## 1 Number: Using calculators

### 1.1 Basic calculations and using brackets

**HOMEWORK 1A**

**1** **a** 67 **b** 85 **c** 33

**2** **a** 253 **b** 54 **c** 240

**3** **a** 53 **b** 136 **c** 68

   **d** 252

**4** **a** 195 **b** 300

**5** **a** 28.08 **b** 48.18

**6** **a** 24.5 **b** 38.3 **c** 326.9

   **d** 11.3

**7** 14 days

**8** Alfie 4.668; Becky 5.464; Chloe 6.137; Daniel 3.773
Daniel is correct.

**9** €75 is approximately £65.79. $100 is approximately £67.11.
So $100 is worth more.

**10 a** 15.26 **b** 194.88

**11 a** 1.7 **b** 4.8

**12 a** 533.05 **b** 5.221 096

### 1.2 Using a calculator to add and subtract fractions

**HOMEWORK 1B**

**1** **a** $\frac{17}{20}$ **b** $1\frac{1}{9}$ **c** $1\frac{9}{20}$

   **d** $\frac{81}{200}$ **e** $\frac{61}{80}$ **f** $1\frac{5}{16}$

   **g** $\frac{13}{30}$ **h** $\frac{1}{3}$ **i** $\frac{19}{96}$

   **j** $\frac{169}{240}$ **k** $\frac{199}{360}$ **l** $\frac{301}{468}$

**2** **a** $12\frac{17}{20}$ **b** $10\frac{1}{9}$ **c** $9\frac{9}{20}$

   **d** $12\frac{81}{200}$ **e** $10\frac{61}{80}$ **f** $12\frac{5}{16}$

   **g** $1\frac{13}{30}$ **h** $1\frac{1}{3}$ **i** $2\frac{19}{96}$

   **j** $1\frac{169}{240}$ **k** $1\frac{199}{360}$ **l** $1\frac{301}{468}$

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

**4** **a** $4\frac{1}{4}$ miles **b** $1\frac{1}{4}$ miles

**5** Use the fraction facility on the calculator to enter one-quarter, then press the multiplication key, then enter the fraction two-thirds, then press the equals key.



**6** 24

**7** **a** $-\frac{8}{575}$

   **b** A negative answer means the first number is less than the second number.

**8**  **a**  $\frac{29}{297}$                    **b**  $-\frac{29}{432}$

    **c**  The positive answer in **a** means that $\frac{10}{27}$ is greater than $\frac{3}{11}$. The negative answer in **b** means that $\frac{10}{27}$ is less than $\frac{7}{16}$.

**9**  28.3 cm

**10**  $\frac{1}{6}$ anticlockwise or $\frac{5}{6}$ clockwise

## 1.3 Using a calculator to multiply and divide fractions

**HOMEWORK 1C**

**1**  **a**  $\frac{3}{20}$                    **b**  $\frac{8}{27}$                    **c**  $\frac{21}{40}$

    **d**  $\frac{7}{200}$                   **e**  $\frac{9}{64}$                    **f**  $\frac{27}{512}$

    **g**  $2\frac{1}{25}$                   **h**  $2\frac{1}{7}$                    **i**  $3\frac{3}{8}$

    **j**  $\frac{63}{80}$                   **k**  $1\frac{1}{24}$                   **l**  $\frac{91}{180}$

**2**  $\frac{1}{4}$ m²

**3**  12

**4**  **a**  $\frac{14}{33}$                   **b**  $\frac{14}{33}$

**5**  **a**  $1\frac{2}{7}$                    **b**  $1\frac{2}{7}$                    **c**  $\frac{1}{3}$

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

**6**  **a**  $8\frac{9}{20}$                   **b**  $9\frac{17}{27}$                   **c**  $20\frac{37}{40}$

    **d**  $11\frac{137}{200}$                **e**  $27\frac{261}{320}$                **f**  $2\frac{439}{512}$

    **g**  $2\frac{1}{145}$                  **h**  $1\frac{8}{31}$                   **i**  $2\frac{11}{104}$

    **j**  $6\frac{93}{160}$                 **k**  $7\frac{61}{792}$                  **l**  $6\frac{409}{558}$

**7**  $11\frac{1}{12}$ m²

**8**  $4\frac{17}{20}$ cm³

**9**  27 mph

**10**  9 gallons

**11**  4 ropes, as 3 ropes would give 99 pieces.

## Functional Maths Activity: Using a calculator

**1**  This is the difference between the readings taken in August and November.

**2**  kilowatt-hour, the amount of energy converted if work is done at an average rate of one thousand watts for one hour

**3**  The higher rate is the standard rate. The lower rate is charged for units over a certain number; this is to encourage people to use electricity without incurring very high bills.

**4**  Yes, although the decimal number 2785.529 327 could be rounded to 2785.53.

**5**  187 metric units convert to 2083.57 kWh (rounded down); first 683 kWh @ 6.683p cost £45.64, the remaining 1400.57 kWh cost £46.11, giving a total bill of £91.75.

## 2 Number: Number properties 2

### 2.1 Rational numbers and reciprocals
**HOMEWORK 2A**

**1**    **a**   0.75        **b**   $0.0\dot{6}$        **c**   0.04

     **d**   $0.\dot{0}\dot{9}$        **e**   0.05

**2**   **a**   $\frac{4}{13} = 0.\dot{3}0769\dot{2}$, $\frac{5}{13} = 0.\dot{3}8461\dot{5}$, $\frac{6}{13} = 0.\dot{4}6153\dot{8}$, $\frac{7}{13} = 0.\dot{5}3846\dot{1}$, $\frac{8}{13} = 0.\dot{6}1538\dot{4}$,

      $\frac{9}{13} = 0.\dot{6}9230\dot{7}$, $\frac{10}{13} = 0.\dot{7}6923\dot{0}$, $\frac{11}{13} = 0.\dot{8}4615\dot{3}$, $\frac{12}{13} = 0.\dot{9}2307\dot{6}$

   **b**   Repeating numbers are cyclic and belong to one of two sets of numbers.

**3**   $\frac{1}{5}$, $\frac{2}{9}$, $\frac{23}{100}$, $\frac{3}{11}$, $\frac{2}{7}$

**4**   **a**   $\frac{57}{100}$        **b**   $\frac{11}{40}$        **c**   $\frac{17}{20}$

     **d**   $\frac{3}{50}$        **e**   $3\frac{13}{20}$

**5**   **a**   0.25        **b**   0.125        **c**   0.031 25

     **d**   0.025        **e**   0.01

**6**   **a**   $\frac{3}{2} = 1\frac{1}{2}$        **b**   $\frac{8}{5} = 1\frac{3}{5}$        **c**   $\frac{10}{9} = 1\frac{1}{9}$

     **d**   $\frac{12}{7} = 1\frac{5}{7}$        **e**   $\frac{20}{17} = 1\frac{3}{17}$

**7**   Reciprocal of 1 = 1 ÷ 1 = 1

**8**   **a**   4        **b**   5

     **c**   The reciprocal of a reciprocal is always the original number.

### 2.2 Multiplying and dividing by powers of 10
**HOMEWORK 2B**

**1**   **a**   350        **b**   21.5        **c**   6740

     **d**   46.3        **e**   301.45        **f**   78 560

     **g**   642        **h**   0.67        **i**   85

     **j**   79 800        **k**   658        **l**   21 530

     **m**   889 000        **n**   35 214.7        **o**   37 284.1

     **p**   34 280 000

**2**   **a**   45.38        **b**   43.5        **c**   76.459

     **d**   64.37        **e**   42.287        **f**   0.2784

     **g**   2.465        **h**   7.63        **i**   0.076

     **j**   0.008 97        **k**   0.0865        **l**   0.015

     **m**   0.000 000 879 9        **n**   0.234        **o**   7.654

     **p**   0.000 073 2

**3**   **a**   120 000        **b**   200 000        **c**   14 000

     **d**   21 000        **e**   900        **f**   125 000

     **g**   40 000        **h**   6000        **i**   14 000

     **j**   300 000        **k**   7500        **l**   140 000

**4**   **a**   5        **b**   300        **c**   35

     **d**   40        **e**   3        **f**   150

| | | | | | |
|---|---|---|---|---|---|
| **g** | 14 | **h** | 50 | **i** | 6 |
| **j** | 15 | **k** | 4 | **l** | 200 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **5** | **a** | 730 | **b** | 329 000 | **c** | 7940 |
| | **d** | 68 000 000 | **e** | 0.0346 | **f** | 0.000 507 |
| | **g** | 0.000 23 | **h** | 0.000 89 | | |
| **6** | **a** | 37 800 | **b** | 180 | | |

**7**   20 × 80 000 = 1 600 000     6000 × 300 = 1 800 000

   500 × 7000 = 3 500 000     10 000 × 900 = 9 000 000

**8**   100 000 km

## 2.3 Prime factors, LCM and HCF

**HOMEWORK 2C**

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | **a** | 70 = 2 × 5 × 7 | **b** | 90 = 2 × 3 × 3 × 5 | **c** | 126 = 2 × 3 × 3 × 7 |
| **2** | **a** | 36 | **b** | 150 | **c** | 63 |
| | **d** | 600 | **e** | 675 | | |
| **3** | **a** | $2^3 \times 3$ | **b** | $2^2 \times 3^2$ | **c** | $3 \times 5^2$ |
| | **d** | $2^2 \times 3 \times 7$ | **e** | $3^2 \times 11$ | | |
| **4** | **a** | 3 × 3 × 5 | **b** | $3^2 \times 5$ | | |

   **c**   $90 = 2 \times 3^2 \times 5$, $180 = 2^2 \times 3^2 \times 5$

| | | | | | |
|---|---|---|---|---|---|
| **5** | **a** | $51^2 = 3^2 \times 17^2$ | **b** | $51^3 = 3^3 \times 17^3$ |

**6**   Because 7 is the third odd prime number and is therefore a factor of 105.

**HOMEWORK 2D**

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | **a** | 12 | **b** | 24 | **c** | 36 |
| | **d** | 60 | **e** | 42 | **f** | 120 |
| **2** | **a** | 8 | **b** | 7 | **c** | 6 |
| | **d** | 12 | **e** | 14 | **f** | 25 |

| | | | | | |
|---|---|---|---|---|---|
| **3** | **a** | **i** | 12 | **ii** | 2 |
| | **b** | **i** | 24 | **ii** | 2 |
| | **c** | **i** | 48 | **ii** | 4 |
| | **d** | **i** | 60 | **ii** | 3 |
| | **e** | **i** | 300 | **ii** | 5 |

**4**   3 packs of nuts and 2 packs of bolts (36 of each)

**5**   25 and 30

## 2.4 Rules for multiplying and dividing powers

**HOMEWORK 2E**

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | **a** | $7^5$ | **b** | $7^9$ | **c** | $7^4$ |
| | **d** | $7^{10}$ | **e** | $7^{12}$ | | |
| **2** | **a** | $x^5$ | **b** | $x^9$ | **c** | $x^7$ |
| | **d** | $x^{10}$ | **e** | $x^9$ | | |
| **3** | **a** | $4^5$ | **b** | $4^3$ | **c** | $4^2$ |
| | **d** | 4 | **e** | $4^9$ | | |
| **4** | **a** | $y^3$ | **b** | $y^5$ | **c** | $y^9$ |
| | **d** | $y^8$ | **e** | $y^7$ | | |
| **5** | **a** | 1 | **b** | $6^0$ | **c** | 1 |

**6**   The answer is always 1.

**7**   Any two values with a sum of 9, e.g. $a$ = 1 and $b$ = 8.

## Problem-solving Activity: The planets

### Task 1

**1**   Jupiter (in mass and diameter)

**2**   Pluto

**3**   Pluto

**4**   Jupiter

**5**   Uranus

**6**   Venus and Earth

### Task 2

Pluto, Mercury, Mars, Venus, Earth, Uranus, Neptune, Saturn, Jupiter

### Task 3

Pluto, Mercury, Mars, Venus, Earth, Neptune, Uranus, Saturn, Jupiter

### Task 4

The smallest planets are those closest to the sun and those furthest away, with the larger planets positioned in the middle of the range. Students could use the internet to check this.

# 3 Number: Percentages

## 3.1 Equivalent percentages, fractions and decimals

**HOMEWORK 3A**

**1 a** $\frac{1}{10}$　　**b** $\frac{2}{5}$　　**c** $\frac{1}{4}$

**d** $\frac{3}{20}$　　**e** $\frac{3}{4}$　　**f** $\frac{7}{20}$

**g** $\frac{3}{25}$　　**h** $\frac{7}{25}$　　**i** $\frac{14}{25}$

**j** $\frac{9}{50}$　　**k** $\frac{21}{50}$　　**l** $\frac{3}{50}$

**2 a** 0.87　　**b** 0.25　　**c** 0.33

**d** 0.05　　**e** 0.01　　**f** 0.72

**g** 0.58　　**h** 0.175　　**i** 0.085

**j** 0.682　　**k** 1.5　　**l** 1.32

**3**

| Percentage | Fraction | Decimal |
|---|---|---|
| 10% | $\frac{1}{10}$ | 0.1 |
| 20% | $\frac{2}{10} = \frac{1}{5}$ | 0.2 |
| 30% | $\frac{3}{10}$ | 0.3 |
| 40% | $\frac{4}{10} = \frac{2}{5}$ | 0.4 |
| 50% | $\frac{5}{10} = \frac{1}{2}$ | 0.5 |
| 60% | $\frac{6}{10} = \frac{3}{5}$ | 0.6 |
| 70% | $\frac{7}{10}$ | 0.7 |
| 80% | $\frac{8}{10} = \frac{4}{5}$ | 0.8 |
| 90% | $\frac{9}{10}$ | 0.9 |

**4** 55%

**5** 16%

**6** 23%

**7** 69%

**8 a** ≈ 20%　　**b** ≈ 75%　　**c** ≈ 90%

**9 a** 75%　　**b** 40%　　**c** 35%

**d** 12%　　**e** 86%　　**f** 37.5%

**10 a** 23%　　**b** 87%　　**c** 9%

**d** 23.5%　　**e** 180%　　**f** 234%

**11 a** $\frac{17}{20}$　　**b** 0.85　　**c** 85%

**d** 43 or more

### 3.2 Calculating a percentage of a quantity

**HOMEWORK 3B**

**1**  **a**  0.23    **b**  0.7    **c**  0.04

    **d**  1.2

**2**  **a**  38%    **b**  80%    **c**  7%

    **d**  150%

**3**  **a**  £50    **b**  £12    **c**  212 kg

    **d**  63 cm    **e**  £18.48    **f**  177.5 g

    **g**  £0.72    **h**  304 m    **i**  £2.52

    **j**  £9.80    **k**  13.6 l    **l**  £297.60

**4**  208

**5**  Y7: 240, Y8: 230, Y9: 210, Y10: 220, Y11: 200; No, it did not reach the target.

**6**  378 tonnes iron, 63 tonnes chromium, 9 tonnes carbon

**7**  **a**  £7    **b**  £14.35    **c**  £42

**8**  £600

**9**  After a reduction of 10%, the prices are 90% of the original; after a further reduction of 10%, the prices are 81% of the original, so this is not a reduction of 20%.

### 3.3 Increasing or decreasing quantities by a percentage

**HOMEWORK 3C**

**1**  **a**  £84    **b**  £165    **c**  920 m

    **d**  400 kg    **e**  £54.60    **f**  £39.60

    **g**  141.6 cm    **h**  £46.72    **i**  1017.5 g

    **j**  £123.84

**2**  £33 800

**3**  £54.18, £42.14, £8.75; total charges £109.32; VAT £8.75; total bill £118.07

**4**  **a**  £2160    **b**  £2320    **c**  £2480

**5**  Yes; clock: £21.15, wallet: £17.86, towel: £15.04, bookmark: £7.52

**6**  £15

**HOMEWORK 3D**

**1**  **a**  £18    **b**  £120    **c**  63 kg

    **d**  440 m    **e**  £247    **f**  60 cm

    **g**  232 g    **h**  £327.25    **i**  12 kg

    **j**  £39.69

**2**  £6384

**3**  2112

**4**  £459

**5**  No, shirt: £24; suit: £104; shoes: £33.60; total £161.60, which is more than he has received for Christmas.

**6**  Cheaper: for example, £100 + 10% = £100 + £10 = £110.
£110 − 10% = £110 − £11.00 = £99.00

## 3.4 Expressing one quantity as a percentage of another quantity

**HOMEWORK 3E**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | **a** | 20% | **b** | 25% | **c** | 10% |
| | **d** | 75% | **e** | 80% | **f** | 46% |
| | **g** | 33.3% | **h** | 30% | **i** | 67.5% |
| | **j** | 23.8% |

**2 a** 75% **b** 37.5%

**3 a** 60% **b** 40%

**4** 29.3%

**5** Yes, in each case. **a** 66.7% profit **b** 50.0% profit

   **c** 50.0% profit **d** 66.6% profit

**6** Paul 33.3%, Val 39.2%. Val has the greater percentage increase.

**HOMEWORK 4F**

**1**

| Fraction | Decimal | Percentage |
|---|---|---|
| $\frac{1}{4}$ | 0.25 | 25% |
| $\frac{4}{10}$ | 0.4 | 40% |
| $\frac{3}{20}$ | 0.15 | 15% |

**2 a** £6.30 **b** 36 kg **c** 84 ml

**3 a** 72% **b** 68% **c** 30%

**4 a** 225 **b** 3906

**5 a** 25% **b** 20% **c** £10.50

**6 a** £640

   **b** Software: £102; total: £742; amount saved: £900; yes, she can afford it.

**7 a** 5 kg **b** i

## Functional Maths Activity: The cost of going to work

**Task 1**

**1** 48 weeks **2** £1500 **3** £217.35

**4** Because she takes two weeks of her holiday.

**5** The answer depends on when she takes the remaining two weeks leave, and whether the monthly ticket covers a calendar month or four weeks exactly/ Likely answer is $11 \times £217.35 + 2 \times \frac{2}{3} \times £6.40 = £2466.05$.

**6** £10 if she chooses small sandwiches (£13.20 for large).

**7** 20% or $\frac{1}{5}$

**8** £3.20

**9** 25 : 32

**10** £12 000

**Task 2**

Look for an answer close to £554.50, depending on variations in students' answers.

**Task 3**

360 hours

**Task 4**
£9529.80 before tax. Discuss what rate of tax he would pay, and adjust the figure.
**Task 5**
Answers will vary.

## 4 Algebra: Basic algebra

### 4.1 The language of algebra

**HOMEWORK 4A**

**1** 8p

**2 a** $x + 4$  **b** $x - 7$  **c** $3 + k$

  **d** $8 - t$  **e** $x + y$  **f** $4x$

  **g** $5t$  **h** $ab$  **i** $\dfrac{m}{2}$

  **j** $\dfrac{p}{q}$

**3 a** $x + 4$  **b** $x - 5$

**4 a** $3n$  **b** $n + 2$  **c** $2n + 5$

**5 a** Number in 14, number out 23, 107  **b** Add 7

  **c** $y + 7$

**6** 16 years

**7** Frank $p + 2$, Chloe $p - 3$, Lizzie $2p$

**8 a** £4  **b** £$(10 - a)$  **c** £$(b - c)$

**9 a** 21  **b** $7z$

**10 a** £10  **b** £$\frac{r}{4}$  **c** £$\frac{p}{q}$

### 4.2 Simplifying expressions

**HOMEWORK 4B**

**1 a** $12t$  **b** $10y$  **c** $8y$

  **d** $9w$  **e** $4t^2$  **f** $6b^2$

  **g** $3w^2$  **h** $12y^2$  **i** $5p^2$

  **j** $128t^2$  **k** $20m^2$  **l** $24t^2$

  **m** $7mt$  **n** $5yw$  **o** $8tq$

  **p** $69nt$  **q** $30q$  **r** $10f$

  **s** $18k$  **t** $35r$

**2 a** $t^3$  **b** $p^3$  **c** $5m^3$

  **d** $3t^3$  **e** $8n^3$  **f** $20r^3$

  **g** $t^4$  **h** $k^5$  **i** $16n^5$

  **j** $12t^7$  **k** $14a^7$  **l** $3k^7$

  **m** $k^3$  **n** $10y^2$  **o** $18d^3$

  **p** $-12p^6$  **q** $5mq^2$  **r** $12m^2y$

  **s** $12m^2t$  **t** $10q^2p^2$

**3** 32

**4 a** D  **b** $12m^2$

**5** $12x^2$

**HOMEWORK 4C**

**1 a** $3a$  **b** $5b$  **c** $9c$

  **d** $4d$  **e** $3e$  **f** $8f$

  **g** 0  **h** $-2h$  **i** $5i^2$

**j**    $4j^2$

**2**   **a**   $8x + 3y$        **b**   $2m + 10p$        **c**   $6x + 4$

     **d**   $5 + 3x$          **e**   $8p$             **f**   $6x - 2$

     **g**   $2p - 6$         **h**   $6x - 2y$         **i**   $7 + 6p - 3t$

     **j**   $6w - 4k$

**3**   **a**   $x + 9$          **b**   $3 + 2y$         **c**   $4a - 2b$

     **d**   $2c - 4d$       **e**   $7x + 8y - 3$     **f**   $2b$

**4**   **a**   $x^2 + 5$        **b**   $a^2 + 5b$        **c**   $5k^2 - 2k$

     **d**   $d$             **e**   $2x^2 + 4y^2$       **f**   $-2y^2 - z^2$

**5**   6.66 m

**6**   **a**   $w - x$          **b**   $w + y$

**7**   **a**   $(3x - 1) - 2x$    **b**   $12x$           **c**   48 cm

## 4.3 Expanding brackets

**HOMEWORK 4D**

**1**   $y + y = 2y$, $y \times y = y^2$, $2(y + 1) = 2y + 2$

**2**   **a**   $12 + 3m$       **b**   $18 + 6p$       **c**   $16 - 4y$

     **d**   $18 + 21k$      **e**   $12 - 20f$      **f**   $8 - 46w$

     **g**   $7g + 7h$       **h**   $8k + 16m$      **i**   $12d - 6n$

     **j**   $t^2 + 5t$        **k**   $m^2 + 4m$      **l**   $k^2 - 2k$

     **m**   $4g^2 + g$      **n**   $3y^2 - 21y$     **o**   $7p - 8p^2$

     **p**   $2m^2 + 10m$    **q**   $3t^2 - 6t$      **r**   $15k - 3k^2$

     **s**   $8g^2 + 6g$     **t**   $8h^2 - 12h$

**3**   **a**   $-4\,°C$        **b**   $F = 2(C + 15)$

**4**   Correct answers such as $2(6x + 12y)$, $12(x + 2y)$, $6(2x + 4y)$

**5**   **a**   $12t - 10t^2$     **b**   $12d^2 + 20de$    **c**   $12y^2 + 15ky$

     **d**   $18m^3 - 6m^2p$   **e**   $y^3 + 7y$       **f**   $h^4 + 9h$

     **g**   $k^3 - 4k$       **h**   $3t^3 + 9t$      **i**   $5h^4 - 10h$

     **j**   $4g^4 - 12g$     **k**   $10m^3 + 5m^2$    **l**   $8d^3 - 2d^4$

     **m**   $12w^3 + 4wt$    **n**   $15a^3 - 3ab$    **o**   $14p^4 - 16mp$

     **p**   $3m^2 + 5m^3$    **q**   $t^4 + 3t^5$      **r**   $4g^2t - 3g^4$

     **s**   $14t^3 + 2mt^2$    **t**   $12h^3 + 15gh^2$

**HOMEWORK 4E**

**1**   **a**   $9t$            **b**   $7m$           **c**   $7y$

     **d**   $10d$         **e**   $2e$           **f**   $3g$

     **g**   $2p$           **h**   $4t$           **i**   $5t^2$

     **j**   $3y^2$         **k**   $7ab$         **l**   $a^2d$

**2**   **a**   $18 + 7t$       **b**   $22 + 24k$      **c**   $13 + 32m$

     **d**   $17 + 13y$      **e**   $28 + 12f$      **f**   $20 + 33g$

**3**   **a**   $-9 - 7h$      **b**   $4g - 7$       **c**   $-3y + 1$

     **d**   $-t + 1$       **e**   $4k + 9$       **f**   $-e + 6$

**4**   **a**   $5m + 2p + 2mp$    **b**   $4k + 5h + 3hk$    **c**   $t + 3n + 7nt$

     **d**   $p + 5q + 8pq$     **e**   $6h + 12j + 11hj$   **f**   $15y + 2t + 20ty$

**5**   **a**   $80x + 270y$    **b**   £1400

**6**   He has worked out 2 × 3 as 5 instead of 6 and he has worked out –2 + 15 as –13, not +13. Answer should be $16x + 13$.

**7**   **a**   $5(x + 0.75) + 3(x + 0.25)$          **b**   £44.50

## 4.4 Factorisation

### HOMEWORK 4F

**1**   **a**   $3(3m + 4t)$     **b**   $3(3t + 2p)$     **c**   $4(m + 3k)$
     **d**   $2(2r + 3t)$     **e**   $4(w – 2t)$     **f**   $2(5p – 3k)$
     **g**   $2(6h – 5k)$     **h**   $m(2n + 3)$     **i**   $g(4g + 3)$
     **j**   $2m(2p + k)$     **k**   $2b(2c + 3k)$     **l**   $4a(2b + c)$

**2**   **a**   $y(3y + 4)$     **b**   $t(5t – 3)$     **c**   $d(3d – 2)$
     **d**   $3m(2m – p)$     **e**   $3p(p + 3t)$     **f**   $4p(2t + 3m)$
     **g**   $2b(4a – 3c)$     **h**   $4a(a – 2b)$     **i**   $2t(4m – 3p)$
     **j**   $4at(5t + 3)$     **k**   $2bc(2b – 5)$     **l**   $2b(2ac + 3ed)$
     **m**   $2(3a^2 + 2a + 5)$     **n**   $3b(4a + 2c + 3d)$     **o**   $t(6t + 3 + a)$
     **p**   $3mt(32t – 1 + 23m)$     **q**   $2ab(3b + 1 – 2a)$     **r**   $5pt(t + 3 + p)$

**3**   **a**   Does not factorise     **b**   $m(3 + 2p)$     **c**   $t(t – 5)$
     **d**   Does not factorise     **e**   $2m(4m – 3p)$     **f**   Does not factorise
     **g**   $a(3a – 7b)$     **h**   Does not factorise     **i**   $b(7a – 4bc)$
     **j**   Does not factorise     **k**   $3mt(2m + 3t)$     **l**   Does not factorise

**4**   **a**   Tess as 9.99 – 1.99 = 8 so she will just have to work out 8 × 8.
     **b**   Tom £48, Tess £64

**5**   **a**   **i**   $x – 4$       **ii**   $3(x – 4)$       **iii**   $x(x – 4)$
     **b**   $x – 4$ as a factor

**6**   **a**   The numbers inside each pair of brackets add up to 101 and there are 50 sets of brackets.
     **b**   5050

## 4.5 Substitution

### HOMEWORK 4G

**1**   **a**   7           **b**   13           **c**   23

**2**   **a**   2           **b**   14           **c**   32

**3**   **a**   8           **b**   24           **c**   $4\frac{1}{2}$

**4**   **a**   4           **b**   0           **c**   –2

**5**   **a**   35         **b**   60         **c**   85

**6**   **a**   10         **b**   28         **c**   1

**7**   **a**   12 cm      **b**   162 m by 27 m by 16.2 m

**8**   **a**   2           **b**   3           **c**   5

**9**   **a**   1           **b**   4           **c**   $5\frac{1}{2}$

**10**   **a**   10        **b**   2           **c**   1

**11**   **a**   21        **b**   33         **c**   45

**12**   **a**   20°C      **b**   $\frac{5}{9}(-40 – 32) = \frac{5}{9}(-72) = 5 \times -8 = -40$

## Functional Maths Activity: Packaging

Discuss the task with students and lead them to identify the third arrangement.

They can do this by drawing or by describing the size of the cuboid.

This is a 1 by 2 by 4 cuboid.

Now work out the amount of string for any of the arrangements;
for example, the cuboid.

Make sure students are clear about the shape for which shape they are
working out the amount of string.

For the cuboid:

$S = 2 \times 30 + 2 \times 30 + 4 \times 30 + 20 = 260$ cm.

They should now do the same for the two other shapes.

For the 1 by 1 by 8:

$S = 2 \times 120 + 2 \times 15 + 4 \times 15 + 20 = 350$ cm.

For the 1 by 2 by 4:

$S = 2 \times 60 + 2 \times 30 + 4 \times 15 + 20 = 260$ cm.

Then they should write down a conclusion, referring to the calculated values.

Masood should pack either as a cube or a 1 by 2 by 4 package, as these both use
the same amount (260 cm) of string.
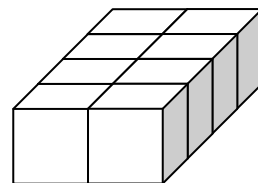
## 5  Statistics: Averages

### 5.1 The mode

**HOMEWORK 5A**

**1 a** 2        **b** 15        **c** 101

   **d** 1        **e** $6\frac{1}{2}$

**2 a** E        **b** C4        **c** ←

   **d** ♣        **e** €

**3 a** 40        **b** 3        **c** 112

**4** 3

**5 a** 31

   **b i** dog        **ii** rabbit        **iii** dog

   **c** Both students like rabbits.

**6** There are equal numbers of each make, so they are all the mode.

**7 a** 30        **b** 21–25 marks

   **c** The 5 students in the 26–30 interval might all have scored fewer than 30 marks.

**8 a**

| Time in minutes | 0–3 | 4–7 | 8–11 | 12–15 |
|---|---|---|---|---|
| **Frequency** | 9 | 13 | 6 | 2 |

   **b**
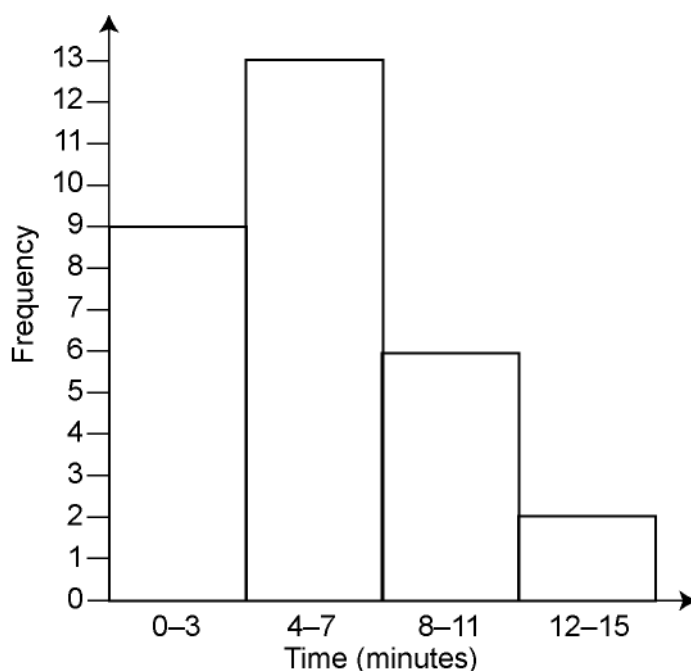


   **c** 8        **d** 4–7 minutes        **e** Open more checkouts.

### 5.2 The median

**HOMEWORK 5B**

**1 a** 15        **b** 34        **c** 0

   **d** 11        **e** 1.6

**2 a** 71 kg        **b** 62 kg

   **c** Median: it is a central value.

**3** **a** 2                              **b** 3

    **c** No, all scores have about the same frequency.

**4** **a** 27                            **b** 35                            **c** 22

    **d** 28

    **e** Could be either with the right reason: girls because the mode is higher, or boys because the median is higher.

**5** **a** Three higher or equal to 11 and 1 less or equal to 11.
There are many possible correct answers, e.g. 10, 14, 20 and 20.

    **b** 4 higher than or equal to 11 and 2 lower than or equal to 11.

    **c** 8 numbers, all 3 or under.

**6** The median of 10 g does not take into account the large weight of 4 kg.

**7** **a** e.g. 7, 8, 9, 10, 15, 20, 20

    **b** e.g. 7, 8, 9, 10, 10, 20, 20, 20

**8** 2 | 7

    3 | 5, 8

    4 | 0, 3, 5, 8, 9

    5 | 2, 5, 7, 9

    6 | 2, 7, 8

    7 | 2, 7, 8

    8 | 0, 1, 7                              **Key:** 2 | 7 means 27

    The median is 57 marks.

**9** **a** 72                            **b** 101

    **c** Pulse rate increases after exercise.

## 5.3 The mean

**HOMEWORK 5C**

**1** **a** 4                              **b** 24                            **c** 333

    **d** 3.3                            **e** 2

**2** **a** 22.1                          **b** 98.9                          **c** 9.8

    **d** 181.6                        **e** 0.8

**3** 3 hours 18 minutes

**4** **a** £800                          **b** £910                          **c** **i** 5      **ii** 2

    **d** Median, as it does not take into account the extreme values.

**5** 4 goals

**6** **a** Tango: 6.8, Salsa: 6.2, Ballroom: 6.4, so Kath is right.

    **b** David and Hannah      **c** 1: Azan and Phyllis

**7** There are many correct answers, e.g. Key family: Brian, Ann, Steve and Albert vs. Charlton family: Hannah, Pete, Chris and George.

**8** **a** 62                            **b** 63                            **c** Fay

    **d** 2

**9** **a** 31                            **b** 47

## 5.4 The range

**HOMEWORK 5D**

**1  a**  13          **b**  14          **c**  32
    **d**  2.7         **e**  10
**2  a**  25          **b**  16          **c**  5 years
    **d**
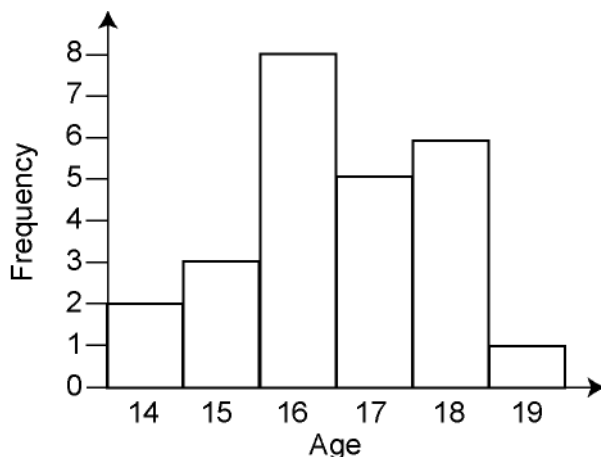


**3  a**  76 °C          **b**  15 Celsius degrees
    **c**  Similar means, but Crete's temperatures are more consistent.
**4  a**  10KG: 26, 10RH: 25, 10PB: 27
    **b**  10KG: 2, 10RH: 8, 10PB: 5
    **c  i**    10PB: highest mean          **ii**    10KG: smallest range
**5  a**  Week 1: £624.20; week 2: £564; week 3: £666.20
    **b**  Week 1: £163; week 2: £280; week 3: £85
    **c**  The week with highest mean had the lowest range so is most consistent.
**6  a**  7 to 12 includes 6 children          **b**  15 to 18
**7**  A school football team with all the players in the same school year.
**8  a**  boys: 37, girls: 37      **b**  boys: 28, girls: 36
    **c**  Same median, but boys are more consistent.

## 5.5 Which average to use

**HOMEWORK 5E**

**1  a  i**    mode 6, median 4, mean 4
        **ii**    mode 15, median 15, mean 15.1
        **iii**    mode 32, median 32, mean 33
    **b  i**    mean, balanced data
        **ii**    mode, appears 6 times
        **iii**    median, 46 is an extreme value
**2  a**  mode 135 g, median 141 g, mean 142.8 g
    **b**  Mean; takes all weights into account.
**3**  Adam mean, Faisal median or mode, Maya mode (his scores are bimodal, with modes 0 and 4, but the mean is 3)
**4  a**  71 kg          **b**  70 kg
    **c**  Median; 53 kg is an extreme weight.

**5 a** 59 **b** 54

**c** Median, the higher average.

**6 a** e.g. 1, 1, 4 **b** e.g. 1.5, 3, 4.5

**7** The teacher might be quoting the mean, while the student is quoting the mode.

## 5.6 Frequency tables

**HOMEWORK 5F**

**1 a** mode = 16, median = 15, mean = 15.3

**b** mode = 5, median = 5, mean = 4.67

**2 a** 289 **b** 2 **c** 142

**d** 1.7

**3 a** 256 **b** 3.53 **c** 72

**d** 158

**4** Eggs: 3 and 4. Frequency: 6 and 4

**5** Find the total of all the frequencies (52), divide by 2 (26) and identify the median number of days (3).

## 5.7 Grouped data

**HOMEWORK 5G**

**1 a i** 61–80 **ii** 58

**b i** 20.01–30.00 **ii** £27.40

**2 a** 79 **b** 35 minutes **c** mode

**3** The first 5 and the 10 are the wrong way round.

**4** Find the mid-point of each group, multiply that by the frequency and add those products. Divide that total by the total frequency.

## 5.8 Frequency polygons

**HOMEWORK 5H**

**1 a** **b** 1.4 goals
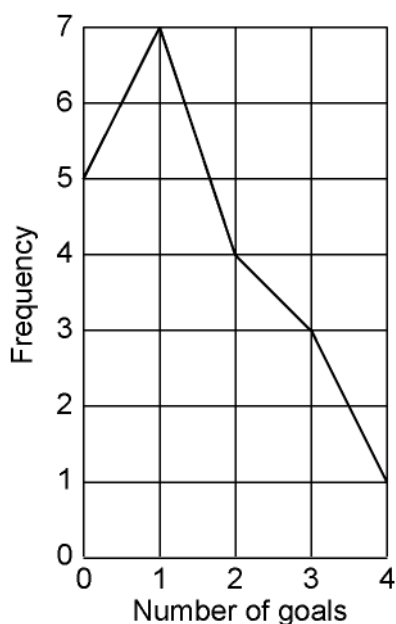
**2 a**
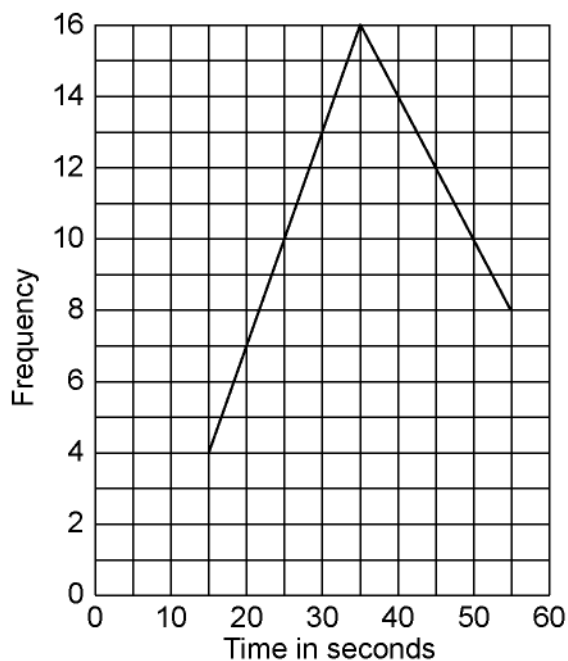
**b** 37 seconds



**3 a**
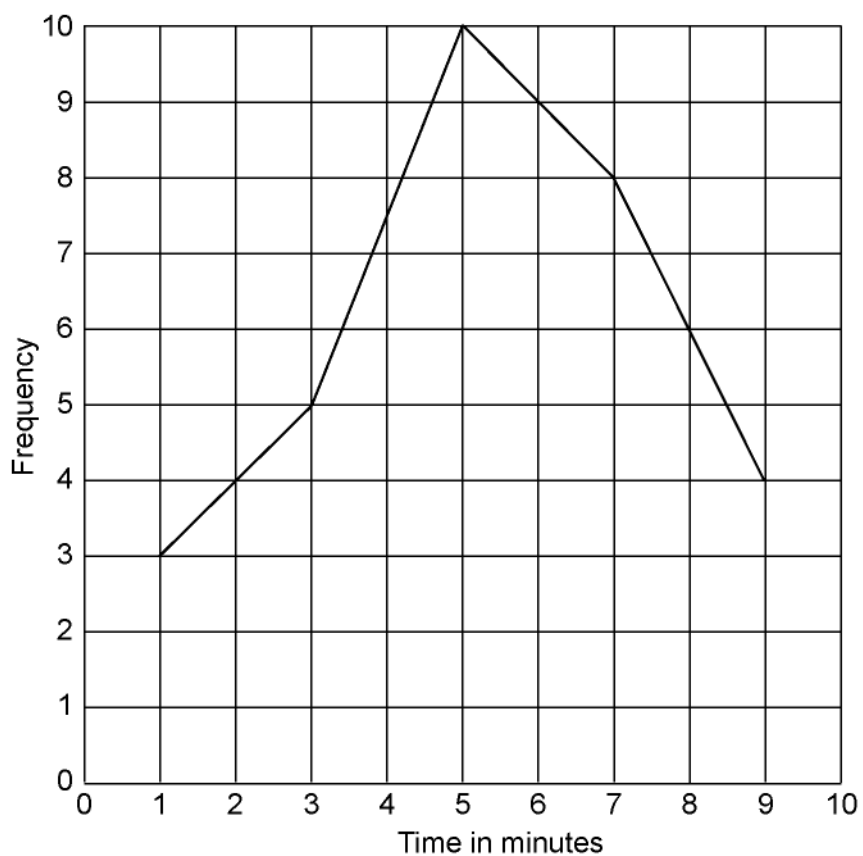


**b** 5.3 minutes

**c** The majority of customers (over 70%) wait longer than 5 minutes, open more checkouts.

**4** 2.49 hours

**5** 30 seconds is exactly in the middle of the zero to one minute group. These people are in that band, but it could be that no one actually waited for exactly 30 seconds.

## Functional Maths Activity: Words and books

Discuss students' answers with them and ask them to explain their reasoning.

# 6 Geometry: Perimeter and area

## 6.1 Perimeter

**HOMEWORK 6A**

**1** **a** 20 cm      **b** 18 cm      **c** 36 cm

   **d** 18 cm      **e** 32 cm      **f** 36 cm

**2** Examples of rectangles with perimeters of 14 cm (1 × 6, 2 × 5, 3 × 4)

**3** Yes, use fractions of a cm, e.g. a rectangle 2 cm by 2.5 cm.

**4** C: the other two both have a perimeter of 16 cm.

**5** 16 m

## 6.2 Area of an irregular shape

**HOMEWORK 6B**

**1** **a** 6 cm$^2$      **b** 13 cm$^2$      **c** $4\frac{1}{2}$ cm$^2$

   **d** 5 cm$^2$

**2** **a** 9–11 cm$^2$      **b** 11–13 cm$^2$      **c** 13–15 cm$^2$

   **d** 12–14 cm$^2$

**3** 15–18 km$^2$

**4** **a** 7 cm$^2$      **b** 4 by 4 square

**5** Outer area = 36 cm$^2$; inner area 16 cm$^2$: (36 + 16) ÷ 2 = 26 cm$^2$

## 6.3 Area of a rectangle

**HOMEWORK 6C**

**1** **a** 10 cm$^2$, 14 cm      **b** 16 cm$^2$, 16 cm      **c** 16 m$^2$, 20 m

   **d** 36 mm$^2$, 30 mm      **e** 200 m$^2$ , 60 m

**2** **a** 12 cm, 8 cm$^2$      **b** 22 cm, 28 cm$^2$      **c** 5 cm, 30 cm$^2$

   **d** 5 cm, 16 cm      **e** 10 cm, 5 cm or 5 cm, 10 cm

**3** 36 cm$^2$

**4** **a** **i** 100      **ii** 300      **iii** 1200

   **b** **i** 10 000      **ii** 40 000      **iii** 100 000

**5** 48 cm$^2$

**6** 375

## 6.4 Area of a compound shape

**HOMEWORK 6D**

**1** **a** 33 cm$^2$      **b** 40 cm$^2$      **c** 60 cm$^2$

   **d** 60 cm$^2$      **e** 500 cm$^2$

**2** **a** 2.5 m$^2$

   **b** Yes, the area in one roll is 2.5 m$^2$

**3** She is incorrect, the area is 52 cm$^2$.

**4** 6 cm and 4 cm

## 6.5 Area of a triangle

### HOMEWORK 6E

**1**  **a**  12 cm, 6 cm$^2$    **b**  24 cm, 24 cm$^2$    **c**  70 cm, 210 cm$^2$

**2**  **a**  40 cm$^2$    **b**  168 m$^2$    **c**  32 m$^2$

**3**  162 cm$^2$

**4**  c: 24 cm$^2$

**5**  Jen, as she used the correct height; Jack used the slanting side.

**6**  120 cm$^2$

### HOMEWORK 6F

**1**  **a**  20 cm$^2$    **b**  35 cm$^2$    **c**  308 cm$^2$

   **d**  7.5 m$^2$    **e**  54 cm$^2$    **f**  100 cm$^2$

**2**  **a**  24 cm$^2$    **b**  35 cm$^2$    **c**  12.5 cm$^2$

   **d**  6 cm    **e**  5 cm

**3**  **a**  1800 cm$^2$    **b**  144 cm$^2$    **c**  116 cm$^2$

**4**  Students should have drawn two triangles with the product of base and height 80 cm$^2$.

**5**  3 cm

**6**  Areas are the same but the perimeters are different.

**7**  40

## 6.6 Area of a parallelogram

### HOMEWORK 6G

**1**  **a**  15 cm$^2$    **b**  40 cm$^2$    **c**  16 m$^2$

   **d**  240 cm$^2$

**2**  256 cm$^2$

**3**  b and c; $\frac{1}{2} \times 12 \times 6 = 36$ cm$^2$ and $9 \times 4 = 36$ cm$^2$

**4**  24 cm

## 6.7 Area of a trapezium

### HOMEWORK 6H

**1**  **a**  23.1 cm, 28 cm$^2$    **b**  36 cm, 66.5 cm$^2$

**2**  **a**  89 m$^2$    **b**  35.5 cm$^2$

**3**  **a**  45 cm$^2$    **b**  24 cm$^2$

**4**  a is larger (a is 10 cm$^2$ and b is 9.6 cm$^2$)

**5**  Incorrect multiplication of terms inside brackets (she should have multiplied both terms by $\frac{1}{2}$) and units are incorrect; correct answer is 65 cm$^2$.

**6**  68.75 m$^2$

**7**  $a + b = 8$ with $a < b$

## Problem-solving Activity: Pick's theorem

Pick's theorem provides a simple formula for calculating the area, $A$, of a polygon constructed on a grid of equally spaced points, so that each vertex is located on one of the grid points. This would be like every vertex falling on the grid lines of a coordinate graph so that they all have integer coordinates.

If the number of points that fall inside the polygon is taken as $i$ and the number of points that are located exactly on the perimeter of the polygon is $b$, then the area is given by:

$$A = i + \frac{b}{2} - 1$$

## 7  Number: Ratios, speed and proportion

### 7.1 Ratio

**HOMEWORK 7A**

**1** **a** 1 : 3    **b** 1 : 5    **c** 1 : 6

   **d** 1 : 3    **e** 2 : 3    **f** 3 : 5

   **g** 5 : 8    **h** 15 : 2    **i** 2 : 5

   **j** 5 : 2

**2** **a** 1 : 4    **b** 3 : 4    **c** 1 : 8

   **d** 2 : 5    **e** 2 : 5    **f** 8 : 15

   **g** 10 : 3    **h** 1 : 3    **i** 3 : 8

   **j** 1 : 5

**3** **a** $\frac{1}{4}$    **b** $\frac{3}{4}$

**4** **a** $\frac{2}{5}$    **b** $\frac{3}{5}$

**5** **a** $\frac{1}{10}$    **b** $\frac{9}{10}$    **c** 100 tonnes

**6** 2 : 1

**7** $\frac{1}{16}$

**HOMEWORK 7B**

**1** **a** £2 : £8    **b** £4 : £8    **c** £10 : £30

   **d** 10 g : 50 g    **e** 1 h : 9 h

**2** **a** 300    **b** 100

**3** 2 m and 18 m

**4** **a** 10 kg : 15 kg    **b** 18 days : 12 days    **c** 30 m : 40 m

   **d** £1.50 : £3.50    **e** 15 h : 9 h

**5** 400

**6** 45

**7** £6

**8** Gas bill: £30; electricity bill: £36; she will need to pay £3 on the electricity bill.

**9** **a** 1 : 1.5    **b** 1 : 2.5    **c** 1 : 1.25

   **d** 1 : 1.6    **e** 1 : 2.1

**10** $\frac{1}{30}$

**HOMEWORK 7C**

**1** 20

**2** 80

**3** **a** 15 litres    **b** 25 litres

**4** **a** 80 kg    **b** 5 kg

**5** 90

**6** **a** 200 g    **b** 320 g

**7** **a** £4000    **b** £6000

**8** Fred's, at 4 : 1; Jodie's is only 3 . 5 : 1.

## 7.2 Speed, time and distance

**HOMEWORK 7D**

**1**  15 mph

**2**  180 miles

**3**  46 mph

**4**  2pm

**5**  **a**  30 mph       **b**  50 km/h       **c**  20 miles

    **d**  50 km       **e**  $3\frac{1}{4}$ hours       **f**  3 hours 36 minutes

**6**  **a**  130 km       **b**  52 km/h

**7**  **a**  30 minutes       **b**  12 mph

**8**  **a**  1.25 h       **b**  45 miles

**9**  24 mph

## 7.3 Direct proportion problems

**HOMEWORK 7E**

**1**  £8

**2**  £2.16

**3**  £49.60

**4**  **a**  €2.25       **b**  20

**5**  **a**  £27.20       **b**  11

**6**  **a**  6 litres       **b**  405 miles

**7**  48 seconds

**8**  **a**  **i**  50 g margarine, 2 tbsp golden syrup, 40 g sugar, 100 g oats

        **ii**  200 g margarine, 8 tbsp golden syrup, 160 g sugar, 400 g oats

        **iii**  250 g margarine, 10 tbsp golden syrup, 200 g sugar, 500 g oats

    **b**  60

**9**  6

## 7.4 Best buys

**HOMEWORK 7F**

**1**  **a**  £2.50 for a twin-pack  **b**  £2.20  for 1       **c**  95p for 10

    **d**  £2.75 for 750 grams

**2**  **a**  large size, 4.0 g/p       **b**  200 g bar, 2.2 g/p       **c**  500 g tin, 0.64 g/p

    **d**  large jar, 3.8 g/p

**3**  large size

**4**  72p, 66p, 70p, 65p; the 3-litre bottle

**5**  3 for the price of 2, 1500 g for £3.38

**6**  Hannah's mark, since it is equivalent to 85 out of 100.
    John's mark is equivalent to 80 out of 100.

## Functional Maths Activity: Average speeds

**1**  60 mph
**2**  Answers will vary, check individual students' responses.
**3**  **i**  80 mph          **ii**  48 mph
**4**  **i**  68.6 mph        **ii**  53.3 mph
**5**  Answers will vary, check individual students' responses.

## 8 Algebra: Equations and inequalities

### 8.1 Solving simple linear equations

**HOMEWORK 8A**

**1** **a** $x = 6$      **b** $y = 7$      **c** $s = 3$

    **d** $t = 11$      **e** $p = 4$      **f** $q = 3$

    **g** $k = 8$      **h** $n = 5$      **i** $a = 6$

    **j** $b = 1$      **k** $c = 14$      **l** $d = 5$

**2** Any valid equation, such as $\dfrac{x}{2} = 12$ or $x - 3 = 21$.

**3** **a** A and B both have 18 as the solution.

    **b** A and C both have the $x$-term on top.

    **c** B and C both use the same letter and numbers.

**4** $2x = 38$, $x = 19$

**5** $10y = 950$, $y = 95$, I litre costs 95p

**HOMEWORK 8B**

**1** **a** 4      **b** 2      **c** 5

    **d** 6      **e** 2      **f** 4

    **g** 3      **h** 1      **i** 5

    **j** 6      **k** 10      **l** 18

    **m** 12      **n** 9      **o** 20

**2** $\dfrac{x}{4} + 2 = 32$

**3** 2

**HOMEWORK 8C**

**1** **a** 1      **b** 7      **c** –2

    **d** 4      **e** 5      **f** 8

    **g** 3      **h** 1      **i** 3.5

    **j** 14      **k** 9      **l** 10

**2** Any valid equation such as $\dfrac{x}{4} + 2 = 8$, $\dfrac{x}{6} + 1 = 5$

**3** **a** Student 1

    **b** 2nd line: Student 2 adds 3 instead of subtracting 3.

       4th line: Student 2 divides by 2 instead of multiplying by 2.

**HOMEWORK 8D**

**1** **a** 3      **b** 4      **c** 4

    **d** 5      **e** 10      **f** 6

    **g** 6      **h** 3      **i** 16

    **j** 6      **k** 5      **l** 2

**2** **a** 10      **b** 14      **c** 36

**3** **a** 7.5      **b** 9

**4** 48

### 8.2 Solving equations with brackets

**HOMEWORK 8E**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | **a** | 3 | **b** | 7 | **c** | 1 |
| | **d** | 5 | **e** | 6 | **f** | 3 |
| | **g** | 2 | **h** | –2 | **i** | –3 |
| | **j** | 1.5 | **k** | 1.25 | **l** | 1.1 |

**2**  $a$ = 5, $b$ = 2 and $c$ = 4

**3**  Zak is wrong. He has not multiplied the brackets correctly, and gets $10x + 3 = 13$ in both cases. First equation: $x$ = –0.2, second equation: $x$ = 0.7.

### 8.3 Equations with the variable on both sides

**HOMEWORK 8F**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | **a** | 2 | **b** | 4 | **c** | 7 |
| | **d** | 3 | **e** | 4 | **f** | 5 |
| | **g** | 2 | **h** | –2 | **i** | 0 |
| | **j** | 2.5 | | | | |

**2**  $5x + 2 = 3x – 6$, $x$ = –4

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **3** | **a** | 9 | **b** | –3 | **c** | 1 |
| | **d** | –18 | | | | |

**4**  $x$ = 4, perimeter = 27 cm

### 8.4 Setting up equations

**HOMEWORK 8G**

**1**  **a**  3      **b**  4

**2**  **a**  $24p + 100 = 1060$      **b**  40p

**3**  **a**  B: 1500 gallons, C: 4500 gallons, D: 3000 gallons

    **b**  7200 gallons      **c**  2400 gallons

**4**  **a**  $12p – 2 = 7$      **b**  £0.75

**5**  Length is 5 m, width is 4 m and area is 45 m². Carpet costs £13.50 per square metre.

**6**  Derek bought the equivalent of 4 magazines, so 1 magazine costs £1.50, so a book costs £3.00. A book and a magazine together cost £4.50; 22.50 ÷ 4.50 = 5, so Kerry bought 5 magazines.

**7**  7 years old

**8**  8 years old

**9**  5

**10**  6 cm, 6 cm, 5 cm, 10 cm, 5 cm

**11**  crime: 20, science fiction: 28, romance: 17

**12**  5

**13**  12

**14**  **a**  50p: 10, £1: 20, £2: 14      **b**  £53

**15**  $5x + 120 = 3x + 908$, $2x = 788$, $x$ = 394

**16**  **a**  6      **b**  8      **c**  $\dfrac{n-2}{2}, \dfrac{n-2}{2} + 5$

**d** $\dfrac{n-2}{2} + 5 = n$, $\dfrac{n-2}{2} = n - 5$, $n - 2 = 2n - 10$, $n = 8$

**17** Put any pair of sides equal, e.g. $3x + 1 = 4x - 1$ and solve. Solution $x = 2$. Put 2 into each expression for the sides: all sides equal 7; so the answer is yes, if $x = 2$.

## 8.5 Trial and improvement

### HOMEWORK 8H

**1 a** 2 and 3      **b** 3 and 4      **c** 9 and 10
   **d** 6 and 7

**2** 3.6

**3 a** 1 and 2      **b** 3 and 4      **c** 4 and 5
   **d** 4 and 5

**4 a** 3.2      **b** 4.6      **c** 5.4
   **d** 7.0

**5** 3.5

**6** 4.7

**7 a** $x^3 + 3x^2 = 1000$      **b** 9.1 cm

**8** 3.3

**9** 7.6 and 2.6

## 8.6 Rearranging formulae

### HOMEWORK 8I

**1** $x = \dfrac{y-3}{2}$

**2** $u = v + 10$

**3** $y = \dfrac{T-2}{3}$

**4** $q = \sqrt{p}$

**5** $q = pL$

**6** $b = \dfrac{2a-1}{5}$

**7 a** 180      **b** $t = \dfrac{v-u}{10}$      **c** 8

**8 a** 4.30 pm

   **b i** $n = \dfrac{T-55}{10}$      **ii** 6

**9 a** $6x = 9y - 90$ (or $2x = 3y - 30$), $y = \dfrac{6x+90}{9}$ (or $y = \dfrac{2x+30}{3}$)      **b** 90p

**10** First journey time = 1 hour 30 minutes.
Return takes 2 hours. Average speed = 45 mph.

## 8.7 Solving linear inequalities

### HOMEWORK 8J

**1 a** $x < 5$      **b** $t > 8$      **c** $p \geq 8$
   **d** $x < 3$      **e** $y \leq 6$      **f** $t > 9$

    **g**  $x < 13$         **h**  $y \leq 11$         **i**  $t \geq 37$

    **j**  $x < 10$         **k**  $x \geq 0$         **l**  $t \geq 7.5$

**2**  **a**  5, 4, 3, 2, 1         **b**  1         **c**  25, 16, 9, 4, 1

    **d**  5, 3, 1         **e**  7, 5, 3, 2

**3**  $3x + 3.50 < 6$, $3x < 2.50$, so the most a can could cost was 83p.

**4**  $6x - 2 \geq 10$, so $x \geq 2$ or $6x - 2 \leq 16$, so $x \leq 3$. Hence the sides are 2 by 3 or 3 by 5, so the area is between 6 cm$^2$ and 15 cm$^2$.

**5**  **a**  **i**   $x > 0$, $x = 2$, $x < 9$         **ii**  $x = 3$, $x \geq 3$, $x < 2$

    **b**  Any value between 3 (inclusive) and 9 (not included).

## HOMEWORK 8K

**1**  **a**  $x \geq 1$         **b**  $x < 2$         **c**  $x > -2$

    **d**  $x \leq 0$         **e**  $x > -5$         **f**  $x \geq -1$

**2**  **a**

**b**

**c**

**d**

**e**

**f**
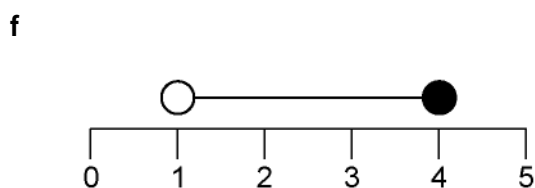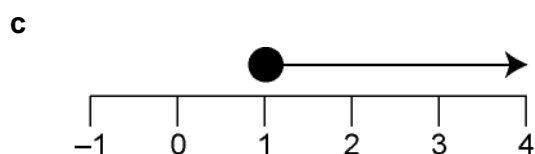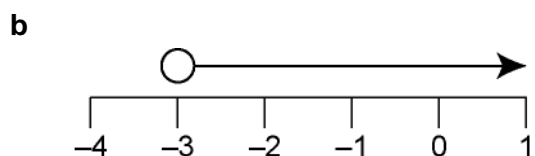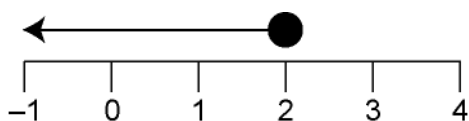
**g**
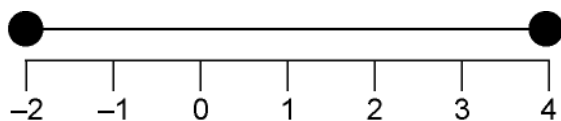


**h**
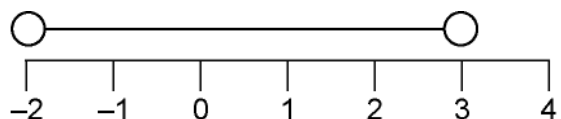


**3**  **a**  $x \geq 4$  **b**  $x < -2$  **c**  $x \leq 5$

   **d**  $x > 3$  **e**  $x \leq 1.5$  **f**  $x \geq 4$

   **g**  $x > 7$  **h**  $x < -1$  **i**  $x < 7$

   **j**  $x \leq 3$  **k**  $x > 24$  **l**  $x \geq -2$

**4**  **a**  Because 2 CDs plus the DVD cost more than £20; $x > 5.25$.

   **b**  Because 2 CDs plus the lipstick is less than £20; $x$ 6.50.

   **c**



or
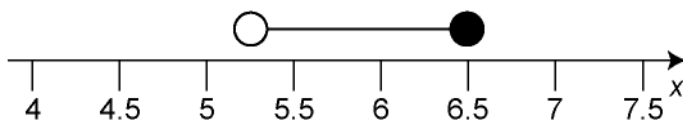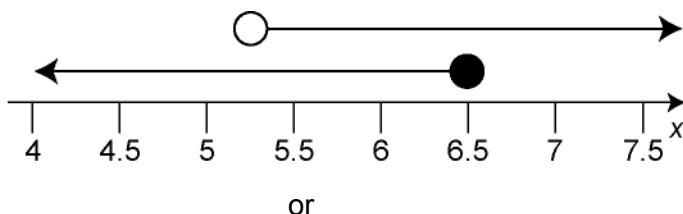


   **d**  £6

**5**  Any two inequalities that overlap only on the integers 5, 6, 7 and 8; for example, $x \geq 5$ and $x < 9$.

## Problem-solving Activity: Number problems

Establish that the first number, as in the problem, is 3.

Discuss why it cannot be 2 or 5 and make sure students can interpret all the conditions to define the number.

Students' answers will vary.

## 9 Probability: Calculating probabilities

### 9.1 Addition rule for events

**HOMEWORK 9A**

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

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

**3  a** $\frac{1}{13}$  **b** $\frac{1}{13}$  **c** $\frac{2}{13}$

**4  a** $\frac{3}{10}$  **b** $\frac{3}{10}$  **c** $\frac{3}{5}$

**5  a** $\frac{11}{15}$  **b** $\frac{2}{3}$  **c** 0

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

**6  a** 0.75  **b** 0.6  **c** 0.25

   **d** 0.6

   **e  i** because 3 and blue overlap  **ii** 0.5

**7  a** $\frac{3}{5}$  **b** $\frac{4}{5}$  **c** $\frac{3}{5}$

**8  a** 3  **b** Not certain he has 3 double yolks to start with.

**9** $\frac{6}{15}$ or $\frac{2}{5}$

**10 a** 10  **b** 20  **c** 60

   **d** $\frac{1}{10}$

**11** Each day has to be considered independently and you cannot add their respective probabilities together.

### 9.2 Experimental probability

**HOMEWORK 9B**

**1  a** $\frac{1}{5}$, $\frac{3}{20}$, $\frac{1}{5}$, $\frac{9}{50}$, $\frac{17}{100}$, $\frac{7}{40}$, $\frac{17}{100}$  **b** $\frac{1}{6}$

**2  a** $\frac{11}{60}$, $\frac{17}{120}$, $\frac{7}{40}$, $\frac{3}{20}$, $\frac{13}{60}$, $\frac{2}{15}$  **b** 20

   **c** Yes: all frequencies are close to 20.

**3  a  i** 90  **ii** 60  **iii** 30

   **b** 0.4

**4** Mon: 0.145; Tue: 0.166; Wed: 0.134; Thu: 0.141; Fri: 0.146

**5** The spinner could be considered unfair since the 3 only landed 31 times and the majority of the other numbers landed over the anticipated 40 times.

**6** Although you would expect the probability to be close to $\frac{1}{2}$, hence 25 tails, we know that there is more chance of the number of tails being close to 25 rather than actually 25.

### 9.3 Combined events

**HOMEWORK 9C**

**1** Check correctly completed sample space diagram.

   **a** 7  **b** 2 and 12  **c** $\frac{1}{36}$

**d i** $\frac{1}{18}$ **ii** $\frac{1}{12}$ **iii** $\frac{1}{6}$

**iv** $\frac{1}{2}$ **v** $\frac{1}{6}$ **vi** $\frac{1}{4}$

**2** (1, H), (2, H), (3, H), (4, H), (5, H), (6, H)
(1, T), (2, T), (3, T), (4, T), (5, T), (6, T)

**a** $\frac{1}{12}$ **b** $\frac{1}{4}$ **c** $\frac{1}{6}$

**3 a** (H, 1), (H, 2), (H, 3), (H, 4), (H, 5),
(T, 1), (T, 2), (T, 3), (T, 4), (T, 5)

**b** $\frac{3}{10}$

**4 a**

**First number**

| | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| 2 | 4 | 6 | 8 | 10 | 12 |
| 4 | 6 | 8 | 10 | 12 | 14 |
| 6 | 8 | 10 | 12 | 14 | 16 |
| 8 | 10 | 12 | 14 | 16 | 18 |
| 10 | 12 | 14 | 16 | 18 | 20 |

**Second number**

**b i** $\frac{1}{5}$ **ii** $\frac{1}{25}$ **iii** 0

**iv** $\frac{4}{25}$ **v** $\frac{9}{25}$

**5 a** $\frac{7}{12}$ **b** $\frac{3}{4}$

**6** $\frac{3}{64}$

**7** It will show him all the possible products he is able to get from each combination.

## 9.4 Expectation

**HOMEWORK 9D**

**1** 100

**2** 250

**3 a** 52 **b** 8 **c** 4

**d** 2

**4** 18

**5** 1667

**6 a** 100 **b** 100 **c** 130

**d** 0

**7** 120

**8 a** You cannot add probabilities for events like this.

**b** Increase, as he is more experienced.

**9 a** 33 **b** 83

**10 a** 28 000 **b** 90% of 112 is 100.8 out of 200, so they should win.

**11** 30 times

**12** Multiply the number of students by 0.14

### 9.5 Two-way tables

**HOMEWORK 9E**

**1** **a** **i** $\frac{1}{6}$      **ii** $\frac{1}{4}$      **iii** $\frac{1}{6}$

     **iv** $\frac{5}{36}$      **v** $\frac{1}{2}$      **vi** $\frac{29}{36}$

**2** **a** $\frac{1}{6}$      **b** $\frac{11}{36}$      **c** $\frac{1}{9}$

     **d** $\frac{3}{4}$      **e** $\frac{1}{36}$      **f** $\frac{11}{36}$

     **g** $\frac{10}{36}$ or $\frac{5}{18}$

**3**

| Score on second dice | 6 | −4 | −2 | 0 | 2 | 4 | 6 |
|---|---|---|---|---|---|---|---|
| | 5 | −3 | −1 | 1 | 3 | 5 | 7 |
| | 4 | −2 | 0 | 2 | 4 | 6 | 8 |
| | 3 | −1 | 1 | 3 | 5 | 7 | 9 |
| | 2 | 0 | 2 | 4 | 6 | 8 | 10 |
| | 1 | 1 | 3 | 5 | 7 | 9 | 11 |
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | **Score on first dice** | | | | | |

     **a** $\frac{1}{12}$      **b** $\frac{1}{6}$      **c** $\frac{1}{2}$

     **d** $\frac{1}{6}$      **e** $\frac{11}{36}$

**4** **a** $\frac{1}{2}$      **b** $\frac{1}{2}$      **c** $\frac{3}{4}$

**5** **a** $\frac{1}{4}$      **b** $\frac{3}{8}$      **c** $\frac{7}{8}$

**6** **a** $\frac{1}{12}$      **b** $\frac{1}{4}$

**7** **a** DD, TD, HD, TT, HH, TH

| **b** | Hyac | DH | DH | TH | HH |
|---|---|---|---|---|---|
| | Tulip | DT | DT | TT | HT |
| | Daff | DD | DD | TD | HD |
| | Daff | DD | DD | TD | HD |
| | | Daff | Daff | Tulip | Hyac |

     **c** $\frac{1}{4}$      **d** There are relatively more daffodils.

**8** **a** British: smaller range

     **b** British: the mean is smaller, so you get more cucumbers in the 5 kg weight.

     **c** 210 g

**9** $\frac{17}{36}$

**10** Either Senuri because she had heavier beans, or Christos because he had longer beans.

## Functional Maths Activity: Lottery competition

**1** This is a problem involving repeated selection without replacement.
The probability of Andrew winning will be $\frac{1}{20} \times \frac{1}{19} \times \frac{1}{18} \times \frac{1}{17}$.

**2** Discuss students' answers. All numbers should have equal probability initially.

**3** Discuss students' answers. The probability of any employee winning is slim, so the charity should do well.

## 10 Algebra: Patterns

### 10.1 Patterns in number

**HOMEWORK 10A**

**1** 7 × 11 × 13 × 6 = 6006, 7 × 11 × 13 × 7 = 7007

**2** 3 × 7 × 13 × 37 × 6 = 60 606, 3 × 7 × 13 × 37 × 7 = 70 707

**3** 7 × 9 = $8^2$ – 1 = 63, 8 × 10 = $9^2$ – 1 = 80

**4** 7 × 11 = $9^2$ – 4 = 77, 8 × 12 = $10^2$ – 4 = 96

**5** 9009

**6** 80 808

**7** 15 015

**8** 151 515

**9** 999 999

**10 a** The total is 45 in each case.      **b** 3 × central number

   **c** 3 × 2 = 36

### 10.2 Number sequences

**HOMEWORK 10B**

**1 a** 12, 14, 16; + 2      **b** 15, 18, 21; + 3      **c** 32, 64, 128; × 2

   **d** 33, 40, 47; + 7      **e** 30 000, 300 000, 3 000 000; × 10

   **f** 25, 36, 49; square numbers

**2 a** 34, 55; add previous two terms

   **b** 23, 30; add one more each time

**3 a** 112, 224, 448; × 2      **b** 38, 45, 52; + 7

   **c** 63, 127, 255; add twice the difference each time *or* × 2 + 1

   **d** 30, 25, 19; subtract one more each time

   **e** 38, 51, 66; add two more each time

   **f** 25, 32, 40; add one more each time

   **g** 13, 15, 16; + 2, + 1

   **h** 20, 23, 26; + 3

   **i** 32, 40, 49; add one more each time

   **j** 0, –5, –11; subtract one more each time

   **k** 0.32, 0.064, 0.0128; ÷ 5

   **l** 0.1875, 0.093 75, 0.046 875; ÷ 2

**4 a** Alexander

   **b** Jack, Briony, Fran, David, Greta, Ellie, Chris, Isabel, Hermione, Alexander

**5** No, they will not. The first sequence increases by 6 each time and the second increases by 3 each time. As 6 is a multiple of 3, the terms of the second sequence will always be 4 different from each term in the first sequence, e.g. 5, 1; 11, 7; 17, 13.

**6** 92, 80, 68, 56, 44, 32, 20, 8

### 10.3 The *n*th term of a sequence

**HOMEWORK 10C**

**1 a** 4, 7, 10, 13, 16      **b** 1, 3, 5, 7, 9      **c** 6, 10, 14, 18, 22

**d** 2, 8, 18, 32, 50    **e** 0, 3, 8, 15, 24

**2** **a** 3, 4, 5, 6, 7    **b** 3, 7, 11, 15, 19    **c** 1, 5, 9, 13, 17

**d** 2, 5, 10, 17, 26    **e** 3, 9, 19, 33, 51

**3** 1, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{4}{7}$, $\frac{5}{9}$

**4** **a** £290    **b** £490    **c** 6

**d** 4 sessions plus 3 sessions costs £160 + £125 = £285. 7 sessions cost £255, so he would have saved £30.

**5** The fractions are $\frac{2}{3}$, $\frac{3}{5}$, $\frac{4}{7}$, $\frac{5}{9}$, $\frac{6}{11}$, $\frac{7}{13}$, $\frac{8}{15}$, $\frac{9}{17}$, which as decimals are 0.6666…,

0.6, 0.571..., 0.5555…, 0.54545..., 0.5384..., 0.53333…, 0.529..., so only $\frac{3}{5}$ gives

a terminating decimal. The denominators that give terminating decimals are power of 5, e.g. 5, 25, 125, 625.

**6** $106 - 4n = 6n - 4$, rearrange as $6n + 4n = 106 + 4$, solve to get $n = 11$.

**HOMEWORK 10D**

**1** **a** $2n + 3$    **b** $4n + 2$    **c** $5n + 1$

**d** $6n - 3$    **e** $3n + 1$    **f** $7n - 4$

**2** **a** 101    **b** 201    **c** 253

**d** 296    **e** 152    **f** 345

**3** **a** **i** $7n - 2$    **ii** 698    **iii** 103

**b** **i** $2n + 7$    **ii** 207    **iii** 99

**c** **i** $5n - 3$    **ii** 497    **iii** 102

**d** **i** $4n - 2$    **ii** 398    **iii** 98 or 102

**e** **i** $8n - 3$    **ii** 797    **iii** 101

**f** **i** $n + 5$    **ii** 105    **iii** 100

**4** **a** 1000

**b** **i** $n^3 + 1$    **ii** $2n^3$    **iii** $\frac{1}{2}n^3$

**5** **a** $2k + 2.5$    **b** $2k + 3$    **c** $2k + 4$

**d** $2k + 5$    **e** £2

**6** **a** $2n + 1$    **b** $3n + 4$

**c** **i** $\dfrac{2001}{3004}$    **ii** 0.0.666 111 88…

**d** No, as the bottom includes +4 and the top is only +1 so it will always be less than $\frac{2}{3}$ .

## 10.4 Special sequences

**HOMEWORK 10E**

**1** **a** $3^6$ (729), $3^7$ (2187), $3^8$ (6561)

**b** **i** $3^n - 1$    **ii** $2 \times 3^n$

**2** **a** even    **b** odd    **c** even

**d** even    **e** even    **f** even

**g** odd    **h** even

**3** $10 + 15 = 25 = 5^2$; $15 + 21 = 36 = 6^2$

**4** **a** C    **b** C    **c** O

**d** E

## 10.5 General rules from given patterns

**HOMEWORK 10F**

**1**  **a**  12        **b**  $3n$        **c**  17

**2**  **a**        **b**  $5n + 1$



  **c**  126        **d**  diagram 39

**3**  **a**



  **b**  $9n + 1$        **c**  541        **d**  11

**4**  **a**  Check student has drawn an equilateral triangle.
  **b**  Perimeter is 36 cm.    **c**  Perimeter is 48 cm.    **d**  64 cm
  **e**  63 100 000 000 000 cm, which is about 631 million kilometres

**5**  **a**  20        **b**  120

**6**  Number of counters needed at each step is 6, 12, 18, 24, ...
  Total number is 6, 18, 36, 60, ….
  Keep this pattern (add 6 more each time) going gives
  6, 18, 36, 60, 90, 126, 168, 216, 270, 330, 309, 468, 546, 630, 720, 816, 918,
  1026, ...
  So Harry can get to the 17th step before he runs out of counters.

## Problem-solving Activity: Pascal's triangle

**1**  1, 6, 15, 20, 15, 6. 1
  1, 7, 21, 35, 35, 21, 7, 1
  1, 8, 28, 56, 70, 56, 28, 8, 1

**2**  Each row is symmetrical.
  The second diagonal is the integers.

**3**  The triangular numbers.

**4**  $2^n$

**5**  Blaise Pascal (1623–1662) was a French mathematician.

  The numbers in Pascal's triangle give the combinations for selecting three items
  from four, for example, if there are 4 items – A, B, C and D – there are four
  combinations of three, which are ABC, ABD, ACD, BCD, and there are six
  combinations of two, which are AB, AC, AD, BC, BD, CD. These are the numbers
  in the 5th row of Pascal's triangle.

## 11 Geometry: Surface area and volume of 3D shapes

### 11.1 Units of volume

**HOMEWORK 11A**

**1** 24 cm$^3$

**2** 30 cm$^3$

**3** 35 cm$^3$

**4** 40 cm$^3$

### 11.2 Surface area and volume of a cuboid

**HOMEWORK 11B**

**1** **a** **i** 72 cm$^3$  **ii** 108 cm$^2$

    **b** **i** 100 cm$^3$  **ii** 160 cm$^2$

    **c** **i** 180 cm$^3$  **ii** 222 cm$^2$

    **d** **i** 125 cm$^3$  **ii** 150 cm$^2$

**2** 24 cm$^3$, 5 cm, 5 cm, 6 cm

**3** 90 m$^3$

**4** **a** 60 cm$^3$  **b** 160 cm$^3$  **c** 120 cm$^3$

**5** 35

**6** 384 cm$^2$

**7** If this were a cube, the side length would be 6 cm, so the total surface area would be 6 × 6 × 6 = 216 cm$^2$ so yes, this particular cuboid could be a cube.

### 11.3 Surface area and volume of a prism

**HOMEWORK 11C**

**1** **a** 480 cm$^3$  **b** 528 cm$^2$

**2** **a** **i** 10.5 m$^2$  **ii** 42 m$^3$

    **b** **i** 25 m$^2$  **ii** 250 m$^3$

**3** **a** 187.8 g  **b** 189 g

**4** **a** 344 m$^3$  **b** 58

**5** 37

**6** Fill the 5-litre jug, then from that fill the 2-litre jug twice. There is 1 litre of water left in the 5-litre jug, which can be poured into the glass bottle so that 1 litre can be marked. From there on, it is simple.

### 11.4 Volume of a cylinder

**HOMEWORK 11D**

**1** **a** 549.8 cm$^3$  **b** 2513.3 cm$^3$  **c** 2261.9 cm$^3$

    **d** 572.6 cm$^3$

**2** **a** 754.0 cm$^3$  **b** 117.8 cm$^3$  **c** 1460.1 cm$^3$

**3** 4.0 kg

**4** **a** 176$\pi$ cm$^3$  **b** 1152$\pi$ cm$^3$

**5** **a** 8100 cm$^3$  **b** 35.34 cm$^3$  **c** 458

    **d** She would only need 1

**6** 2761 full  lorries

**7**   The paper on the roll is 35 cm thick.
The number of layers will be 35 ÷ 0.004 = 8750.
Taking the average radius as 22.5 cm, find the average circumference as
$2\pi \times 22.5 = 141.372$ cm, then multiply this by 8750 to get 1 237 002.107 cm,
which rounds to 12 370 metres or 12.37 km.

## Functional Maths Activity: Baking cakes

**1**   Yes, the volume of the 18 cm tin is 763.4 $cm^3$, the volume of the 25 cm tin is
1472.6 $cm^3$, which is approximately double that of the smaller tin, so she needs to
double the amounts of the ingredients.

**2**   The volume of the square tin is 768 $cm^3$, which is close to the volume of the
18 cm circular tin, so she will need 100 g of flour.

**3**   Comparing the volume of the 25 cm circular tin, she would need a tin about
22 cm square.

## 12  Geometry: Transformations 2

### 12.2 Translations

**HOMEWORK 12A**

**1  a**
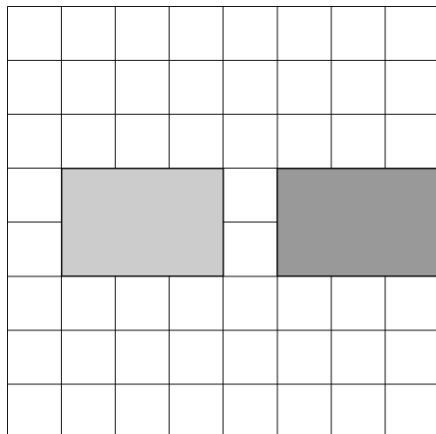


**b**
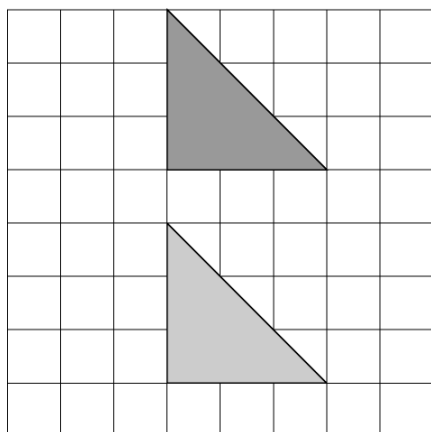


**c**
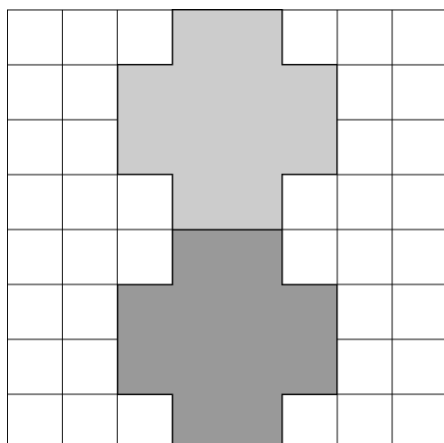
**d**
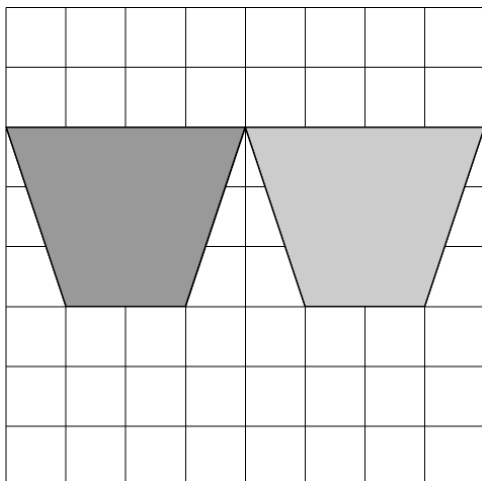
**2** **a**
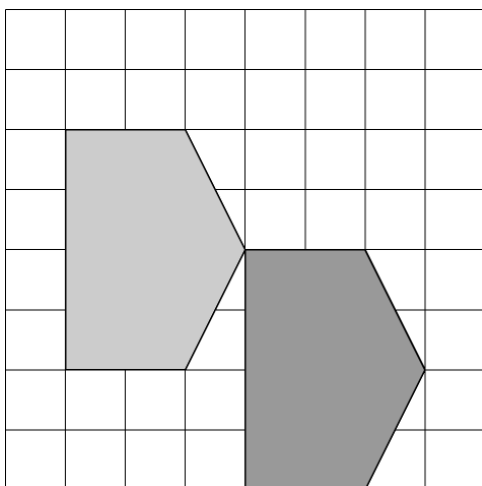
**b**
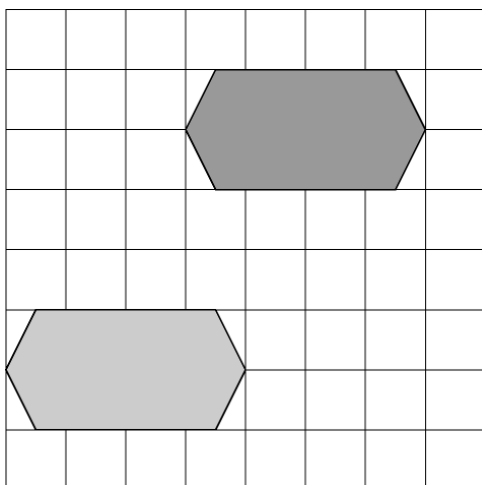
**c**
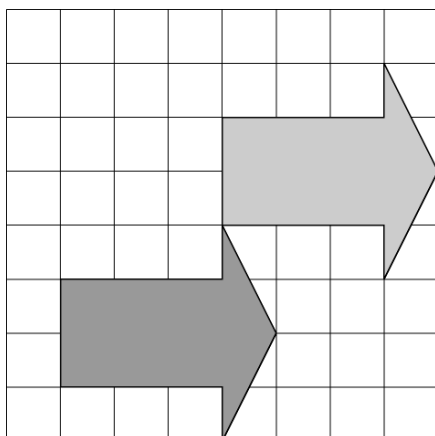


**d**
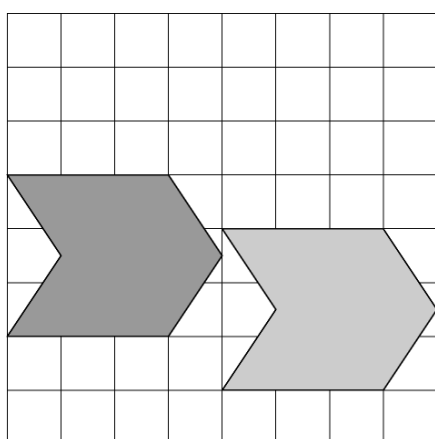


**3**  **i** $\begin{pmatrix} 7 \\ 1 \end{pmatrix}$    **ii** $\begin{pmatrix} 10 \\ -2 \end{pmatrix}$    **iii** $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$

  **iv** $\begin{pmatrix} -7 \\ -1 \end{pmatrix}$    **v** $\begin{pmatrix} 3 \\ -3 \end{pmatrix}$    **vi** $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$

**4 a–e**
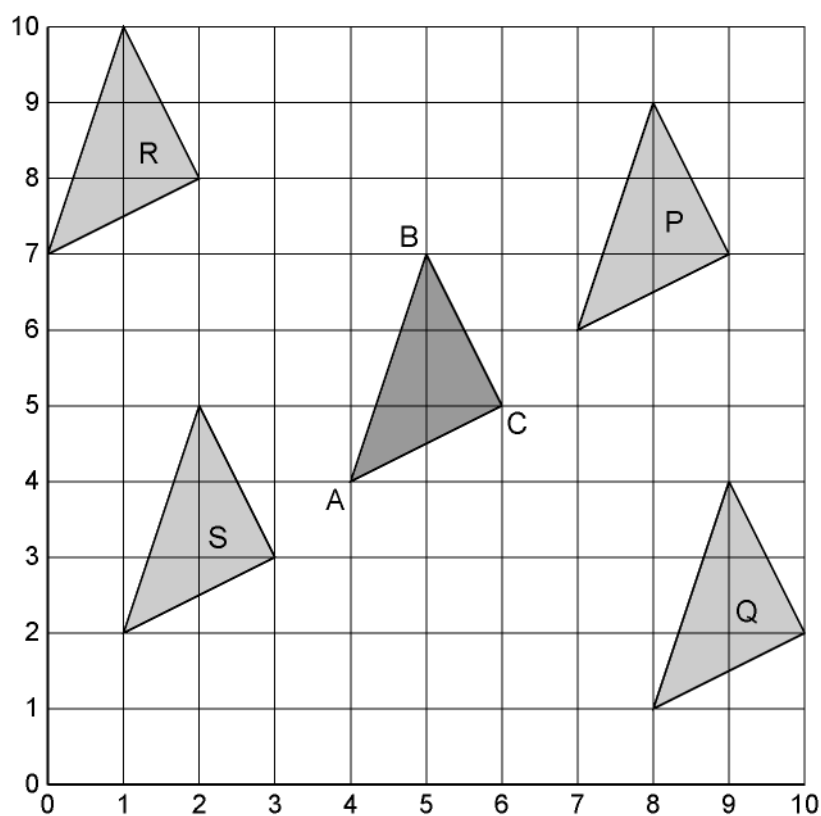


**5** $\begin{pmatrix}2\\5\end{pmatrix}$, $\begin{pmatrix}3\\-3\end{pmatrix}$, $\begin{pmatrix}-5\\-2\end{pmatrix}$ or $\begin{pmatrix}5\\2\end{pmatrix}$, $\begin{pmatrix}-3\\3\end{pmatrix}$, $\begin{pmatrix}-2\\-5\end{pmatrix}$

**6** 0 or $\begin{pmatrix}0\\0\end{pmatrix}$

## 12.2 Reflections

### HOMEWORK 12B

**1 a**
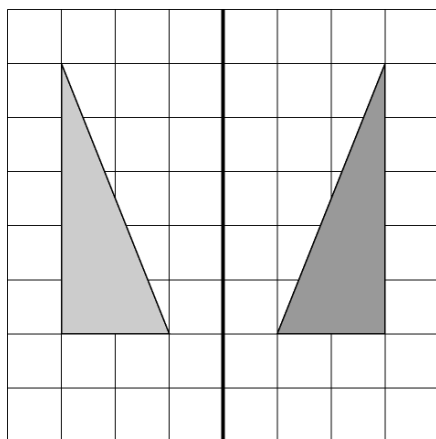
**b**
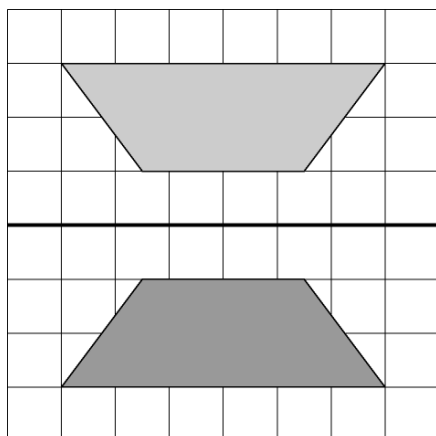


**c**
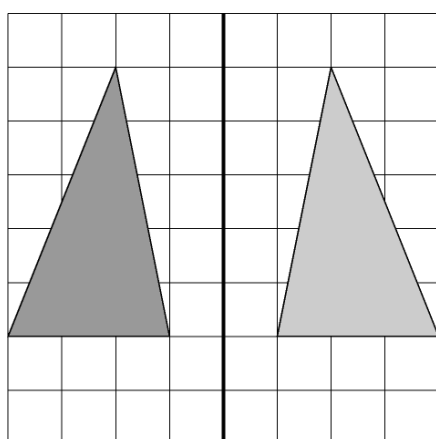


**d**
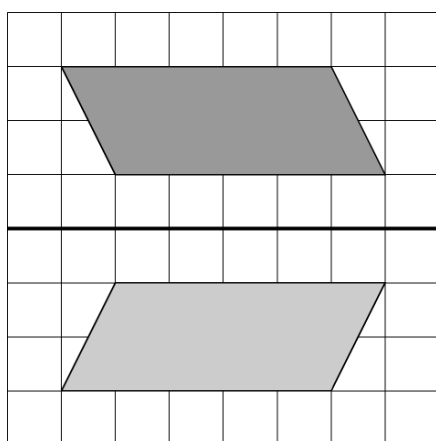
**2  a**
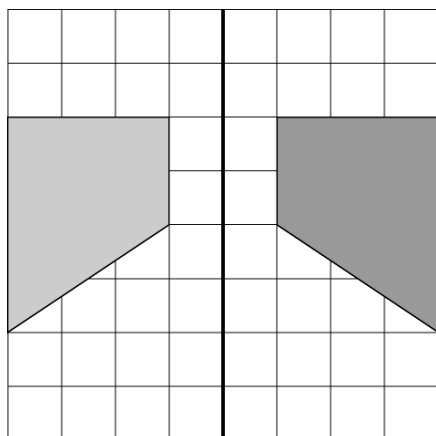


**b**
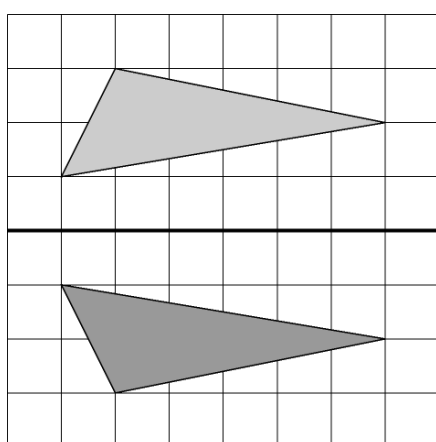


**c**
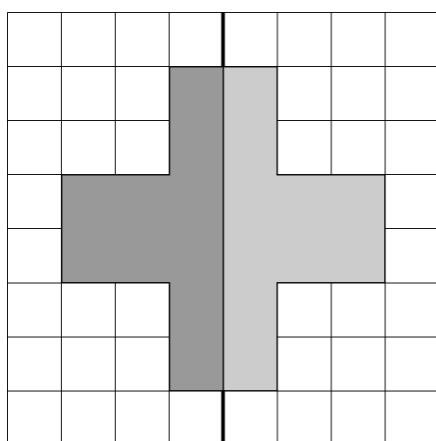
**d**
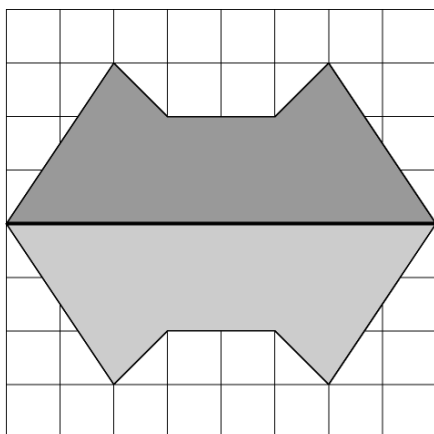


**3  a, b**
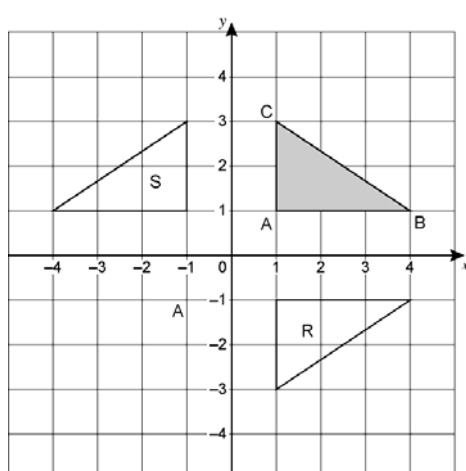


**c**  Congruent

**4**  C → O,  D → B, L → U , T → I, V → W

**5**  An equilateral triangle.

**6 a–e**
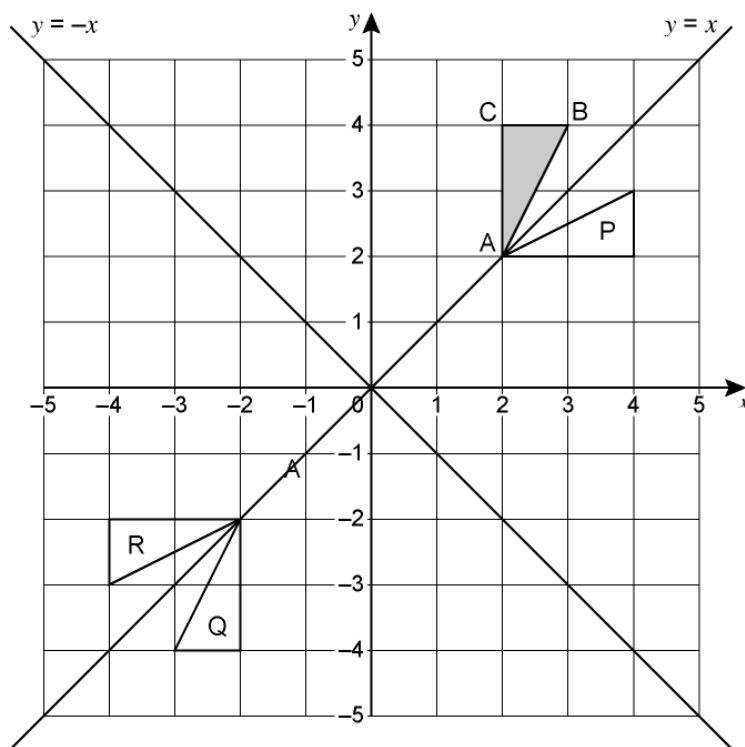


**f**   Reflection in $y = -x$

## 12.3 Rotations

**HOMEWORK 12C**

**1 a**



**b**



**c**
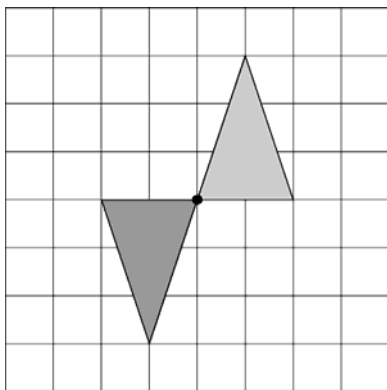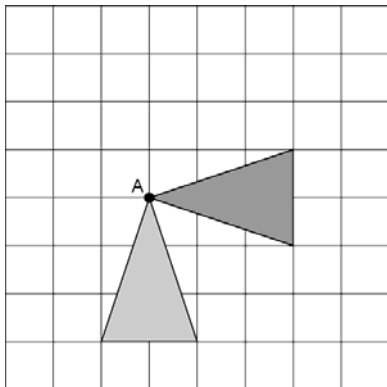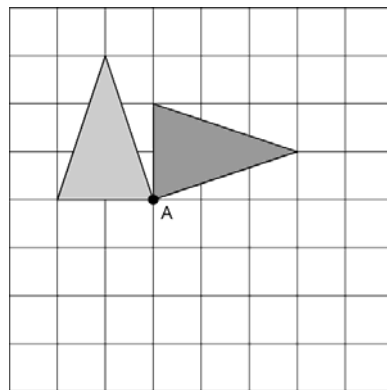


**d**
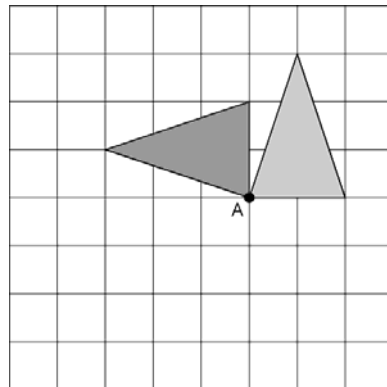
**2  a**
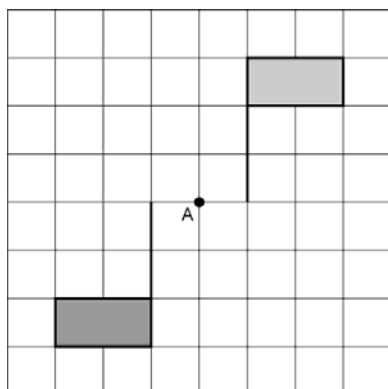
**b**
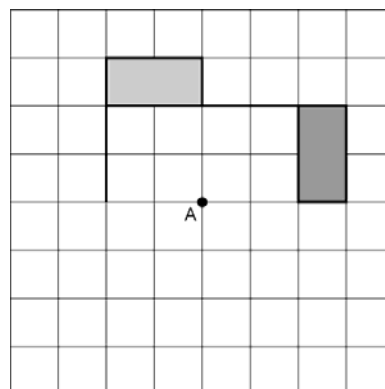
**c**
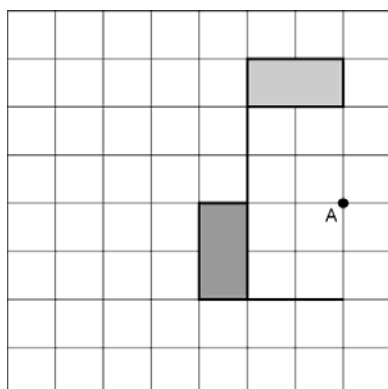
**d**
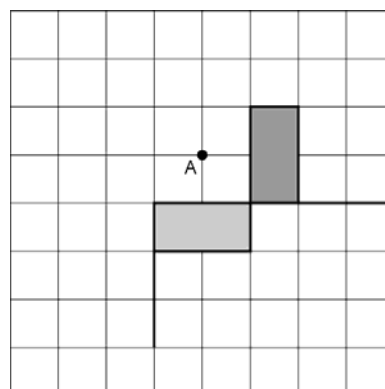
**3  a–c**
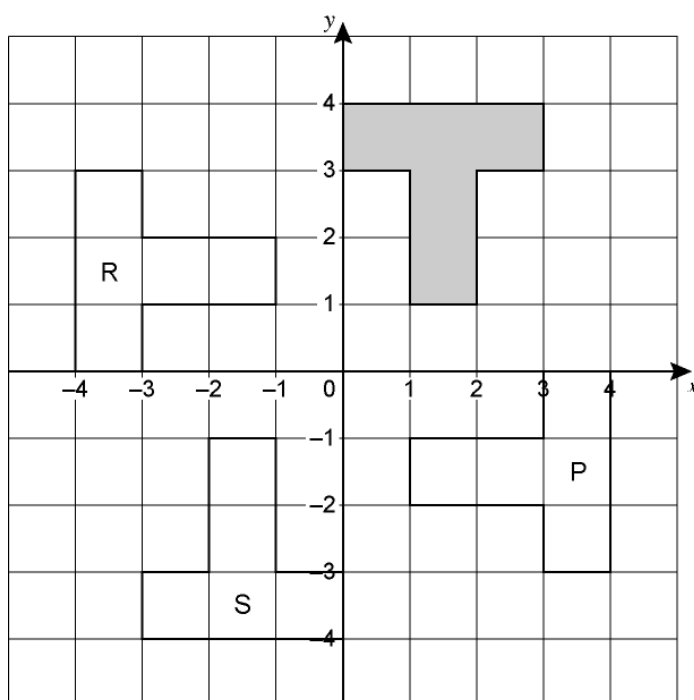
**d**  Rotation 90° clockwise about O

**4**  Check students' own designs.

**5**  There will be many different possibilities here, for example, taking the centre triangle as ABC: Rotate 60° clockwise about B, rotate image 180° about B, rotate image 120° anticlockwise about C.

**6   a–d**
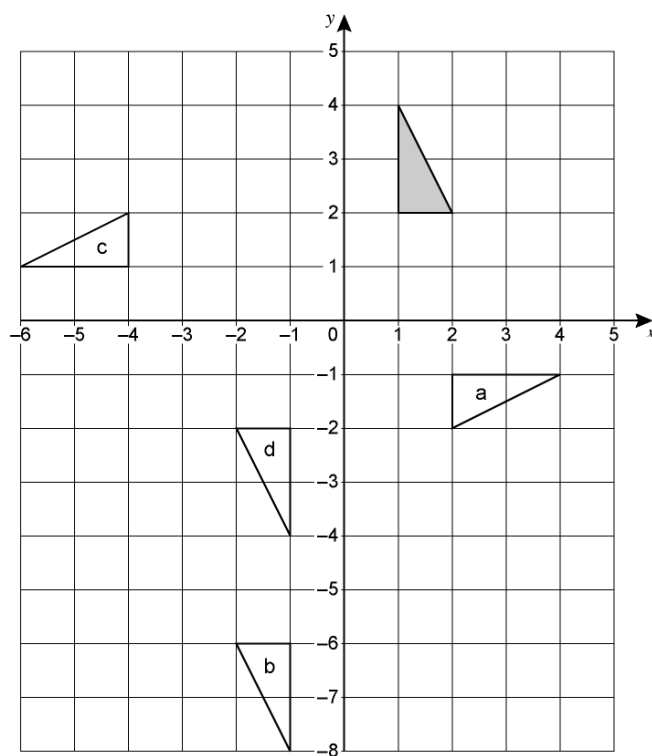


**7   C: always true**

## 12.4 Enlargements

**HOMEWORK 12D**

**1   a**
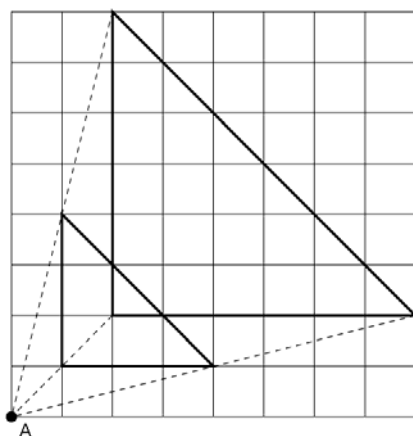
**b**
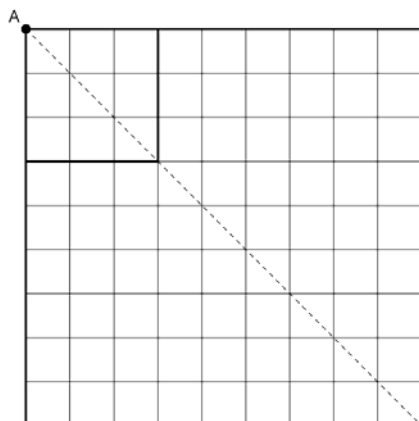


**2  a**
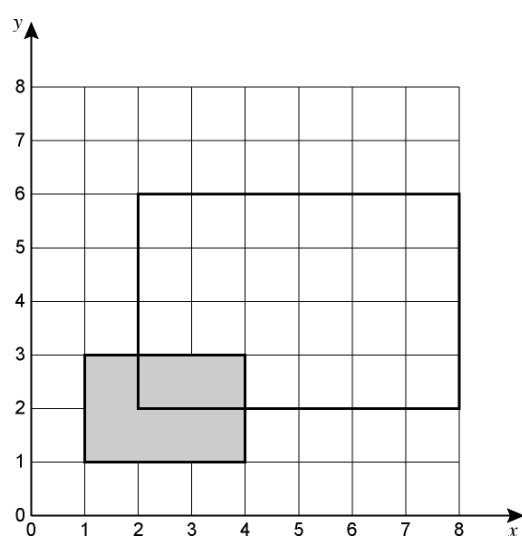


**b**
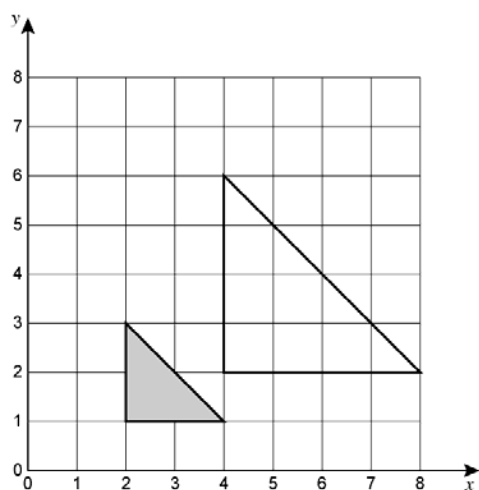
**c**
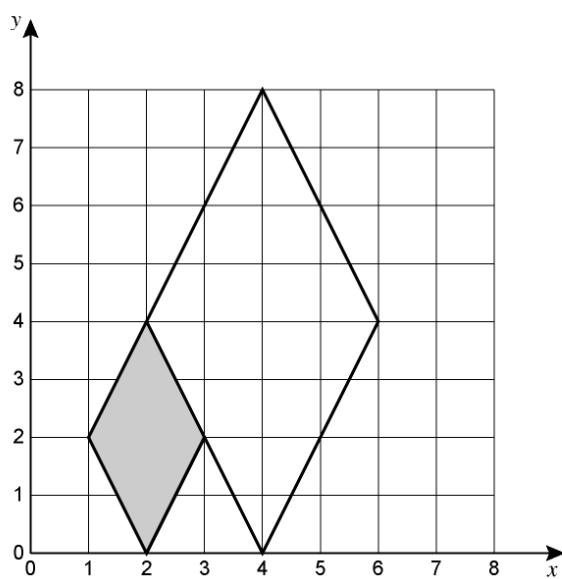


**d**
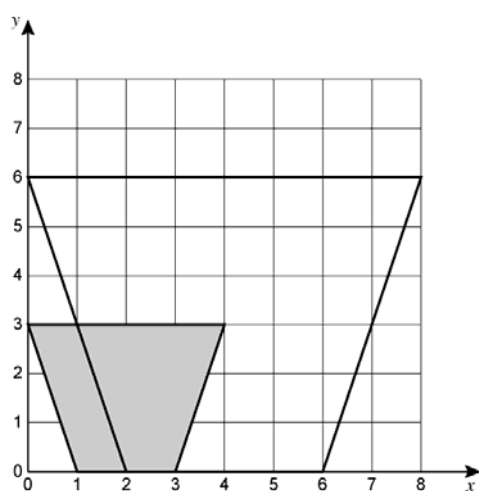


**3  a**
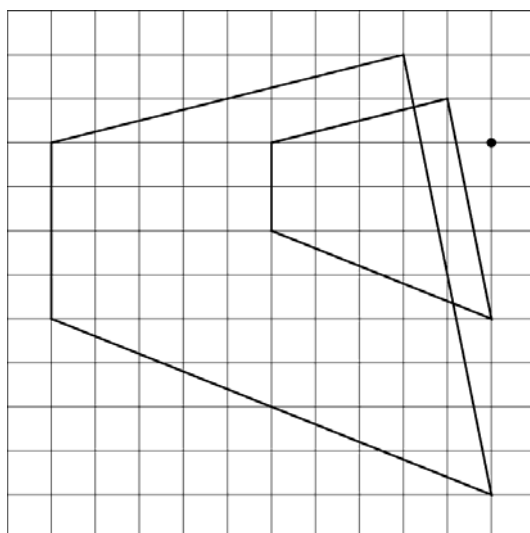
**b**
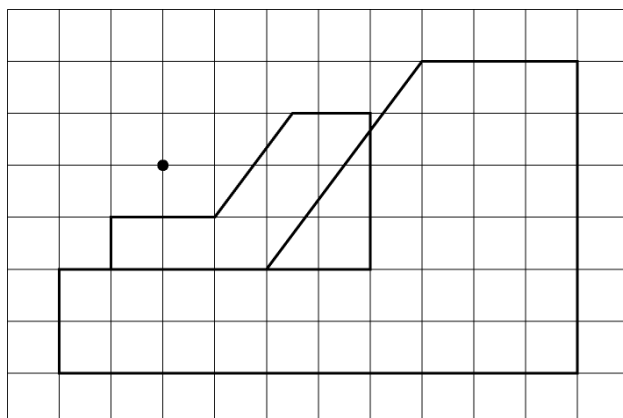


4   Check students' own designs.

5   It would have to be drawn with a scale factor of 1.

6   By a factor of 16

## Problem-solving Activity: Transformation problem 2

Check students' answers. Ask them to explain their reasoning and encourage them to investigate different combinations.

## 13  Geometry: Circles

### 13.1 Drawing circles

**HOMEWORK 13A**

**1**  **a**  Radius 1 cm, diameter 2 cm

　　**b**  Radius 2.5 cm, diameter 5.0 cm

　　**c**  Radius 3.0 cm, diameter 6.0 cm

**2**  Check students' circles.

　　**a**  Radius 1.5 cm　　**b**  Radius 4 cm　　**c**  Diameter 7 cm

　　**d**  Diameter 9.6 cm

**3**  Check students' accurate diagrams.

**4**  Check students' accurate diagrams. Diameter is 5 cm.

**5**  2.9 cm

**6**  $a$ = 12 cm, $b$ = 18 cm

**7**  **a**  tangent

　　**b**  Check students' diagrams with radius OY drawn.
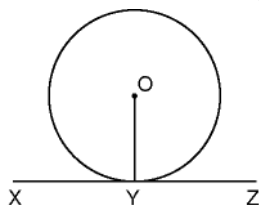


　　**c**  It is a right angle.

**8**  22

### 13.2 The circumference of a circle

**HOMEWORK 13B**

**1**  **a**  9.4 cm　　　**b**  28.3 cm　　　**c**  31.4 cm

　　**d**  37.7 cm　　　**e**  66.0 cm

**2**  **a**  12.6 cm　　　**b**  22.0 cm　　　**c**  44.0 cm

　　**d**  62.8 cm　　　**e**  78.5 cm

**3**  48 m

**4**  **a**  314.2 m　　　**b**  16

**5**  51.4 m

**6**  12.7 cm

**7**  15.9 cm

**8**  $2\pi(r + 1) - 2\pi r = 2\pi r + 2\pi - 2\pi r = 2\pi$

**9**  850 (2 sf)

### 13.3 The area of a circle

**HOMEWORK 13C**

**1**  **a**  12.6 cm$^2$　　**b**  113.1 cm$^2$　　**c**  201.1 cm$^2$

　　**d**  314.2 cm$^2$　　**e**  452.4 cm$^2$

**2**  **a**  3.1 cm$^2$　　　**b**  28.3 cm$^2$　　**c**  78.5 cm$^2$

　　**d**  227.0 cm$^2$　　**e**  490.9 cm$^2$

**3**  **a**  Yes.

   **b**  A tablecloth with a diameter of 1 metre.

**4**  **a**  113.1 m$^2$        **b**  7 m         **c**  153.9 m$^2$

   **d**  40.8 m$^2$

   **e**  No, he needs about 41 square metres and the cost would be close to £500.

**5**  **a**  357 m        **b**  6963 m$^2$

**6**  **a**  15.9 cm       **b**  8.0 cm

   **c**  199.0 cm$^2$ (using the value on the calculator for part b); rounded value of 8.0 cm gives 201.1 cm$^2$.

**7**  9.3 cm$^2$

**8**  Choose a value for *d*, the radius will be $\frac{1}{2}d$. Working out the area, using either the diameter or radius, should then give the same answer.

   $A = \pi r^2 = \pi(\frac{1}{2}d)^2$, so $A = \dfrac{\pi d^2}{4}$

**9**  189.3 cm$^2$

## 13.4 Answers in terms of $\pi$

**HOMEWORK 13D**

**1**  **a**  $7\pi$ cm       **b**  $10\pi$ cm       **c**  $19\pi$ cm

   **d**  $6\pi$ cm

**2**  **a**  $64\pi$ cm$^2$     **b**  $12.25\pi$ cm$^2$   **c**  $81\pi$ cm$^2$

   **d**  $20.25\pi$ cm$^2$

**3**  15

**4**  He doubled the radius instead of squaring it; correct answer is $64\pi$ cm$^2$.

**5**  4 cm

**6**  6 cm

**7**  $\dfrac{20}{\pi}$ cm

**8**  $\sqrt{\dfrac{20}{\pi}}$ cm

**9**  **a**  **i**  $(4\pi + 8)$ cm    **ii**  $8\pi$ cm$^2$

   **b**  **i**  $(2\pi + 16)$ m   **ii**  $(2\pi + 24)$ m$^2$

**10**  $4a^2 - \pi a^2$

## Functional Maths Activity: Track-and-field event measurement

**1**  9620 m$^2$

**2**  1608 m$^2$

**3**  401 m

**4**  464 m

**5**  30 km/h

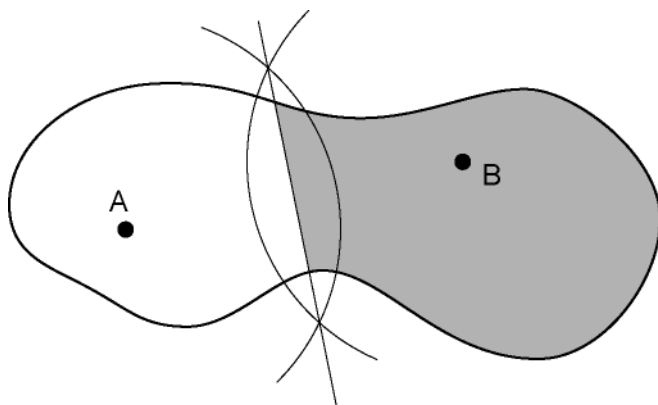**6**  Discuss students' answers. They could try internet searches to explore reasons.

## 14 Geometry: Constructing bisectors and loci

### 14.1 Bisectors

**HOMEWORK 14A**

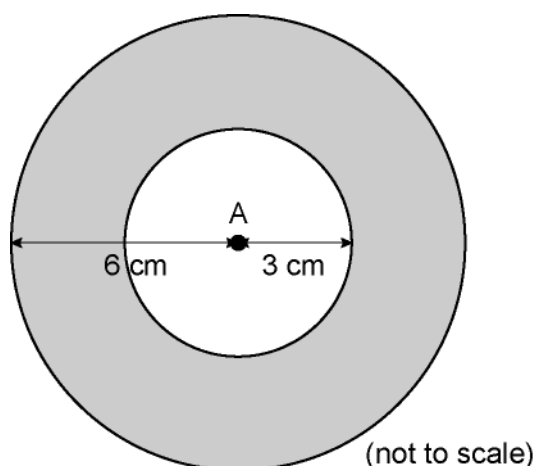**1–4** Check students' own drawings.

**5**



**6** Students should:

    **a** construct and bisect an angle of 60°, then bisect one of the angles of 30° to get 15°

    **b** construct an angle of 60°, then use one of its sides to construct an angle of 75° to make 75°.

**7** Because each angle bisector is the locus of points equidistant from the two sides enclosing the bisected angle; therefore the point where they all meet will be the only point equidistant from all three sides.
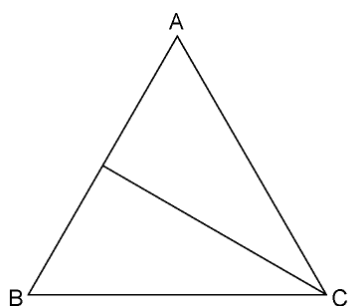
### 14.2 Loci

**HOMEWORK 14B**

**1**

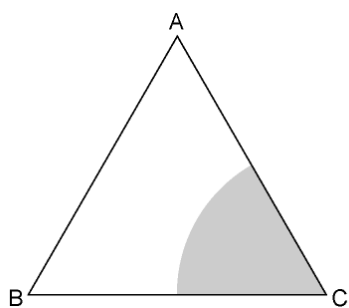**2**  **a**
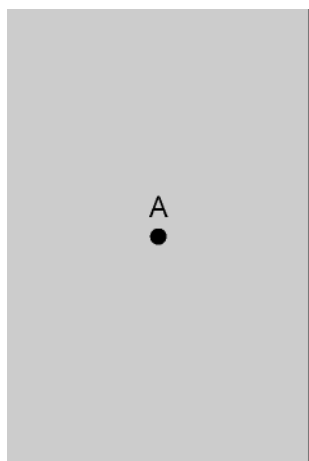


**b**
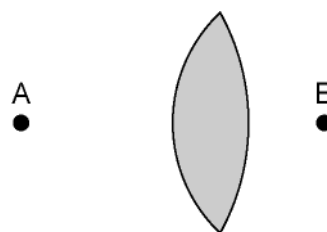


**3**  Sphere, radius 1 metre

**4**  **a**
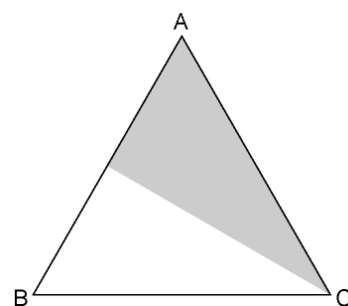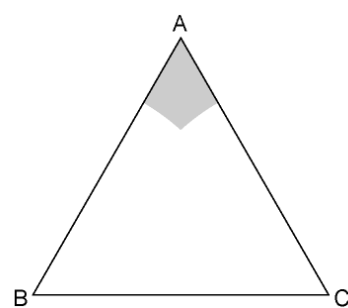


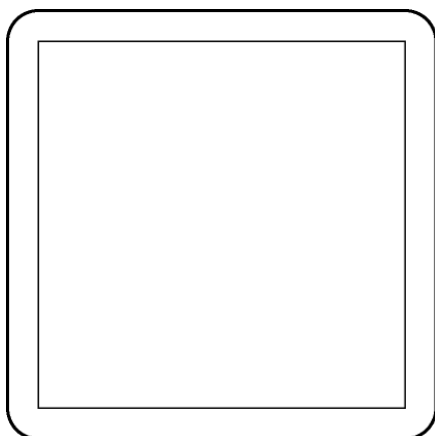**b**



**c**



**d**



**5**
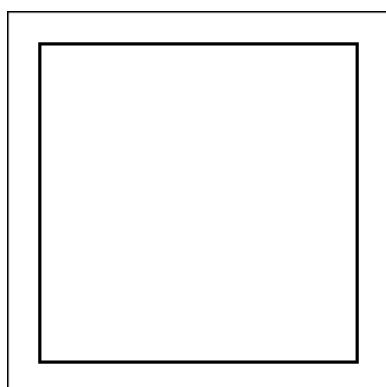
**6**



**7**



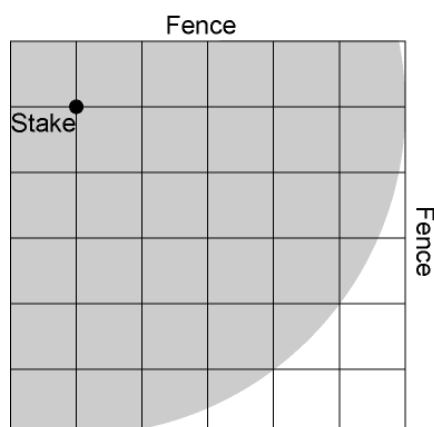**8** Check students' own drawings.

**9**



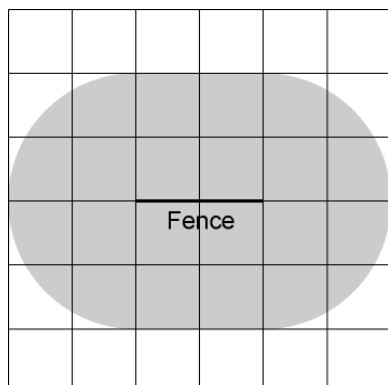Note: the starting point may be any point along the locus.

**10** The smallest number is 4. He can cover the whole courtyard if a camera is placed at the centre of each side. Other arrangements are possible.


**HOMEWORK 14C**

**1**

**2**



**3**
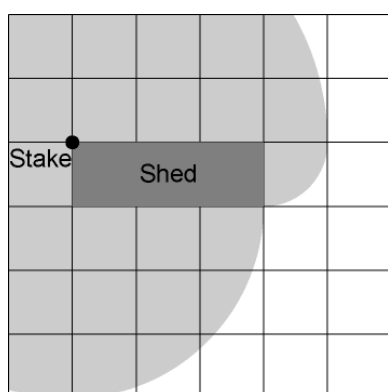


**4**  **a**  Check students' diagrams.

    **b**  No                **c**  No

**5**  No

**6**  **a**  Check students' diagrams.

    **b**  No

**7**  Between 50 and 210 km

**8**  b: The locus is just two points.

## Functional Maths Activity: Loci

**1**  Check students' diagrams.
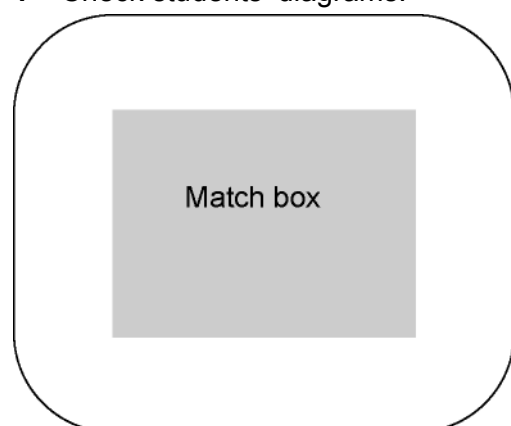
**2** Check students' diagrams.

Match box
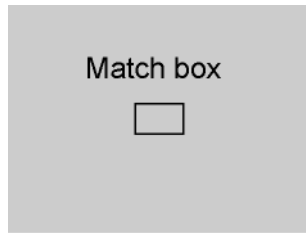
**3** The distance between the centre of the coin and the edge of the box would be halved.

**4** Similar in the plan view, depending on the size of the marble, but it would be three-dimensional, the height of the radius above the base of the box.

**5** Discuss students' answers, referring to the hint and the locus described in part 4.

## 15 Algebra: Quadratic graphs

### 15.1 Drawing quadratic graphs

**HOMEWORK 15A**

**1 a**



| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $y = 2x^2$ | 18 | 8 | 2 | 0 | 2 | 8 | 18 |
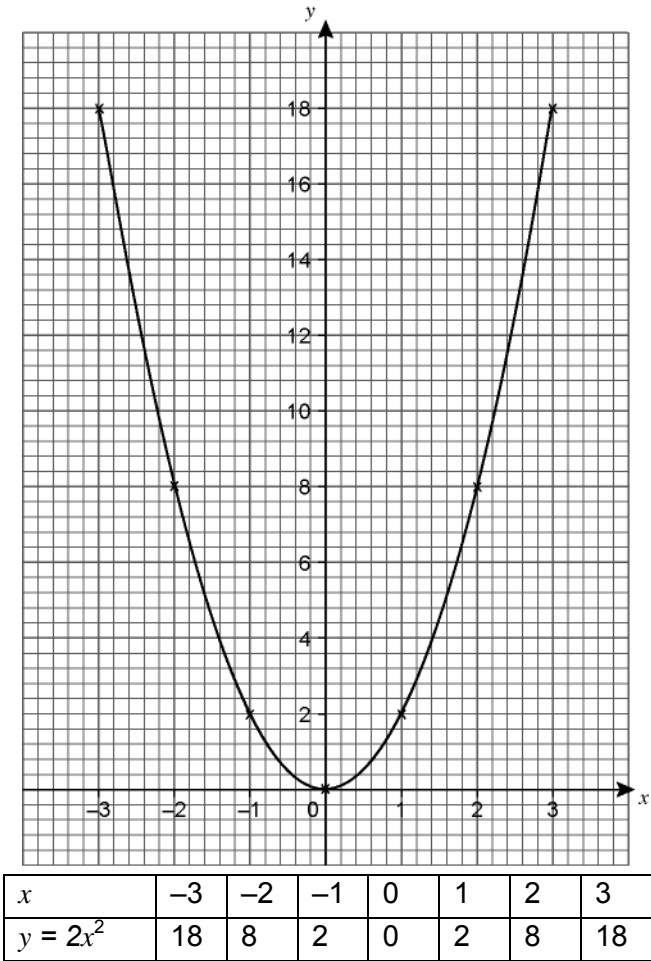
**b** $y = 4$        **c** ±2.2

**2   a**
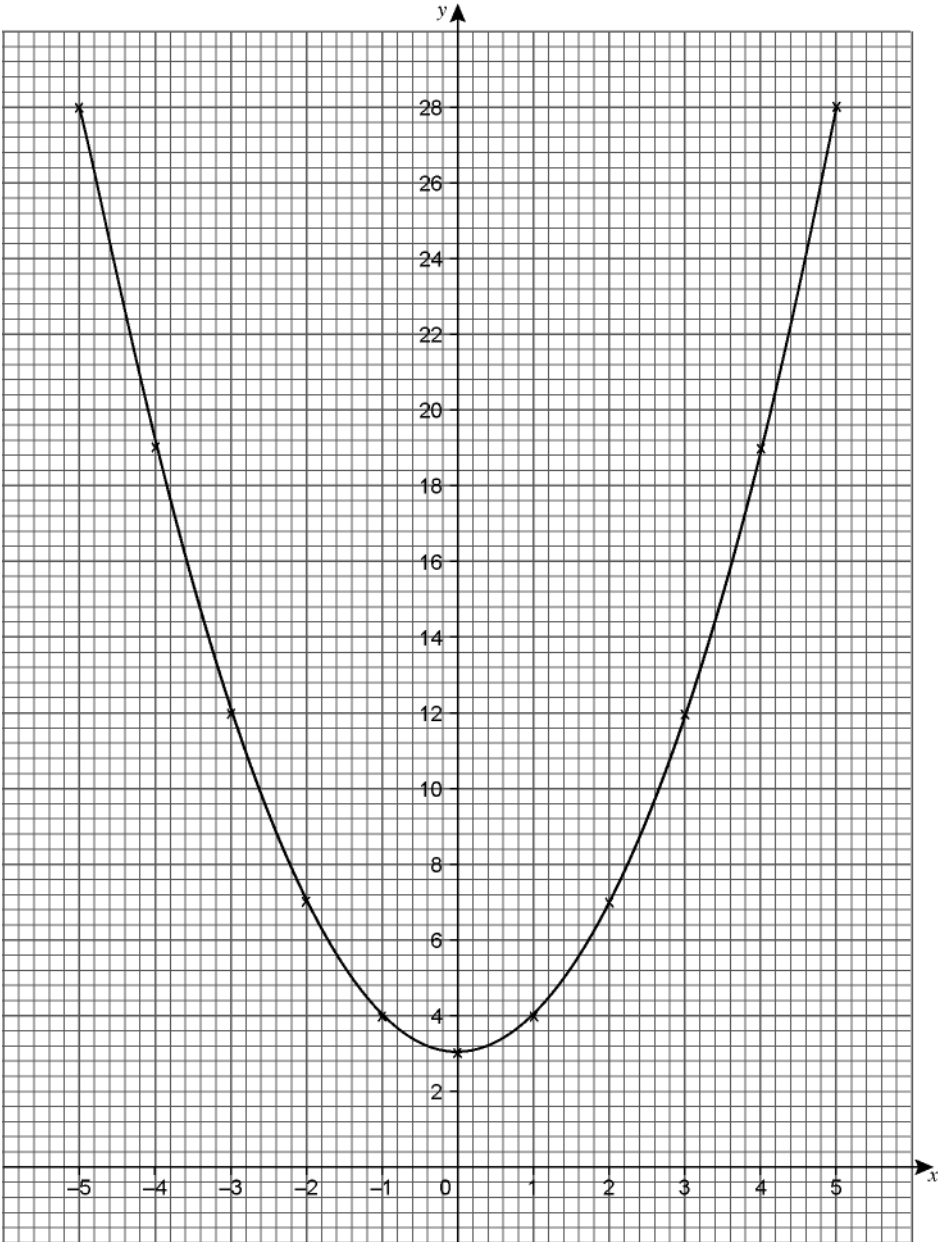


| $x$ | −5 | −4 | −3 | −2 | −1 | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $y = x^2 + 3$ | 28 | 19 | 12 | 7 | 4 | 3 | 4 | 7 | 12 | 19 | 28 |

**b**  9.2                    **c**  ±2.6

**3   a**
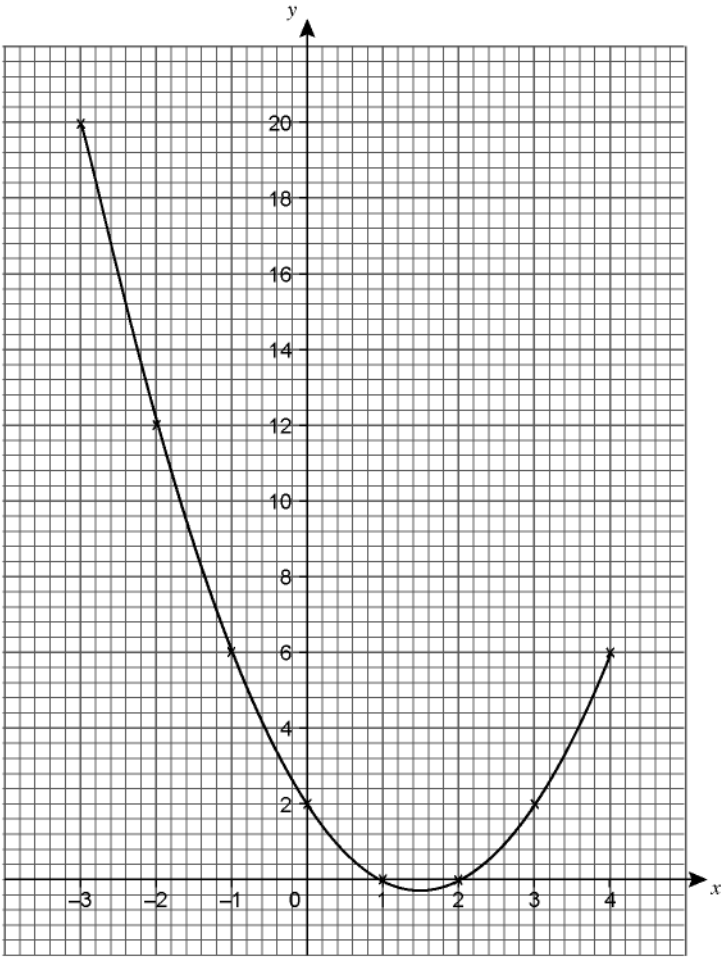


| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| $y = x^2 - 3x + 2$ | 20 | 12 | 6 | 2 | 0 | 0 | 2 | 6 |

**b**   8.75                **c**   −0.15, 3.15

**4 a**
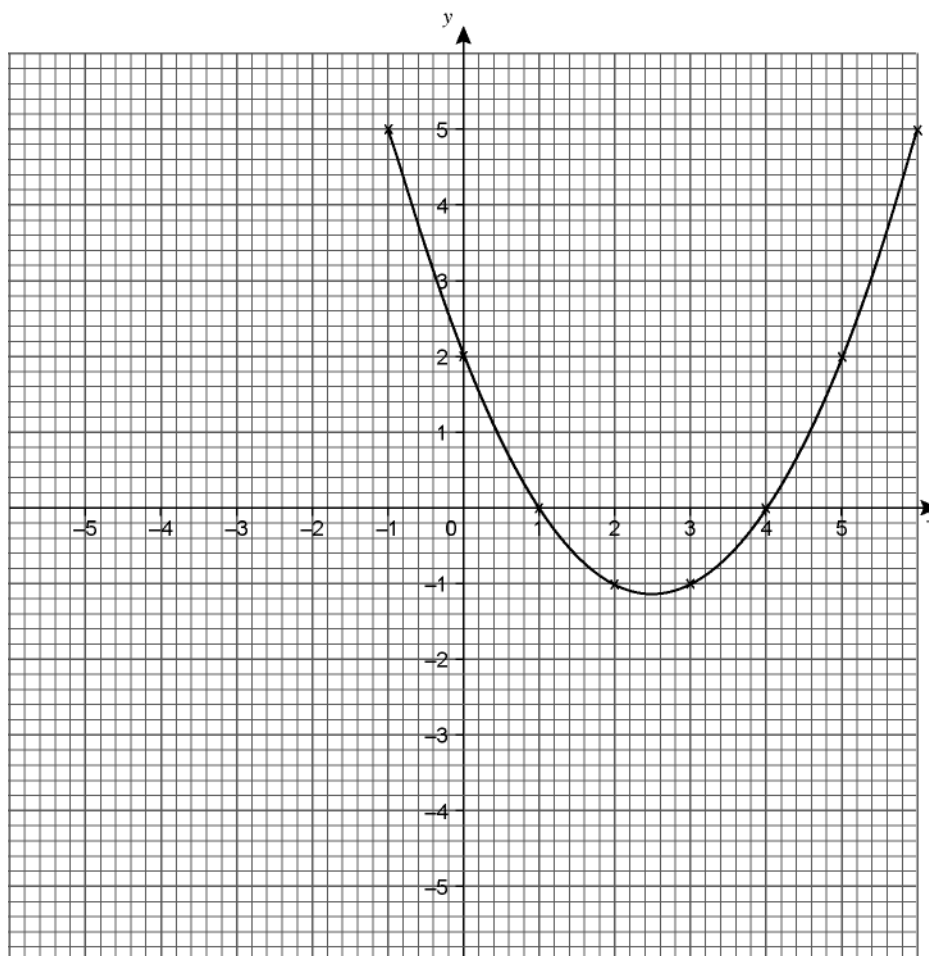


| $x$ | −1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| $y = x^2 - 5x + 4$ | 10 | 4 | 0 | −2 | −2 | 0 | 4 | 10 |

**b** $x = 1, x = 4$ **c** −2.25 **d** −0.7, 5.7

**5** B and C

**6** Car headlights are parabolic in shape and the bulb is at the focus, so that the headlight beam shines straight forward and isn't dispersed all around the car.

## Problem-solving Activity: Drawing quadratic graphs

The graph of $y = x^2 - ax$ will cross the $x$-axis at (0, 0) and ($a$, 0).

The graph of $y = x^2 + bx$ will cross the $x$-axis at (0, 0) and (−$b$, 0).

## 16 Geometry: Pythagoras' theorem

### 16.1 Pythagoras' theorem

**HOMEWORK 14A**

**1**  5 cm

**2**  4.4 cm

**3**  10.6 cm

**4**  35.4 cm

**5**  a, b, d, f, g, h

**6**  56.6 cm

**7**  One side of square is $\sqrt{\frac{1}{2}}$ of $8^2$ = $\sqrt{32}$

  Area of square = $\sqrt{32}$ × $\sqrt{32}$ = 32

### 16.2 Finding a shorter side

**HOMEWORK 16B**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1** | **a** | 23.7 cm | **b** | 22.2 cm | **c** | 6.9 cm |
| | **d** | 32.6 cm | **e** | 8.1 cm | **f** | 760 m |
| | **g** | 0.9 cm | **h** | 12 m | | |
| **2** | **a** | 10 m | **b** | 27.2 cm | **c** | 29.4 m |
| | **d** | 12.4 cm | | | | |

**3**  6.7 m

**4**  224 km

**5**  The sum of the areas of the two smaller semicircles is equal to the area of the larger semicircle.

**6**  An equilateral triangle

### 16.3 Solving problems using Pythagoras' theorem

**HOMEWORK 16C**

**1**  9.0 m

**2**  3.2 m

**3**  14.1 m

**4**  10 km

**5**  3.2 km

**6**  **a**  7.9 m

  **b**  3.9 m

**7**  1.4 units

**8**  12.0 cm$^2$

**9**  Yes, $41^2 = 40^2 + 9^2 = 1681$

**10**  14.8 units

**11**  616 km

**12**  Diameter 5 cm, height 12 cm
  or diameter 12 cm, height 5 cm

## Problem-solving Activity: Pythagoras' theorem

**1**  Check students' answers, may depend on the size of paper!

**2**  Check students' answers.

**3**  For the $n$th triangle drawn, the hypotenuse is $\sqrt{2^2 + n}$.

**4**  Check students' answers, may depend on the size of paper!

**5**  Check students' answers.

**6**  For the $n$th triangle drawn, the hypotenuse is $\sqrt{5^2 - n}$.