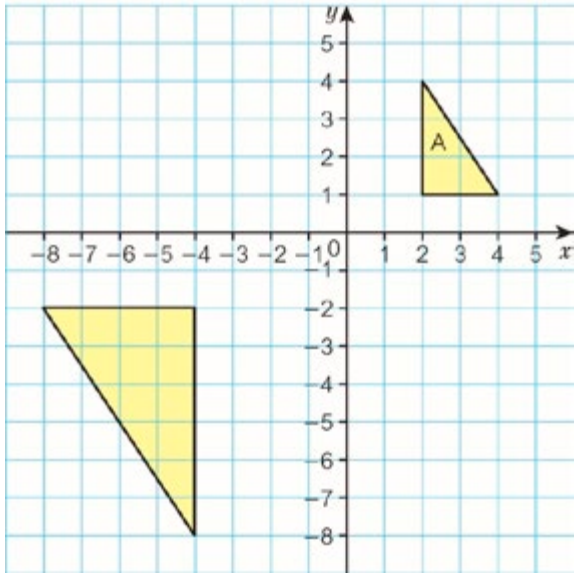
**6 a**




**b**



**7**




**8** 80 $cm^3$

## Planes of symmetry

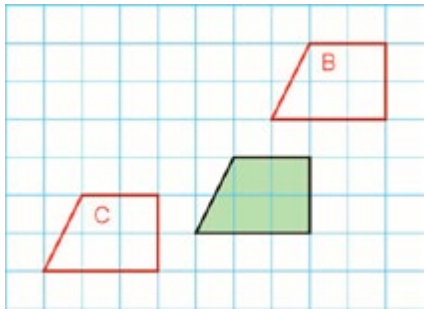
**9** 5 planes of symmetry

# Unit 5 Answers

## 5 Strengthen

### Reflection, rotation and translation

**1**



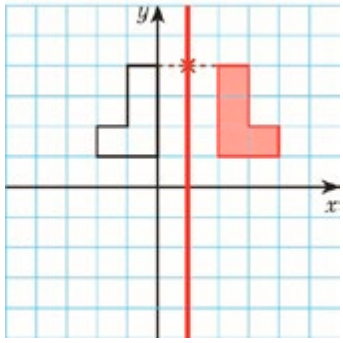

**2 a** 3 left, 2 up

**b** 4 left, 5 down

**c** 3 right, 3 up

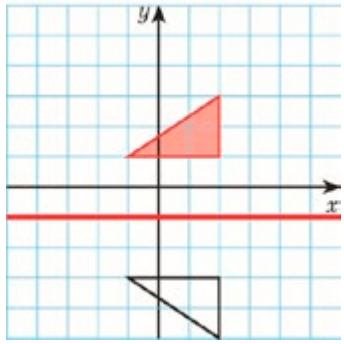
**d** 3 down

**3 a i**



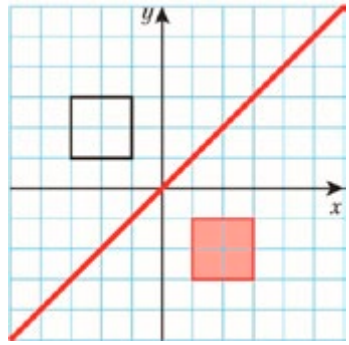

**ii** $x = 1$

**b i**




**ii** $y = -1$

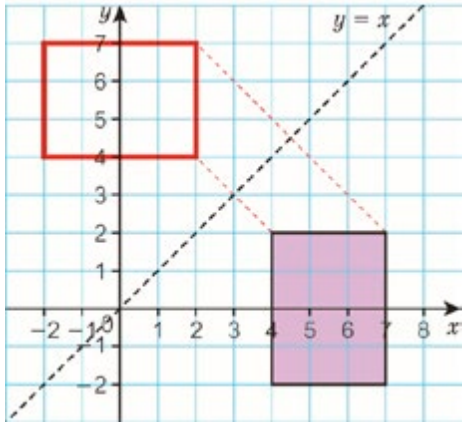
**c i**




**ii** $y = x$

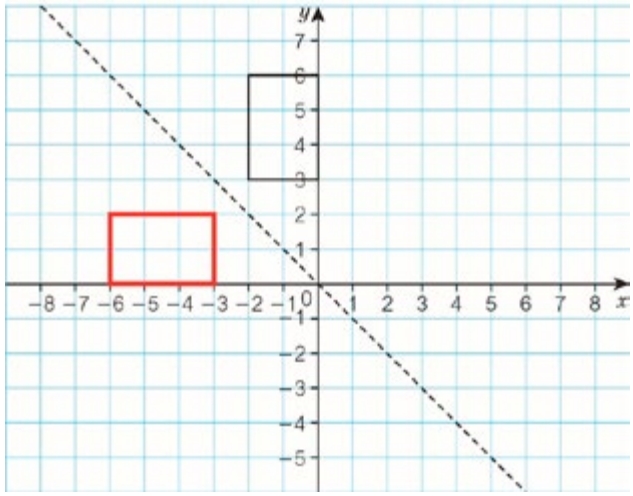
**4** A

**5 a, b**

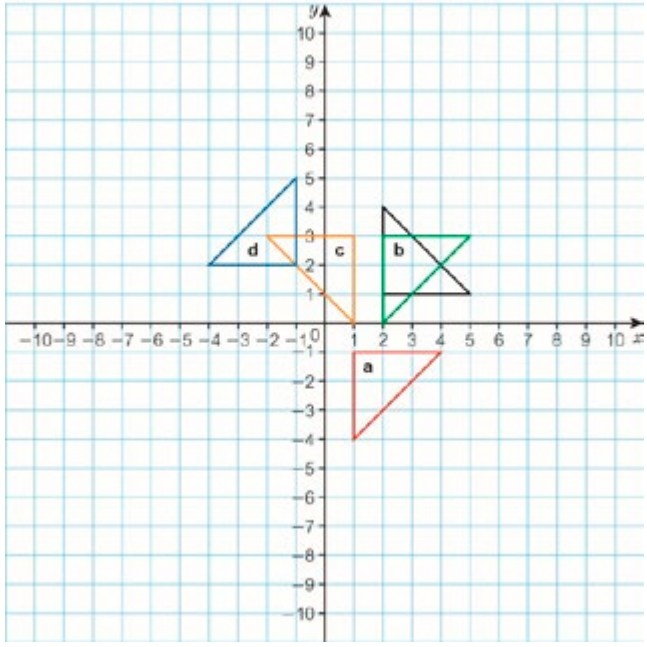



**c** The object and its image are on top of each other.

**6**



**7**

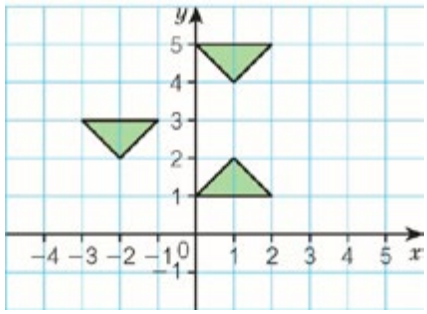



**8** A

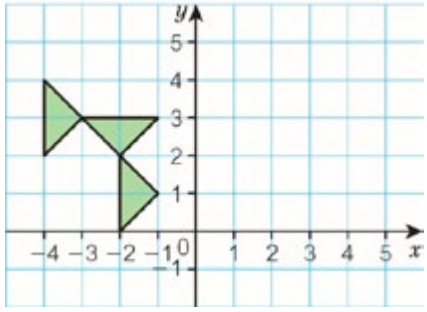
**9** **a** Rotation 180°, centre (0, 1)

**b** Rotation 90° clockwise / 270° anticlockwise, centre (-2, 1)

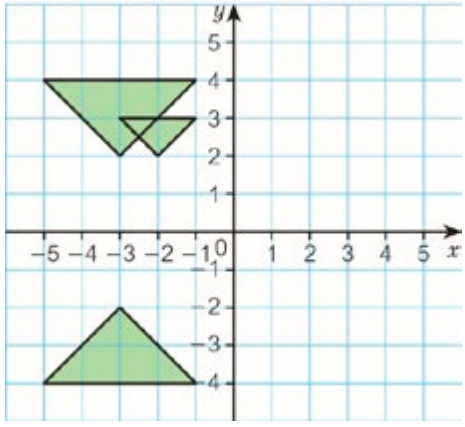
**10 a**



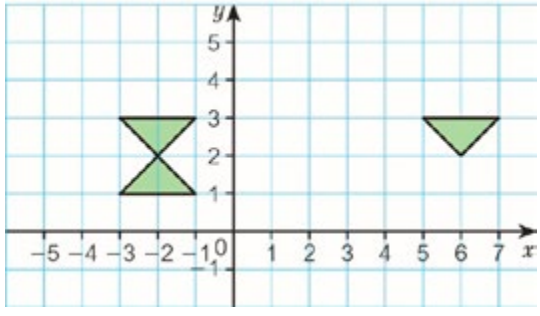

**b**




**c**



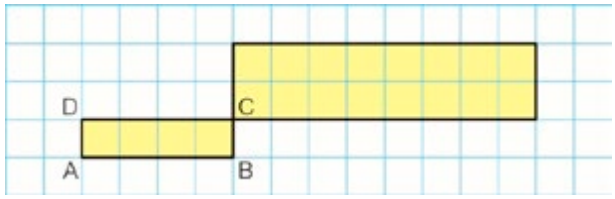

**d**



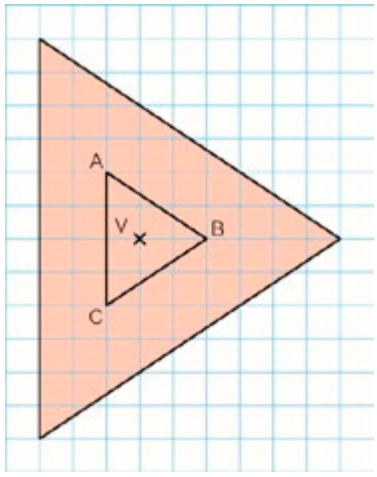
## Enlargement

**1** Y to C 6 right, 2 up × 2 = 12 right, 4 up

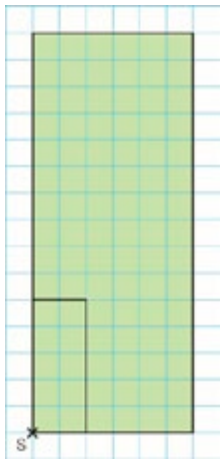
Y to D 2 right, 2 up × 2 = 4 right, 4 up




**2**




**3**




**4 a** 5

**b** 10

**5 a i** 14 cm

**ii** 42 cm

**b** 3

**6 a i** 12 $cm^2$

**ii** 108 $cm^2$

**b** 9

**7 a i** 20 $cm^3$

**ii** 160 $cm^3$

**b** 8

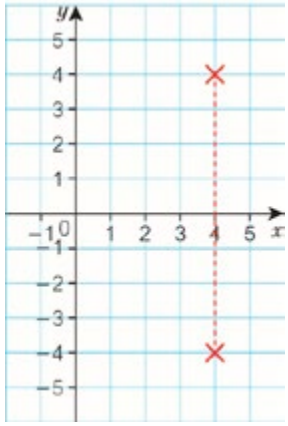
## Planes of symmetry

**1** C

**2** 2

## Enrichment

**1 a, b**




**c** (3, –4)

**d**

| **Point** | (3, 4) | (2, 7) | (1, 5) | (9, 2) | (–1, 3) | (2, –4) | (–2, –7) | (–8, –1) | (0, 3) |
|---|---|---|---|---|---|---|---|---|---|
| **Reflection in the x-axis** | (3, –4) | (2, –7) | (1, –5) | (9, –2) | (–1, –3) | (2, 4) | (–2, 7) | (–8, 1) | (0, –3) |

**e** The x-coordinate stays the same and the y-coordinate is multiplied by –1.

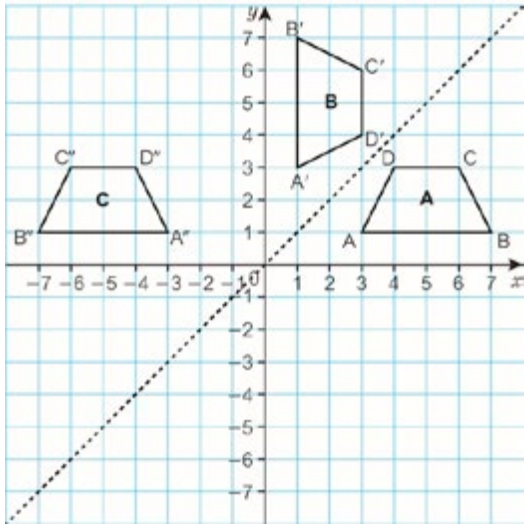
**f**

| **Point** | (3, 4) | (2, 7) | (1, 5) | (9, 2) | (–1, 3) | (2, –4) | (–2, –7) | (–8, –1) | (0, 3) |
|---|---|---|---|---|---|---|---|---|---|
| **Reflection in the y-axis** | (–3, 4) | (–2, 7) | (–1, 5) | (–9, 2) | (1, 3) | (–2, –4) | (2, –7) | (8, –1) | (0, 3) |

# Unit 5 Answers

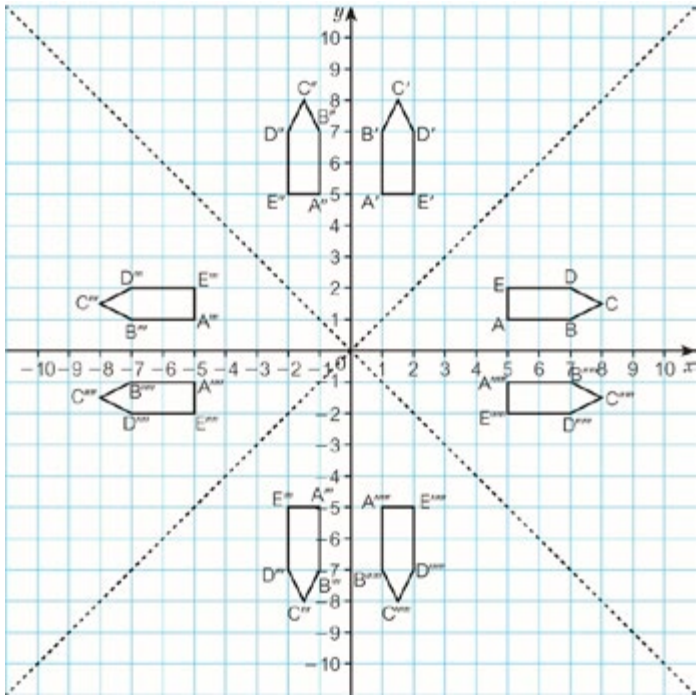
## 5 Extend

**1 a, b**




**c** Reflection in the $y$-axis ($x = 0$)

**2 a–i**

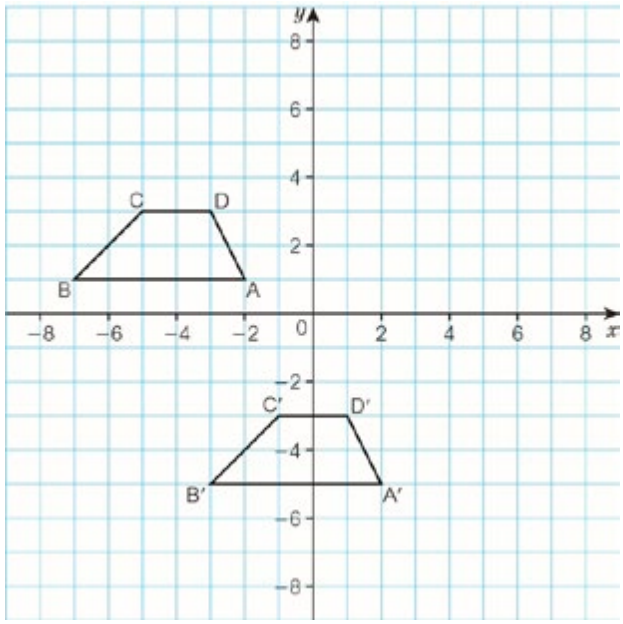



**j** 4

**3 a** 2

**b** 4

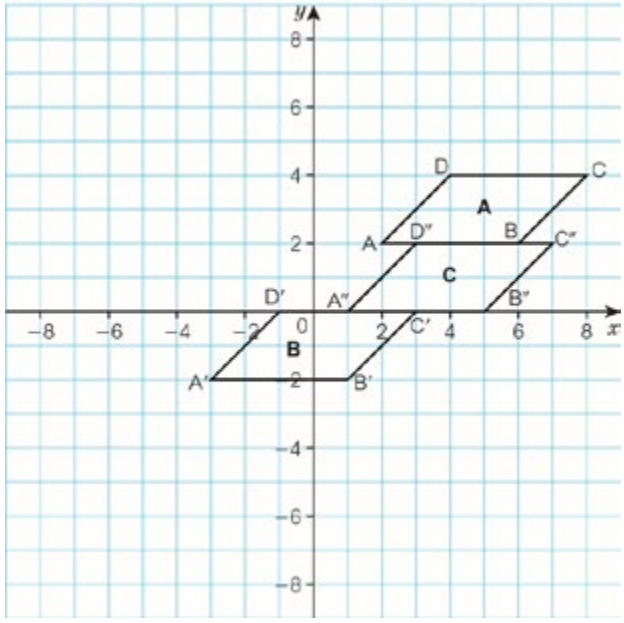
**4 a, b, d**




**c** 7 units$^2$

**e** 7 units$^2$

**5 a, b**



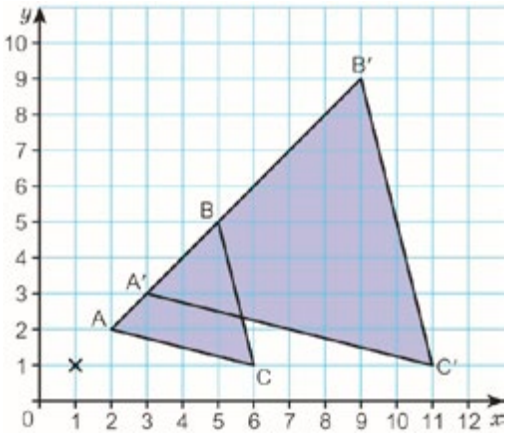

**c** $\begin{pmatrix}-1\\-2\end{pmatrix}$

**6 a** $\begin{pmatrix}2\\4\end{pmatrix}$

**b** $\begin{pmatrix}-2\\-4\end{pmatrix}$

**7** 60 cm

**8 a**




**b** $2\sqrt{17} = 8.25$

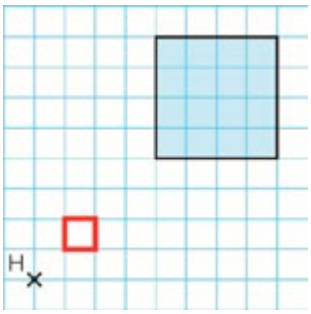
**9 a** True

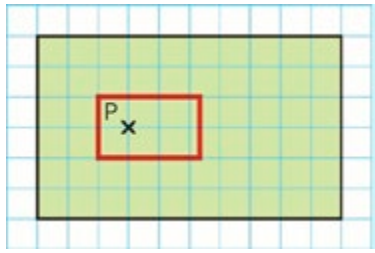
**b** True

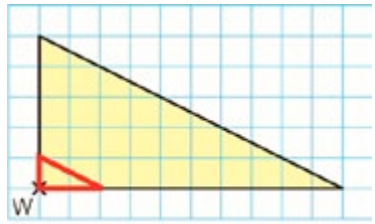
**c** False

**d** True

**10a** **b** **c**



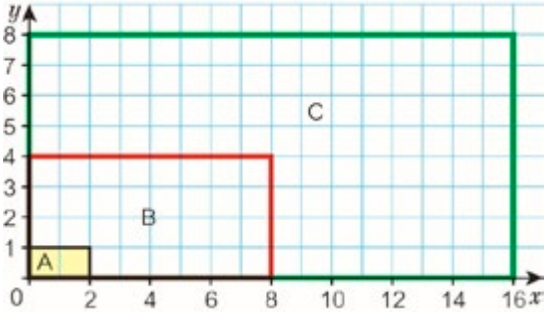




**11a** $\frac{1}{3}$

**b** 2.5

**c** $\frac{1}{2}$

**12 a-b**




**c** 8

**d** Yes: 2 × 4

**e** No

**13a** 3 **b** $1\frac{1}{3}$

**c** 4 **d** $\frac{1}{3}$

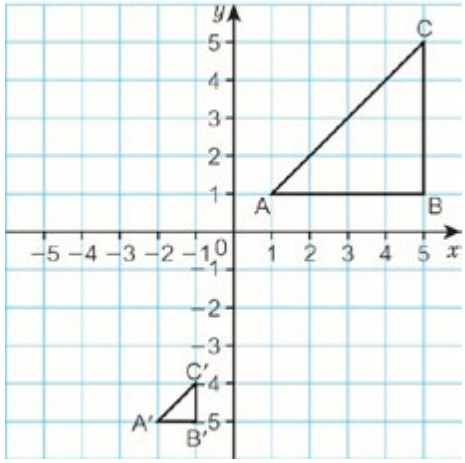
**e** $\frac{1}{4}$

**14a** 225π = 706.9 cm

**15a** $3\sqrt{2}$ = 4.2 cm

**b** 18π = 56.6 cm$^2$

**16a, b**




**17a** £55.92

**b** 3240

**c** £454.35

**d** 36 hours

**18a** 484 m$^2$

**b** 684 m$^3$

**19** 240 ml

**20a** Centre (-5, 5) scale factor 5

**b** Centre (-2, -2) scale factor 3

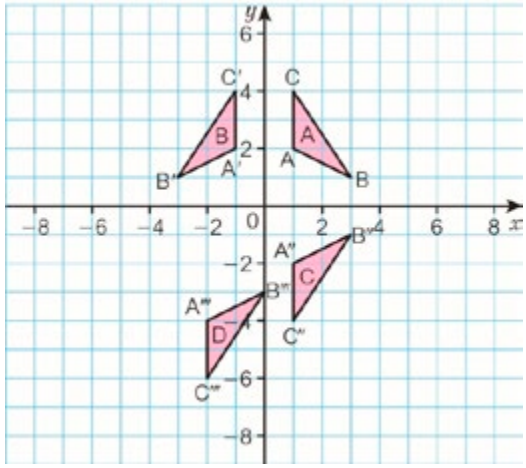
**c** Centre (4, 5) scale factor 2

# Unit 5 Answers

## 5 Unit test

**1** **a** 90° anti-clockwise about (–1, 1)

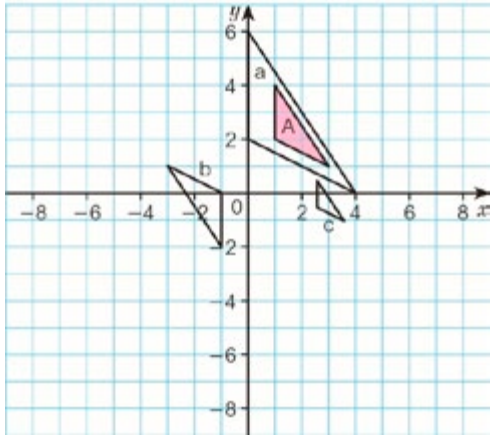
**2** **a–c**




**d** Reflection in $x$ –axis ($y = 0$).

**3** 7

**4**




**5** **a** 3

**b** $\frac{1}{2}$

**6** 51 cm

**7** 480 cm$^3$

# Unit 6 Answers

## Exercise 6.1

**1 a** 0.125

**b** 0.875

**c** $0.08\dot{3}$

**2 a** $0.\dot{6}$

**b** $0.\dot{1}\dot{7}$

**c** $0.\dot{5}4\dot{8}$

**3 a** $9x$

**b** $99x$

**4 a** $x = 6$

**b** $x = 9$

**5 a** $x = \frac{1}{2}$ **b** $x = \frac{3}{4}$ **c** $x = 6$

**d** $x = 1\frac{1}{3}$ **e** $\frac{17}{99}$ **f** $\frac{10}{33}$

**6 a** 0.166 666... or $0.1\dot{6}$

**b** 1.666 666... or $1.\dot{6}$

**7 a** $0.\dot{0}\dot{9}, 0.\dot{1}\dot{8}$

**b** $0.\dot{2}\dot{7}, 0.3\dot{6}, 0.\dot{4}\dot{5}, 0.\dot{5}\dot{4}, 0.6\dot{3}, 0.\dot{7}\dot{2}, 0.\dot{8}\dot{1}, 0.\dot{9}\dot{0}$

**8** 92 p

**9**

| | |
|---|---|
| **Flour** | 117 g |
| **Butter** | 88 g |
| **Sugar** | 105 g |
| **Eggs** | 2 |
| **Vanilla** | 29 ml |

**10a** $\frac{1}{9}$

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

**11a** $\frac{17}{99}$

**b** $\frac{277}{333}$

**c** $\frac{26}{111}$

**12a** $\frac{1}{6}$

**b** $\frac{7}{30}$

**c** $\frac{41}{90}$

**13a** $3\frac{4}{9}$

**b** $6\frac{14}{99}$

**c** $12\frac{35}{99}$

**14** £73 = $99

**15** £26 = $33

# Unit 6 Answers

## Exercise 6.2

**1** **a** 1.1

**b** 1.15

**c** 0.77

**d** 0.95

**e** 1.025

**f** 0.91

**2** £300

**3** 10.5 cm

**4**

| Without VAT | Including VAT |
|---|---|
| £10 | £12 |
| £15 | £18 |
| £25 | £30 |
| £40 | £48 |
| £60 | £72 |
| £100 | £120 |
| £150 | £180 |

**5** 5100

**6**

| Item | Original price | Discount | New price |
|---|---|---|---|
| scented candles | £12.50 | 25% | £9.38 |
| house signs | £14.99 | 20% | £11.99 |
| desk tidies | £10.50 | 15% | £8.93 |
| sealed jars (small) | £7.99 | 12% | £7.03 |
| sealed jars (large) | £9.99 | 14% | £8.59 |
| coasters | £6.00 | 22% | £4.68 |

**7** £5600

**8** £80

**9** £250 000

**10** £23 550

**11** £830

**12a** £7.08

**b** £38.13

**13a** £1794.50

**b** We don't know if they used the same amount of fuel.

**14** 11 million

**15** 1 hour 48 min

**16** £825

# Unit 6 Answers

## Exercise 6.3

**1 a** 80%

**b** 21.4%

**c** 12%

**d** 55%

**2 a** 35 more

**b** 10%

**3**

| Person | Original weight (kg) | Final weight (kg) | Percentage |
|---|---|---|---|
| A | 74 | 78 | 5.4% |
| B | 68 | 70 | 2.9% |
| C | 90 | 93 | 3.3% |
| D | 107 | 112 | 4.7% |

A made the biggest improvement

**4**

| Printer | Old ink | New ink | Percentage increase |
|---|---|---|---|
| Printer A | 1254 | 1456 | 16.1% |
| Printer B | 4152 | 4786 | 15.3% |
| Printer C | 4563 | 5554 | 21.7% |
| Printer D | 2759 | 3173 | 15.0% |

Yes it is true

**5** 4.0%

**6 a** No.

**b** Her rise should be 11.1%

**7 a** Car D

**b** Yes, all increases are greater than 10%

**8 a** £6.70 less

**b** 6.4%

**9** 75%

**10** 37.5% decrease.

**11** 2.6% decrease.

**12** Cat

# Unit 6 Answers

## Exercise 6.4

**1 a** £452.25

**b** £396.98

**2 a** 1.3225

**b** 1.08 243

**c** 3093.38

**3** 5 years

**4**

| Bank | Interest rate | Start balance | End of year 1 balance | End of year 2 balance | End of year 3 balance | End of year 4 balance |
|---|---|---|---|---|---|---|
| Bank A | 1.2% | £5000 | £5060 | £5120.73 | £5182. 17 | £5244.35 |
| Bank B | 1.3% | £5000 | £5065 | £5130.85 | £5197.55 | £5265.11 |

**5** £28 679.04

**6 a** £1530

**b** £1689.24

**c** £1902.36

**7** 5 years

**8** £15 647.99

**9 a** 18.65 billion

**b** 13.21 billion

**10a** 100%

**b** 167 772 160

**11** £58.43

# Unit 6 Answers

## 6 Check up

### Recurring decimals

**1 a** 0.222 222...

**b** 0.833 333...

**2 a** 0.142 857 142 857

**b** 0.068 181 818 181

**3 a** $\frac{7}{9}$

**b** $\frac{7163}{9900}$

### Using percentages

**4 a** £38.50

**b** £118.71

**5** A 1.2

B 0.8

C 1.02

D 0.02

E 1.002

F 1.8

**6 a** 47.6 $m^2$

**b** 70.8 $m^2$

**7** £185

**8** 6.5m

**9** 18%

**10** Denes Dynamos 11% decrease; Edgefield Eagles 12% decrease

### Repeated percentage change

**11** £520.93

**12** £102.66

**13** £5587.87

# Unit 6 Answers

## 6 Strengthen

### Recurring decimals

**1** **b** and **c**

**2** **a** 0.777 777 777 777

**b** 0.133 333 333 333

**c** 0.131 313 131 313

**d** 0.123 333 333 333

**e** 0.231 313 131 313

**f** 0.317 317 317 317

**3** **a** $0.0\dot{6}$

**b** $0.\dot{1}42857\dot{}$

**4** **a** $0.1\dot{6}$

**b** $0.\dot{6}$

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

**d** No, $\frac{3}{6} = \frac{1}{2} = 0.5$

**5** $\frac{4}{9}$

**6** **a** $\frac{2}{3}$ **b** $\frac{1}{3}$ **c** $\frac{5}{9}$

**7** **a** $\frac{23}{99}$ **b** $\frac{74}{99}$ **c** $\frac{9}{11}$

**8** **a** $\frac{1}{6}$ **b** $\frac{61}{90}$ **c** $\frac{7}{15}$

### Percentages

**1** **a** 1.2

**b** 1.15

**c** 0.9

**2** **a** 78

**b** 92

**c** 150.5

**3** **a** 76.5

**b** 96

**c** 72.96

**4**

| Car | New price |
|---|---|
| A | £11 088 |
| B | £12 988.80 |
| C | £5913.60 |
| D | £23654.40 |

**5 a** £157 250

**b** £191 632.50

**c** £319 515

**6** £56

**7 a** £30

**b** £18

**c** £18

**8** £30

**9 a** £625

**b** £750

**c** £750

## Percentage change

**1 a** 4%

**b** Check: 4% × £6000 = £240

**2 a i** 25%

**ii** 30%

**iii** 85%

**3 a** 25%

**b** 15%

**c** 37%

**4**

| Item | Old price | New price | % change |
|---|---|---|---|
| multipack crisps | £1.25 | £1.30 | 4% |
| baked beans (tin) | 64p | 68p | 6.25% |
| milk (litre) | £1.50 | £1.56 | 4% |
| washing powder (1kg) | £4.80 | £5.10 | 6.25% |

**5 a**

| Person | Original mass | New mass | % change |
|---|---|---|---|
| Shemar | 94kg | 89.3kg | 5% decrease |
| Daniel | 82.5kg | 85.8kg | 4% increase |
| Jennifer | 76kg | 74.1kg | 2.5% decrease |

**b** Shemar

**c** Daniel

**6** End of year 1 £824; end of year 2 £848.72; end of year 3 £874.18

**7** £1429.22

**8**

| Name | Investment | Interest rate | Value |
|---|---|---|---|
| Anya | £1000 | 2% | £1082.43 |
| Birgitte | £800 | 3% | £900.41 |
| Carlos | £1200 | 1.9% | £1293.83 |

Carlos has the most money after 4 years.

**9** £378.83

**10a** Percentage is compounded

**b** £327.68

**11** £110 94.36

## Enrichment

**1** £100 invested at 1% compound interest for 5 years gives £105.10

£100 invested at 2% compound interest for 5 years gives £110.41

So, investing at 2% gives slightly more than double investing at 1%

# Unit 6 Answers

## 6 Extend

**1 a** No

**b** £100 x 0.9 = £90, £90 x 1.1 = £99

**2** $\frac{1}{14}$ = 0.071 428 571...; $\frac{2}{14}$ = 0.142 857 142...; $\frac{3}{14}$ = 0.214 285 714...;

$\frac{4}{14}$ = 0.285 714 285...; $\frac{13}{14}$ = 0.928 571 428...

The digits begin to follow the same cyclic sequence (...714285...).

**3 a** $\frac{223}{990}$ **b** $\frac{334}{495}$ **c** $\frac{247}{495}$ **d** $\frac{73}{300}$

**4** $\frac{5}{7}$

**5**

| Staff | Pay rise | Original salary |
|---|---|---|
| shop floor staff | 2.4% | £17 600 |
| shop floor manager | 2.8% | £23 450 |

**6 a**

| Department | Percentage reduction | Original staff number |
|---|---|---|
| telemarketing | 7.1% | 254 |
| sales | 20.6% | 564 |
| administration | 12.9% | 248 |
| accounts | 9.8% | 512 |

**b** 13.7%

**7**

| Show | Percentage change | Original length |
|---|---|---|
| Breakfast show | 12.5% reduction | 40 minutes |
| Buy that house! | 8.3% increase | 1 hour |
| Rip-off busters | 6.7% increase | 1 hour 15 minutes |
| Helicopter Rescues | 21.4% decrease | 1 hour 10 minutes |
| Lunchtime news | 44.4% decrease | 81 minutes |

**8** 6.83 cm

**9 a i** 227 cm

**ii** 207 cm

**b** No, because the increase is compounded.

**10** 63 872

**11a** 60

**b** 62

**12**

| Bird | Day 1 | Day 2 | Percentage increase |
|---|---|---|---|
| sparrow | 56 | 95 | 70% |
| chaffinch | 45 | 84 | 87% |
| gold crest | 25 | 37 | 48% |
| blue tit | 98 | 135 | 38% |
| blackbird | 17 | 24 | 41% |

Chaffinch has greatest increase

**13a**

| Fraction | $\frac{1}{2}$ | $\frac{1}{3}$ | $\frac{1}{4}$ | $\frac{1}{5}$ | $\frac{1}{6}$ | $\frac{1}{7}$ | $\frac{1}{8}$ | $\frac{1}{9}$ | $\frac{1}{10}$ | $\frac{1}{12}$ | $\frac{1}{20}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Decimal | 0.5 | $0.\dot{3}$ | 0.25 | 0.2 | $0.1\dot{6}$ | $0.\dot{1}42857\dot{}$ | 0.125 | $0.\dot{1}$ | 0.1 | $0.08\dot{3}$ | 0.05 |

**b** 3, 6, 7, 9, 12

**c** 2, 4, 5, 8, 10, 20

**d** 2; 3; 4: 2 × 2; 5; 6: 2 × 3; 7; 8: 2 × 2 × 2; 9: 3 × 3; 10: 2 × 5; 12: 2 × 2 × 3; 20: 2 × 2 × 5

**e** Yes, Dan is correct.

**14a** **i** 2% **ii** 4% **iii** 6%

**b** If you round to the nearest 1% then the answer to part **iii** is the same as the sum of the answers to parts **i** and **ii**, but without the rounding the percentage changes are different because of compounding.

**c** **i** 5% **ii** 3%

**15a** 39 million

**b** 53.2 million

**c** 36.4%

**d** 49%

**e** No, percentages are of different amounts

**16a** £9274.19

**b** 8 years

**17** £179 106.92

**18** 67.93 million

**19a** 4297 rabbits, 28175 foxes

**b** Year 6

**20a** £114 600

**b** £109 011

**c** 17 years

# Unit 6 Answers

## 6 Unit test

**1** **a** 0.555 555...

**b** 0.416 666...

**c** 0.466 666...

**d** 0.727 272...

**2** **a** $0.1\dot{6}$

**b** $0.\dot{2}\dot{3}$

**c** $0.\dot{1}3\dot{6}$

**3** **a** 64.4 kg

**b** 490.5 g

**4** **a** 34.4 cm

**b** £503.25

**5** £49

**6** 425

**7** **a** $\frac{8}{9}$ **b** $\frac{3}{11}$ **c** $1\frac{13}{33}$ **d** $\frac{115}{333}$

**8** None

**9** 14% loss

**10** 19% increase

**11** £5081.18

**12** 26

**13** £16 696.06

**14** £100.27

**15** 5.78 million

# Unit 7 Answers

## Exercise 7.1

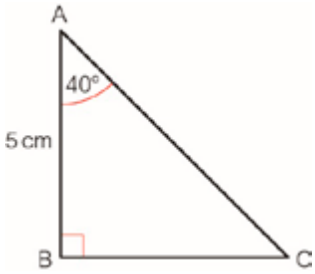
**1** Line of length 8.2 cm

**2** Angles drawn accurately

**a** 27°

**b** 138°

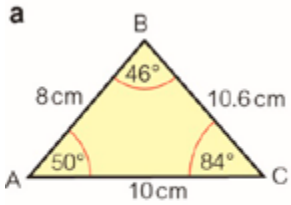
**3**



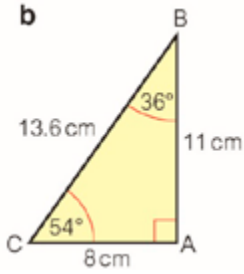

**4**

Not drawn to scale

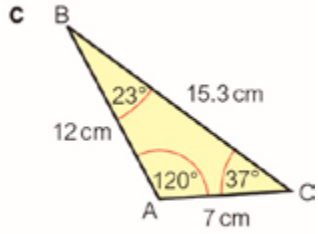
**a**



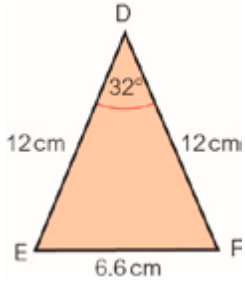

**b**




**c**




**5**

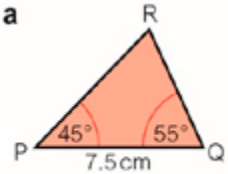



**6** Students' own drawings

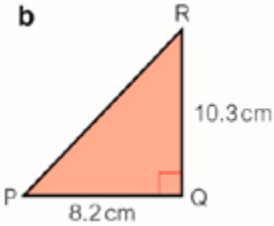
**7 a b c**

Not drawn to scale

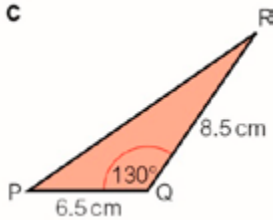
**a**




**b**




**c**




**8** Yes, using a ruler, compass and protractor (two possible triangles). More difficult using just a ruler and protractor, but still possible.

**9 b** 12.1 cm

**c** 121 cm

**10a** Students' own drawing.

**b** 15°

**c i** 7 cm

**ii** 700 cm

**11** Students' accurate drawings.

**12a** Students own drawings.

**b** AC = 39 km, BC = 28 km

**c** From A, 1 h 34 min, from B, 1 hour 7 min

**13** 27 m

# Unit 7 Answers

## Exercise 7.2

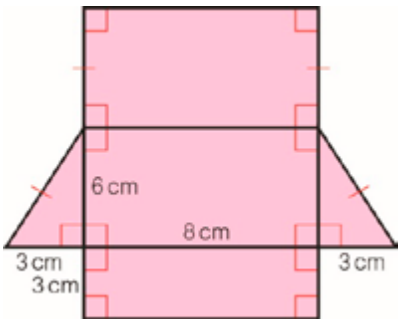
**1** **a** Cube

**b** Square-based pyramid

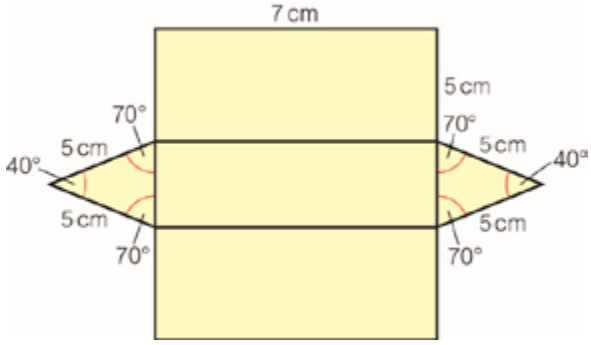
**c** Triangular prism

**d** Cuboid

**2** **a** Not drawn to scale

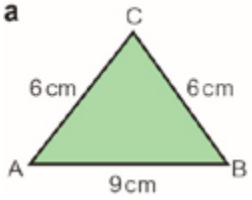



**b** Not drawn to scale

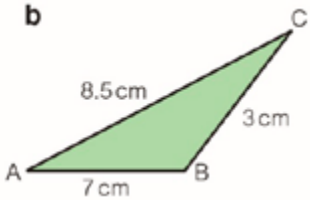



**3** Not drawn to scale

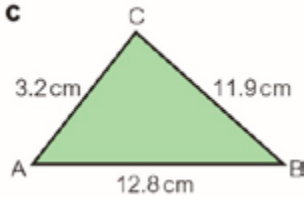
**a**



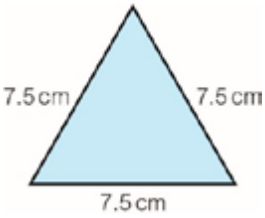

**b**




**c**



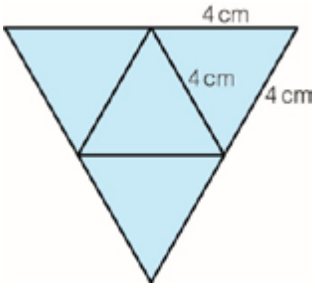

**4** Not drawn to scale



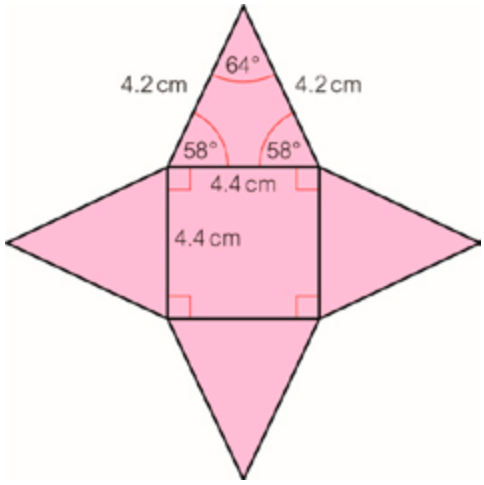

**5** **a** Students' own accurate drawings.

**b** Yes, ladder makes and angle of 68° to the ground.

**6** Not drawn to scale



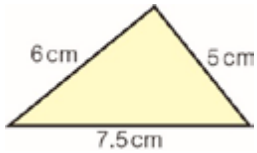
**7**



# Unit 7 Answers

## Exercise 7.3

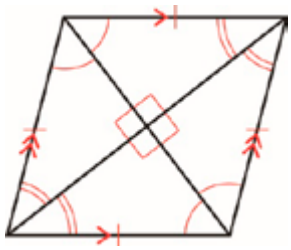
**1**



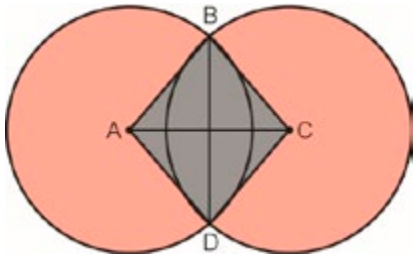

**2** **a** Rhombus

**b** 2

**c**, **d**



**3** **a, b, d**




**c** Rhombus

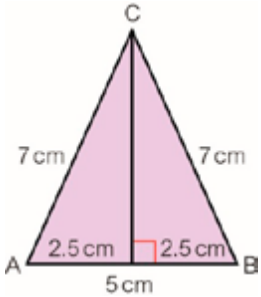
**e** Midpoint of AC and BD. Cross at right-angles.

**4** **a** Students' accurate construction of perpendicular bisector.

**b** Students check their answers.

**c** P is equidistant from A and B.

**5** **a** Not drawn to scale




**b** Isosceles

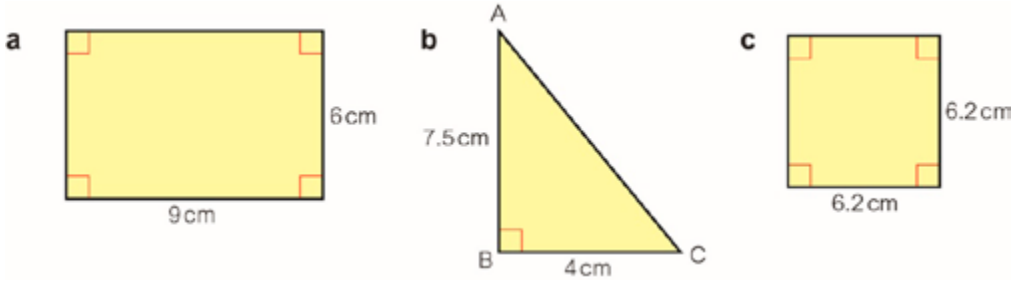
**c** Students' accurate construction of perpendicular bisector.

**d** Two congruent right-angled triangles.

**6** Students' accurate construction.

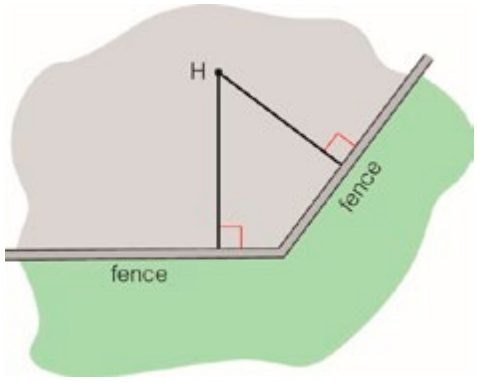
**7 a, b** Students' accurate constructions

**8** Not drawn to scale




**9 a, b** Perpendicular bisector passes through P.

**10a, b** Not drawn to scale

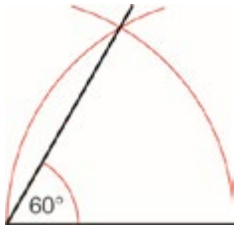



**c** 4 m

# Unit 7 Answers

## Exercise 7.4

**1**




**2** **a, b** Students' accurate constructions.

**3** **a** 12 m

**b** 2.5 cm

**4** Students' accurate constructions.

**a** **i** 70°

**iii** 35°

**b** **i** 130°

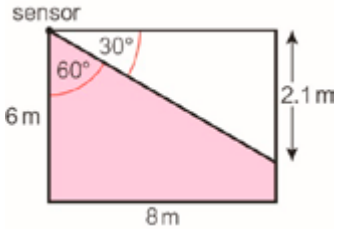
**iii** 65°

**5** Students' accurate constructions.

**a** Bisect 60° to give 30°

**b** Bisect 90° to give 45°

**6** **b** Not drawn to scale




**c** 29.52 $m^2$

**7** **b** 5.1 m

**8** Students' accurate construction.

**9** Students' own answer.

# Unit 7 Answers

## Exercise 7.5

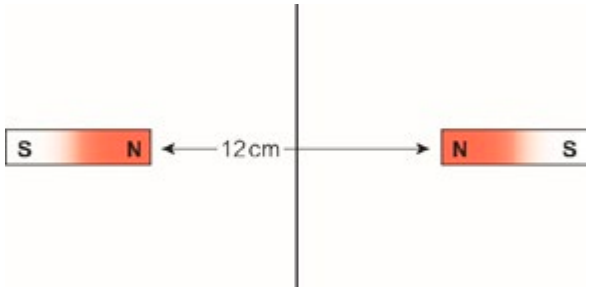
**1** Distance is always the same.

**2** Students' accurate construction.

**3** Students' accurate construction.

**4** Circle with radius 5 m.

**5**

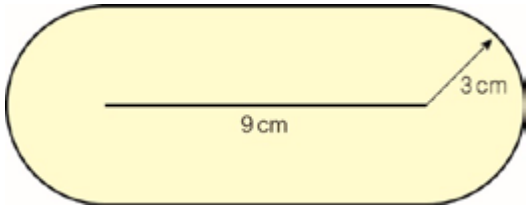



**6** Students' accurate construction.

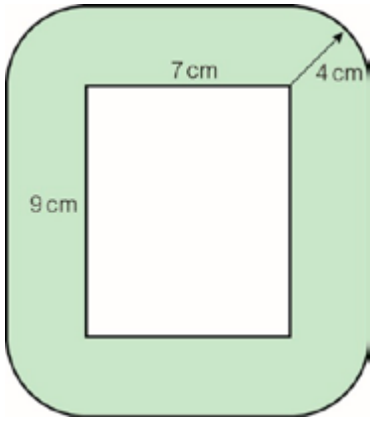
**7** **a** Students' accurate scale drawing

**b** 16.3 m

**8** Not drawn to scale

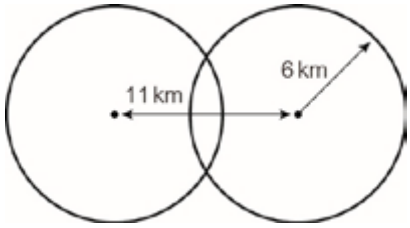



**9** Not drawn to scale



**10** Not drawn to scale

**a**




**b** No

**11** Circle with radius 100 km, centred on transmitter

# Unit 7 Answers

## 7 Check up

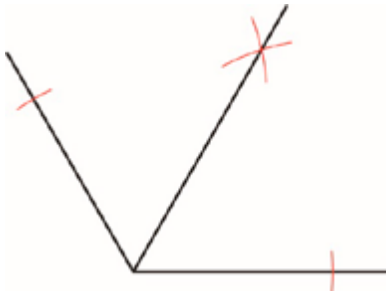
### Accurate drawings

**1** Students' accurate constructions.

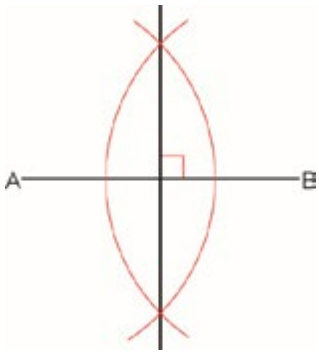
**2** Students' accurate scale drawing.

### Constructions

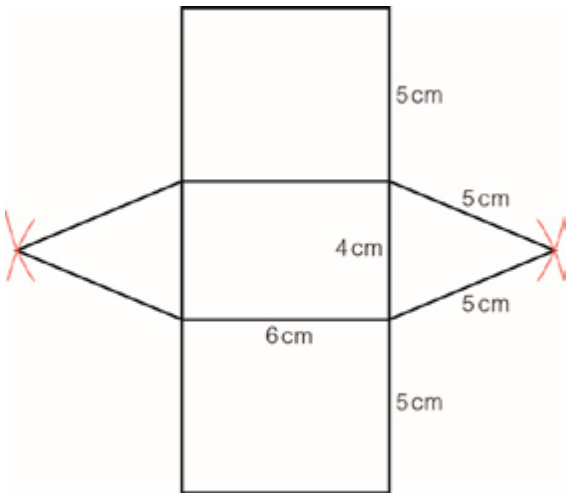
**3 a, b** Not drawn to scale



**4 a, b** Not drawn to scale

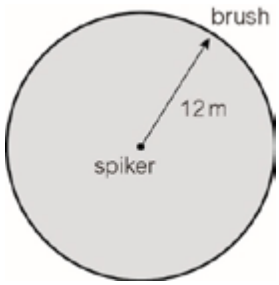



**5** Not drawn to scale

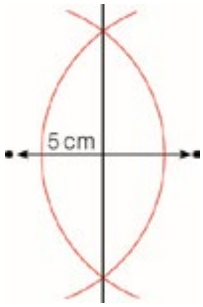


## Loci

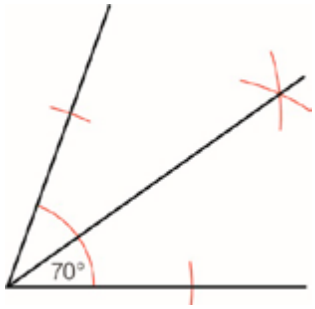
**6 a, b** Not drawn to scale



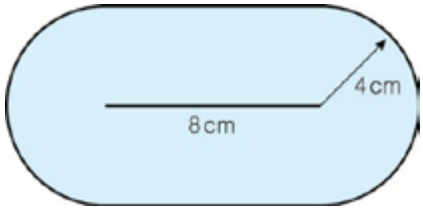

**7** Not drawn to scale




**8**




**9 a, b** Not drawn to scale



# Unit 7 Answers

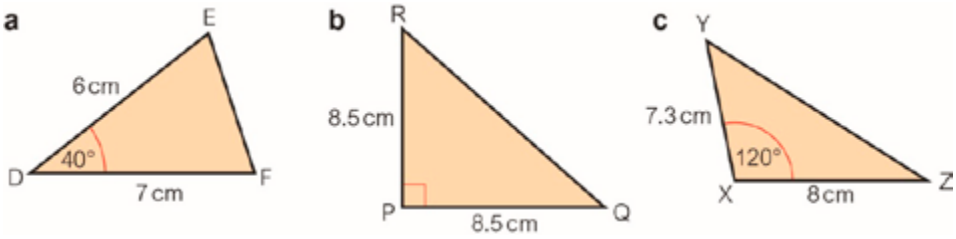
## 7 Strengthen

### Accurate drawings

**1** **a, b** Students' accurate drawing.

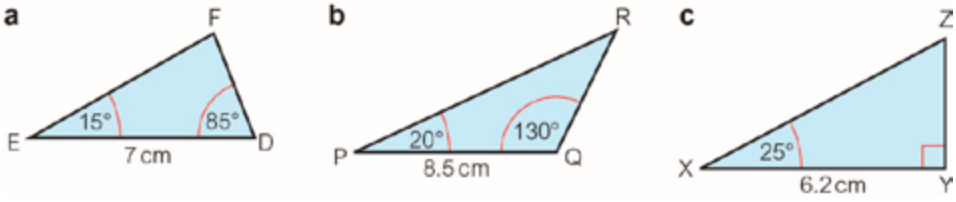
**2** **a, b, c** Students' accurate drawings.

**3** Not drawn to scale




**4** Students' accurate constructions.

**5** Not drawn to scale




**6** **a** **i** 7 cm

**ii** 5 cm

**iii** 6.5 cm

**c** 9.6 cm

**d** 960 m

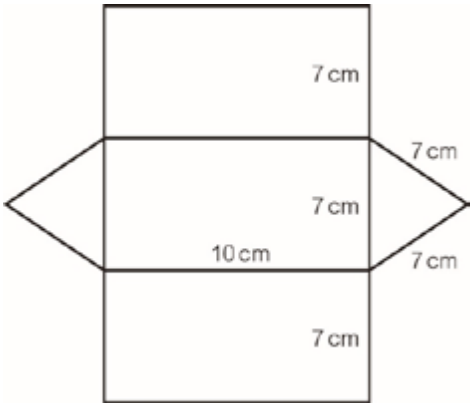
### Constructions

**1** Students' accurate construction of triangle.

**2** Students' accurate construction of triangle.

**3** Students' accurate scale drawing.

**4** Not drawn to scale

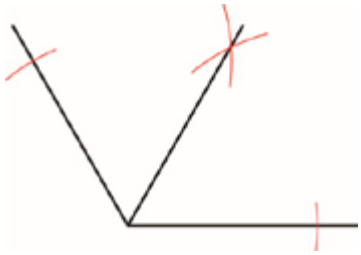



**5** Students' accurate construction of perpendicular bisector.

**6** Students' accurate construction of angle bisector.

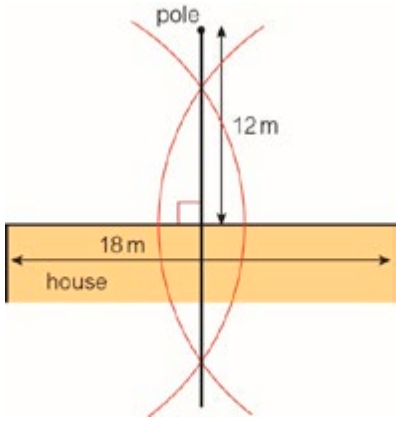
**7** Students' accurate construction of angle bisector.

**8** Not drawn to scale



**9** Students' accurate construction.

**10** Not drawn to scale




**11** Students' accurate construction.

## Loci

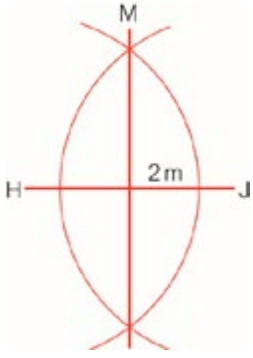
**1** **a, b, c** Points that are all the same distance from a dot make a **circle**.

**2** **a, b** Circle radius 4 cm, mark X centre.

**3** **a, b** Students' accurate construction.

**c** Points that are all the same distance from two dots make the **perpendicular bisector** of the line joining them.

**4** Not drawn to scale




**5** **a, b** Students' accurate construction.

**c** Points that are all the same distance from two lines meeting at an angle make the **angle bisector** of the angle.

**6** **c** Semi-circles.

## Enrichment

**1** A i ; B ii ; C v ; D iv ; E iii

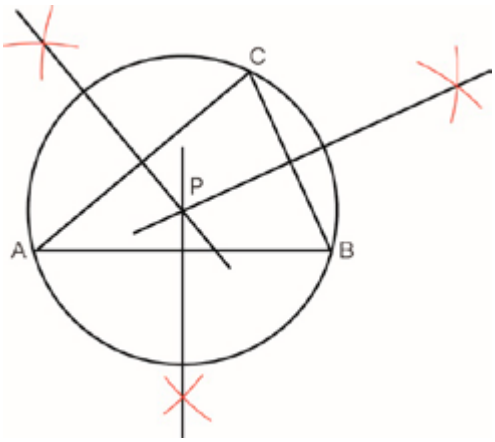
# Unit 7 Answers

## 7 Extend

**1 a** Students' accurate scale drawing.

**b** 16.2 m

**2 a–d**




**c** Perpendicular bisectors of sides pass through the same point P.

**d** Circumscribing circle.

**e** Students' accurate construction of triangle with obtuse angle.

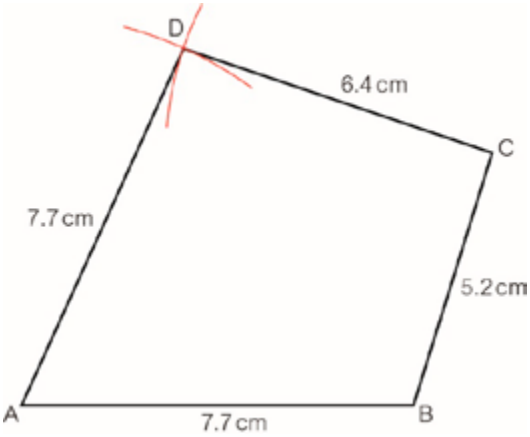
**3 a, b** Students' accurate constructions.

**4 b** Perpendicular is 4.1 cm

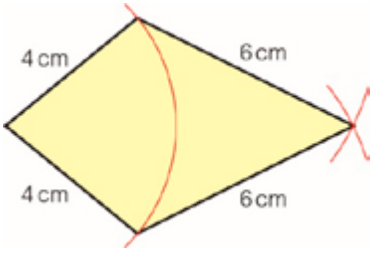
**c** area = 21 $cm^2$

**5 a, b** Students' accurate construction.

**c** Students' own answer. For example:



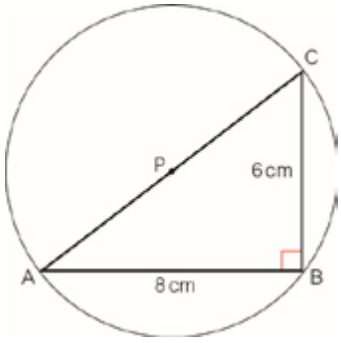

**6 c** Not drawn to scale



**7** **a, b** Not drawn to scale


**b** Yes

**8** **a–d** Not drawn to scale

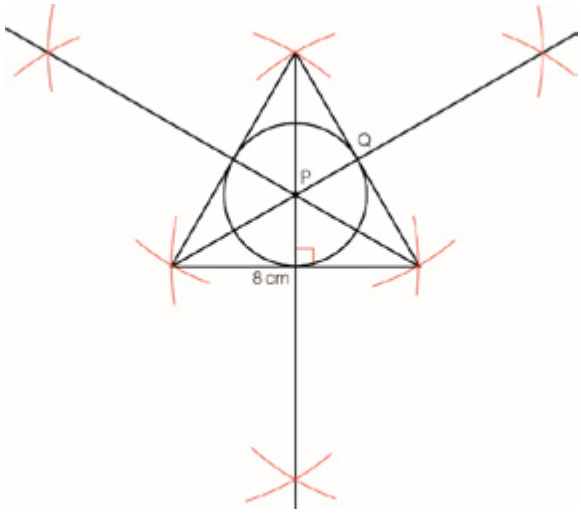



**c** A, B and C are on circumference of circle.

**9** **a** 45°

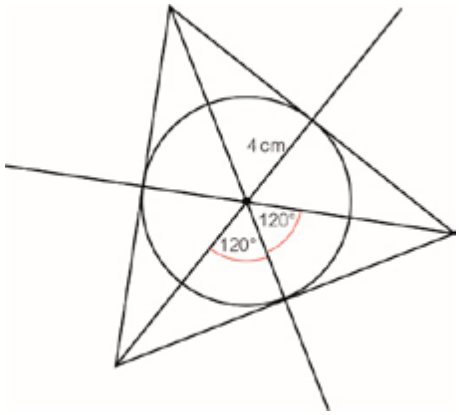
**b, c** Students' accurate drawing of octagon.

**10a–e**

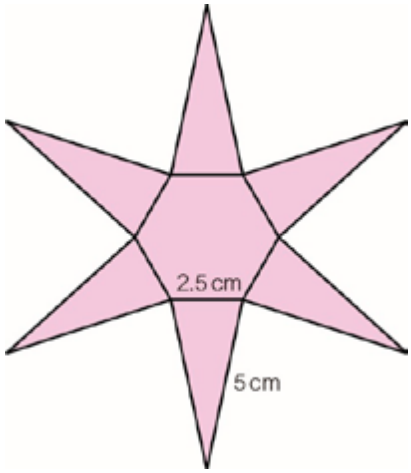



**c** Angle bisectors pass through the same point.

**f**

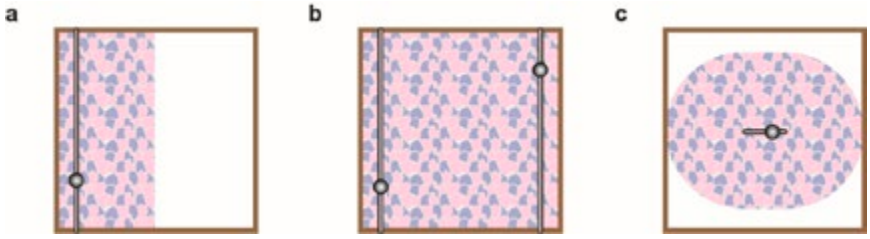



**11** Not drawn to scale




**12a, b** In the shaded intersection area, the pitch is watered by both sprinklers.

**13** Not drawn to scale



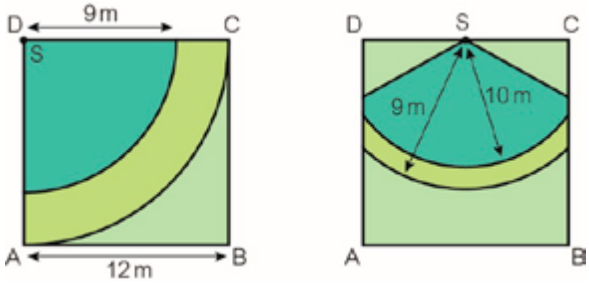

**iii** b

**14a** Students' accurate construction of triangle

**b, c** 12.8 cm

**15 a–c** Not drawn to scale

First position allows cat to cross the garden. Second position prevents cat from crossing garden.




**16** On a sphere of radius 24 375 km with centre at the Earth's centre (assumes Earth is a sphere).

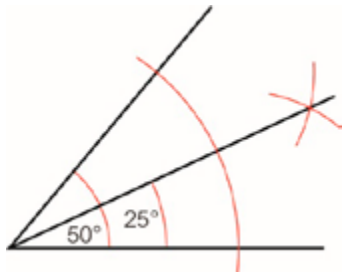
# Unit 7 Answers

## 7 Unit test

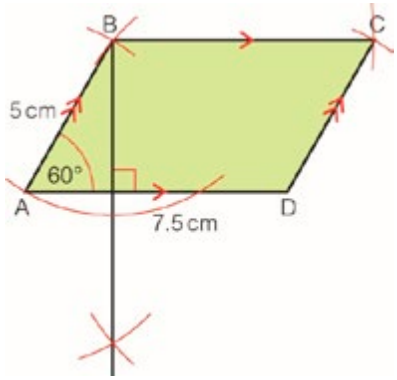
**1 a, b** Students' accurate construction of triangles.

**2** Students' accurate scale drawing.

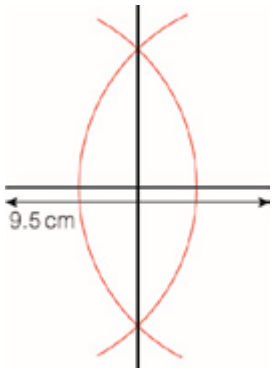
**3 a, b**



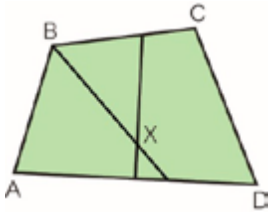

**4 a, b** Not drawn to scale



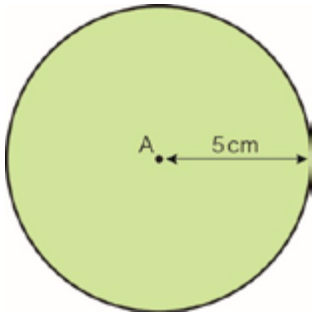

**5** Not drawn to scale



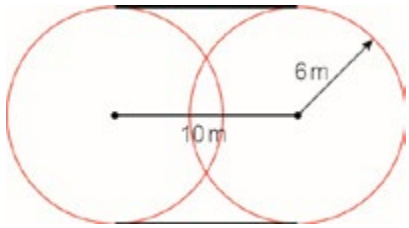

**6 b–d**



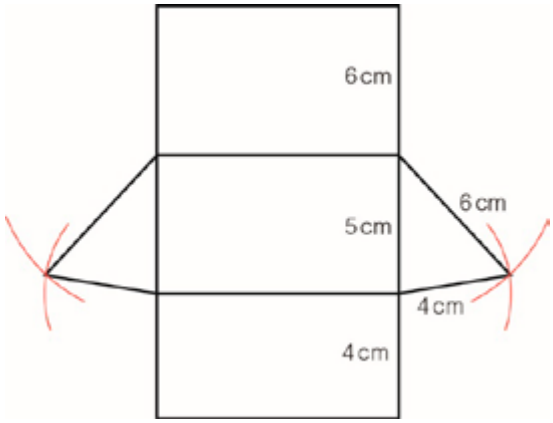
**7**




**8** Not drawn to scale




**9**



# Unit 8 Answers

## Exercise 8.1

**1 a** $\frac{7}{10}$

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

**2** 0.1 = 10% = $\frac{1}{10}$ 0.2 = 20% = $\frac{1}{5}$

0.25 = 25% = $\frac{1}{4}$ 0.4 = 40% = $\frac{4}{10}$

0.5 = 50% = $\frac{1}{2}$

**3 a, b**


**4 a** A 1, 2, 3, 4, 5, 6, 7, 8

B 1, 2, 3, 4, 5

C 1, 2, 3, 4

**b** A 8; B 5; C 4

**5 a** 2, 4, 6

**b** 1, 2, 3, 4

**c** 2, 3, 5

**d** 2, 3, 4, 5, 6

**6 a–d i** $\frac{5}{10}$ or $\frac{1}{2}$ or 0.5 or 50%, even chance **ii** $\frac{3}{10}$ or 0.3 or 30%, unlikely

**iii** $\frac{7}{10}$ or 0.7 or 70%, likely **iv** 0 or 0%, impossible

**7 a** $\frac{26}{52}$ or $\frac{1}{2}$ or 0.5 or 50% **b** $\frac{1}{52}$

**c** $\frac{4}{52}$ or $\frac{1}{13}$ **d** $\frac{12}{52}$ or $\frac{4}{13}$

**8 a** Red

**b** Bag B

**9 a i** $\frac{7}{160}$

**ii** $\frac{17}{160}$

**b** Girl with brown eyes (32 vs 24)

**10a** **i** The number 3 with dice B ($\frac{1}{5}$ vs $\frac{1}{10}$)

**ii** An even number with dice A ($\frac{1}{2}$ vs $\frac{2}{5}$)

**b** Dice B

**11** Kampala

**12** **a** Fair

**b** Unfair because Nora has greater chance.

**c** Fair (if you count ace as 1).

# Unit 8 Answers

## Exercise 8.2

**1 a** $\frac{2}{5}$

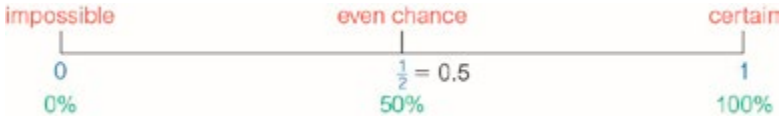
**b** $\frac{7}{10}$

**c** $\frac{11}{12}$

**2 a** 0.3

**b** 67%

**3**




**4 a** 1, 2, 3, 4, 5, 6

**b** $\frac{1}{6}$

**c** 1

**d** The sum of the probabilities of all possible outcomes is 1.

**e** $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \frac{5}{5} = 1$

**5** 88%

**6 a** The Venn diagram shows two events: square numbers and multiples of 3. Intersection is empty. There is no square number that is also a multiple of 3.

**b** 2 and 5 are neither square numbers or a multiple of 3.

**c** $\frac{2}{6}$ or $\frac{1}{3}$

**d** $\frac{2}{6}$ or $\frac{1}{3}$

**e** $\frac{4}{6}$ or $\frac{2}{3}$

**f** True because P(rolling a square number) + P(rolling a multiple of 3) = $\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$ = P(rolling a square number or a multiple of 3)

**7 a** Because the intersection is not empty. 1 is a square number and is less than 4.

**b** $\frac{2}{6}$ or $\frac{1}{3}$

**c** $\frac{3}{6}$ or $\frac{1}{2}$

**d** $\frac{4}{6}$ or $\frac{2}{3}$

**e** False because P(rolling a square number) + P(rolling a number less than 4) = $\frac{2}{6} + \frac{3}{6} = \frac{5}{6}$

whereas P(rolling a square number or a number less than 4) = $\frac{4}{6}$

**8 a** No

**b** Yes

**c** No

**d** Yes

**9 a** 0.3

**b** 0.15

**c** 0.35

**10a** No intersection.

**b** P(square) = $\frac{2}{6}$ or $\frac{1}{3}$, P(prime) = $\frac{3}{6}$ or $\frac{1}{2}$, P(biggest) = $\frac{1}{6}$

**c** $\frac{6}{6} = 1$

**d** 1

**11** 0.3

**12a** $\frac{5}{6}$

**b** $\frac{3}{6}$ or $\frac{1}{2}$

**c** 0.9

**13** 95%

# Unit 8 Answers

## Exercise 8.3

**1 a** 15

**b** 120

**c** 105

**2 a** 37%

**b** 45%

**c** 15.2%

**3 a–c**

| Outcome | Frequency | Relative frequency |
|---|---|---|
| Great improvement | 75 | $\frac{75}{100}$ |
| Slight improvement | 20 | $\frac{20}{100}$ |
| Same or worse | 5 | $\frac{5}{100}$ |
| **Total frequency** | 100 | |

**d** 285

**4 a** 325

**b** 405

**5 a**

| Seats | Frequency | Relative frequency |
|---|---|---|
| 2 | 30 | $\frac{30}{80}$ |
| 3 | 10 | $\frac{10}{80}$ |
| 4 | 25 | $\frac{25}{80}$ |
| 5 | 5 | $\frac{5}{80}$ |
| 6 | 10 | $\frac{10}{80}$ |
| **Total frequency** | 80 | |

**b** $\frac{30}{80}$ or $\frac{3}{8}$ or 0.375 or 37.5%

**c** Incorrect. P(less than 4) = $\frac{40}{80}$ = 0.5, even chance.

**d** 75

**6 a**

| Number of bananas | Frequency | Relative frequency |
|---|---|---|
| 200–219 | 120 | $\frac{120}{1000}$ |
| 220–239 | 160 | $\frac{160}{1000}$ |
| 240–259 | 200 | $\frac{200}{1000}$ |
| 260–279 | 230 | $\frac{230}{1000}$ |
| 280–299 | 170 | $\frac{170}{1000}$ |
| 300–319 | 120 | $\frac{120}{1000}$ |
| **Total frequency** | 1000 | |

**b**

**i** $\frac{120}{1000}$ or 0.12 or 12%

**ii** $\frac{520}{1000}$ or 0.52 or 52%

**c** 2600

**7** 280

**8 a i** $\frac{21}{50}$ or 0.42 or 42%

**ii** $\frac{14}{50}$ or 0.28 or 28%

**b** 56

**9** Sven, because of the larger sample.

**10a** $\frac{11}{20}$

**b** $\frac{45}{80}$ or 56.25%

**c** Odval's because the sample is larger.

**d i** $\frac{56}{100}$ or 0.56 or 56% **ii** 112

# Unit 8 Answers

## Exercise 8.4

**1 a** $\frac{1}{10}$ or 0.1 or 10%

**b** $\frac{2}{10}$ or 0.2 or 20%

**2 a** 6

**b** 15

**3 a** 50

**b i** $\frac{8}{50}$ or 0.16 or 16% **ii** $\frac{42}{50}$ or 0.84 or 84%

**c** 16

**4 a** $\frac{4}{52}$ or $\frac{1}{13}$

**b** $\frac{13}{52}$ or $\frac{1}{4}$

**5** A No

B No

C Yes

**6 a** 5

**b** 25

**c** 24

**7 a** $\frac{1}{4}$ or 0.25 or 25%

**b** 25

**c** Probably fair because frequencies are close to 25. Spin more times to be more confident.

# Unit 8 Answers

## Exercise 8.5

**1 a** $\frac{5}{8}$ **b** $\frac{3}{8}$

**c** 1 **d** $\frac{3}{8}$

**e** $\frac{2}{8} = \frac{1}{4}$

**2 a** H, H H, T T, H T, T

**b** 4

**c i** $\frac{1}{4}$ or 0.25 or 25% **ii** $\frac{1}{2}$ or 0.5 or 50%

**3 a**

| | **H** | **T** |
|---|---|---|
| **1** | H, 1 | T, 1 |
| **2** | H, 2 | T, 2 |
| **3** | H, 3 | T, 3 |
| **4** | H, 4 | T, 4 |
| **5** | H, 5 | T, 5 |
| **6** | H, 6 | T, 6 |

12 possible outcomes

**b i** $\frac{3}{12}$ or $\frac{1}{4}$ or 0.25 or 25%

**ii** $\frac{2}{12}$ or $\frac{1}{6}$

**iii** $\frac{2}{12}$ or $\frac{1}{6}$

**4 a**

| | | First spin | | |
|---|---|---|---|---|
| | | **1** | **2** | **3** |
| **Second spin** | **1** | 2 | 3 | 4 |
| | **2** | 3 | 4 | 5 |
| | **3** | 4 | 5 | 6 |

**b** 9

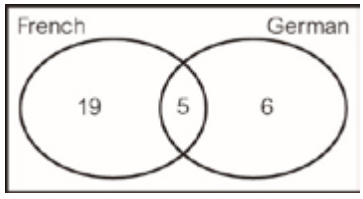
**c** 4

**d i** $\frac{1}{9}$ **ii** $\frac{3}{9}$ or $\frac{1}{3}$

**iii** $\frac{5}{9}$ **iv** $\frac{6}{9}$ or $\frac{2}{3}$

**e** 15

**5 a**




**b i** $\frac{19}{30}$ **ii** $\frac{5}{30} = \frac{1}{6}$ **iii** $\frac{25}{30} = \frac{5}{6}$

**6 a**

| | | First dart | | |
|---|---|---|---|---|
| | | **5** | **20** | **1** |
| **Second dart** | **5** | 10 | 25 | 6 |
| | **20** | 25 | 40 | 21 |
| | **1** | 6 | 21 | 2 |

**b i** $\frac{1}{9}$ **ii** $\frac{2}{9}$ **iii** $\frac{4}{9}$ **iv** $\frac{5}{9}$

**7 a** H, H, H H, H, T H, T, H H, T, T
T, T, T T, T, H T, H, T T, H, H

**b i** $\frac{1}{8}$ **ii** $\frac{3}{8}$ **iii** $\frac{7}{8}$

# Unit 8 Answers

## Exercise 8.6

**1 a** $\frac{1}{5}$

**b** 58%

**c** 0.3

**2 a** $\frac{3}{6} = \frac{1}{2}$ **b** $\frac{8}{12} = \frac{2}{3}$

**c** $\frac{3}{16}$ **d** $\frac{7}{18}$

**3 a** $\frac{1}{2}$ or 0.5 or 50% **b** $\frac{1}{4}$ or 0.25 or 25%

**c i**

| | ♣ | ♠ | ♦ | ♥ |
|---|---|---|---|---|
| **H** | ♣, H | ♠, H | ♦, H | ♥, H |
| **T** | ♣, T | ♠, T | ♦, T | ♥, T |

**ii** $\frac{1}{8}$

**d** Same probability.

**4 a** No

**b** Yes

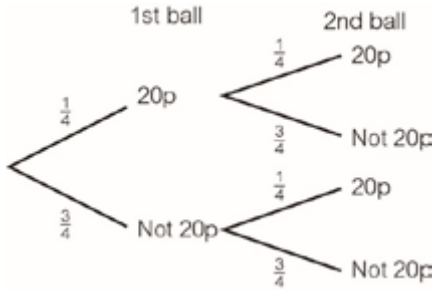
**c** Yes

**5 a** $\frac{1}{36}$

**b** $\frac{1}{12}$

**c** $\frac{1}{12}$

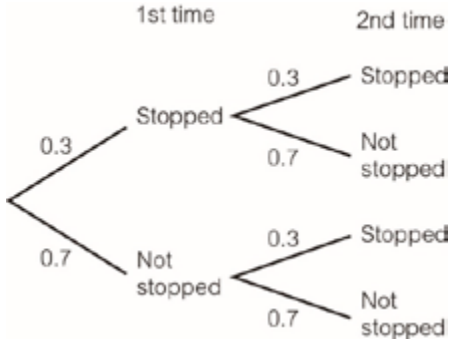
**6 a**




**b i** $\frac{1}{16}$ **ii** $\frac{9}{16}$ **iii** $\frac{3}{16}$ **iv** $\frac{6}{16} = \frac{3}{8}$

**7 a** 0.7

**b**



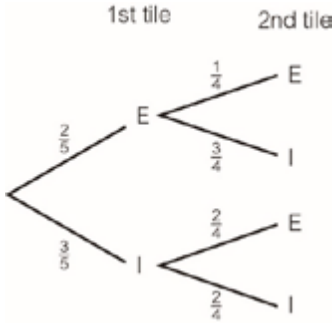

**c i** 0.42 **ii** 0.49

**8 a** $\frac{2}{5}$

**b** 4

**c** $\frac{1}{4}$

**d**




**e i** $\frac{2}{20}$ or $\frac{1}{10}$ or 0.1 or 10% **ii** $\frac{12}{20}$ or 0.6 or 60% **iii** 1

**f** P(E second) = P(EE) + P(IE) = $\frac{2}{20} + \frac{6}{20} = \frac{8}{20} = \frac{2}{5}$

**9** $\frac{9}{12} = \frac{3}{4}$

# Unit 8 Answers

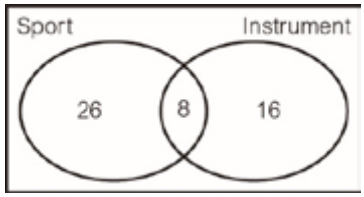
## 8 Check up

### Calculating probability

**1 a** 1, 1, 1, 2, 2, 3, 4, 5

**b i** $\frac{3}{8}$ **ii** $\frac{5}{8}$ **iii** $\frac{7}{8}$

**2 a**




**b** $\frac{16}{50}$ or $\frac{8}{25}$

**3 a** $\frac{5}{8}$

**b** Chocolate

**c** $\frac{7}{8}$

**4 a**

| | | 1st spin | | |
|---|---|---|---|---|
| | | **1** | **2** | **3** |
| **2nd spin** | **1** | 2 | 3 | 4 |
| | **2** | 3 | 4 | 5 |
| | **3** | 4 | 5 | 6 |

**b i** $\frac{2}{9}$ **ii** $\frac{5}{9}$

**c** Yes, because the outcome of the first spin doesn't affect the outcome of the second spin.

**5** No, because Doran has a greater chance of winning ($\frac{5}{10}$ vs $\frac{4}{10}$)

### Estimating probability

**6 a** $\frac{1}{5}$

**b** No; the expected frequency of white is $\frac{1}{5} \times 60 = 12$ times, compared to the experimental frequency of 20.

**7 a i** $\frac{38}{80} = \frac{19}{40}$ **ii** $\frac{12}{80} = \frac{3}{20}$ **iii** $\frac{21}{80}$ **iv** $\frac{13}{80}$

**b** Male aged 25 or over ($\frac{21}{80}$ vs $\frac{18}{80}$)

**c** $\frac{7}{38}$

**8 a**

| Visitor | Frequency | Relative frequency |
|---|---|---|
| Adult | 70 | $\frac{70}{200}$ |
| Child | 90 | $\frac{90}{200}$ |
| Dog | 40 | $\frac{40}{200}$ |
| **Total frequency** | 200 | |

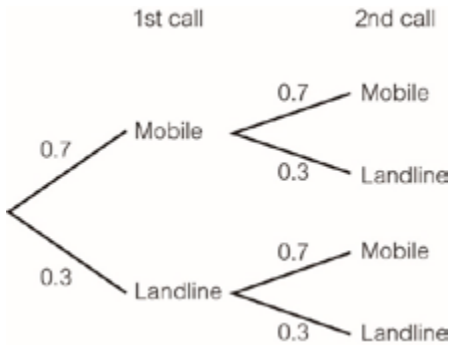
**b** $\frac{90}{200}$ = 0.45

**c** 60

## Tree diagrams

**9 a** 0.3

**b**




**c i** 0.49 **ii** 0.42

# Unit 8 Answers

## 8 Strengthen

### Calculating probability

**1 a** 10

**b** 4

**c** $\frac{4}{10}$ or $\frac{2}{5}$

**d i** $\frac{6}{10}$ or $\frac{3}{5}$ or 0.6 or 60%

**ii** 0

**iii** $\frac{5}{10}$ or $\frac{1}{2}$ or 0.5 or 50%

**iv** $\frac{8}{10}$ or $\frac{4}{5}$ or 0.8 or 80%

**2 a** 17

**b i** $\frac{17}{180}$ **ii** $\frac{49}{180}$

**c** $\frac{20}{92} = \frac{5}{23}$

**d** $\frac{40}{88} = \frac{5}{11}$

**3 a**

| | | | | |
|---|---|---|---|---|
| **Race 1** | **3rd** | 3, 1 | 3, 2 | 3, 3 |
| | **2nd** | 2, 1 | 2, 2 | 2, 3 |
| | **1st** | 1, 1 | 1, 2 | 1, 3 |
| | | **1st** | **2nd** | **3rd** |
| | | **Race 2** | | |

**b** 9

**c** $\frac{1}{9}$

**d** (1, 1), (1, 2), (1, 3), (2, 1), (3, 1)

**e** $\frac{5}{9}$

**4 a**

| | | Spinner 1 | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **1** | **2** | **2** | **3** | **3** |
| **Spinner 2** | **2** | 1, 2 | 1, 2 | 2, 2 | 2, 2 | 3, 2 | 3, 2 |
| | **2** | 1, 2 | 1, 2 | 2, 2 | 2, 2 | 3, 2 | 3, 2 |
| | **4** | 1, 4 | 1, 4 | 2, 4 | 2, 4 | 3, 4 | 3, 4 |
| | **4** | 1, 4 | 1, 4 | 2, 4 | 2, 4 | 3, 4 | 3, 4 |
| | **6** | 1, 6 | 1, 6 | 2, 6 | 2, 6 | 3, 6 | 3, 6 |
| | **6** | 1, 6 | 1, 6 | 2, 6 | 2, 6 | 3, 6 | 3, 6 |

**b i** $\frac{12}{36}$ or $\frac{1}{3}$ **ii** $\frac{12}{36}$ or $\frac{1}{3}$ **iii** $\frac{24}{36}$ or $\frac{2}{3}$

**c** Two even numbers.

**d**

| | | Spinner 1 | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **1** | **2** | **2** | **3** | **3** |
| **Spinner 2** | **2** | 3 | 3 | 4 | 4 | 5 | 5 |
| | **2** | 3 | 3 | 4 | 4 | 5 | 5 |
| | **4** | 5 | 5 | 6 | 6 | 7 | 7 |
| | **4** | 5 | 5 | 6 | 6 | 7 | 7 |
| | **6** | 7 | 7 | 8 | 8 | 9 | 9 |
| | **6** | 7 | 7 | 8 | 8 | 9 | 9 |

**e** 5 and 7

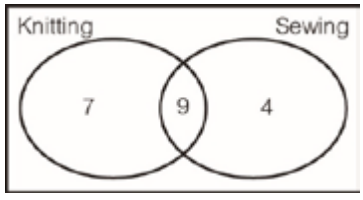
**f** $\frac{32}{36}$

**5 a** B

**b** A

**c** A $\frac{1}{4}$, B $\frac{2}{8}$ or $\frac{1}{4}$, equally likely

**6 a**




**b i** $\frac{9}{20}$ **ii** $\frac{7}{20}$

**7 a** 6

**b i** $\frac{1}{6}$ **ii** $\frac{2}{6} = \frac{1}{3}$ **iii** $\frac{3}{6} = \frac{1}{2}$

**iv** $\frac{5}{6}$ **v** $\frac{5}{6}$ **vi** $\frac{3}{6} = \frac{1}{2}$

**8** $\frac{4}{8} = \frac{1}{2}$

**9** No, because P(H, H) is $\frac{1}{4}$ and P(H and T) is $\frac{1}{2}$

## Estimating probability

**1 a** $\frac{1}{10}$

**b** 20

**2 a** $\frac{6}{20} = \frac{3}{10}$

**b** Rainbowfish $\frac{10}{20} = \frac{1}{2}$ and sunfish $\frac{4}{20} = \frac{1}{5}$

**c i** 18 **ii** 30 **iii** 12

**3 a** 40

**b** No, because the experimental frequency of 24 is much lower than the expected frequency of 40.

## Tree diagrams

**1 a** B

**b** $\frac{2}{52} = \frac{1}{26}$

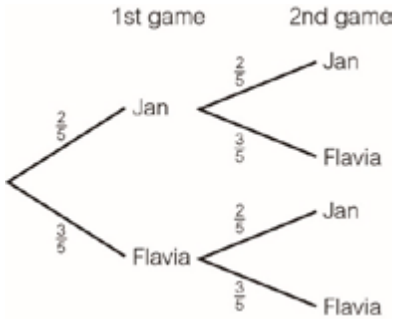
**2 a** 0.04

**b i** 0.16

**ii** 0.16

**iii** 0.32

**3 a**

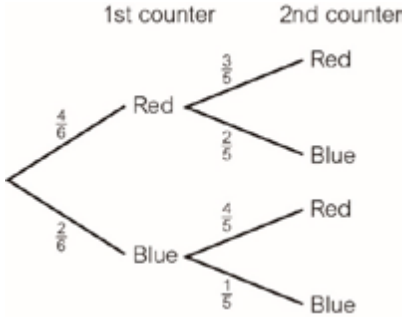



**b i** $\frac{4}{25}$ **ii** $\frac{9}{25}$ **iii** $\frac{12}{25}$

**4 a i** $\frac{4}{6}$ or $\frac{2}{3}$ **ii** $\frac{2}{6}$ or $\frac{1}{3}$

**b** 5

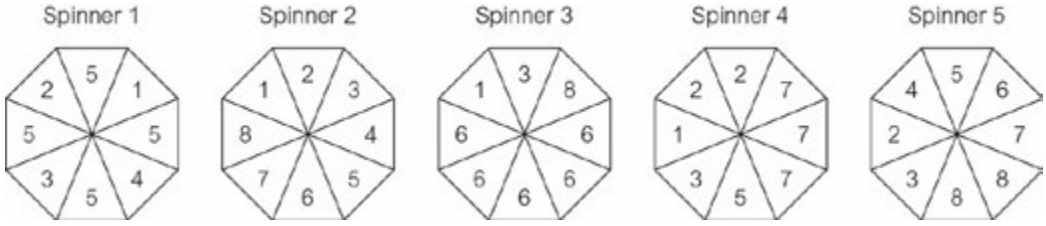
**c**




**d i** $\frac{12}{30}$ or $\frac{2}{5}$ **ii** $\frac{2}{30}$ or $\frac{1}{15}$ **iii** $\frac{16}{30}$ or $\frac{8}{15}$

## Enrichment

**1 a, b** Students' own answer. For example:



# Unit 8 Answers

## 8 Extend

**1 a** The matchbox is more likely to end face up because the base has a larger surface area than the end.

**b** Outcomes are not equally likely, so you cannot use the formula based on equally likely outcomes.

**2** B, A, D, C

**3 a** Captain Cole 24%, Arrows Alan 32%

**b** Arrows Alan (32% vs 24%)

**c** Captain Cole because it is based on more data.

**d** 64

**4** Students' own answer.

**5 a** $\frac{50}{800} = 0.0625 = 6.25\%$

**b** 14 500

**c** It is unlikely to be organic because only 10 out of 800 weigh 1.4 kg or more.

**6** Yes, because 0.3 + 0.8 = 1.1 so the two events cannot be mutually exclusive.

**7 a i** 0.3

**ii** 0.63

**b i** 17.6, so 18 computers

**ii** 26.4, so 26 computers.

**8 a**

| | | Ben | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **1** | **1** | **3** | **4** | **6** |
| **Annabel** | **1** | 1, 1 | 1, 1 | 1, 1 | 3, 1 | 4, 1 | 6, 1 |
| | **2** | 1, 2 | 1, 2 | 1, 2 | 3, 2 | 4, 2 | 6, 2 |
| | **3** | 1, 3 | 1, 3 | 1, 3 | 3, 3 | 4, 3 | 6, 3 |
| | **4** | 1, 4 | 1, 4 | 1, 4 | 3, 4 | 4, 4 | 6, 4 |

**b** Ben wins 9 outcomes, Annabel wins 10 outcomes, so the game is not fair.

**c** Ben 28 (28.4), Annabel 32 (31.6)

**9 a, b**

| Colour | Probability | Prize | Expected number of wins in 200 games | Expected prizes in 200 games |
|---|---|---|---|---|
| red | 0.2 | 50p | 40 | £20 |
| blue | 0.5 | 20p | 100 | £20 |
| yellow | 0.3 | 0p | 60 | £0 |

**c** £40 ÷ 200 = 20p so they should charge more than 20p.

**10a i** 1 **ii** 13

**b** 20

**c** $\frac{6}{20}$ or $\frac{3}{10}$ or 0.3 or 30%

**11** Students' own answer.

**12a i** 0.4

**ii** 0.3

**b** Red 24, blue 48, green 12, black 36

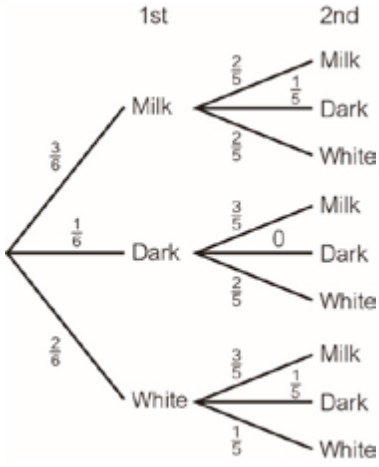
**13** $\frac{4}{9}$

**14a i** $\frac{12}{50}$ or 0.24 or 24% **ii** $\frac{13}{50}$ or 0.26 or 26%

**b** 49.98 = 50 days

**c** $\frac{49}{2500}$ or 0.0196

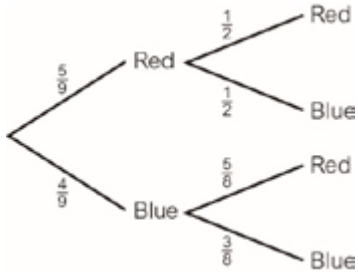
**15**




**a** $\frac{2}{30}$ or $\frac{1}{15}$ **b** $\frac{24}{30}$ or $\frac{8}{10}$ or 0.8 or 80%

**16a** No because P(first counter is blue) = $\frac{4}{9}$ and P(second counter is blue) = $\frac{1}{2}$

**b**



**17a** $(\frac{20}{38})^3 = \frac{8000}{54872}$

**b** P(W, W, L or W, L, W or L, W, W) = $\frac{12000}{54872}$

P(W, W, D or W, D, W or D, W, W) = $\frac{9600}{54872}$

So P(winning two of next three games) = $\frac{21600}{54872}$

# Unit 8 Answers

## 8 Unit test

**1 a** $\frac{1}{6}$

**b** $\frac{2}{6}$ or $\frac{1}{3}$

**c** $\frac{3}{6}$ or $\frac{1}{2}$

**2** 20

**3 a**

| Use | Frequency | Relative frequency |
|---|---|---|
| **Discarded** | 50 | $\frac{50}{1000}$ |
| **Food products** | 250 | $\frac{250}{1000}$ |
| **Small** | 200 | $\frac{200}{1000}$ |
| **Medium** | 300 | $\frac{300}{1000}$ |
| **Large** | 200 | $\frac{200}{1000}$ |
| **Total frequency** | 1000 | |

**b** $\frac{700}{1000}$ or 0.7 or 70%

**c** 1000

**4 a** $\frac{5}{10}$ or $\frac{1}{2}$ or 0.5 or 50%

**b** $\frac{3}{5}$ or 0.6 or 60%

**c** Erica because 60% is greater than 50%

**5 a** (red, red), (red, red), (red, red), (red, red), (red, blue), (red, blue), (blue, red), (blue, red), (blue, blue)

**b** P(A) = $\frac{4}{9}$ P(B) = $\frac{5}{9}$

**c** No because event B includes the outcomes of event A.

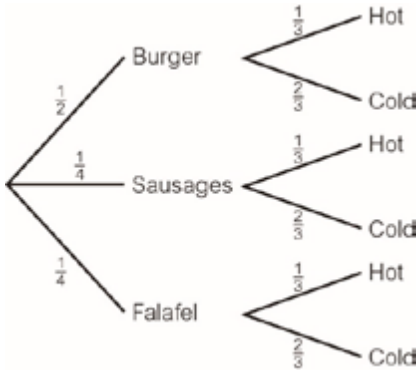
**6** Player A wins with 6 outcomes, and player B wins with 7 outcomes. So the game is not fair. Player B is more likely to win.

**7 a i** P(purple) = 0.4

**ii** P(pink) = 0.1

**b** 6 white, 8 purple, 4 yellow, 2 pink

**8 a**




**b i** $\frac{2}{6}$ or $\frac{1}{3}$ **ii** $\frac{2}{12}$ or $\frac{1}{6}$

# Unit 9 Answers

## Exercise 9.1

**1** **a** 200 cm

**b** 6.2 m

**c** 1.35 km

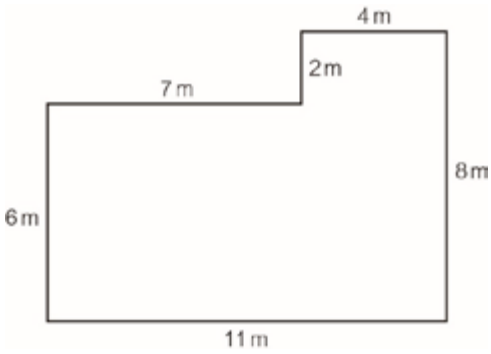
**2** **a** 25 cm

**b** 30 cm

**c** 75 cm

**d** 22.5 cm

**3**




**4** **a** 1800 m

**b** 1440 m

**c** 5400 m

**d** 720 m

**5** **a** 20 cm

**b** 300 cm

**c** 45 cm

**d** 50 cm

**e** 250 cm

**f** 450 cm

**6** **a** **i** 250 m

**ii** 150 m

**iii** 100 m

**b** 6 minutes

**7** **a** 1 cm on the map is 200 km in real life.

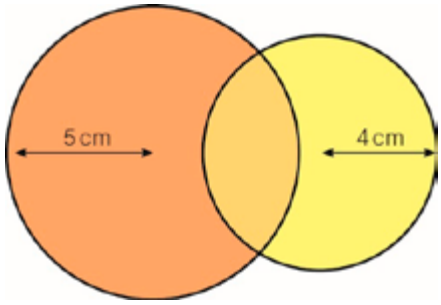
**b** **i** 300 km

**ii** 540 km

**iii** 900 km

**8** Angle is 78°

**9**



# Unit 9 Answers

## Exercise 9.2

**1** Angles accurately drawn.

**2** **a** a = 323°

**b** b = 98°

**c** c, d = 70°

**3** **a** 120 km

**b** 6 cm

**4** **a** 090°

**b** 180°

**c** 270°

**d** 135°

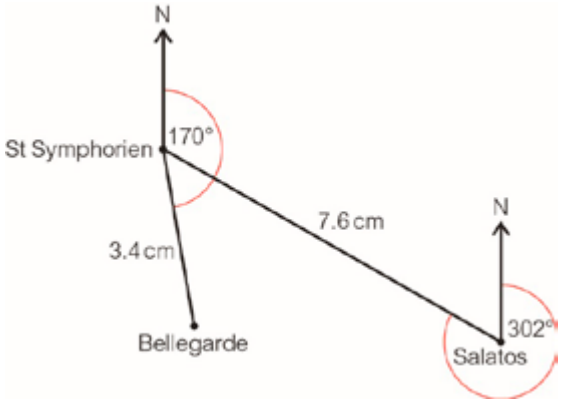
**e** 225°

**f** 315°

**5** **a** 115°

**b** 295°

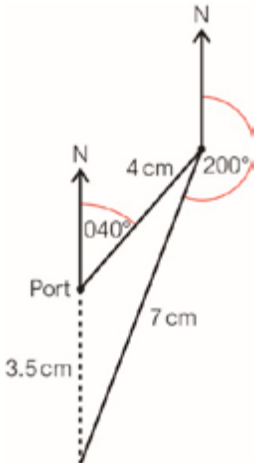
**6**




**7** **a**

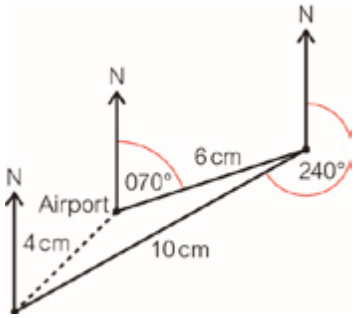

**b** Bearing 095°, distance 104 km

**8 a**




**b** 7 km

**9 a**




**b** 40 miles **c** 050°

**10a** 300°

**b** 060°

**c** 140°

# Unit 9 Answers

## Exercise 9.3

**1 a** 250 m

**b** 400 m

**c** 1 km

**d** 1.5 km

**2 a** 1 : 5

**b** 1 : 3

**c** 1 : 15

**d** 1 : 10

**3 a** 300

**b** 150

**c** 1000

**d** 1500

**4 a** 800 m

**b** 1200 m

**c** 900 m

**d** 100 m

**5** A iv

B i

C iii

D ii

**6 a i** 1.7 cm

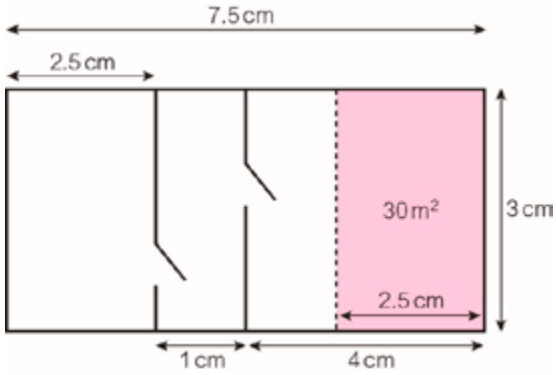
**ii** 8.5 km

**6 b i** 12.5 km

**ii** 5 km

**iii** 15.5 km

**7 a, b**




**c** 18 $m^2$

**8 a** 1: 100

**b** 1 : 500 000

**c** 1: 20 000

**d** 1: 75 000

**9 a i** 400 m

**ii** 2 km

**iii** 10 km

**b i** 100 cm

**ii** 20 cm

**iii** 4 cm

# Unit 9 Answers

## Exercise 9.4

**1 a** 2

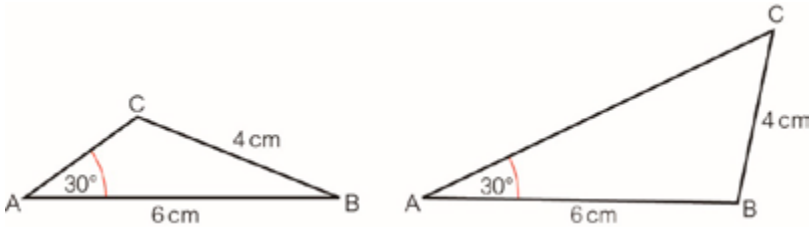
**b** $\frac{1}{2}$

**2 a** a = c and b = d (vertically opposite).

**b** a = c and b = d (alternate angles).

**3** A and C, B and E are congruent.

**4**




**5 a** SAS

**b** SSS

**c** ASA

**6** DEF congruent – SSS

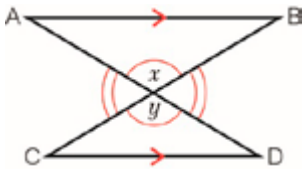
HGI congruent – SAS

JKL not congruent because the 93° angle is adjacent to the 4.2 cm dimension, not opposite to it.

**7** Yes – because SAS

**8 a** $x = y$ (vertically opposite angles)

**b**




**c** Angle AEB = Angle CED (vertically opposite)

Angle BAE = Angle EDC (alternate angles)

Angle ABE = Angle ECD (alternate angles)

AB = CD

As all angles are the same and one side is equal , the two triangles are congruent.

**9** Angle BAC = 85° which is equal to angle EDF

Angle EFD = 30° which is equal to angle BCA

As all angles are the same the triangles are similar

**10** 12 cm

**11a** a = 4.5, b = 2

**b** c = 2.5 cm, d = 2.4 cm

**12** A and C are similar.

# Unit 9 Answers

## Exercise 9.5

**1** No, they are not similar.

**2** $x$ = 5 cm

**3** **a** Vertically opposite

**b** d is equal to b – alternate angles

**c** c is equal to f – alternate angles

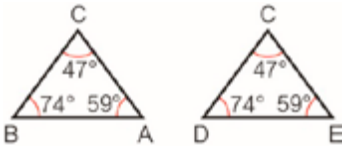
**4** **a** Angle DCE = 47° – vertically opposite

Angle CDE = 74° – alternate angles

Angle CED = 59° – alternate angles

**b** As all angles are the same the triangles ABC and CDE are similar.

**c**




**5** **a** Angle MPN = Angle QPR – vertically opposite

Angle NMP = Angle PRQ – alternate angles

Angle MNP = Angle PQR – alternate angles

As all angles are the same the two triangles are similar.

**b** 6 cm

**6** **a** Angle AEC = Angle BDC

Angle CAE = Angle CBD = 90°

Angle DCB = Angle ECA

As the triangles have the same angles they are similar.

**b** 6 cm

**c** 4 cm

**7** **a** Angle ACB = Angle AED

Angle ABC = Angle ADC

Angle BAC = Angle DAE = 36°

As the triangles have the same angles they are similar.

**b** 14 cm

**c** 7 cm

**d** 3 cm

**8** 320 m

# Unit 9 Answers

## 9 Check Up

### Maps and scales

**1** 48 cm

**2** 0.5 cm

**3** **a** 250 m

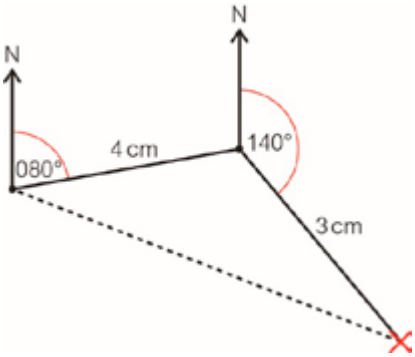
**b** 8 cm

**4** 1000 m

### Bearings

**5** 020°

**6** **a**




**b** 18 km **c** 285°

### Congruence and similarity

**7** A and C as they are SAS

**8** **b** $x$ = 8 cm

**c** $y$ = 6 cm

**9** Angle AED = Angle ACB = 90°

Angle ABC = Angle ADE

Angle A is the same in both

AAA so are similar

**10a** Angle DAE = Angle BAC, vertically opposite

Angle DEA = Angle ACB, alternate angles

Angle EDA = Angle ABC, alternate angles

AAA, so are similar

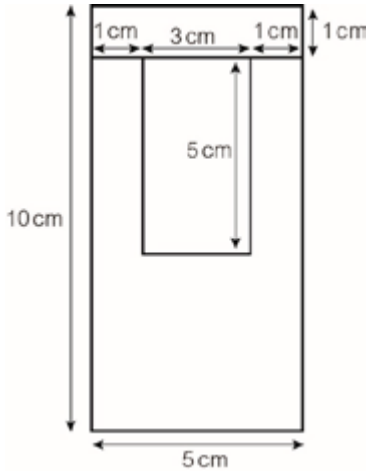
**b** $a$ = 10 $b$ = 3

# Unit 9 Answers

## 9 Strengthen

### Maps and Scales

**1**




**2** **a** 2 cm

**b** 6 cm

**c** 20 cm

**d** 40 cm

**e** 20 cm

**3** **a** 20 m

**b** 4 m

**c** 4 m by 8 m

**4** **a** 100 cm

**b** 200 cm

**c** 460 cm

**d** 840 cm

**5** **a** 1.4 km

**b** 1.5 km

**c** 2.15 km

**6** **a** 1 : 100

**b** 1 : 20

**c** 1 : 100

**d** 1 : 300

**e** 1 : 100 000

### Bearings

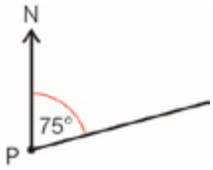
**1** **a** 048°

**b** 075°

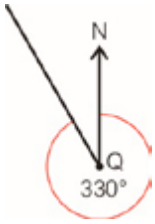
**c** 170°

**d** 240°

**2**




**3**



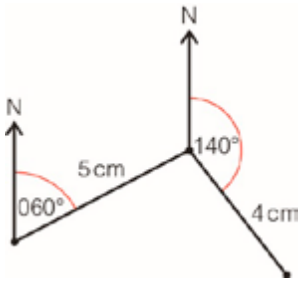

**4** **a** 285°

**b** 000°

**c** 075°

**d** 105°

**5** **a, b**




**c** **i** 14 km **ii** 320°

## Congruence and Similarity

**1** B

**2** **b** **i** congruent ASA

**ii** similar AAA

**iii** congruent SAS

**3** **a**

| P | Q |
|---|---|
| 5 | 10 |
| 12 | $x$ |
| 13 | $y$ |

**b** 2

**c** $x = 24$, $y = 26$

**4** 6

**5** **a** = 16 cm

**b** = 3 cm

**c** = 9 cm

**d** = 6 cm

**6** C and E

**7 a i** Alternate angles

**ii** Alternate angles

**iii** Vertically opposite angles

**b** They are similar

**c** $x$ = 4 cm, $y$ = 10 cm

**8 a** BC and DE are parallel because both are at right angles to AE

**b** Angle ABC = angle ADE because triangles ABC and ADE are similar (AAA)

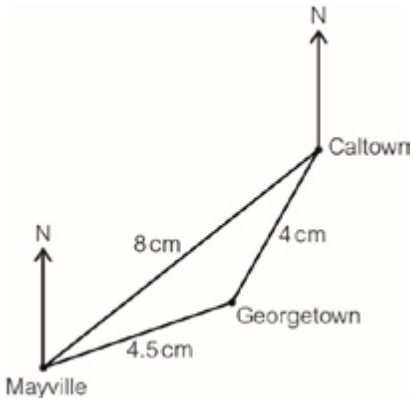
**c** 2

**d** 20 cm

# Unit 9 Answers

## 9 Extend

**1 a**, **b**




**c** 4.5 km

**2 a** 1: 50 000

**b** 1 : 500 000

**c** 3 : 200 000

**3 a i** 135 km

**ii** 75 km

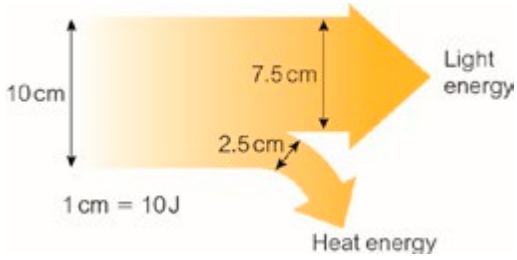
**iii** 145 km

**b** 3 hours 40 minutes

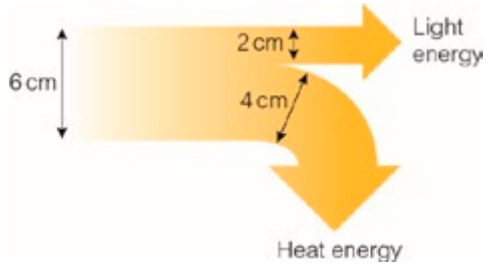
**c** Roads aren't straight, so the actual distance travelled will be greater.

**4 a i** 40 J **ii** 30 J **iii** 10 J

**b i**




**ii**




**5 a** 1 cm to 20 m

**b** 8000 $m^2$

**c** 600 $m^2$

**d** £40 500

**6 a** Students' own accurate scale drawing made using an appropriate scale.

**b** 40 $m^2$

**c** 160

**d** £800

**7 a** 105°

**b** 105°

**c** 35°

**d** All angles are the same and all sides are the same.

**8 a** 8 cm

**b** 4.5 cm

**c** 85°

**d** 5 cm

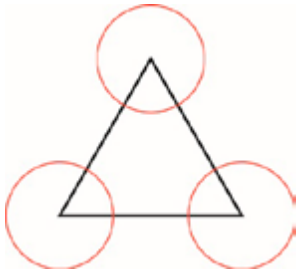
**e** 45°

**9 a** 5 cm

**b** 15 cm

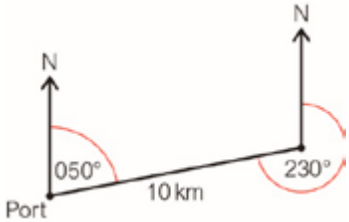
**10** Memmingen

**11a**

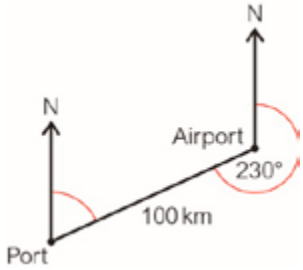


**b** No

**12a** Bearing back to port is 230°




**b** Bearing back to airport is 050°




**13** $x$ = 6 cm, $y$ = 12.5 cm

**14** Angle B = Angle D

Angle BAC = Angle ACD – alternate angles

Angle DAC = Angle BCA – alternate angles

Side AD = Side BC

AAA and a side the same – must be congruent

**15** OC is a side of both triangles

Side OB = OA as both radii so triangle ABO is an isosceles triangle.

Angle OBC = Angle OAC

Angle BOC = Angle AOC

As all angles are the same and two pairs of sides are the same, must be congruent.

# Unit 9 Answers

## 9 Unit Test

**1 a** 095°

**b** 150°

**c** Kalimnos

**2 a** 100 m

**b** 250 m

**c** 12.5 m

**3 a** 3 cm

**b** 8 cm

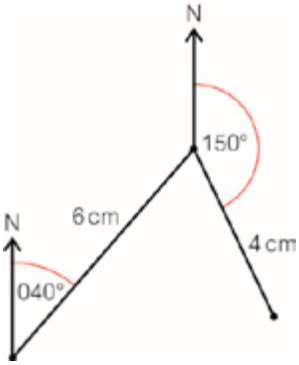
**c** 20 cm

**d** 0.2 cm

**4 a** 1000 m

**b** 325 m

**5 a**




**b** 29 km **c** 260°

**6 a** a = 80°, b = 6 cm, c = 8cm, d = 80°, e = 6 cm, f = 35°, g = 80°

**b** 6 cm side is between angles of 35° and 80° in A, B and C.

**7 a** a = 5 cm

**b** b = 12.8 cm

**c** c = 12.5 cm

**8 a** a = 7 cm

**b** b = 9 cm, c = 12 cm

**c** d = 15 cm, e = 24 cm, f = 21 cm

**9 a** Angle ACE is the same in both triangles

Angle BDC = Angle AEC – corresponding angles

Angle DBC = Angle EAC – corresponding angles

As the angles are the same the triangles are similar.

**b** $6\frac{2}{3}$

**c** 5

**10** Triangle SXT and triangle VXU are congruent.

Angle SXT = Angle VXU – vertically opposite

Angle TSU = Angle SUV alternate angles

Angle STV = Angle TVU alternate angles

Side ST = VU

AAA and side equal, so must be congruent.

Triangle SXV and triangle TXU are congruent.

Angle SXV = Angle TXU – vertically opposite

Angle VSU = Angle SUT – alternate angles

Angle VTU = Angle SVT – alternate angles

Side SV = side TU

AAA and side equal so must be congruent.

# Unit 10 Answers

## Exercise 10.1

**1 a** $y = 5$

**b** $y = -3$

**c** $y = -9$

**2** A $y = 3$

B $x = 2$

C $y = -2$

D $x = -1.5$

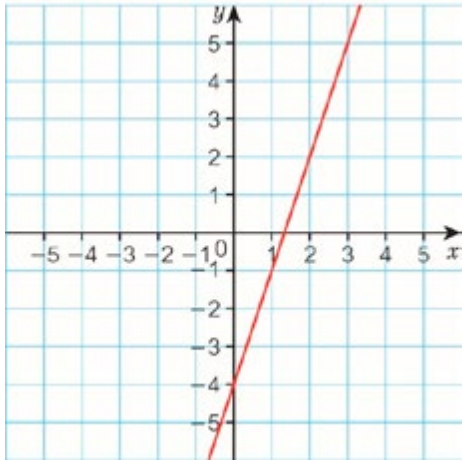
E $y = x$

F $y = -x$

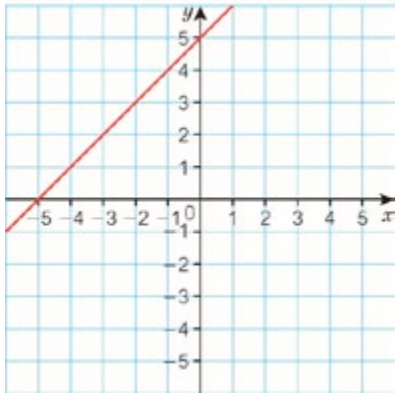
**3 a**

| $x$ | −2 | −1 | 0 | 1 | 2 |
|---|---|---|---|---|---|
| $y$ | −10 | −7 | −4 | −1 | 2 |

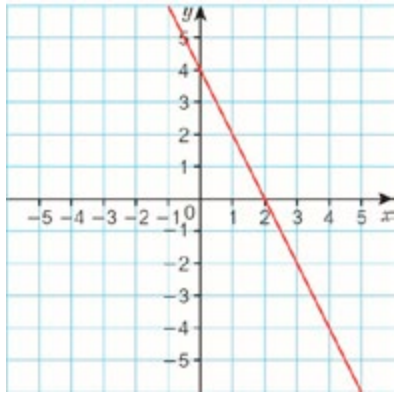
**b**



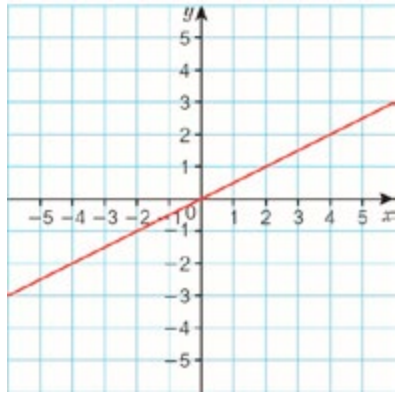
**4 a**



**b**



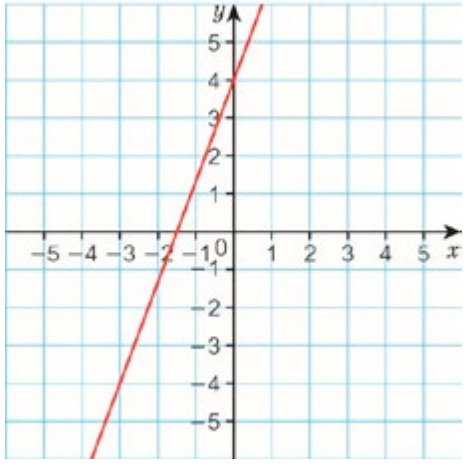
**c**



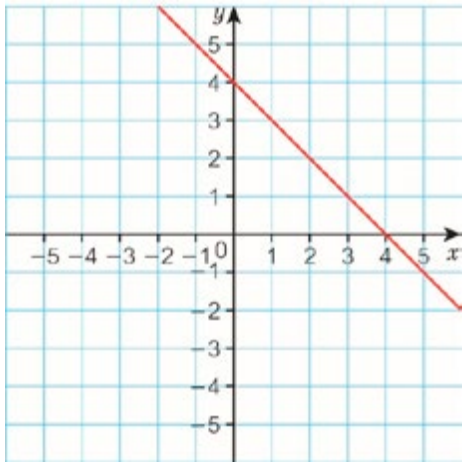
**5 a** $y = 4$

**b** $x = -\frac{12}{8} = -\frac{3}{2} = -1.5$

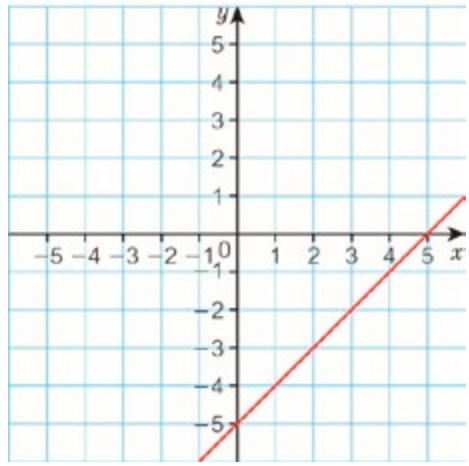
**c** $(0, 4)$, $(-\frac{3}{2}, 0)$



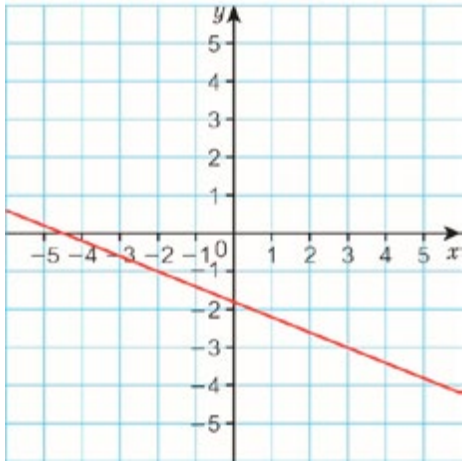
**6 a**



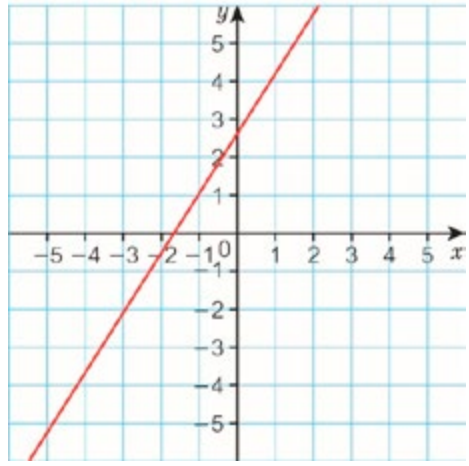

**b**




**c**




**d**




**7 a** −4 **b** 1 **c** −3
**d** 1 **e** −4 **f** −5
**g** 0 **h** 0 **i** 1
**j** −4

**8** A $y = -2x + 4$ B $y = 3x - 1$
C $y = -x$ D $y = 3x + 1$
E $y = -4x + 2$ F $y = -\frac{1}{2}x - 2$

**9** Any of the form $y = mx + 5$

**10a**


**b** £1750

# Unit 10 Answers

## Exercise 10.2

**1** **a** (0, 4)

**b** (0, 1)

**c** (0, −5)

**d** (0, −2)

**2** B

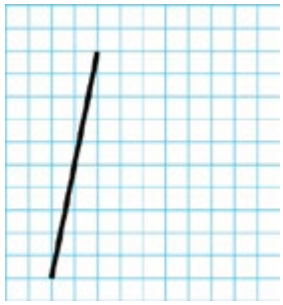
**3** A 2 B $\frac{1}{2}$

C −2 D −3

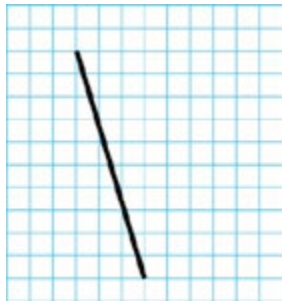
E 1 F 2

**4** 3

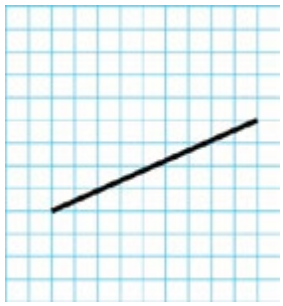
**5** **a**



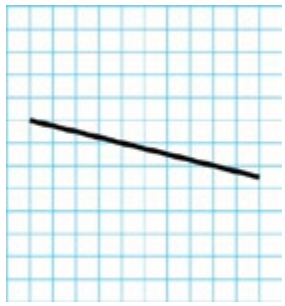
**b**



**c**



**d**



**6** **a** 0.5 or $\frac{1}{2}$

**b** $-\frac{1}{3}$

**7**

| Equation of line | Gradient | Y−intercept |
|---|---|---|
| $y = 2x - 5$ | 2 | −5 |
| $y = x + 1$ | 1 | 1 |
| $y = 3x + 4$ | 3 | 4 |
| $y = -x + 2$ | −1 | 2 |
| $y = -2x - 7$ | −2 | −7 |
| $y = \frac{1}{3}x + 1$ | $\frac{1}{3}$ | 1 |

Students' own graphs, with appropriate axes.

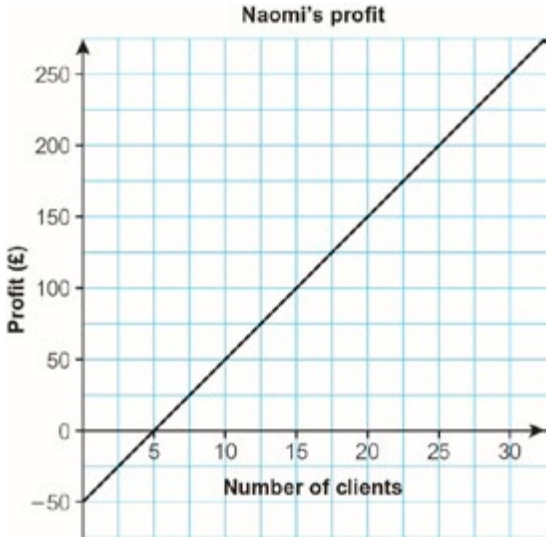
**8 a** (0, 10)

**b** £10

**c** 0.5

**d** £0.50

**9 a**



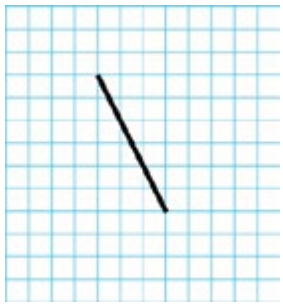

**b i** −£50 **ii** The cost of hiring the room.

**c** £10

# Unit 10 Answers

## Exercise 10.3

**1**



**2 a i** 3

**ii** −12

**iii** −6

**b i** 4

**ii** 1

**iii** 2

**3 a** Gradient 2; $y$−intercept −5

**b** Gradient 3; $y$−intercept 0

**c** Gradient $-\frac{1}{2}$; $y$−intercept 4

**d** Gradient −1; $y$−intercept 0

**4 a** 2

**b** 2

**c** $y = 2x + 2$

**5** A $y = 2x + 1$ B $y = \frac{1}{2}x - 1$

C $y = -2x + 3$ D $y = x - 3$

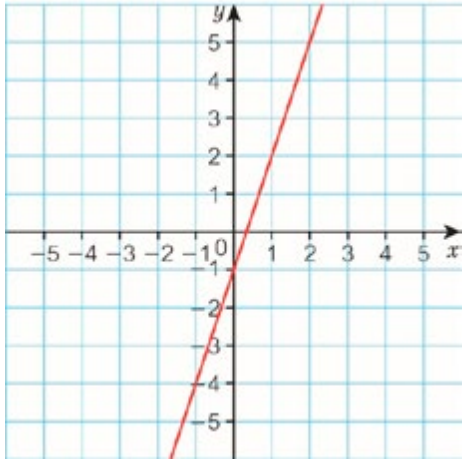
E $y = 3x$ F $y = -2x$

**6** C, A, B

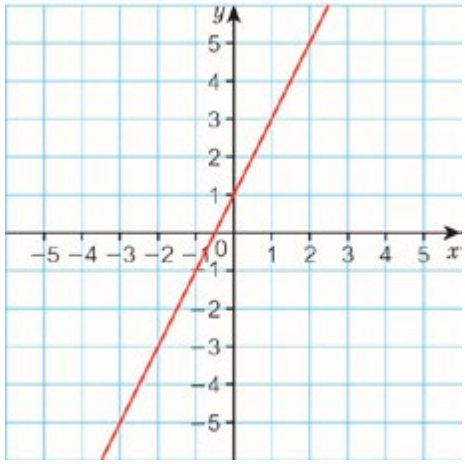
**7 a** −1

**b** 3

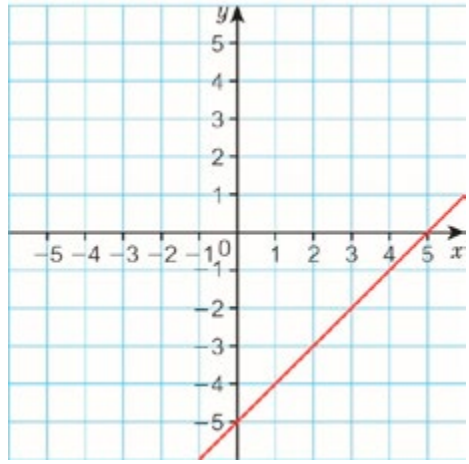
**c**



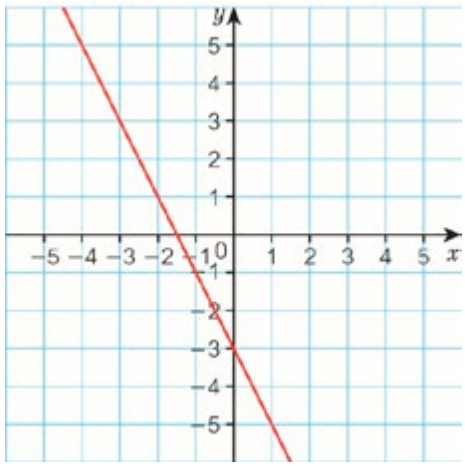

**8 a**



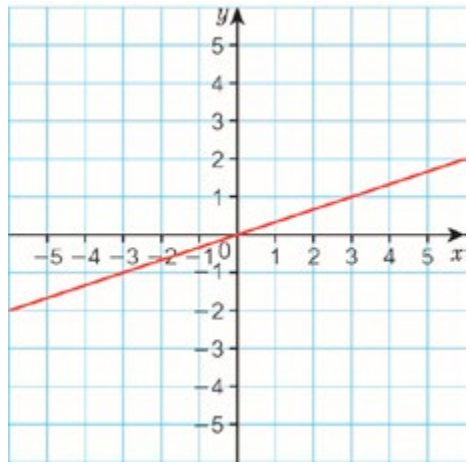

**b**




**c**




**d**




**9** a, d

**10a** £500

**b** £300

**c** $y = 300x + 500$

**11a** (3, 11)

**b** No

**12a** C

**b** A, C, G

**c** None

**d** A, D, F

# Unit 10 Answers

## Exercise 10.4

**1** A, B perpendicular; C, D parallel

**2** Gradient 4; $y$−intercept −7

**3** They are equal.

**4** A and E

**5** **a** $y = 3x + c$

**b** $y = -2x + c$

**c** $y = 3x + 4$

**d** $y = -2x - 5$

**6** **a** $y = 2x + c$

**b** $y = 2x + 3$

**7** $y = 30x + 500$

**8** $y = \frac{1}{2}x + 2$

**9** **a** $y = -\frac{1}{2}x + c$ **b** $y = \frac{1}{3}x + c$

**c** $y = -2x + c$ **d** $y = 2x + c$

**10** $y = 4x - 7$

**11a** $y = \frac{1}{2}x + \frac{1}{2}$

**b** $y = -5x - 4$

# Unit 10 Answers

## Exercise10.5

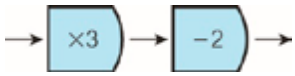
**1** **a** −1

**b** 3

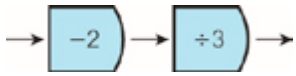
**c** 16

**d** 7

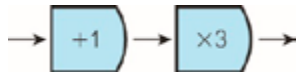
**2** **a**




**b**



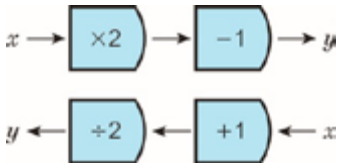

**c**




**3** **a** $x \rightarrow \frac{x-5}{3}$ **b** $x \rightarrow 2(x + 1)$

**c** $x \rightarrow \frac{x}{2} + 3$ **d** $x \rightarrow x - \frac{2}{7}$

**4** **a**




**c** $y = \frac{x+1}{2}$

**5** **a** $y = \frac{x}{3}$ **b** $y = x + 4$ **c** $y = 2x$

**d** $y = x - 5$ **e** $y = -\frac{x}{2}$ **f** $y = -x$

**6** **a** $y = \frac{x-7}{3}$ **b** $y = \frac{x}{2} + 1$ **c** $y = 3(x - 4)$

**d** $y = 3x + 2$ **e** $y = \frac{-x+7}{4}$ **f** $y = -\frac{x}{2} - 5$

**7** $y = \frac{1-x}{2}$

**8** Segments of lines: $y = \frac{-x-5}{3}$ and $y = -2x + 6$

# Unit 10 Answers

## Exercise 10.6

**1** **a** 2.10 pm and 3.00 pm

**b** 1.00 pm to 1.10 pm and 1.50 pm to 2.10 pm.

**c** $13\frac{1}{3}$ miles per hour

**2** The parachute opens at a height of 2000 m: the rate of descent slows and the gradient of the line becomes constant, so the speed of the fall is constant.

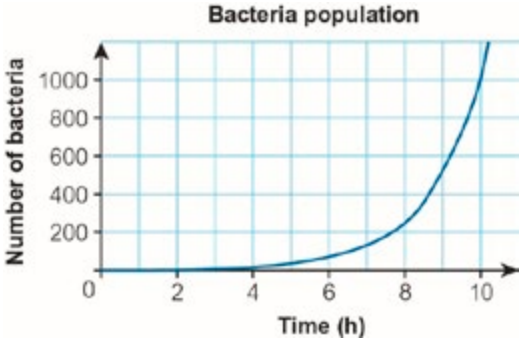
**3** **a** 0 and 1 as the gradient is steeper.

**b** 2 seconds

**c** 24 m

**4** **a** 64

**b–d**




**e** **i** 100 **ii** 375

**5** **a** 75 counts per second

**b** 40 days

**c** 27 days

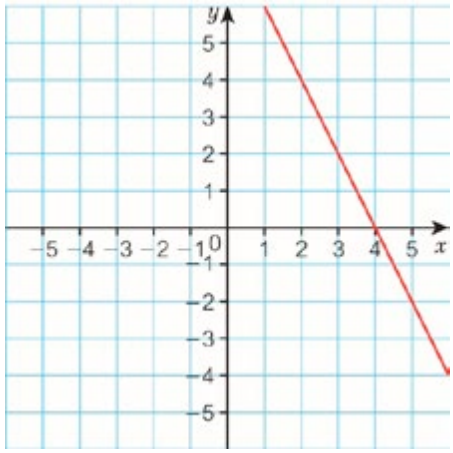
**6** Students' own answer.

# Unit 10 Answers

## 10 Check up

### Linear graphs

**1**




**2** 2

**3** **a** $y$ −intercept −4; gradient 2

**b** $y$ −intercept 0; gradient $\frac{1}{2}$

**4** B

**5** $y = 3x - 2$

**6** **a** A and E
**b** A and D or E and D

**7** $y = -3x + 4$

**8** $y = \frac{1}{2}x - 1$

### Inverse functions

**9** **a** $x \rightarrow \frac{x}{5}$ **b** $x \rightarrow \frac{x+7}{2}$

**c** $y = 3x - 36$ **d** $y = \frac{x}{3} + 5$

**10** A and E, B and F, C and D

### Non−linear graphs

**11a** Between 0 and 1 hours, the gradient is the steepest.

**b** About 4 hours.

# Unit 10 Answers

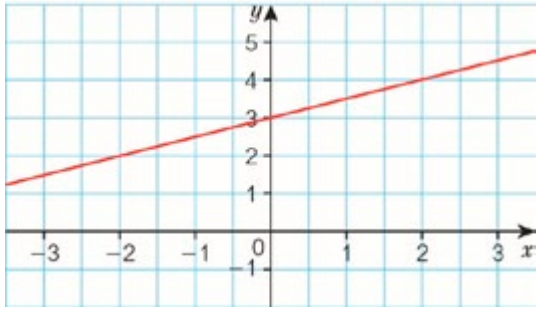
## 10 Strengthen

### Linear graphs

**1 a**

| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $\frac{1}{2}x$ | −1.5 | −1 | −0.5 | 0 | 0.5 | 1 | 1.5 |
| + 3 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 |
| $y$ | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 |

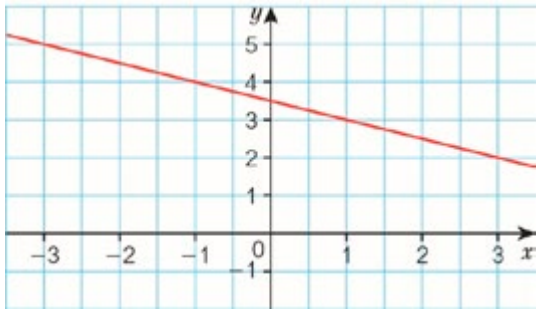
**b**




**2 a**

| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $-x + 7$ | 10 | 9 | 8 | 7 | 6 | 5 | 4 |
| $2y$ | 10 | 9 | 8 | 7 | 6 | 5 | 4 |
| $y$ | 5 | 4.5 | 4 | 3.5 | 3 | 2.5 | 2 |

**b**




**3 a** (0, −7)

**b** (0, −5)

**c** (0, 1)

**d** (0, 7)

**e** (0, −2)

**f** (0, 0)

**4 a** C

**b** 1

**c** A gradient 1; B gradient 2; C gradient 3

**5** Gradient = $\frac{6}{2}$ = 3

**6 a–c** will vary according to point chosen.

**d** 4

**7 a** 1

**b** (3)

**c** $x = 4$

**d** (5, 9)

**8 a** No

**b** (0, 5) and (4, 9)

**9**

| Equation | gradient | y−intercept |
|---|---|---|
| **a** $y = 3x + 1$ | 3 | (0, 1) |
| **b** $y = 2x$ | 2 | (0, 0) |
| **c** $y = x + 5$ | 1 | (0, 5) |
| **d** $y = 2x - 3$ | 2 | (0, −3) |

| Equation | gradient | y−intercept |
|---|---|---|
| **e** $y = 5x - 7$ | 5 | (0, −7) |
| **f** $y = -2x + 4$ | −2 | (0, 4) |
| **g** $y = -5x - 2$ | −5 | (0, −2) |
| **h** $y = -x + 7$ | −1 | (0, 7) |

**10a** Parallel

**b** It is equal

**c** The coefficient of $x$ is the same if the equation is in the form $y = mx + c$.

**d** b and d

**11a** 3

**b** 4

**c** $y = 3x + 4$

**12** $y = -\frac{1}{2}x - 2$

## Inverse functions

**1 a**


$y = x - 7$

**b**


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

**c**


$y = 2x$

**d**


$y = x + 4$

**2** $y = \frac{x-1}{2}$

**3 a** $y = \frac{x+20}{3}$ **b** $y = \frac{x-12}{5}$

**c** $y = 3x - 2$ **d** $y = 10x + 7$

**4** B

## Non-linear graphs

**1 a** £75

**b** £100

**c** £25, except the first hour when she charges £50

**d** £50

**2 a** 13–14 cm

**b** Between 15 and 17 days.

**c** 4 days

## Enrichment

**1** Students' own answers.

**2** C is the odd one out because it has a gradient of 3 whereas all the others have gradient 2.

# Unit 10 Answers

## 10 Extend

**1 a** $y = -x$

**b** Yes

**c** $y = x$

**2 a i** $y = 10 - x$

**ii** $y = 20 - x$

**iii** $y = 8 - x$

**iv** $y = 1 - x$

**b** They are all self-inverses.

**3 a** −2

**b** $y = -2x - 3$

**4 a** $y = 3x + c$

**b** $4 = 3(-2) + c$

**c** $c = 10$

**d** $y = 3x + 10$

**5** $y = -2x + 5$

**6 a** 2

**b** 3

**c** −2

**d** 1

**7** $y = 3x + 6$

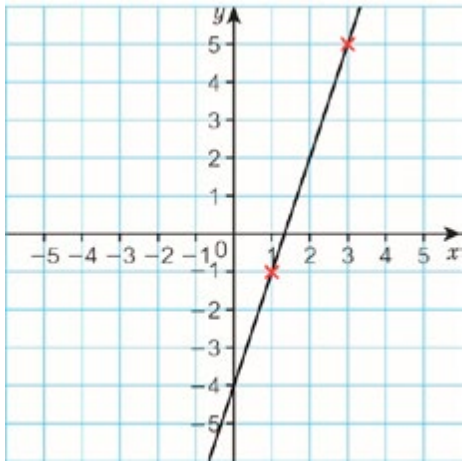
**8** 6

**9** $y = 3x + 9$

**10a** 1 **b** −1 **c** 3

**d** 7 **e** 9 **f** 4

**11a, b**




**c** $y = 3x - 4$

**12a** 3000 rupees

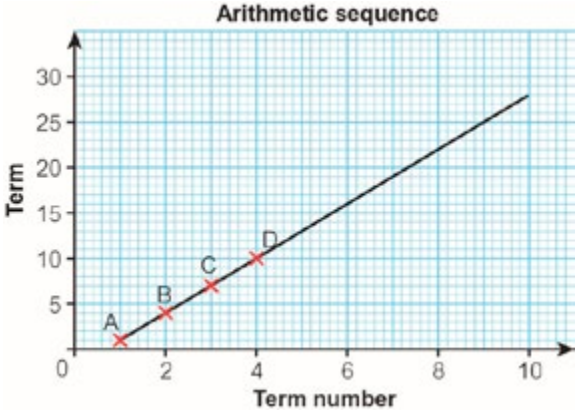
**b** £120

**c** 100

**d** The gradient represents how many rupees you get for every £1

**e** There is a £20 charge by the bank

**13a**




**b** $y = 3x - 2$

**c** $3n - 2$. It is the same as the equation of the line.

**d** 58

**e** No. If you substitute $y = 23$ into the equation of the graph it does not give you a whole number value of $x$.

**14a** $y = 2x + 1$

**b** 21 cm

**15a** 21:00 and 09:00

**b** 6 hours

**c** 2

**d** 16:30 to 19:30 and 04:30 to 07:30

**16** Orange line $y = 2x + 5$; green line $y = -\frac{1}{2}x + 4$; red line $y = -\frac{1}{2}x - 1$

**17a** £1276.28

**b** A

**18a** True

**b** True

**c** True

**d** False

**19** Students' own answers.

**20a** (3, 5)

**b** 2

**c** $-\frac{1}{2}$

**d** $y = -\frac{1}{2}x + 6.5$

**21** c and d

**22a** 90°

**b** A (0, 0); B (3, 9); C (30, 0)

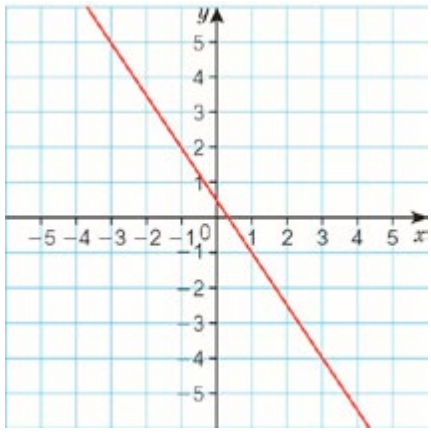
**c** $3\sqrt{2}\sqrt{5}$ = 9.49

**d** $9\sqrt{2}\sqrt{5}$ = 28.46

# Unit 10 Answers

## 10 Unit test

**1**




**2** **a** $x \rightarrow \frac{x}{3}$ **b** $x \rightarrow \frac{x+5}{2}$

**c** $x \rightarrow \frac{x}{3} + 1$ **d** $y = x - 7$

**e** $y = \frac{x+2}{3}$

**3** $y = 3x$

**4** **a** −5

**b** −2

**5** B

**6** $y = 4x - 3$

**7** Substitute $x = 6$ into $y = 2x - 14$
$y = 12 - 14$
$y = -2$
No, the point does not lie on the line.

**8** −4

**9** 37.5 cm$^2$

**10a** £10 000

**b** £100

**c** It reached its maximum (it stopped increasing).

**11** B, E

**12** $y = -2x + 1$