## 1    Number: Basic Number

### 1.1 Place value and ordering numbers
### Homework 1A

**1**  **a**  70                    **b**  4                    **c**  600
   **d**  4000                 **e**  7                    **f**  600
   **g**  2                    **h**  2000                 **i**  80 000
   **j**  7 000 000

**2**  **a**  Seven thousand, two hundred and forty-five
   **b**  Nine thousand and seventy-two
   **c**  Twenty-nine thousand, four hundred and fifty
   **d**  Two million, seven hundred and sixty thousand
   **e**  Five million, eight hundred thousand

**3**  **a**  8500                  **b**  42 042               **c**  6 000 000
   **d**  5 000 005

**4**  **a**  8, 12, 14, 20, 22, 25, 30, 31
   **b**  151, 155, 159, 167, 168, 170, 172, 176
   **c**  1990, 1998, 2000, 2002, 2010, 2070, 2092, 2100

**5**  **a**  75, 72, 62, 57, 50, 49          **b**  1052, 1010, 1007, 999, 988, 980
   **c**  4765, 4756, 4675, 4657, 4576, 4567

**6**  **a**  Great Yarmouth          **b**  Scarborough

**7**  **a**  5789, 5798, 5879, 5897, 5978, 5987, 7589, 7598, 7859, 7895, 7958, 7985, 8579, 8597, 8759, 8795, 8957, 8975, 9578, 9587, 9758, 9785, 9857, 9875
   **b**  5789                  **c**  9875

**8**  66, 64, 62, 46, 44, 42, 26, 24, 22

**9**  **a**  Twelve thousand, seven hundred and fifty-six
   **b**  Two hundred and thirty-eight thousand
   **c**  Ninety-four million, six hundred thousand

**10**     9516 or 9156

**11** **a** −30, −28, −13, −10, −5, 5, 12, 20
   **b** −2.9, −2, −1.1, −1, 0, 1, 1.1, 1.6, 2
   **c** −13, −12, −6, −1, 0, 1, 5, 26
   **d** $-6, -4, -1.3, -\dfrac{1}{2}, 0, 1.8, 2, 2\dfrac{3}{4}, 3.1$

**12** **a** 15 °C               **b** 4 °C               **c** 1 °C              **d** 2 °C
   **e** −14 °C              **f** 7 °C               **g** −21 °C             **h** −1 °C
   **i** −1 °C               **j** −9 °C

**13** **a** 3 °C               **b** 10 °C              **c** 2 °C              **d** 4 °C
   **e** 4 °C                **f** 1 °C               **g** 6 °C              **h** 7 °C
   **i** 12 °C               **j** 2 °C

### 1.2 Order of operations and BIDMAS
### Homework 1B

**1**  **a**  19                   **b**  16                   **c**  8
   **d**  6                    **e**  6                    **f**  12
   **g**  11                   **h**  2                    **i**  6
   **j**  20                   **k**  13                   **l**  13

**2**  **a**  18                   **b**  2                    **c**  2
   **d**  9                    **e**  9                    **f**  13
   **g**  4                    **h**  20                   **i**  15

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **j** | 4 | **k** | 2 | **l** | 5 |

**3** **a** 4 × (5 − 1)  **b** (8 ÷ 2) + 4  **c** (8 − 3) × 4
  **d** 12 − (5 × 2)  **e** 3 × (3 + 2)  **f** 12 ÷ (2 + 1)
  **g** 9 × (6 ÷ 3)  **h** 20 − (8 + 5)  **i** (6 + 4) ÷ 2
  **j** 16 ÷ (4 ÷ 2)  **k** (20 ÷ 2) + 2  **l** (5 × 3) − 5

**4** No, 8 − 3 × 2 = 8 − 6 = 2

**5** **a** 2 × 5 − 10  **b** 10 ÷ (2 × 5) or (10 ÷ 2) ÷ 5
  **c** 10 − (5 + 2) or 10 − 5 − 2
  **d** 10 × 2 ÷ 5  **e** (10 − 5) + 2  **f** 5 + 10 ÷ 2
  **g** 10 + (5 − 2)  **h** 5 + 10 + 2  **i** 10 + 2 × 5
  **j** 5 × 10 ÷ 2 or 5 + 10 × 2
  **k** (2 + 2) ÷ 2 or 2 × 2 − 2 or 2 + 2 − 2

**6** Amanda did the addition first: (3 + 4) × 5 = 35;
Andrew did the multiplication first: 3 + (4 × 5) = 23

**7** Do the multiplication first: 7 + 2 × 6 = 7 + 12
Now do the addition:  7 + 12 = 19

**8** (2 + 5) × 6 = 42

**9** (8 − 3) ÷ 5 = 1

**10** **i** (**ii** would also give the correct answer, if he used a scientific calculator.)

## 1.3 The four rules
### Homework 1C

**1** **a** 98  **b** 401  **c** 600
  **d** 8109  **e** 4917

**2** **a** 126  **b** 642  **c** 933
  **d** 985  **e** 5044

**3** **a** 234  **b** 523  **c** 578
  **d** 272  **e** 2853

**4** **a** 90  **b** 191  **c** 66
  **d** 542  **e** 5644

**5** **a** 183 minutes or 3 hours 3 minutes  **b** 17 minutes

**6** 435

**7** **a** 2, 7  **b** 4, 5  **c** 5, 6, 0
  **d** 2, 6, 8

**8** **a** 2, 6  **b** 6, 4  **c** 4, 4, 8
  **d** 6, 2, 2

**9** **a** 6.88  **b** 67.95  **c** 11.67  **d** 102.71
  **e** 73.81  **f** 53.32  **g** 115.57  **h** 55.66
  **i** 82.46  **j** 11.58

**10** **a** 72  **b** 152  **c** 620
  **d** 2448  **e** 2872

**11** **a** 105  **b** 259  **c** 1827
  **d** 3504  **e** 19 284  **f** 6.3  **g** 14.8
  **h** 121.8  **i** 3.424  **j** 19.29

**12** **a** 342  **b** 175  **c** 201
  **d** 1452  **e** 320

**13** **a** 47  **b** Jake = £75, Tomas = £60, Theo = £100

**14** Three numbers with a total of 55. Second number must be the smallest; third number must be the biggest, e.g. 15, 10, 30

**15 a** 385     **b** £1.61     **c** 720
    **d** £6272     **e** 10 560
**16 a** 36     **b** 63     **c** 125
    **d** £515     **e** 342
**17 a** 8.5     **b** 7.25     **c** 7.25
    **d** 6.8     **e** 9.5     **f** 155.5
    **g** 23.5     **h** 15     **i** 12     **j** 45.5

## Homework 1D

**1 a** 2   **b** 4   **c** 3   **d** 3   **e** −3   **f** −1
**2 a** −4   **b** −1   **c** 2   **d** 30   **e** 4   **f** 7
**3 a** −134   **b** 22   **c** 9   **d** 0   **e** −31   **f** 0
**4** 12 °C
**5** −£122
**6** 62 degrees

## Homework 1E

**1 a** −5   **b** −1   **c** −7   **d** −10   **e** −2   **f** −8
**2 a** −17   **b** −9   **c** −21   **d** −20   **e** −2   **f** −3
**3 a** −20   **b** −17   **c** 28   **d** 28   **e** 2   **f** 12
**4 a** −77   **b** −85   **c** −77   **d** −29   **e** −72   **f** 66
    **g** 40   **h** 42   **l** 51   **j** 15

## Homework 1F

**1 a** −40   **b** 28   **c** −56   **d** −63   **e** −36   **f** −169
**2 a** 12   **b** 4   **c** −16   **d** −6   **e** −12   **f** −7
**3 a** −18   **b** 28   **c** −3   **d** −7   **e** −20   **f** 4
    **g** 24   **h** −5   **i** −60   **j** 10   **k** −22   **l** −37
**4 a** −2   **b** −8   **c** −6   **d** 9   **e** 3   **f** −4   **g** −7   **h** −4
**5**

| × | −2 | 2 | 6 |
|---|---|---|---|
| −3 | 6 | −6 | −18 |
| −7 | 14 | −14 | −42 |
| 8 | −16 | 16 | 48 |

**6 a** 16     **b** 4     **c** 100
    **d** 144     **e** 4     **f** 40

## Homework 1G

**1 a** 1968     **b** 792     **c** 1316     **d** 6972
    **e** 4644     **f** 6897     **g** 14 472     **h** 4862
    **i** 13 442     **j** 30 444
**2 a** 1176     **b** 2565     **c** 4368
    **d** 408     **e** 70 980     **f** 1311
**3 a** 307 992     **b** 5 517 358     **c** 1 423 314
    **d** 567 987     **e** 454 425     **f** 1 771 990
**4** 1653
**5** 312
**6** 4176

## Homework 1H

**1 a** 22     **b** 34     **c** 39
    **d** 24     **e** 48
**2** 18

**3**    **a**   5          **b**   72

**4**    9

**5**    **a**   £458.40      **b**   £14.50

**6**    14

**7**    **a**   £88.20       **b**   42

## Homework 1I

**1**    **a**   13.44          **b**   37.518          **c**   21.85

       **d**   19.692        **e**   4.774           **f**   32.964

       **g**   5.089          **h**   21.924         **I**   15.174

       **j**   12.32          **k**   3.872           **l**   5.06

       **m**   3.424         **n**   8.109           **o**   33.32

**2**    **a**   765.3492      **b**   6000.2856      **c**   358.7286

       **d**   5161.2138     **e**   3519.6288      **f**   4449.289

       **g**   266.5908      **h**   1617.6264      **i**   2135.9052      **j**      5343.0963

**3**    £39.81

**4**    £3.17

**5**    £2103.85

## 2 Geometry and measures: Measures and scale drawing

## 2.1 Systems of measurement

### Homework 2A

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | **a** | centimetres | **b** | kilometres or metres | **c** | millimetres |
| | **d** | kilograms | **e** | litres | **f** | grams |
| | **g** | metres | **h** | grams | | |

**2** Answers will vary.

**3** The metre is too small a unit. This distance is an approximation and is also a large distance, so the unit needs to be a large one. Many people are more familiar with miles than the metric units.

**4** 4 metres, as this is long enough to reach the windows but short enough for her to handle easily. 2 metres is too short. 6 metres is too long.

| | | | | | | |
|---|---|---|---|---|---|---|
| **5** | **a** | 1.55 m | **b** | 9.5 cm | **c** | 0.78 m |
| | **d** | 3.1 km | **e** | 3.1 m | **f** | 3.05 m |
| | **g** | 15.6 cm | **h** | 2.18 km | **i** | 1.07 m |
| | **j** | 13.24 m | **k** | 0.175 km | **l** | 0.083 m |
| | **m** | 62 cm | **n** | 21.3 m | **o** | 5.12 km |
| | **p** | 8.15 kg | **q** | 2.3 t | **r** | 3.2 cl |
| | **s** | 1.36 l | **t** | 5.8 l | **u** | 0.95 t |
| **6** | **a** | 0.12 kg | **b** | 0.15 l | **c** | 3.5 l |
| | **d** | 54 cl | **e** | 2.06 t | **f** | 7.5 l |
| | **g** | 3.8 kg | **h** | 6.05 l | **i** | 0.015 l |
| | **j** | 6.3 $m^3$ | **k** | 45 $cm^3$ | **l** | 2.35 $m^3$ |
| | **m** | 0.72 $m^3$ | **n** | 820 cm | **o** | 71 000 m |
| | **p** | 8600 mm | **q** | 156 mm | **r** | 83 cm |
| | **s** | 5150 m | **t** | 18.5 mm | **u** | 275 cm |

**7** She should buy the 2400 mm lengths, as she would only waste 2 lengths of 45 cm.

**8** 10 000 000 000

**9** No, because 1 litre = 1000 $cm^3$ so 2 litres = 2000 $cm^3$, which is a lot greater than 101 $cm^3$.

### Homework 2B

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | **a** | 60 inches | **b** | 15 feet | **c** | 5280 yards |
| | **d** | 96 ounces | **e** | 70 pounds | **f** | 4480 pounds |
| | **g** | 32 pints | **h** | 84 inches | **i** | 72 inches |
| | **j** | 33 feet | **k** | 80 ounces | **l** | 13 yards |
| | **m** | 448 ounces | **n** | 2.5 miles | **o** | 96 pints |
| | **p** | 10 560 feet | **q** | 7 feet | **r** | 3 pounds |
| | **s** | 7 yards | **t** | 10 tons | **u** | 126 720 inches |
| | **v** | 16 pounds | **w** | 10 gallons | **x** | 20 stones |
| | **y** | 6 miles | **z** | 71 680 ounces | | |

**2** 27 878 400

**3** 26.4

**4** 1 tonne = 1000 kilograms
1 ton = 2240 pounds = 2240 × 450 grams = 1 008 000 g = 1008 kg
1000 is smaller than 1008.

## 2.2 Conversion factors

### Homework 2C

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | **a** | 13.2 lb | **b** | 17.6 lb | **c** | 33 lb |
| | **d** | 70.4 lb | **e** | 99 lb | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2** | **a** | 4.5 kg | **b** | 8.2 kg | **c** | 11.4 kg |
| | **d** | 18.2 kg | **e** | 25.5 kg | | |
| **3** | **a** | 3.5 pints | **b** | 14 pints | **c** | 43.75 pints |
| | **d** | 105 pints | **e** | 131.25 pints | | |
| **4** | **a** | 4 l | **b** | 11 l | **c** | 20 l |
| | **d** | 24 l | **e** | 57 l | | |
| **5** | **a** | 32 km | **b** | 48 km | **c** | 80 km |
| | **d** | 104 km | **e** | 192 km | | |
| **6** | **a** | 10 miles | **b** | 15 miles | **c** | 25 miles |
| | **d** | 45 miles | **e** | 187.5 miles | | |
| **7** | **a** | 22.5 l | **b** | 54 l | **c** | 121.5 l |
| | **d** | 225 l | **e** | 324 l | | |
| **8** | **a** | 4 gallons | **b** | 10 gallons | **c** | 16 gallons |
| | **d** | 60 gallons | **e** | 200 gallons | | |
| **9** | **a** | 78 ins | **b** | 195 ins | **c** | 312 ins |
| | **d** | 390 ins | **e** | 468 ins | | |
| **10** | **a** | 90 cm | **b** | 150 cm | **c** | 210 cm |
| | **d** | 300 cm | **e** | 900 cm | | |
| **11** | **a** | 1.2 m | **b** | 1.3 m | **c** | 1.5 m |
| | **d** | 1.9 m | **e** | 2.5 m | | |
| **12** | **a** | 16.25 miles | **b** | 25 mph | **c** | 39 minutes |

**13** 3 hours 16 minutes

**14** 1440

## 2.3 Scale drawings

## Homework 2D

**1 a i** 90 cm by 60 cm    **ii** 90 cm by 60 cm    **iii** 60 cm by 60 cm
   **iv** 90 cm by 60 cm
  **b** 10 800 cm$^2$

**2 a** Check student's scale drawing. **b**    4.12 m

**3 a** 10.5 km    **b** 12.5 km    **c** 20 km
  **d** 13 km    **e** 4 km

**4 a** Check student's scale drawing.
  **b** about 134 m, 8040 bricks

**5 a** 4.5 km    **b** 10 km    **c** 7.5 km
  **d** 16 km    **e** 9.5 km

**6 a** 1 : 10 000    **b** 550 m

## Homework 2E

All answers in this exercise are estimates. Answers close to these should be accepted.
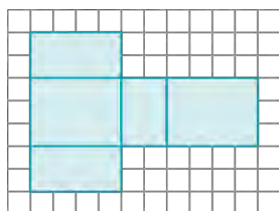
**1 a** 2 m    **b** 5 m

**2 a** 70 kg    **b** 1200 kg    **c** 80 g

**3 a** 16.5 m    **b** 90–120 m

**4 a** 300 ml    **b** 2 l    **c** 65 l

## 2.4 Nets
## Homework 2F

**1**  **b** and **d**
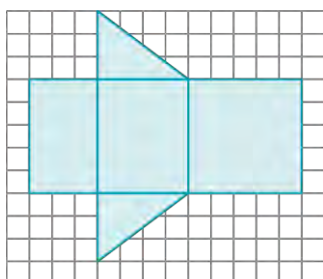
**2**  **a**
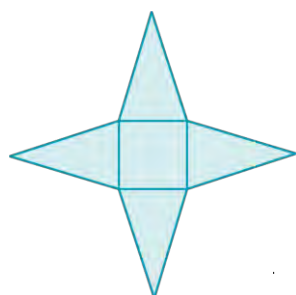
**b**
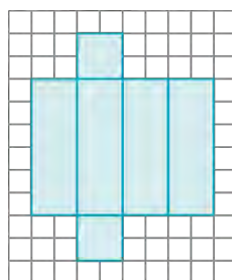
**3**

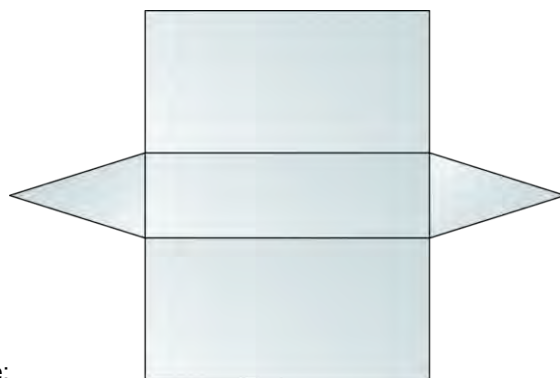**4**  **a**  **i**  5  **ii**  8  **iii**  5

**b**  Check students' net drawings. The sides of the triangles should be 5 cm in length, whilst the base measures 3 cm on each side.

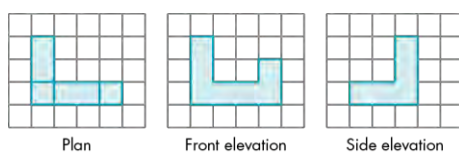**5**  3 and 6, 4 and 5, 7 and 14, 8 and 11, 9 and 10, 12 and 13

**6**

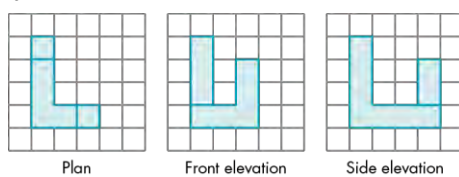**7** For example:

## 2.5 Using an isometric grid

## Homework 2G

**1** Check students' drawings.

**2** **a i-iii**

Plan    Front elevation    Side elevation

**b i-iii**

Plan    Front elevation    Side elevation

**3**

**4** **a** F **b** D

# 3 Statistics: Charts, tables and averages

## 3.1 Frequency tables
## Homework 3A

**1 a i**

| Number | Frequency |
|--------|-----------|
| 2 | 3 |
| 3 | 2 |
| 4 | 2 |
| 5 | 1 |
| 6 | 2 |
| 7 | 4 |
| 8 | 6 |
| 9 | 1 |

**ii** Most frequent = 8

**iii** Total number of values = 21

**b i**

| Number | Frequency |
|--------|-----------|
| 1 | 1 |
| 2 | 3 |
| 4 | 2 |
| 5 | 2 |
| 6 | 2 |
| 7 | 3 |
| 8 | 3 |
| 9 | 2 |

**ii** Most frequent = 2, 7, 8

**iii** Total number of values = 18

**c i**

| Number | Frequency |
|--------|-----------|
| 1 | 2 |
| 2 | 3 |
| 3 | 3 |
| 4 | 2 |
| 6 | 3 |
| 7 | 3 |
| 8 | 2 |
| 9 | 1 |

**ii** Most frequent = 2, 3, 6, 7

**iii** Total number of values = 19

**d i**

| Number | Frequency |
|--------|-----------|
| 2 | 2 |
| 3 | 4 |
| 4 | 1 |
| 5 | 0 |
| 6 | 2 |
| 7 | 4 |
| 8 | 2 |
| 9 | 2 |

**ii** Most frequent = 3, 7
**iii** Total number of values = 17

**e i**

| Number | Frequency |
|--------|-----------|
| 2 | 1 |
| 3 | 3 |
| 4 | 2 |
| 5 | 2 |
| 6 | 4 |
| 7 | 1 |
| 8 | 1 |

**ii** Most frequent = 6

**iii** Total number of values = 14

**2** Answers may vary from those given.

Possible groups:

**a**

| Age | Frequency |
|-------|-----------|
| 10–13 | 4 |
| 14–17 | 3 |
| 18–21 | 6 |
| 22–27 | 7 |

**b**

| Grade | Frequency |
|-------|-----------|
| 1–4 | 9 |
| 5–8 | 12 |

**c**

| Visits abroad | Frequency |
|---------------|-----------|
| 0–3 | 5 |
| 4–6 | 8 |
| 7–9 | 2 |
| 10–15 | 3 |

**d**

| Number | Frequency |
|--------|-----------|
| 18–21 | 5 |
| 22–25 | 6 |
| 26–29 | 1 |
| 30–33 | 1 |

## 3.2 Statistical diagrams
## Homework 3B

**1**  **a**  4

  **b**  16, 10, 16

  **c**  Fri $3\frac{3}{4}$ symbols, Sat $5\frac{1}{2}$ symbols

**2**  **a**  9 h, $4\frac{1}{2}$ h, 9 h, 6 h, $10\frac{1}{2}$ h

**b** Difficult to show $\frac{5}{6}$ of a symbol.

**3** **a** Brian: 20, Kontaki: 20, Robert: 15, Steve: 25, Azam: 15

   **b** It is difficult to show single call-outs.

   **c** Check new pictogram with symbol appropriate to show frequencies:
      20, 20, 15, 25, 15, 16

**4** Check pictogram shows frequencies: 30, 19, 12, 5, 1

**5** **a** **i** 25          **ii** 85

   **b** $5\frac{1}{2}$ envelopes

   **c** The envelope symbol cannot be split up easily to show 13.

**6** Use a key of 16 students to one symbol, which then requires 8 symbols for musicals, 3 for comedy and 5 for drama.

**7** Because it would result in too many symbols to fit sensibly into the table.

**8** **a** Emmerdale          **b** 50

   **c** No: friends all of a similar age, friends will have similar interests, likely to be more girls than boys, etc.

**9** **a** 5          **b** 31          **c** 8

   **d** No, each bar represents girls and boys.

**10**
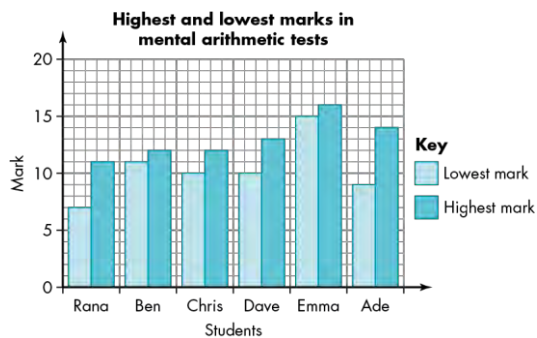


**11 a**

| Time (min) | 1–10 | 11–20 | 21–30 | 31–40 |
|------------|------|-------|-------|-------|
| **Frequency** | 8 | 13 | 10 | 5 |
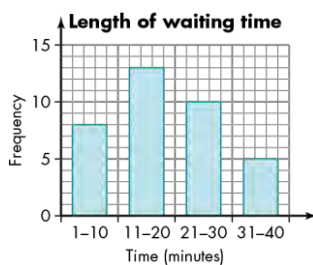


**b**

**c** For example: no patient has to wait longer than 40 minutes; most patients wait between 11 and 30 minutes; very few patients are seen in less than 10 minutes.

**12** Re-label axes 'Frequency' and 'Brand of crisps preferred', scale frequency axis correctly and start from 0, make bars of equal width and leave gaps between bars.

**Favourite brands of crisps**
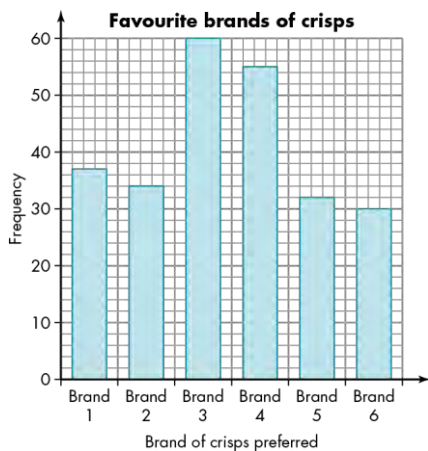


**13 a** Check for correctly drawn pictogram.

   **b** Check for correctly drawn bar chart.

   **c** Either could be used, depending on how you drew each one.

**14 a** Boys = 13, Girls = 13.5

   **b** The graph makes it look as though the boys have done better because their bars are higher, but this is just because there are more boys than girls.

**15** No, because the graph starts at 50, not at zero. 100 is not 3 times 65.

## 3.3 Line graphs

## Homework 3C

**1 a**
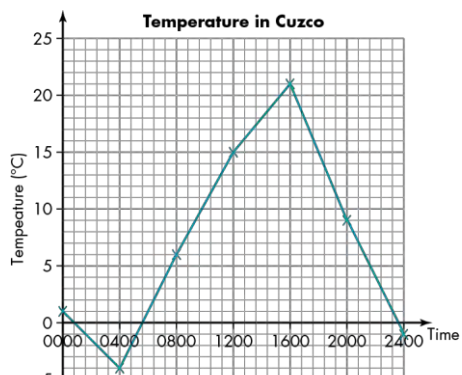


   **b** 15 °C
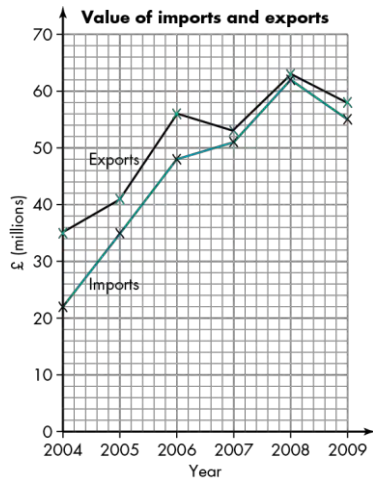
**2 a**



**b** Smallest £1m (2008), greatest £13m (2004)

**3 a** Check for correctly drawn line graph.

   **b** 870

   **c** 1975–1980

   **d** It is increasing all the time, so maybe the population is increasing.

**4** Students should use a graph to estimate 245 cm.

**5** To emphasise the differences between each of the games, or because the lowest attendance was 18 000.

**6 a** August, 250 Yen

   **b** 25 Yen

   **c** June and July

   **d** 51 200 Yen

## 3.4 Statistical averages

## Homework 3D

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

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

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

   **d** ♣                **e** €

**3** Bethan travelled 52 weeks in total.
   Median = (52 + 1)/2 = 26.5[th] value, which is 3 days.

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

**5** 3

**6 a** 31

   **b i** dog            **ii** rabbit            **iii** dog
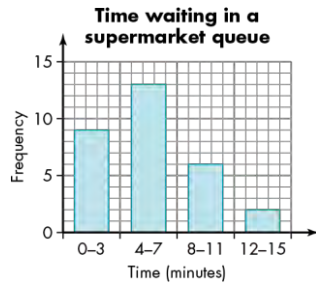
   **c** Both students like rabbits.

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

**8 a** 30                **b** 21–25 marks

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

**9 a**

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

**Time waiting in a supermarket queue**



**b**

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

## Homework 3E

**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** Three higher than or equal to 11 and 1 less than 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.
**5** The median of 10 g does not take into account the large weight of 4 kg.
**6 a** e.g. 7, 8, 9, 10, 15, 20, 20
  **b** e.g. 7, 8, 9, 10, 10, 20, 20, 20
**7** The median is 57 marks. The marks are very spread out, so the median is not very useful here.

## Homework 3F

**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.
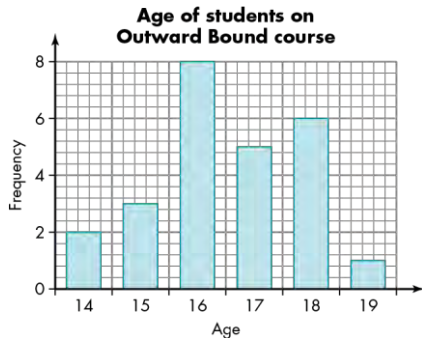**8 a** 62 **b** 63 **c** Fay
  **d** 3
**9 a** 31 **b** 47

## Homework 3G

**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**   mode or median, 46 is an extreme value

**2**   **a i**  mode 135 g **ii** median 141 g **iii** mean 143 g

    **b**   Mean; takes all weights into account.

**3**   Adam mean, Faisal median, Maya mode (his scores are bimodal, with modes 0 and 4, but the mean is 1.8)

**4**   **a**   71 kg              **b**   70 kg

    **c**   Median; 53 kg is an extreme mass.

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

    **c**   Median, the higher average.

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

## Homework 3H

**1**   **a**   13               **b**   14           **c**   32

    **d**   2.7              **e**   10

**2**   **a**   25               **b**   16           **c**   5 years

    **d**



Age of students on Outward Bound course

**3**   **a**   76 °F               **b**   15 Fahrenheit 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: £194.20; week 2: £176.20; week 3: £179.80

    **b**   Week 1: £313; week 2: £320; week 3: £256

    **c**   Week 1 had the highest takings and week 3 had the most consistent takings.

**6**   **a**   8 to 12 and 7 to 11 both include 4 children       **b**   20 to 23

**7**   A school football team with all the players in the same school year.

**8**   **a**   For example: 2, 2, 5     **b**   1.5, 3, 4.5

## 4 Geometry and measures: Angles

### 4.1 Angle facts
**Homework 4A**

| 1 | **a** | 60° | **b** | 45° | **c** | 300° |
|---|---|---|---|---|---|---|
| | **d** | 120° | **e** | 27° | **f** | 101° |
| | **g** | 100° | **h** | 60° | **i** | 59° |
| | **j** | 50° | **k** | 100° | **l** | 138° |
| | **m** | 63° | **n** | 132° | | |

**2** Yes, they add up to 180°.

| 3 | **a** 120° | **b** 45° | **c** 50° |
|---|---|---|---|

| 4 | **a** 60° | **b** 75° | **c** 40° |
|---|---|---|---|

| 5 | **a** $x = 60°$, $y = 120°$ | **b** $x = 30°$, $y = 140°$ | **c** $x = 44°$, $y = 58°$ |
|---|---|---|---|

**6** 3 × 120° = 360°

### 4.2 Triangles
**Homework 4B**

| 1 | **a** 70° | **b** 40° | **c** 88° |
|---|---|---|---|
| | **d** 12° | **e** 42° | **f** 118° |

**2 a, d** and **e** as the all add up to 180°

| 3 | **a** 70° | **b** 60° | **c** 10° |
|---|---|---|---|
| | **d** 43° | **e** 5° | **f** 41° |

| 4 | **a** 60° | **b** Equilateral triangle | **c** All sides equal in length |
|---|---|---|---|

| 5 | **a** 55° | **b** Isosceles triangle | **c** Equal in length |
|---|---|---|---|

**6** $x = 30°$, $y = 60°$

| 7 | **a** 119° | **b** 70° |
|---|---|---|

**8** 22°

**9** Check students' sketches for A, B and D.
C false (more than 180° in the triangle, E false (more than 180° in the triangle)

**10** ∠ABC = 140° (angles on a line), $a + 15° + 140° = 180°$ (angles in a triangle),
so $a = 25°$ (or use the fact that 40° is the exterior angle, so is equal to the sum of the two interior angles)

## 4.3 Angles in a polygon
## Homework 4C

**1**  **a** 6 triangles  **b** 1080°  **c** 135°

**2**  **a** 10 triangles  **b** 1800°  **c** 150°

**3**  **a** 28 triangles  **b** 5040°  **c** 168°

## Homework 4D

**1**  **a** 70°  **b** 120°  **c** 65°
  **d** 70°  **e** 70°  **f** 126°

**2**  **b, c** and **f** as they all add up to 360°

**3**  **a** 90°  **b** 80°  **c** 80°
  **d** 46°  **e** 30°  **f** 137°

**4**  **a** 290°  **b** reflex  **c** kite or arrowhead

**5**  **a** pentagon divided into 3 triangles, 3 × 180° = 540°  **b** 80°

**6**  **a** 112°  **b** 130°

**7**  135°

**8**  $x = 20°$

**9**  Paul thinks that there are 365° in a quadrilateral (or he thinks the top and bottom are parallel), $x = 57°$

## 4.4 Regular polygons
## Homework 4E

**1 a** $x = 60°, y = 120°$  **b** $x = 90°, y = 90°$  **c** $x = 108°, y = 72°$
  **d** $x = 120°, y = 60°$  **e** $x = 135°, y = 45°$

**2 a** 18  **b** 12  **c** 20  **d** 90
**3 a** 8  **b** 24  **c** 36  **d** 15

**4** Octagon

**5** A square

**6** Angle AED = 108° (interior angle of a regular pentagon),
angle ADE = 36° (angles in an isosceles triangle)

**7** B and C

### 4.5 Angles in parallel lines
**Homework 4F**

**1**　　**a**　　$a = 60°$　　**b**　　$b = 50°$　　**c**　　$c = 152°$

　　　　**d**　　$d = e = 62°$　　**e**　　$f = g = 115°$　　**f**　　$h = i = 72°$

**2**　　**a**　　$a$ (vertically opposite) = $b$ (corresponding) = $c$ (alternate) = 55°

　　　　**b**　　$d$ (corresponding) = 132°, $e$ (angles on a striaght line, alternate angles) = 48°

　　　　**c**　　$f$ (co-interior) = 78°, $g$ (co-interior) = 102°

**3**　　**a**　　70°　　**b**　　68°

**4**　　**a**　　$x = 30°, y = 110°$　　**b**　　$x = 20°, y = 120°$

**5**　　76°, ACB = ABC = 52° (isósceles triangle) and angle sum of triangle = 180°

**6**　　$360° − p − q$

**7**　　$a = 47°$ (alternate angles)
　　　　$b = 180° − 64° = 116°$ (allied or interior angles)
　　　　$a + b = 47° + 116° = 163°$

### 4.6 Special quadrilaterals
**Homework 4G**

**1**　　**a** $a = 110°, b = 100°$　　　　**b** $c = 68°, d = 108°$　　**c** $e = 90°, f = 105°$

**2**　　**a** a = $c = 130°, b = 50°$　　　　**b** $d = f = 45°, e = 135°$　　**c** $g = i = 139°, h = 41°$

**3**　　**a** $a = 120°, b = 50°$　　　　**b** $c = d = 90°$　　　　**c** $e = 96°, f = 56°$

**4**　　**a** $a = c = 125°, b = 55°$　　**b** $d = f = 70°, e = 110°$　　**c** $g = i = 117°, h = 63°$

**5**　　The angles add up to 180° (angles in a quadrilateral, or interior angles between parallel lines). The acute angle between AD and the perpendicular from D to AB must be no less that 20°, so the obtuse angle at D must be at least 110°; the angle at A can be no greater than 70°.

**6**　　**a** Angle B = 75° and angle ACD = 15° (opposite angles in a parallelogram are equal), so $x$ = 90° (angles in a triangle = 180°)
　　　　**b** 90 + 15 = 105°

**7**　　For example only one pair of parallel sides in the trapezium, opposite angles are not the same, no rotational symmetry, diagonals do not bisect each other.

### 4.7 Bearings
**Homework 4H**

**1**　　**a**　　062°　　**b** 130°　　**c** 220°　　**d** 285°

**2**　　**a**　　160°　　**b** 095°　　**c** 005°　　**d** 275°

**3**     **a** 160°     **b** 250 km     **c** 340°

**4**     **a** 180° + $x°$     **b** $y°$ − 180°

**5**     027°

**6**     126°

**7**     120°

## 5     Number: Number properties

## 5.1 Multiples of whole numbers

### Homework 5A

**1**    **a**   4, 8, 12, 16, 20       **b**   6, 12, 18, 24, 30       **c**   8, 16, 24, 32, 40
     **d**   12, 24, 36, 48, 60     **e**   15, 30, 45, 60, 75

**2**    **a**   28, 36, 64, 56, 60     **b**   60, 15, 45            **c**   64, 56
     **d**   77, 66

**3**    **a**   252, 161, 224, 378, 315, 182
     **b**   225, 252, 297, 162, 378, 315, 369     **c**   252, 312

**4**    **a**   198                **b**   196               **c**   195
     **d**   192                **e**   198

**5**    **a**   12                 **b**   102              **c**   1002
     **d**   10 002          **e**   1 000 000 002

**6**    Yes: 96 ÷ 12 = 8, so there will be 8 full bags.

**7**    Any factor of 48 will do but 6, 8 or 12 are sensible answers.

**8**    **a**   14                 **b**   12                **c**   20

**9**    45

## 5.2 Factors of whole numbers

### Homework 5B

**1**    **a**   1, 2, 3, 4, 6, 12        **b**   1, 13             **c**   1, 3, 5, 15
     **d**   1, 2, 4, 5, 10, 20     **e**   1, 2, 11, 22      **f**   1, 2, 3, 4, 6, 9, 12, 18, 36
     **g**   1, 2, 3, 6, 7, 14, 21, 42    **h**   1, 2, 3, 4, 6, 8, 12, 16, 24, 48
     **i**   1, 7, 49           **j**   1, 2, 5, 10, 25, 50

**2**    **a**   1, 2, 4, 5, 10, 20, 25, 50, 100
     **b**   1, 3, 37, 111
     **c**   1, 5, 25, 125
     **d**   1, 2, 3, 4, 6, 11, 12, 22, 33, 44, 66, 132
     **e**   1, 2, 4, 5, 7, 10, 14, 20, 28, 35, 70, 140

**3**    **a**   13                 **b**   23                **c**   25
     **d**   33                 **e**   42                **f**   44
     **g**   51                 **h**   53                **i**   72
     **j**   81

     The answer is the two outer digits of the number.

**4**    Six ways (1, 2, 3, 6, 9, 18 per box)

**5**   **a**   8                     **b**   10                   **c**   13

**6**   Factors of 15 are 1, 3, 5, 15; factors of 20 are 1, 2, 4, 5, 10, 20; factors of 24 are 1, 2, 3, 4, 6, 8, 12, 24; factors of 27 are 1, 3, 9, 27; factors of 30 are 1, 2, 3, 5, 6, 10, 15, 30; 20 is the only one that does not have 3 as a factor.

**7**   6

## 5.3 Prime numbers

### Homework 5C

**1**   2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37

**2**   43, 47, 59, 61, 67

**3**   **a**   $2 \times 2 \times 2 \times 2 - 1 = 15$, $2 \times 2 \times 2 \times 2 \times 2 - 1 = 31$,
          $2 \times 2 \times 2 \times 2 \times 2 \times 2 - 1 = 63$

      **b**   Lines 2, 3 and 5

**4**   39, 51, 123

**5**   7 and 13

**6**   **a, b** For example, 5 and 11 or 7 and 13 or 11 and 17.

**7**   No, unless he puts them all in one compartment, or has 23 compartments, since 23 is a prime number.

## 5.4 Prime factors, LCM and HCF
### Homework 5D

**1**   138: $2 \times 3 \times 23$
    64: $2^6$
    255: $3 \times 5 \times 17$

**2**   **a**   $2 \times 2 \times 3 = 2^2 \times 3^1$
      **b**   $2 \times 2 \times 2 \times 2 \times 3 \times 3 = 2^4 \times 3^2$
      **c**   The indices have doubled

### Homework 5E

**1**   **a**   HCF 5, LCM 180       **b**   HCF 14, LCM 210       **c**   HCF 10, LCM 1560
      **d**   HCF 4, LCM 360       **e**   HCF 20, LCM 1440

**2**   2517

**3**   $24 \times 24$

**4**   20

## 5.5 Square numbers

### Homework 5F

**1**
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **a** | 25 | **b** | 225 | **c** | 625 |
| **d** | 1225 | **e** | 2025 | **f** | 3025 |
| **g** | 4225 | **h** | 5625 | **i** | 7225 |
| **j** | 9025 |

Answers all end in 25.

**2 a** 121
   **b** Answer between 100 and 121 (Note: exact answer is 110.25)

**3** £2.25

**4** 60 bricks cost £36, she has £4 left over, she can buy 6 more bricks

**5** 400

### Homework 5G

**1 a** 5, 10, 15, 20, 25   **b** 7, 14, 21, 28, 35   **c** 16, 32, 48, 64, 80
   **d** 25, 50, 75, 100, 125   **e** 30, 60, 90, 120, 150

**2 a** 1, 2, 3, 6, 9, 18   **b** 1, 5, 25   **c** 1, 2, 4, 7, 14, 28
   **d** 1, 5, 7, 35   **e** 1, 2, 4, 5, 8, 10, 20, 40

**3 a** 10, 20, 30   **b** 12, 24, 36   **c** 30, 60, 90
   **d** 12, 24, 36   **e** 40, 80, 120

**4** Those with numbers 30, 60 or 90.

**5 a** $5^2 - 4^2 = 9$, $6^2 - 5^2 = 11$, $7^2 - 6^2 = 13$   **b** 41, 20 + 21

**6 a** 7, 13, 23, 37   **b** 4, 16, 25, 49

**7**

| | Square number | Factor of 24 |
|---|---|---|
| **Odd number** | 25 | 3 |
| **Multiple of 6** | 36 | 12 |

**8** 1024 ($32^2$)

## 5.6 Square roots

### Homework 5H

**1**  **a**  8          **b**  5          **c**  7
   **d**  9          **e**  4          **f**  6
   **g**  10         **h**  11         **i**  12
   **j**  20

**2**  **a**  ±15         **b**  ±17        **c**  ±21
   **d**  ±25         **e**  ±33        **f**  ±37
   **g**  ±56         **h**  ±78        **i**  ±202
   **j**  ±333

**3**  **a**  $\sqrt{1} + \sqrt{4} + \sqrt{9} + \sqrt{16} = 10$, $\sqrt{1} + \sqrt{4} + \sqrt{9} + \sqrt{16} + \sqrt{25} = 15$,
$\sqrt{1} + \sqrt{4} + \sqrt{9} + \sqrt{16} + \sqrt{25} + \sqrt{36} = 21$

   **b**  The answers are triangular numbers.

**4**  $\sqrt{10}$, $2^2$, $\sqrt{20}$, $3^2$

**5**  6 and 7

**6**  121 tiles

**7**  11

## 5.7 Basic calculations on a calculator

### Homework 5I

**1**  **a**  93    **b**  9    **c**  −34

**2**  7

**3**  **a**  90    **b**  135

**4**  −114.3

**5**  **a**  1.962631579          **b**  1.96

**6**  **a**  0.2783266999          **b**  0.28

**7**  7.968

**8**  0.4434501603

**9**  **a**  3.884682778          **b**  3.88

**10**  2.904451744

**Number: Approximations**

## 6.1 Rounding whole numbers

### Homework 6A

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | **a** | 30 | **b** | 70 | **c** | 20 | | |
| | **d** | 50 | **e** | 60 | **f** | 10 | | |
| | **g** | 100 | **h** | 120 | **i** | 110 | | |
| | **j** | 130 | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **2** | **a** | 200 | **b** | 400 | **c** | 400 | | |
| | **d** | 800 | **e** | 900 | **f** | 100 | | |
| | **g** | 600 | **h** | 300 | **i** | 1000 | | |
| | **j** | 1200 | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **3** | **a** | 2000 | **b** | 4000 | **c** | 7000 | | |
| | **d** | 4000 | **e** | 1000 | **f** | 7000 | | |
| | **g** | 6000 | **h** | 9000 | **i** | 2000 | | |
| | **j** | 10 000 | | | | | | |

**4**  £90 000, £93 000, £75 000, £86 000, £100 000

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **5** | **a** | 15 minutes | **b** | 30 minutes | **c** | 35 minutes | | |
| | **d** | 40 minutes | **e** | 25 minutes | **f** | 15 minutes | | |

| | | | | | |
|---|---|---|---|---|---|
| **6** | **a** | £2235 | **b** | £2244.99 | |

| | | | | | |
|---|---|---|---|---|---|
| **7** | **a** | 56 500 | **b** | 57 499 | |

| | | | | | |
|---|---|---|---|---|---|
| **8** | **a** | 274 | **b** | 20 | |

**9**  134 fish + 94 frogs, so 228 in total

## 6.2 Rounding decimals

### Homework 6B

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | **a** | 3.7 | **b** | 8.7 | **c** | 5.3 | | |
| | **d** | 18.8 | **e** | 0.4 | **f** | 26.3 | | |
| | **g** | 3.8 | **h** | 10.1 | **i** | 11.1 | | |
| | **j** | 12.0 | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **2** | **a** | 6.72 | **b** | 4.46 | **c** | 1.97 | | |
| | **d** | 3.49 | **e** | 5.81 | **f** | 2.56 | | |
| | **g** | 21.80 | **h** | 12.99 | **i** | 2.30 | | |
| | **j** | 5.56 | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **3** | **a** | 4.6 | **b** | 0.09 | **c** | 5.716 | | |
| | **d** | 4.56 | **e** | 2.10 | **f** | 0.763 | | |
| | **g** | 7.1 | **h** | 8.90 | **i** | 23.781 | | |
| | **j** | 1.0 | | | | | | |

**4**  **a**  7                        **b**  9                        **c**  3
      **d**  8                        **e**  8                        **f**  3
      **g**  2                        **h**  2                        **i**  5
      **j**  4

**5**  £5 + £7 + £5 + £1 = £18

**6**  9, 9.28, 9.3

**7**  6.140 and 6.143

## 6.3 Approximating calculations

### Homework 6C

**1**  **a**  50 000                   **b**  60 000                   **c**  30 000
      **d**  90 000                   **e**  90 000                   **f**  50
      **g**  90                       **h**  30                       **i**  100
      **j**  200                      **k**  0.5                      **l**  0.3
      **m**  0.006                    **n**  0.05                     **o**  0.0009
      **p**  10                       **q**  90                       **r**  90
      **s**  200                      **t**  1000

**2**  Hellaby 850 to 949, Hook 645 to 654, Hundleton 1045 to 1054.

**3**  95 or 96

**4**  650 − 549 = 101

### Homework 6D
Answers are approximations. Answers close to these are acceptable.

**1**  **a**  28 000                   **b**  42 000                   **c**  210
      **d**  20 000                   **e**  2000                     **f**  2100
      **g**  5                        **h**  9 or 10                   **i**  700
      **j**  75                       **k**  50                       **l**  8

**2**  **a**  £4000                    **b**  £2000                    **c**  £1500

**3**  **a**  £30 000                  **b**  £36 000

**4**  £1300 or £1400

**5**  **a**  20p
      **b**  10p per apple

**6**  **a**  105 km                   **b**  450 km                   **c**  5000 km

**7**  6

**8**  £10 (£20 ÷ 2)

**9**   25 jars

**10**  65 minutes to 2 sf

**11**  £180

**12**  £217

**13**      **a** 3.5 ≤ side < 4.5,  4.5 ≤ side < 5.5, 5.5 ≤ side < 6.5
            **b** 13.5 ≤ perimeter <16.5

## 7    Number: Decimals and Fractions

## 7.1 Calculating with decimals
### Homework 7A

**1**  **a**  1                      **b**  0.07                      **c**  4.32
   **d**  2.324

**2**  **a**  4                      **b**  160                      **c**  0.03
   **d**  13

**3a**  **i** 15 **ii** 15.68           **iii** 0.68

**b**  **i** 90 **ii** 82.65           **iii** 7.35

**c**  **i** 300               **ii** 422.84               **iii** 122.84

**d**  **i** 2800              **ii** 2809.95              **iii** 9.95

**4a**  3825
 **b**  **i** 38.25            **ii** 0.3825              **iii** 382.5

**5**  **a** 5.9              **b** 59              **c** 0.59

## 7.2 Fractions and reciprocals
### Homework 7B

**1**  **a**  0.75              **b**  $0.0\dot{6}$              **c**  0.04
   **d**  $0.0\dot{9}$              **e**  0.05

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

    $0.\dot{6}15384$, $\dfrac{9}{13} = 0.\dot{6}9230\dot{7}$, $\dfrac{10}{13} = 0.\dot{7}6923\dot{0}$, $\dfrac{11}{13} = 0.\dot{8}46153$, $\dfrac{12}{13} = 0.\dot{9}2307\dot{6}$

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

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

**4**  **a**  $\dfrac{57}{100}$              **b**  $\dfrac{11}{40}$              **c**  $\dfrac{17}{20}$
   **d**  $\dfrac{3}{50}$              **e**  $3\dfrac{13}{20}$

**5**  **a**  0.25              **b**  0.125              **c**  0.031 25
   **d**  0.025              **e**  0.01

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

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

## 7.3 Fractions of quantities

## Homework 7C

**1**

**a** $\dfrac{1}{8}$

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

**c** $\dfrac{3}{7}$

**d** $\dfrac{11}{14}$

**e** $\dfrac{15}{17}$

**f** $\dfrac{12}{13}$

**g** $\dfrac{4}{11}$

**h** $\dfrac{3}{16}$

**2** $\dfrac{1}{10}$, £30

**3** $\dfrac{19}{105}$, £90.48

**4** 1 m 43 cm

## 7.4 Adding and subtracting fractions

## Homework 7D

**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.

[▤] [1] [↓] [4] [→] [×] [▤] [2] [↓] [3] [→] [=]

**6** 24

## 7.5 Multiplying and dividing fractions

### Homework 7E

**1**

**a** $\dfrac{3}{32}$

**b** $\dfrac{5}{48}$

**c** $\dfrac{1}{9}$

**d** $\dfrac{4}{25}$

**e** $\dfrac{7}{16}$

**2**

**a** $\dfrac{13}{6} \times \dfrac{5}{3} = \dfrac{65}{18} = 3\dfrac{11}{18}$

**b** $\dfrac{11}{3} \times \dfrac{3}{1} = 11$

**c** $\dfrac{8}{3} \times \dfrac{3}{1} = 8$

**d** $\dfrac{3}{2} \times \dfrac{2}{3} = 1$

**e** $\dfrac{5}{4} \times \dfrac{2}{5} = \dfrac{1}{2}$

**3**

**a.** $\dfrac{3}{4}$

**b.** 4

**c.** 1

**d.** 1

**e.** $\dfrac{5}{16}$

**4**

**a.** $1\dfrac{1}{3}$

**b.** $1\dfrac{1}{51}$

**c.** $1\dfrac{7}{9}$

**d.** $\dfrac{88}{95}$

**e.** $1\dfrac{11}{25}$

**f.** $1\dfrac{37}{80}$

**g.** $\dfrac{45}{47}$

**h.** $\dfrac{7}{8}$

**i.** $\dfrac{18}{19}$

**j.** $\dfrac{24}{25}$

**5** $\dfrac{1}{4}$ m²

**6** 12

**7** $4\frac{17}{20}$ cm³

**8** 27 mph

## 7.6 Fractions on a calculator
## Homework 7F

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

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

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

**4** **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** $8\frac{31}{40}$      **k** $7\frac{61}{792}$      **l** $38\frac{67}{234}$

**5a** $\frac{43}{35}$ or $1\frac{8}{35}$      **b** $\frac{51}{143}$      **c** $\frac{2}{9}$

**d** $\frac{35}{2}$ or $17\frac{1}{2}$      **e** $\frac{25}{6}$ or $4\frac{1}{6}$      **f** $\frac{291}{170}$ or $1\frac{121}{170}$

**g** $\frac{2263}{132}$ or $17\frac{19}{132}$      **h** 51.7      **i** $\frac{382}{75}$ or $5\frac{7}{75}$

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

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

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

## 8      Algebra: Linear graphs

## 8.1 Graphs and equations

## Homework 8A

**1**    A (4, 3), B (1, 2), C (−3, 4), D (−1, 2), E (−2, −1), F (−4, −3),  G (1, −2), H (4, −1), J (0, 3), K (−3, 0)

**2**    **a i** $y = x − 3$

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 |
|-----|---|---|---|---|---|---|
| $y$ | −3 | −2 | −1 | 0 | 1 | 2 |

       **ii** Graph with straight line through values in the table

   **b  i** $y = 2x + 1$

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 |
|-----|---|---|---|---|---|---|
| $y$ | 1 | 3 | 5 | 7 | 9 | 11 |

       **ii** Graph with straight line through values in the table

   **c i** $y = 4x − 2$

| $x$ | 0 | 1 | 2 | 3 | 4 |
|-----|---|---|---|---|---|
| $y$ | −2 | 2 | 6 | 10 | 14 |

       **ii** Graph with straight line through values in the table

   **d i** $y = 5x$

| $x$ | 0 | 1 | 2 | 3 | 4 |
|-----|---|---|---|---|---|
| $y$ | 0 | 5 | 10 | 15 | 20 |

       **ii** Graph with straight line through values in the table

   **e i** $y = −3x − 1$

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 |
|-----|---|---|---|---|---|---|
| $y$ | −1 | −4 | −7 | −10 | −13 | −16 |

       **ii** Graph with straight line through values in the table

**2**



**3**   **a**
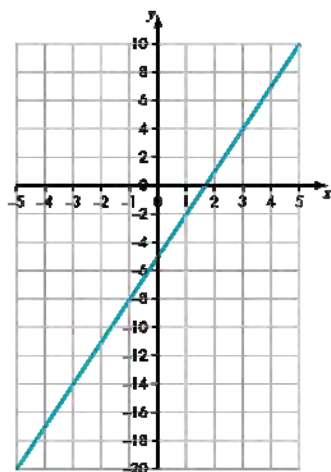


   **b**       $y = 8x + 3$

   **c**
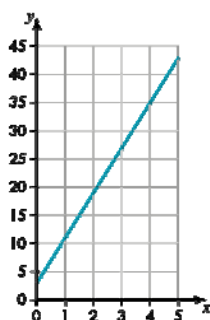


   **d**  From $y = 27$, draw a horizontal line across to the graph then down to the $x$-axis to find $x = 3$.

## 8.2 Drawing linear graphs by finding points

## Homework 8B

**1**   End points at (0, 3) and (5, 13).

**2**   End points at (0, –1) and (5, 14).

**3**   End points at (0, –2) and (12, 4).

**4**   End points at (–2, –3) and (2, 5).

**5**   End points at (–6, 2) and (6, 8).

**6**   **a**   End points at (0, –1) and (5, 14), (0, 3) and (5, 13).

   **b**   (4, 11)

**7**   **a**   End points at (0, –3) and (6, 21), (0, 2) and (6, 20).

   **b**   (5, 17)

**8**   **a**   End points at (0, 1) and (12, 7), (0, 2) and (12, 6).

   **b**   (6, 4)

**9**   **a**   End points at (0, 3) and (4, 11), (0, –1) and (4, 7).

   **b**   No, the lines are parallel.

**10 a** Graph as shown in part b

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| $y$ | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

**b** Graph of $x + y = 3$
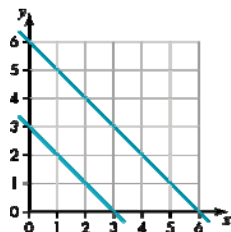


**11 a**
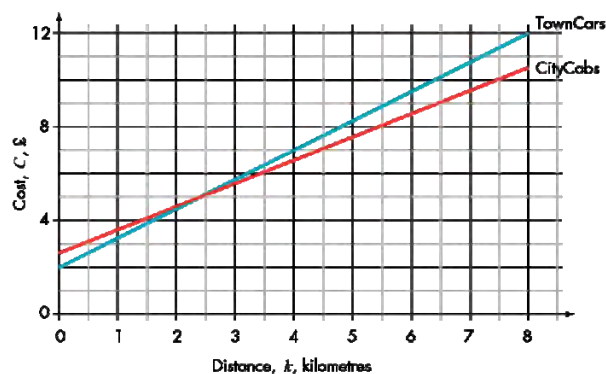


**b** 2 kilometres

**12** Two lines chosen so that the sum or difference of $a$ and $b$ is 2, e.g. $y = 1$, $x = 1$, or $x = 3$, $y = 5$.

## 8.3 Gradient of a line

### Homework 8C

**1 A** 2      **B** −3      **C** $\frac{2}{3}$

    **D** $-\frac{1}{3}$      **E** 4      **F** $-\frac{4}{5}$

    **G** $-\frac{1}{4}$      **H** $\frac{1}{3}$      **I** 8

    **J** −3

**2 a** to **f**: Check students' own diagrams.

**3 a** Check students' own diagrams.

    **b** Check students' own diagrams.

    **c** The diagram is symmetrical about the $x$-axis and the $y$-axis.

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

    **e** 3

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

**e** 3

**6a** −8                **b** −6                **c** 0        **d** −9
**e** −10 **f** −6

## 8.4 $y = mx + c$

## Homework 8D

**1a** gradient = 4, $y$-intercept = 3
**b** gradient = 3, $y$-intercept = −2
**c** gradient = 2, $y$-intercept =1
**d** gradient = −3, $y$-intercept =3
**e** gradient = 5, $y$-intercept =0
**f** gradient = −2, $y$-intercept = 3
**g** gradient = 1, $y$-intercept =0
**h** gradient = −0.5 , $y$-intercept =3
**i** gradient = 0.25, $y$-intercept =2

**2**
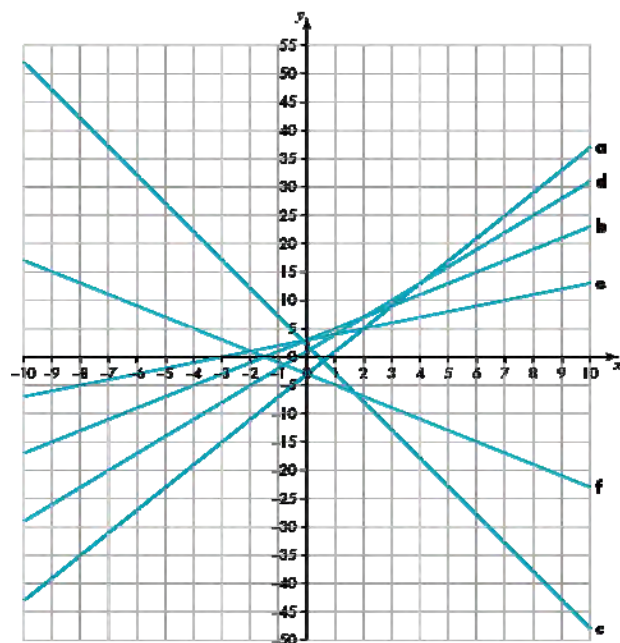


## Homework 8E

**1** Straight line through (0, 2) and (−1.5, 0)
**2** Straight line through (0, −2) and (−0.8, 0)
**3** Straight line through (0, −1.5) and (3, 0)
**4** Straight line through (0, 0) and (1, 1)
**5** Straight line through (0, 7) and (−7/3, 0)
**6** Straight line through (0, 4) and (−2, 0)
**7** Straight line through (0, 3) and (2, 0)
**8** Straight line through (0, 4) and (6, 0)
**9** Straight line through (0, 8) and (10, 0)
**10** Straight line through (0, 6) and (6, 0)
**11** Straight line through (0, −12) and (8, 0)
**12** Straight line through (0, 6) and (−6, 0)

## 8.5 Finding the equation of a line from its graph

### Homework 8F

**1**  **a.**  $y = \dfrac{2}{3}x - 2$      **b.**  $y = x + 1$      **c.**  $y = 2x - 3$

    **d.**  $y = 0.5x + 3$      **e.**  $y = x$      **f.**  $y = 1.5x - 2$

**2**  **a.**  $y = -2x + 1$      **b.**  $y = -0.5x$      **c.**  $y = -x + 1$

    **d.**  $y = -0.5x - 1$      **e.**  $y = -1.5x - 3$

**3**  **a**  $y = -4x + 2$      **b**  $y = 3x - 14$      **c**  $y = 8x - 5$

    **d**  $y = -3x + 24$      **e**  $y = \dfrac{13}{12}x - 0.5$

**4**  $7x + 2y = 14$

## 8.6 The equation of a parallel line

### Homework 8G

**1**  Students own answers.  Need to say they are all parallel, all have the same gradient, of 1
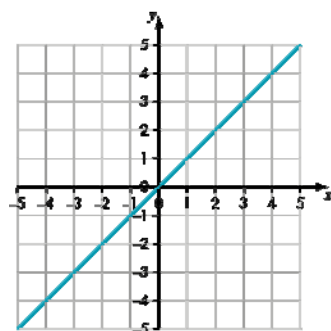


**2**  Students own answers.  Need to say they are all parallel, all have the same gradient, of −0.5.
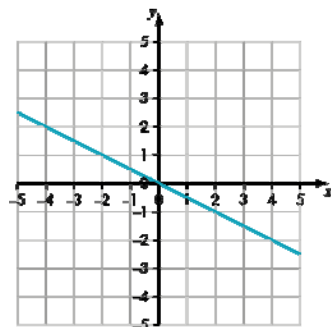


**3**  If the gradient of a line is $m$ then the gradient of a line which is parallel is $m$.

**4**  $y = 2x + 8$
**5**  $y = -9x - 8$

## 8.7 Real-life uses of graphs

## Homework 8H

**1**    **a i**    15 feet    **ii**    8 yards    **iii**    30 feet
    **b**    6.5 yards in 20 feet so smaller

**2**    **a**    50p    **b**    8 mins

**c**    5 mins = 60p per day. £$\dfrac{20}{150}$ × 5 = 67p per 5 mins on contract.  Stay PAYG

**3**    **a**    80 km    **b**    75 miles

**c**    Joe. $\dfrac{55}{2}$ = 22.5 miles per 30 mins.  22.5 × 1.6 = 36 km in 30 mins

## 8.8 Solving simultaneous equations using graphs
## Homework 8I

**1**    (1, 2)
**2**    (1, 1)
**3**    (0, −2)
**4**    (1, 1)
**5**    (6, 11)
**6**    (12, −18)
**7**    (4, 1)
**8**    (−1, −4)

## 9 Algebra: Expressions and formulae

## 9.1 Basic algebra

**Homework 9A**

1  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  $\dfrac{p}{q}$

2  a  $x + 4$    b  $x - 5$

3  a  21    b  $7z$

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

5  a  £10    b  £$\dfrac{r}{2}$    c  £$\dfrac{p}{q}$

6  16 years

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

8  8p

## 9.2 Substitution

**Homework 9B**

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  20    b  $6\dfrac{2}{3}$    c  5

11  a  21    b  33    c  45

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

## 9.3 Expanding brackets

**Homework 9C**

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  $F = 2(C + 15)$

### Homework 9D

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **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** $4k + 3kh + 5h$

    **c** $t + 7nt + 3n$

    **d** $p + 5q + 8pq$

    **e** $6h + 11jh + 12j$

    **f** $20ty + 15y + 2t$

**5** 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 $16x + 13$.

## 9.4 Factorisation

### Homework 9E

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **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** $2(x - 2)$     **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

## 9.5 Quadratic expansion

### Homework 9F

**1a** $x^2 + 6x + 8$

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

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

**d** $x^2 - 7x + 10$

**e** $x^2 - 9$

**f** $x^2 - 6x + 9$

**g** $x^2 + 7x + 6$

**h** $x^2 - 7x + 6$

**2a** Added instead of multiplied 3 x 2

**b** Ignored the minus sign in front of 7

**c** Got signs incorrect

**d** $-2x + -12x$ should be $-14x$

## Homework 9G

**1 a** $x^2 + 15x + 44$

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

**c** $x^2 - x - 20$

**d** $x^2 - 16x + 55$

**e** $x^2 + x - 6$

**f** $x^2 - 10x + 21$

**g** $x^2 + 10x + 16$

**h** $x^2 - 8x + 7$

## Homework 9H

**1.** $x^2 + 8x + 12$

**2.** $x^2 + 6x + 5$

**3.** $x^2 - 5x - 36$

**4.** $x^2 + 6x + 9$

**5a.** $x^2 - 3x - 10$

**b.** $x^2 - 5x - 24$

**c.** $x^2 - 8x + 16$

**d.** $x^2 + ax + bx + ab$

**e.** $x^2 + 2ax + a^2$

**f.** $x^2 - 4$

## Homework 9I

**1** $2x^2 + 10x + 8$

**2** $3x^2 - 3$

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

**4** $5x^2 - 15x + 10$

**5** $3x^2 + 6x - 9$

**6** $2x^2 - 9x + 9$

**7** $6x^2 + 15x + 6$

**8** $20x^2 - 34x + 6$

**9** $6x^2 + 7x + 5$

**10** $4y^2 + 4y - 8$

**11** $(4x^2 + 12x - 91)$ m$^2$

## Homework 9J

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

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

**c** $x^2 - 18x + 81$

**d** $x^2 + 6x + 9$

**e** $x^2 + 10x + 25$

**2a** $4x^2 - 36x + 81$

**b** $a^2 + 2ab + b^2$

**c**    $a^2 - 2ab + b^2$

**d**    $m^2 - 4mn + 4n^2$

**e**    $x^2 + 2xy + y^2$

**f**    $4a^2 + 12ab + 9b^2$

**g**    $9a^2 - 36ab + 36b^2$

## 9.6 Quadratic factorization
### Homework 9K
**1**    **a**    $(x + 6)(x + 1)$

    **b**    $(x + 3)(x + 2)$

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

    **d** $(x + 3)(x - 5)$

**2**    **a** $(x + 2)(x + 1)$

    **b** $(x + 7)(x + 2)$

    **c**    $(x - 7)(x - 4)$

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

    **b** $(x - 8)(x + 7)$

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

**4**    **a** $(x + 7)(x + 3)$

    **b** $(x + 8)(x + 5)$

    **c** $(x - 7)(x - 2)$

**5**    **a** $(x + 9)(x + 4)$

    **b** $(x - 8)(x + 1)$

    **c** $(x + 7)(x - 4)$

### Homework 9L
1. $(x + 1)(x - 1)$
2. $(x + 11)(x - 11)$
3. $(x + 13)(x - 13)$
4. $(x + 10)(x - 10)$
5. $(3 - x)(3 + x)$
6. $(4 - x)(4 + x)$
7. $(15 - x)(15 + x)$
8. $(14 - x)(14 + x)$

## 9.7 Changing the subject of a formula
### Homework 9M

**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 m/s  **b**  $t = \dfrac{v-u}{10}$  **c**  8 s

**8**  **a**  4:30 pm

   **b**  $n = \dfrac{T-55}{10}$  **c**  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.

## 10 Ratio, proportion and rates of change: Ratio, speed and proportion

### 10.1 Ratio

### Homework 10A

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **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** $\frac{9}{10}$

**6** 2 : 1

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

### Homework 10B

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1** | **a** | £2 : £8 | **b** | £4 : £8 | **c** | £10 : £30 |
| | **d** | 10 g : 50 g | **e** | 1 h : 9 h | | |
| **2** | **a** | 300 | **b** | 25% | | |
| **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** | **a** | 1 : 1.5 | **b** | 1 : 2.5 | **c** | 1 : 1.25 |
| | **d** | 1 : 1.6 | **e** | 1 : 2.1 | | |

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

### Homework 10C

| | | | | | |
|---|---|---|---|---|---|
| **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. | | | | |

## 10.2 Speed, distance and time
### Homework 10D

**1**   15 mph
**2**   180 miles
**3**   46 mph
**4**   2 pm
**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

## 10.3 Direct proportion problems
### Homework 10E

**1**   £8
**2**   £2.16
**3**   £49.60
**4**   **a**   €2.25           **b**   20
**5**   **a**   £27.20          **b**   No, she only has enough for 11 tickets.
**6**   **a**   6 litres        **b**   405 miles
**7**   48 seconds
**8**   **a**   **i**     50 g margarine, 50 g golden syrup, 40 g sugar, 100 g oats
        **ii**    200 g margarine, 200 g golden syrup, 160 g sugar, 400 g oats
        **iii**   250 g margarine, 250 g golden syrup, 200 g sugar, 500 g oats
    **b**   60
**9**   6

## 10.4 Best buys
### Homework 10F

**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**   **a** 72p, 66p, 70p, 65p        **b** the 3-litre bottle
**4**   large size
**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.

## 11    Geometry and measures: Perimeter and area

## 11.1 Rectangles

## Homework 11A

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

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

**3**  **a**  **i** 10 cm$^2$          **ii** 14 cm
    **b**  **i** 16 cm$^2$          **ii** 16 cm
    **c**  **i** 16 m$^2$          **ii** 20 m
    **d**  **i** 36 mm$^2$          **ii** 30 mm
    **e**  **i** 160 m$^2$          **ii** 56 m

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

**5**  **c**: the other two both have a perimeter of 16 cm.

**6**  16 m

**7**  **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

**8**  36 cm$^2$

**9**  48 cm$^2$

**10**  375

## 11.2 Compound shapes

## Homework 11B

**1**  **a**  **i** 33 cm$^2$          **ii** 28 cm
    **b**  **i** 40 cm$^2$          **ii** 32 cm
    **c**  **i** 30 cm$^2$          **ii** 38cm
    **d**  **i** 60 cm$^2$          **ii** 40 cm
    **e**  **i** 500 cm$^2$          **ii** 120 cm

**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

## 11.3 Area of a triangle
### Homework 11C

**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**  Mia, as she used the correct height; Bethany used the slanting side.

**6**  120 cm$^2$

### Homework 11D

**1**  **a**  20 cm$^2$  **b**  35 cm$^2$  **c**  308 cm$^2$
   **d**  7.5 cm$^2$  **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**  120 cm$^2$  **c**  116 cm$^2$

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

**5**  4 cm

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

## 11.4 Area of a parallelogram
### Homework 11E

**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

## 11.5 Area of a trapezium

### Homework 11F

**1**  **a**  **i** 23.1 cm                    **ii** 28 cm$^2$
    **b**  **i** 36 cm                       **ii** 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 $\frac{1}{2}$), no answer is shown and units are not shown; correct answer is 65 cm$^2$.

**6**  68.75 m$^2$

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

## 11.6 Circles

### Homework 11G



### Homework 11H

**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)

## 11.7 The area of a circle

### Homework 11I

**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**  The circumference is 251 cm.
In total, six people need 420 cm
251 cm < 420 cm, therefore the table is not big enough for six people to sit comfortably.

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

**4**  15

**5**  **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.

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

**7**  **a**  15.9 cm      **b**  8.0 cm
     **c**  198.9 cm$^2$ (using the value on the calculator for part b); rounded value of 8.0 cm gives 201.1 cm$^2$.

**8**  9.3 cm$^2$

**9**  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 $A = \dfrac{\pi d^2}{4}$

**10**  189.3 cm$^2$

## 11.8 Answers in terms of $\pi$

### Homework 11J

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

**4**  4 cm

**5**  6 cm

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

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

**8**  **a**  **i**  $(4\pi + 8)$ cm  **ii**  $8\pi$ cm$^2$
    **b**  **i**  $(2\pi + 16)$ m  **ii**  $(2\pi + 24)$ m$^2$

**9**  $4a^2 - \pi a^2$

## 12 Geometry and measures: Transformations

### 12.1 Rotational symmetry

### Homework 12A

1   **a**   2        **b**   2        **c**   2
     **d**   3        **e**   2

2   **a**   5        **b**   6        **c**   2
     **d**   2        **e**   8

3   **a**   2        **b**   2        **c**   4
     **d**   4        **e**   5

4   **a**   1        **b**   2        **c**   2
     **d**   1        **e**   2        **f**   1
     **g**   2        **h**   2

5   **a**                          **b**



6   **a**   6        **b**   2        **c**   8
     **d**   4

7
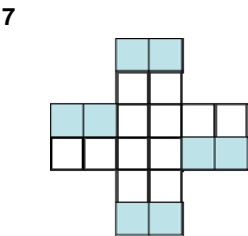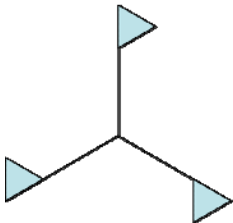


8   **For example:**

## 12.2 Translations
### Homework 12B

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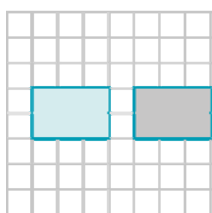
**b**
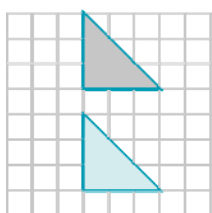
**c**
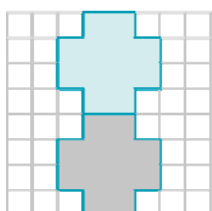
**d**
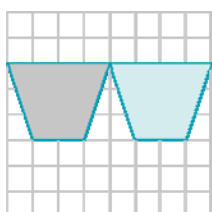
**2  a**
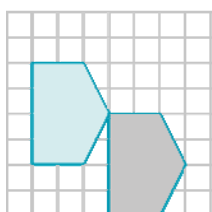
**b**
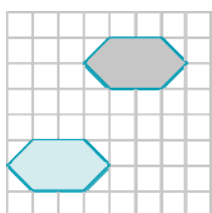
**c**
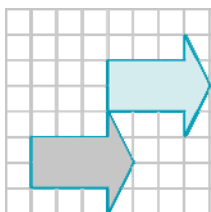


**d**
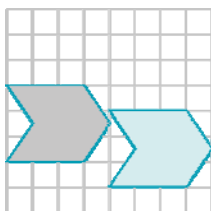


**3**  **i**  $\begin{pmatrix} 7 \\ 1 \end{pmatrix}$  **ii**  $\begin{pmatrix} 10 \\ -2 \end{pmatrix}$  **iii**  $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$

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

**4**  **a-e**
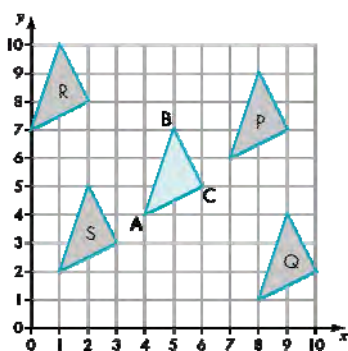


**5**  For example  $\begin{pmatrix} 0 \\ 4 \end{pmatrix}, \begin{pmatrix} 4 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ -4 \end{pmatrix}, \begin{pmatrix} -4 \\ 0 \end{pmatrix}$

**6**  No, the opposite of  $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$  is  $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$

## 12.3 Reflections

**Homework 12C**

**1    a**
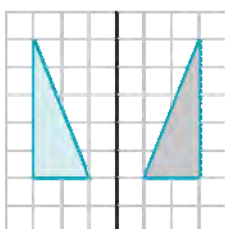


**b**
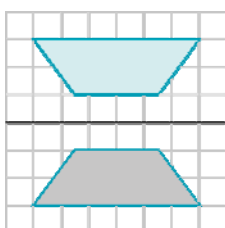


**c**
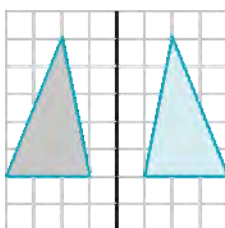


**d**
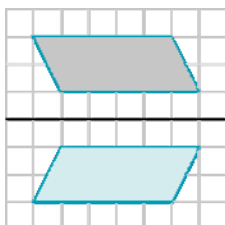


**2    a**
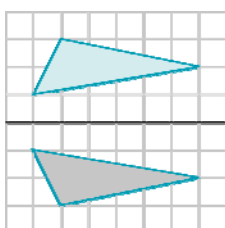
**b**
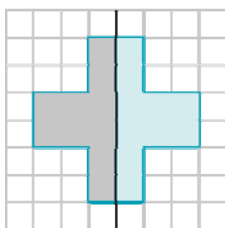


**c**
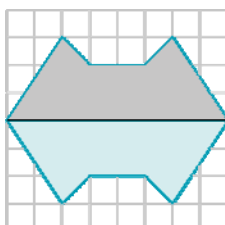


**3 a, b**
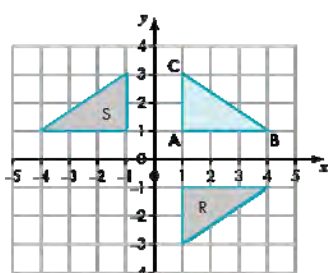


    **c**    Congruent

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

**5**    An equilateral triangle.

**6 a-e**
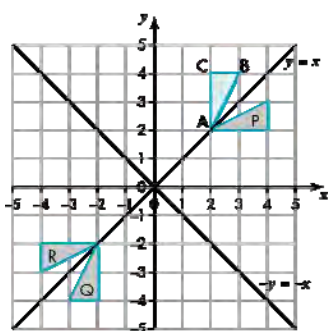


    **f**    Reflection in $y = -x$

## 12.4 Rotations

### Homework 12D

**1**  **a**
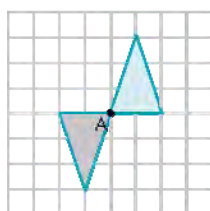


      **b**
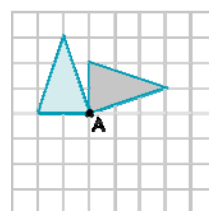


    **c**
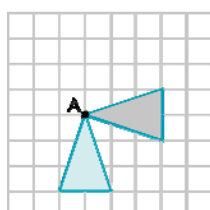


      **d**
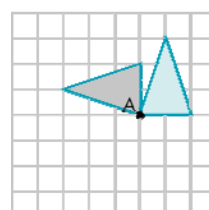


**2**  **a**
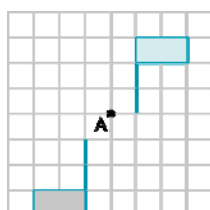


      **b**
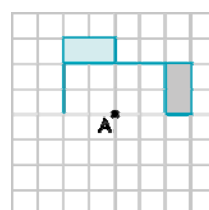


    **c**
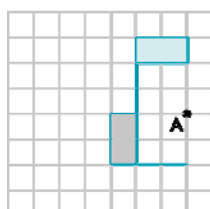


      **d**
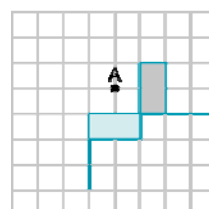


**3**  **a–c**
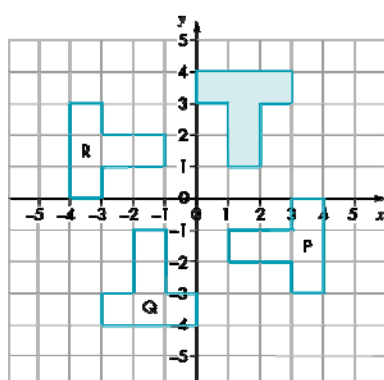


    **d**    Rotation 90° clockwise about O

**4**  Check students' own designs.

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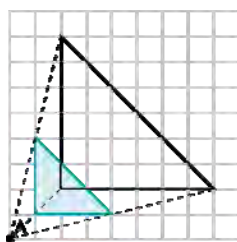Rotate 60° clockwise about B, rotate image 180° about B, rotate image 120° anticlockwise about C.
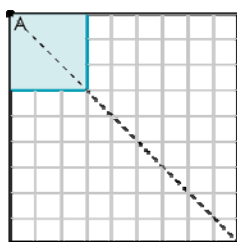
**6** **a–d**
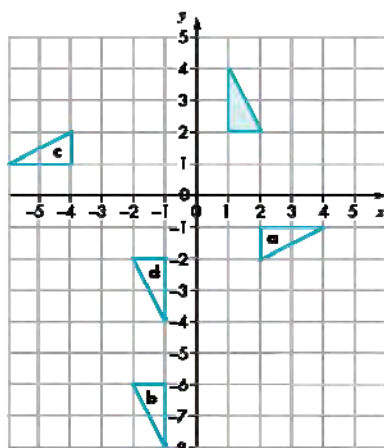


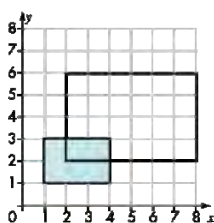**7** C: always true

## 12.5 Enlargements

## Homework 12E

**1** **a**



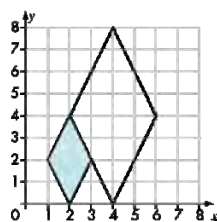**b**



**2** **a**

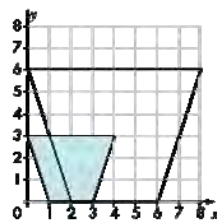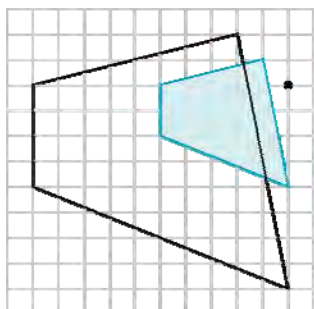

**b**
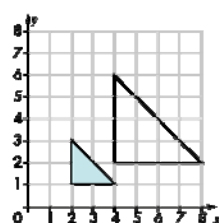
**c**



**d**



**3**  **a-b**



Scale factor 2
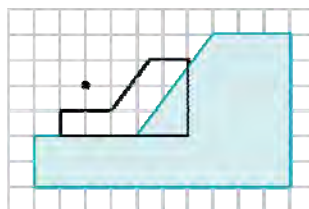


Scale factor $\frac{1}{2}$

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

**6**  By a factor of 16

## 12.6 Using more than one transformation
## Homework 12F

**1**

| From | To | Transformation |
|------|----|----------------|
| A | B | Rotation, 180 about (0, 5) |
| C | D | Reflection in $x = 0$ (*y*-axis) |
| D | F | Reflection in y = 0 (*x*-axis) |
| E | F | Reflection in x = 0 (*y*-axis) |
| G | H | Rotation, 180 about (−1, −5) |

## 12.7 Vectors
## Homework 12G

Check pupils own drawings:

**1**  **a**  3 right, 4 up      **b**  3 left, 4 up      **c**  3 right, 4 down
    **d**  3 left, 4 down

**2**  **a**  Coordinate grid showing X(0, 2), Y(4, 5) and Z(−2, −6)

**b i** $\overrightarrow{XY}\begin{pmatrix} 4 \\ 3 \end{pmatrix}$

**ii** $\overrightarrow{YZ}\begin{pmatrix} -6 \\ -11 \end{pmatrix}$

**iii** $\overrightarrow{XZ}\begin{pmatrix} -2 \\ -8 \end{pmatrix}$

**3** D (−1, −1)

**4a** J (2, −2), L (4, 3), **b** $\overrightarrow{JL}\begin{pmatrix} 2 \\ 5 \end{pmatrix}$

**5** **a-d**
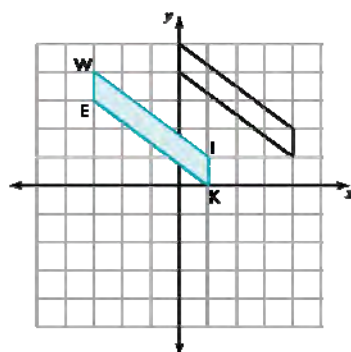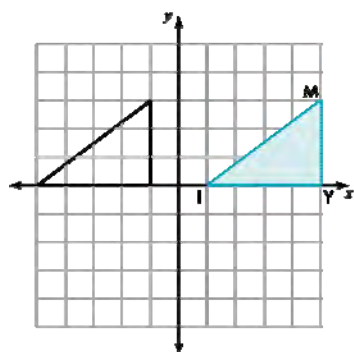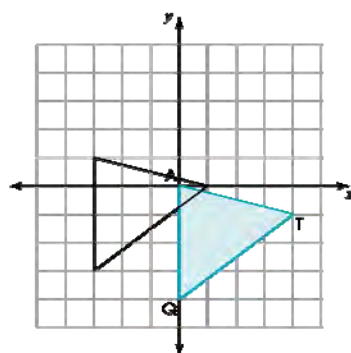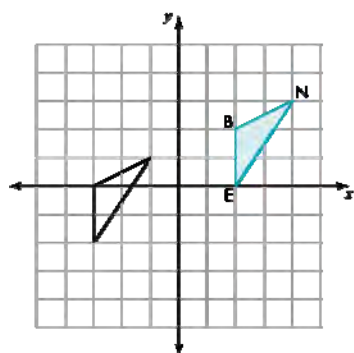


**6a** **i** $\begin{pmatrix} 1 \\ 8 \end{pmatrix}$   **ii** $\begin{pmatrix} -1 \\ -9 \end{pmatrix}$

**b** **i** $\begin{pmatrix} -5 \\ -5 \end{pmatrix}$   **ii** $\begin{pmatrix} 6 \\ 3 \end{pmatrix}$

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

**d**     **i**     $\begin{pmatrix} 3 \\ -6 \end{pmatrix}$     **ii**     $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$

## Homework 12H

**1**     **i**     −**a**          **ii**     −**b**          **iii**     **a** − **b**          **iv**     2**b**
         **v**     2**b** − 2**a**          **vii**     −2**a**          **viii**     2**b** − **a**

**2**     **i** $\dfrac{2}{3}$ **b**          **ii** $\dfrac{2}{3}$ **b** − **a**          **iii** $-\dfrac{1}{3}$ **b**

## 13 Probability: Probability and events
## 13.1 Calculating probabilites

### Homework 13A

1  a  $\frac{1}{13}$  b  $\frac{3}{13}$  c  $\frac{1}{4}$

   d  $\frac{2}{13}$  e  $\frac{1}{52}$  f  $\frac{1}{26}$

   g  $\frac{1}{2}$

2  a  $\frac{1}{10}$  b  $\frac{1}{2}$  c  $\frac{3}{5}$

   d  $\frac{2}{5}$  e  $\frac{3}{10}$

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

   d  0

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

   d  $\frac{4}{5}$  e  $\frac{4}{5}$

5  a  i  $\frac{1}{5}$  ii  $\frac{1}{3}$  iii  $\frac{7}{15}$

   b  They add up to 1.  c  All possible outcomes are used.

6  a  AE, AK, AD, AM, EK, ED, EM, KD, KM, DM  b  3

   c  $\frac{3}{10}$  d  6  e  $\frac{6}{10} = \frac{3}{5}$

   f  $\frac{1}{10}$

7  The Year 8 class

## 13.2 Probability that an outcome will not happen
### Homework 13B

1  a  0.7  b  0.6  c  0.48

   d  0.79  e  75%  f  92%

   g  44.5%  h  $\frac{3}{10}$  i  $\frac{4}{10} = \frac{2}{5}$

   j  $\frac{3}{15} = \frac{1}{5}$

2  a  $\frac{24}{25}$  b  35%  c  0.2

   d  $\frac{35}{36}$

3  a  i  $\frac{1}{13}$  ii  $\frac{12}{13}$

   b  i  $\frac{1}{4}$  ii  $\frac{3}{4}$

**c** **i** $\frac{2}{13}$ **ii** $\frac{11}{13}$

**4** **a** **i** $\frac{5}{11}$ **ii** $\frac{6}{11}$

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

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

**6** Harris

**7** The game might end in a draw.

## 13.3 Mutually exclusive and exhaustive outcomes
## Homework 13C

**1.** **d**

**2a**. $\frac{4}{20} = \frac{1}{5}$

**b**. $\frac{6}{20} = \frac{3}{10}$

**c**. $\frac{10}{20} = \frac{1}{2}$

**d**. $\frac{14}{20} = \frac{7}{10}$

**e**. $\frac{16}{20} = \frac{4}{5}$

**3**. 20%

**4a** $\frac{1}{20}$ **b** $\frac{1}{2}$ **c** $\frac{2}{5}$

**d** $\frac{3}{20}$ **e** $\frac{1}{10}$

**5a** 0.85 **b** 0.17 **c** 0.83

**6.** The two chances might not be equally likely, depending on how good each player is.

**7** 0.24

## 13.4 Experimental probability

**Homework 13D**

**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.

## 13.5 Expectation

**Homework 13E**

**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**  Multiply the number of students by 0.14

**8**  120

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

**10**  30 times

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

**12  a**  You cannot add probabilities for events like this.
    **b**  Increase, as he is more experienced.

## 13.6 Choices and outcomes

### Homework 13F

**1**  **a**  24  **b**  20  **c**  3

**2**  $\dfrac{1}{6}$

**3**  **a**  5 choices for the first card and 4 for the second card, 5 × 4 = 20

   **b**  $\dfrac{1}{10}$

**4**  20

**5**  **a**  10 000  **b**  $\dfrac{1}{504}$

## 14 Geometry and measures: Volumes and surface areas of prisms

### 14.1 3D shapes
### Homework 14A

| 1 | **ai** 10 | **ii** | 15 | **iii** | 7 |
|---|---|---|---|---|---|
| | **bi** 16 | **ii** | 24 | **iii** | 10 |
| | **ci** 5 | **ii** | 8 | **iii** | 5 |

| 2 | **ai** 24 cm$^3$ | | | **ii** 52 cm$^2$ |
|---|---|---|---|---|
| | **bi** 30 cm$^3$ | | | **ii** 72 cm$^2$ |
| | **ci** 35 cm$^3$ | | | **ii** 86 cm$^2$ |
| | **di** 40 cm$^3$ | | | **ii** 88 cm$^2$ |
| | **ei** 27 cm$^3$ | | | **ii** 66 cm$^2$ |
| | **fi** 27 cm$^3$ | | | **ii** 66 cm$^2$ |
| | **gi** 27 cm$^3$ | | | **ii** 72 cm$^2$ |

3    **a**    Shape A: Volume = 60 cm$^3$, Surface area = 94 cm$^2$

        Shape B: Volume = 480 cm$^3$, Surface area = 376 cm$^2$

        **b**  **i** 2        **ii** 4        **iii** 8

### 14.2 Volume and surface area of a cuboid
### Homework 14B

1    90 m$^3$

| 2 | **ai** | 72 cm$^3$ | | **ii** | 108 cm$^2$ |
|---|---|---|---|---|---|
| | **bi** | 100 cm$^3$ | | **ii** | 160 cm$^2$ |
| | **ci** | 180 cm$^3$ | | **ii** | 222 cm$^2$ |
| | **di** | 125 cm$^3$ | | **ii** | 150 cm$^2$ |

3    35

| 4 | **a** 24 cm$^3$ | **b** 5 cm | **c** 5 cm |
|---|---|---|---|
| | **d** 6 cm | | |

| 5 | **a** 60 cm$^3$ | **b** 160 cm$^3$ | **c** 120 cm$^3$ |
|---|---|---|---|

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.

## 14.3 Volume and surface area of a prism

### Homework 14C

**1**  Volume = 480 cm$^3$, Surface area = 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.

## 14.4 Volume and surface area of cylinders

### Homework 14D

**1**  **a**  Volume: 549.8 cm$^3$       Surface area: 377.0 cm$^2$
    **b**  Volume: 2513.3 cm$^3$       Surface area: 1131.0 cm$^2$
    **c**  Volume: 2261.9 cm$^3$       Surface area: 980.2 cm$^2$
    **d**  Volume: 572.6 cm$^3$       Surface area: 381.7 cm$^2$

**2**  **a**  Volume: 754.0 cm$^3$       Surface area: 477.5 cm$^2$
    **b**  Volume: 117.8 cm$^3$       Surface area: 133.5 cm$^2$
    **c**  Volume: 1460.1 cm$^3$       Surface area: 714.7 cm$^2$

**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

## 15    Algebra: Linear equations

### 15.1 Solving linear equations
### Homework 15A

**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**  **a**  38               **b**  £104.80

**3**  $2x = 38$, $x = 19$

**4**  $10y = 950$, $y = 95$, 1 litre costs 95p

### Homework 15B

**1**  **a**  $x = 4$            **b**  $x = 2$            **c**  $x = 5$
     **d**  $y = 6$            **e**  $a = 2$            **f**  $x = 4$
     **g**  $y = 3$            **h**  $x = 1$            **i**  $x = 5$
     **j**  $x = 6$            **k**  $a = 10$           **l**  $c = 18$
     **m**  $x = 12$           **n**  $m = 9$            **o**  $z = 20$

**2**  $\dfrac{x}{4} - 2 = 6$

**3**  **a**  $x + 3$           **b**  Check students' working

### Homework 15C

**1**  **a**  $x = 1$            **b**  $y = 7$            **c**  $x = -2$
     **d**  $y = 4$            **e**  $t = 5$            **f**  $x = 8$
     **g**  $y = 3$            **h**  $x = 1$            **i**  $m = 3.5$

**2**  **a**  $x = 3$            **b**  $t = 4$            **c**  $x = 4$
     **d**  $y = 5$            **e**  $x = 10$           **f**  $t = 6$
     **g**  $x = 6$            **h**  $k = 5$            **i**  $z = 2$

### Homework 15D

**1**  **a**  $x = 6$            **b**  $p = 3$            **c**  $x = 16$
     **d**  $x = 14$           **e**  $a = 9$            **f**  $z = 10$

**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.

**4 a** $x = 10$    **b** $y = 14$    **c** $z = 36$

**5 a** 7.5    **b** 9

**6** 48

## 15.2 Solving equations with brackets

### Homework 15E

**1 a** $x = 3$    **b** $x = 7$    **c** $t = 1$
  **d** $x = 5$    **e** $y = 6$    **f** $x = 3$
  **g** $t = 2$    **h** $t = -2$    **i** $x = -3$
  **j** $y = 1.5$    **k** $k = 1.25$    **l** $x = 1.1$

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

**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: $x = 0.7$.

## 15.3 Solving equations with the variable on both sides

### Homework 15F

**1 a** $x = 2$    **b** $y = 4$    **c** $a = 7$
  **d** $t = 3$    **e** $p = 4$    **f** $k = 5$
  **g** $m = 2$    **h** $s = -2$    **i** $w = 0$
  **j** $x = 2.5$

**2** $5x + 2 = 3x - 6$, $x = -4$

**3 a** $t = 9$    **b** $x = -3$    **c** $p = 1$
  **d** $x = -18$

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

**5 a** 3    **b** 4

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

**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** 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 $x = 2$.

## 16 Ratio and proportion and rates of change: Percentage and compound measures

## 16.1 Equivalent fractions, percentages and decimals

### Homework 16A

**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 | | | | |

## 16.2 Calculating a percentage of a quantity

### Homework 16B

| 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 litres | l | £297.60 |

**4** 208

**5** Y7: 240, Y8: 230, Y9: 210, Y10: 220, Y11: 200; No, total is 1100 and target is 1125 so 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

## 16.3 Increasing and decreasing quantities by a percentage

### Homework 16C

| 1a | 1.15b 1.175 | c 1.22 | d 1.08 |
|----|-------------|--------|--------|

| 2a | 0.91b 0.86 | c 0.16 | d 0.63 |
|----|------------|--------|--------|

| 3 | 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 | | | | |

| 4 | 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

**5** £137 800

**6** Car will be worth £13 984

**7** Population now 2112

**8** Yes; clock: £21.15, wallet: £17.86, towel: £15.04, bookmark: £7.52 giving a total of £61.57

**9** £15

**10** £459

**11** Cheaper: for example, £100 + 10% = £100 + £10 = £110.
£110 – 10% = £110 – £11.00 = £99.00
or 1.1 × 0.9 = 0.99 so cheaper by 1%

**12** 1.05 × 1.05 = 1.1025 or 10.25% so shop A

**13** 0.8 × 1.2 = 0.96 or 4% reduction

## 16.4 Expressing one quantity as a percentage of another

### Homework 16D

**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** **a** **i** 66.7% profit      **ii** 50.0% profit
  **iii** 50.0% profit      **iv** 66.6% profit
  **b** Yes, in each case.

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

**7** 60

**8** 1000

## 16.5 Compound Measures
## Homework 16E

**1**  **a**  £105.60  **b**  £919.13  **c**  £832.20  **d**  £78

**2**  **a**  £10.50  **b**  £17.25  **c**  £23.12
    **d**  £19.84

**3**  **a**  15.5 hours  **b**  19 hours  **c**  37 hours
    **d**  62 hours

**4**  39 × £12.13 = £473.07, income tax = £94.61,
    national insurance paid = £378.46 − £340.61 = £37.85 = 8%

## Homework 16F

**1**  **a**  8960 kg/m$^3$  **b**  35 650 kg

**2**  170.12 g

**3**  90 g

**4**  Metal B, 21 cm$^3$

**5**  25 cm × 30 cm

**6**  £$\dfrac{h}{14}$

**7**  15 m$^2$, 37.5 m$^2$ and 7.5 m$^2$

## 17      Ratio and proportion and rates of change: Percentages and variation
## 17.1 Compound interest and repeated percentage change

### Homework 17A

**1**    **a.**    £2160    **b**.    £2320    **c.**    £2480

**2.**    £3795.96

**3.**    £3176.76

**4.**    £20 240.75

**5.**    Veronika £174.47, Amelia £241.94 , Scarlett £308.46.  Scarlett's phone is worth the most.

**6**    **a.**    87.55 g    **b.**    98.54 g    **c.**    114.23 g
      **d.**    153.52 g

**7**    **ai**    2012    **ii**    2015    **iii**    2020

      **iv**    2030

      **b**    2022

## 17.2 Reverse percentage (working out the original value)
### Homework 17B

   **1.**  £611.76

   **2.**  £24

   **3.**  £150

   **4.**  £440

   **5.**  51 400

   **6.**  3 hr 45 mins

   **7.**  23 612 800

   **8.**  2100

   **9.**  220

   **10.** £45 000

## 17.3 Direct proportion

### Homework 17C

**1.**  **a i**      7

**ii**

| *x* | 2 | 4 | 20 | 8 |
|---|---|---|---|---|
| *y* | 14 | 28 | 140 | 56 |

**iii**      Graph of values in the table      **iv**      *y* =70

**b. i** 5

**ii**

| *p* | 4 | 20 | 1 | 15 |
|---|---|---|---|---|
| *q* | 20 | 100 | 5 | 75 |

**iii**      Graph of values in the table      **iv**      *q* =10

**c. i** 6

**ii**

| *x* | 5 | 1 | 20 |
|---|---|---|---|
| *y* | 30 | 6 | 120 |

**iii**      Graph of values in the table      **iv**      *y* = 60

**d.  i** 7.5

**ii**

| *x* | 2 | 6 | 12 |
|---|---|---|---|
| *y* | 15 | 45 | 90 |

**iii**      Graph of values in the table      **iv**      *y* = 22.5

**e. i** 3.5

**ii**

| *a* | 2 | 8 | 30 |
|---|---|---|---|
| *b* | 7 | 28 | 105 |

**iii**      Graph of values in the table      **iv**      *b* = 38.5

**f. i** 4

**ii**

| *x* | 6 | 12 | 30 | 1 |
|---|---|---|---|---|
| *y* | 24 | 48 | 120 | 4 |

**iii**      Graph of values in the table      **iv**      *y* = 40

**g.  i** 2.5

**ii**

| *x* | 4 | 12 | 20 |
|---|---|---|---|
| *y* | 10 | 30 | 50 |

**iii**      Graph of values in the table      **iv**      *y* = 2.5

**h. i** 4.5

**ii**

| *a* | 4 | 12 | 20 |
|---|---|---|---|
| *b* | 18 | 54 | 90 |

**Iii**     Graph of values in the table     **iv**     *b* = 22.5

    **i.**  **i** 1.5
    **ii.**

| *x* | 12 | 8 | 4.6 |
|---|---|---|---|
| *y* | 18 | 12 | 6.9 |

**iii**     Graph of values in the table     **iv**     *y* = 8.25

**j. i** 1.5

**ii**

| Pounds (*P*) | 3 | 12 | 25 | 120 |
|---|---|---|---|---|
| Dollars (*D*) | 4.50 | 18 | 37.5 | 180.00 |

**Iii**     Graph of values in the table     **iv**     $60

**2.**     **a**     *A* = 18     **b**     *r* = 20

**3.**     **a**     *C* = 90     **b**     *p* = 1

**4**     **a**     Yes
               REASON: straight line through (0, 0)

     **b**     No
               REASON: does not go through (0, 0)

     **c**     Yes
               REASON: straight line through (0, 0)

     **d**     No
               REASON: Not a straight line and does not go through (0, 0)

## 17.4 Inverse proportion
## Homework 17D

**1**  16 men

**2** 10 days

**3** 51 days

**4** 36 minutes

**5** *y* = 9

**6** *h* = 6

**7** *y* = 3

**8** $y = \dfrac{1}{3}$

**9** $z$ = 128

**10**

| $s$ | 50 | 25 | 20 | 12.5 | 10 | 5 | 3.333 | 2.5 |
|-----|-----|-----|-----|------|-----|-----|-------|-----|
| $t$ | 1 | 2 | 2.5 | 4 | 5 | 10 | 15 | 20 |
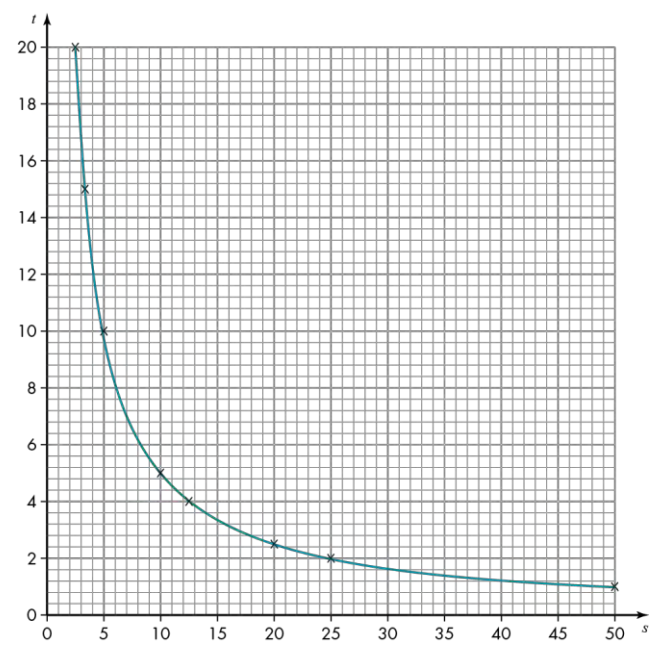
## 18 Statistics: Representation and interpretation
## 18.1 Sampling

### Homework 18A

**1** Only asking people at 8.30 am, so not representative of whole population. Asking people their age is personal so may not get answered. Asking the first 10 is not a random sample and will not represent the whole population.

**2 a** Only asks Y11students

  **b** Number students and use rand key on calculator between 1–1000 and repeat 50 times. Or names in a hat and pick out 50. A method which implies everyone has the same chance of selection.

**3** Not a fair representation of each gender – the sample uses $\frac{3}{4}$ of the boys but only $\frac{1}{8}$ of the girls.

## 18.2 Pie charts

### Homework 18B

**1** Check students' pie charts, with angles as listed.

| Time in minutes | 10 or less | Between 11 and 30 | 31 or more |
|---|---|---|---|
| Angle on pie chart | 48° | 114° | 198° |

**2** Check students' pie charts, with angles as listed.

| GCSE passes | 9 or more | 7 or 8 | 5 or 6 | 4 or less |
|---|---|---|---|---|
| Angle on pie chart | 40° | 200° | 100° | 20° |

**3 a** Check students' pie charts, with angles as listed.

| Main use | Email | Internet | Word processing | Games |
|---|---|---|---|---|
| Angle on pie chart | 50° | 130° | 30° | 150° |

  **b** Most used the computer for playing games and only a few used it for word processing.

  **c** Not enough in sample, only a small age range of people, probably only boys, etc.

**4 a** Check students' pie charts, with angles as listed.

| Type of programme | Comedy | Drama | Films | Soaps | Sport |
|---|---|---|---|---|---|
| Angle on pie chart | 54° | 33° | 63° | 78° | 132° |

  **b** No; the researcher only asked people who are likely to have similar interests, e.g. sport.

**5 a** 25%     **b** Rarely

  **c** No, it only shows proportions.

  **d** What is your age? How often do you take exercise? How often do you see a doctor? There are other possibilities.

**6** $\frac{5}{36}$

**7** A sample of students and the frequencies or numbers of different breakfasts taken.

## 18.3 Scatter diagrams
### Homework 18C

**1**  **a, b**
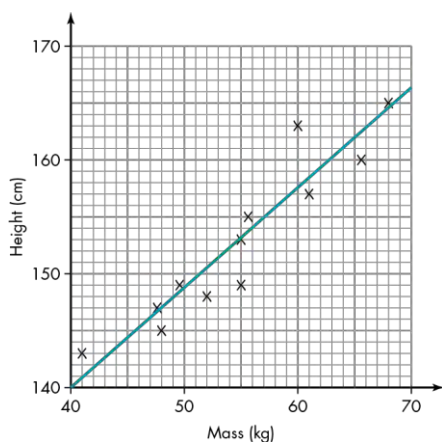


    **c**   ≈ 54 kg         **d**   ≈ 144 cm

**2**  **a, b**
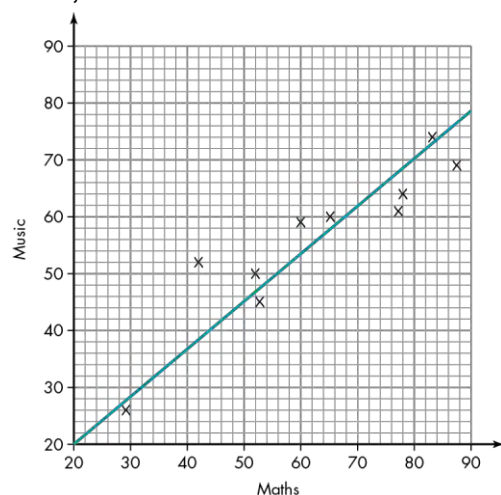


    **c**   Ben         **d**   ≈ 40 marks         **e**   ≈ 89 marks

**3**   About 52, depending on graph drawn and line of best fit

**4**   Points all over the place, showing no pattern at all.

## 18.4 Grouped data and averages
### Homework 18D

**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**   1 has been recorded in the 40-49 but should go in the 30-39 group

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

## 19    Geometry and measures: Constructions and loci
## 19.1 Constructing triangles

### Homework 19A

**1**    Check students have accurately constructed the triangles.

**2**    You can draw this triangle. Start by drawing two sides at an angle of 60°. Using compasses, measure one side to be 5 cm along. From the endpoint of this line, use compasses set to 6 cm to find the intersection with the other line.

**3**    **a**    Check students have accurately constructed the rhombus. **b**    rhombus

**4**    She is correct: either the angle lies between the two given sides which can be drawn and joined together, or the triangle can be drawn using the method given in question 2 above.

**5**
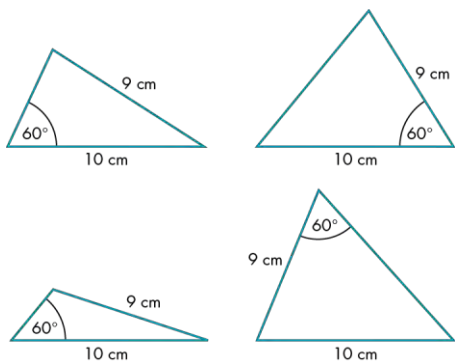


## 19.2 Bisectors
### Homework 19B

**1–4** Check students' own drawings.

**5**
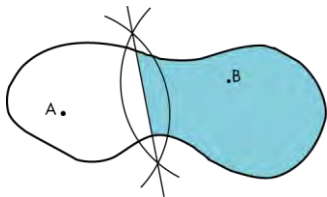


**6**    Students should:

   **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 15° 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.
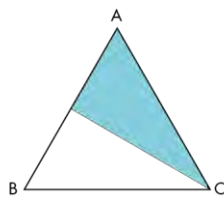
## 19.3 Defining a locus

### Homework 19C

**1**



6 cm    A 3 cm

(not to scale)

**2** **a**
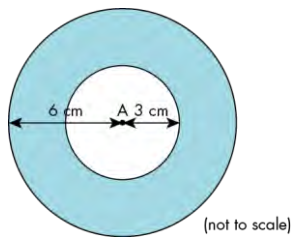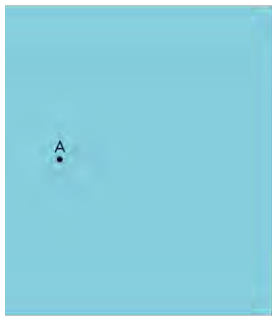


**b**

**3** Sphere, radius 1 metre

**4** **a**
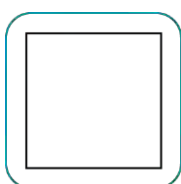


**b**    **c**    **d**
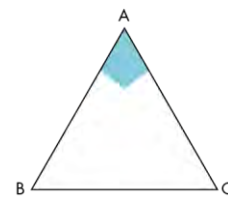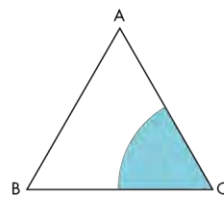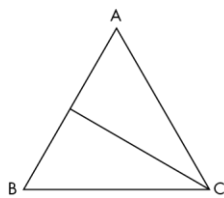
**5**
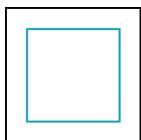


**6**

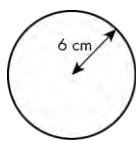**7 a**　　　　　　　　**b**
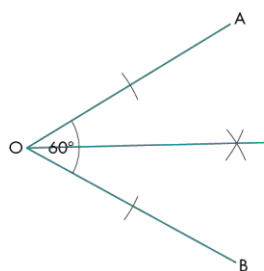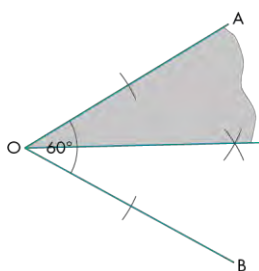


　a) The locus of a fixed point will be a circle exactly 6 cm radius.
　b) The locus of a fixed point less than 6 cm from the center of a circle will be a 6 cm radius circle, shaded inside as all those points are within 6 cm.

**c**　　　　　　　　　　　　　**d**



　c) This is an angle bisector so all points an equal distance from the two lines making the angle.
　d) This is an angle bisector again, but the points between the bisector and line OA should be shaded as all these points are closer to OA than OB.
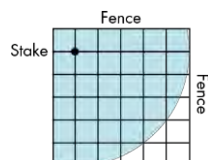
**8**　Check students' own drawings.

**9**



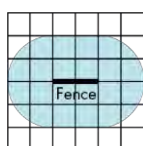　Note: the starting point may be any point along the locus.

## 19.4 Loci problems
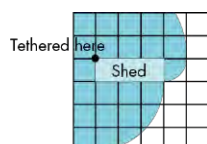## Homework 19D

**1**



**2**

**3**



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

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

**5**  No

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

  **b**  Yes

**7**  Between 160 and 300 km

**8**
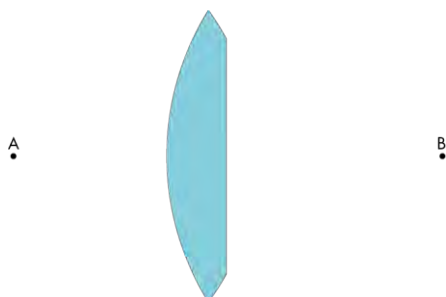


**9**
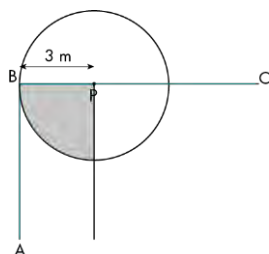


**10**
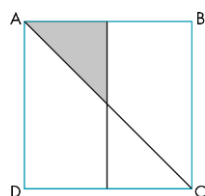
## 20    Geometry and measures: Curved shapes and pyramids
## 20.1 Sectors

### Homework 20A

| 1 | a | 2.793 cm | b | 6.283 cm | c | 21.991 mm |
|---|---|---|---|---|---|---|
|   | d | 5.341 cm | e | 35.709 cm | f | 22.619 mm |

| 2 | a | 6.283 cm$^2$ | b | 381.791 mm$^2$ | c | 82.1 cm$^2$ |
|---|---|---|---|---|---|---|
|   | d | 22.253 cm$^2$ | e | 3880.521 mm$^2$ | f | 76.027 mm$^2$ |

3    a    i 2.5 cm     ii 2.5 cm$^2$
     b    i 17.4 cm    ii 82.7 cm$^2$
     c    i 28.3 cm    ii 84.8 cm$^2$
     d    i 1.7 cm     ii 4.8 cm$^2$

4    a    $\dfrac{1}{3}$

     b    26.2 cm$^2$

5    33.5 cm$^2$
6    19.0985…cm
7    138.641…°

## 20.2 Pyramids
### Homework 20B

1    a    90 cm$^3$     b    65.333 cm$^3$

2    64 cm$^3$

3    384 cm$^3$

4    66.667 cm$^3$

5    78.064 cm$^3$

6    7.396 cm$^3$

7    29.715 cm$^3$

### Homework 20C

1    64 cm$^2$

2    13 cm

3    a    117.3 cm$^2$     b    105 cm$^2$

### 20.3 Cones
### Homework 20D

**1**    A: 2.79 cm²      B: 9.42 cm²      C: 66.0 mm²
      D: 13.6 cm²      E: 111 cm²      F: 54.3 mm²

**2a**    Students' own measurements

**b**    A: 2.79 cm      B: 6.28 cm      C: 21.99 mm
    D: 5.34 cm      E: 35.71 cm      F: 22.62 mm

**c**    Students' own answers. If their drawings are accurate they should find that their answers in part a are similar to those in part b.

**3a**    A: 2.79 cm      B: 6.28 cm      C: 21.99 mm
      D: 5.34 cm      E: 35.71 cm      F: 22.62 mm

**b**    A: 0.444 cm      B: 0.999 cm      C: 3.50 mm
    D: 0.85 cm      E: 5.68 cm      F: 3.60 mm

**4**

| Sector | Area of sector | Length of arc | Radius of cone, $r$ | Slant height, $l$ | $\pi \times r \times l$ |
|---|---|---|---|---|---|
| A | 2.79 cm² | 2.79 cm | 0.444 cm | 2 | 2.79 |
| B | 9.42 cm² | 6.28 cm | 0.999 cm | 3 | 9.42 |
| C | 65.97 mm² | 21.99 mm | 3.50 mm | 6 | 65.97 |
| D | 13.62 cm² | 5.34 cm | 0.85 cm | 5.1 | 13.62 |
| E | 110.70 cm² | 35.71 cm | 5.68 cm | 6.2 | 110.63 |
| F | 54.29 mm² | 22.62 mm | 3.60 mm | 4.8 | 54.29 |

### Homework 20E

**1**    **a**    252.584 cm       **b**    259.181 cm       **c**    16.588 cm

**2**    **a**    628.319 cm²       **b**    329.867 cm²

**3**    **a**    50.265 cm³       **b**    141.372 cm³

**4**    **a**    **i** 418.879 cm³      **ii** 342.434 cm²
      **b**    **i** 20.944 cm³      **ii** 56.549 cm²
      **c**    **i** 14 241.887 cm³      **ii** 3480.885 cm²
      **d**    **i** 41.888 cm³      **ii** 87.965 cm²
      **e**    **i** 314.159 cm³      **ii** 282.743 cm²

### 20.4 Spheres
### Homework 20F

**1**    **a**    **i** 1436.755 cm³      **ii** 615.752 cm²
      **b**    **i** 57 905.836 cm³      **ii** 7238.229 cm²
      **c**    **i** 1047.394 cm³      **ii** 498.759 cm²

      **d**      **i** 24 429.024 cm$^3$      **ii** 4071.504 cm$^2$

      **e**      **i** 70 276.238 cm$^3$      **ii** 8235.497 cm$^2$

      **f**      **i** 10 305 994.7 mm$^3$      **ii** 229 022.104 mm$^2$

**2**      **a**      314.159 cm$^2$

      **b**      804.248 cm$^2$

**3**      30.902 cm

**4**      70 cm

**5**      **a**      0.524 cm$^3$

      **b**      0.010 cm$^3$

## 21 Algebra: Number and sequences

### 21.1 Patterns in number
### Homework 21A

**1** 12 345 × 8 + 5 = 98 765, 123 456 × 8 + 6 = 987 654

**2** 98 765 × 9 + 3 = 888 888, 987 654 × 9 + 2 = 8 888 888

**3** 7 × 11 × 13 × 6 = 6006, 7 × 11 × 13 × 7 = 7007

**4** 3 × 7 × 13 × 37 × 6 = 60 606, 3 × 7 × 13 × 37 × 7 = 70 707

**5** 9009

**6** 80 808

**7** 15 015

**8** 151 515

**9** 999 999

**10 a** Students' own work     **b** The total is the same in each case.
    **c** 3 × central number
    **d** Students should predict 3 × central number of their new square

**11 a** $7 \times 9 = 8^2 - 1 = 63$, $8 \times 10 = 9^2 - 1 = 80$
    **b** $7 \times 11 = 9^2 - 4 = 77$, $8 \times 12 = 10^2 - 4 = 96$

### 21.2 Number sequences
### Homework 21B

**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** 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

**5 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

**6**   $1, \frac{2}{3}, \frac{3}{5}, \frac{4}{7}, \frac{5}{9}$

**7**   **a**   $2k + 2.5$           **b**   $2k + 3$           **c**   $2k + 4$
       **d**   $2k + 5$             **e**   £2

**8**   **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 $\frac{2}{3}$.

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

**10**  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.

**11**  92, 80, 68, 56, 44, 32, 20, 8

**12**  $106 - 4n = 6n - 4$, rearrange as $6n + 4n = 106 + 4$, solve to get $n = 11$.

## 21.3 Finding the $n$th term of a linear sequence

### Homework 21C

**1**   **a**   15, 17; $2n + 3$       **b**   43, 51; $8n - 5$       **c**   31, 36; $5n + 1$
       **d**   33, 39; $6n - 3$       **e**   19, 22; $3n + 1$       **f**   38, 45; $7n - 4$

**2**   **a**   $2n + 1$, 101         **b**   $4n + 1$, 201         **c**   $5n + 3$, 253
       **d**   $6n - 4$, 296         **e**   $3n + 2$, 152         **f**   $7n - 5$, 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**   £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.
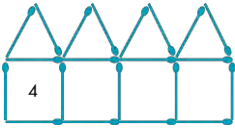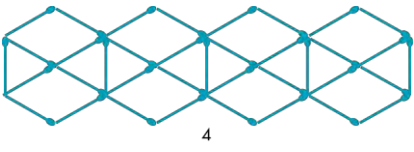
## 21.4 Special sequences

### Homework 21D

**1** **a** odd    **b** even    **c** odd
   **d** odd    **e** even    **f** odd
   **g** even    **h** odd

**2** **a** 1000
   **b** **i** $n^3 + 1$    **ii** $2n^3$    **iii** $\frac{1}{2}n^3$

**3** **a** even    **b** odd    **c** even
   **d** even    **e** even    **f** even
   **g** odd    **h** even

**4** $10 + 15 = 25 = 5^2$; $15 + 21 = 36 = 6^2$

**5** **a** C    **b** C    **c** O
   **d** E

**6** **a** $3^5$ (243), $3^6$ (729), $3^7$ (2187)
   **b** **i** $3^n - 1$    **ii** $2 \times 3^n$

## 21.5 General rules from given patterns

### Homework 21E

**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** Number of bricks 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
So they can get to the 5th step before they run out of bricks.

## 22   Geometry and measures: Right angled triangles

## 22.1 Pythagoras' theorem

## Homework 22A

Check pupils own drawings

Largest angle should be 90°

Should notice that the sum of the squares of the two smaller sides equals the square of the larger side.

## Homework 22B

1   **a**   5 cm
     **b**   4.4 cm
     **c**   10.6 cm
     **d**   35.4 cm

2   a, b, d, f, g, h

3   56.6 cm

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

     Area of square = $\sqrt{32} \times \sqrt{32}$ = 32 cm²

## 22.2 Calculating the length of a shorter side

## Homework 22C

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   She is correct. From triangle ABC we can work out that AC = 5 cm, and $3^2 + 4^2 = 5^2$

## 22.3 Applying Pythagoras' theorem in real-life situations

## Homework 22D

1   9 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 cm²

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

**10**   Horizontal distance = 7 units, vertical distance = 13 units and $\sqrt{7^2 + 13^2} = 14.8$ units

**11**   616 km

**12**   Length 12 cm, width 5 cm

## 22.4 Pythagoras' theorem and isosceles triangles
## Homework 22E

**1**   **a** 5.66 cm          **b** 8.49 cm          **c** 13.2 cm          **d** 171.1 mm

**2**   **a** 10.61 cm         **b** 6.58 cm          **c** 9.05 m           **d** 3.54 m          **e** 12.73 cm
     **f** 14.85 m

**3**   **a** 24.21 cm²        **b** 7.15 cm²         **c** 27.98 cm²

**4** 27.71 cm²

## 22.5 Trigonometric ratios
## Homework 22F

Check students own table. They should find that the values are the same in each of the last three columns

## Homework 22G

**1**      Sin $\theta = \dfrac{5}{13}$

        Cos $\theta = \dfrac{12}{13}$

        Tan $\theta = \dfrac{5}{12}$

**2**      Sin $\theta = \dfrac{24}{25}$

$$\text{Cos } \theta = \frac{7}{25}$$

$$\text{Tan } \theta = \frac{24}{7}$$

**3**    $\text{Sin } \theta = \dfrac{8}{17}$

$$\text{Cos } \theta = \frac{15}{17}$$

$$\text{Tan } \theta = \frac{8}{15}$$

**4**    $\text{Sin } \theta = \dfrac{40}{41}$

$$\text{Cos } \theta = \frac{9}{41}$$

$$\text{Tan } \theta = \frac{40}{9}$$

**5**    $\text{Sin } \theta = \dfrac{60}{61}$

$$\text{Cos } \theta = \frac{11}{61}$$

$$\text{Tan } \theta = \frac{60}{11}$$

**6**    $\text{Sin } \theta = \dfrac{12}{37}$

$$\text{Cos } \theta = \frac{35}{37}$$

$$\text{Tan } \theta = \frac{12}{35}$$

**7**    $\text{Sin } \theta = \dfrac{13}{85}$

$$\text{Cos } \theta = \frac{84}{85}$$

$$\text{Tan } \theta = \frac{13}{84}$$

**8**  Sin $\theta = \dfrac{112}{113}$

Cos $\theta = \dfrac{15}{113}$

Tan $\theta = \dfrac{112}{15}$

**9**  Sin $\theta = \dfrac{63}{65}$

Cos $\theta = \dfrac{16}{65}$

Tan $\theta = \dfrac{63}{16}$

## Homework 22H

| **1** | **a** 0.707 | **b** 0.391 | **c** 0.191 | **d** 1 | **e** −1 | **f** 0 |
|---|---|---|---|---|---|---|
| | **g** 0.921 | **h** 0.829 | | | | |

| **2** | **a** 0.829 | **b** 0.052 | **c** 0 | **d** −1 | **e** 0 |
|---|---|---|---|---|---|
| | **f** −0.191 | **g** 0.875 | **h** −0.829 | | |

| **3** | **a** 3.37 | **b** 18.5 | **c** 0 | **d** 0.389 | **e** 1.73 |
|---|---|---|---|---|---|
| | **f** Error | | | | |

## 22.6 Calculating lengths using trigonometry
## Homework 22I

**1**  **a** $a$ = 6.95 cm  **b** $b$ = 15.6 cm  **c** $c$ = 7.59 cm  **d** $d$ = 40.0 cm

**2**  **a** $e$ = 6.11 cm  **b** $f$ = 16.3 cm  **c** $g$ = 7.50 cm  **d** $h$ = 10.9 cm

**3**  **a** $i$ = 4.86 cm  **b** $j$ = 4.56 cm  **c** $k$ = 2.90 cm  **d** $l$ = 1.97 cm

**4**  **a** 12.6 cm  **b** 4.30 cm  **c** 3.88 cm  **d** 17.1 cm  **e** 25.5 cm
     **f** 26.4 cm

**5**  **a** 6.37 cm  **b** 38.8 cm  **c** 8.83 cm  **d** 30.1 cm  **e** 30.6 cm

**6**  6.02 metres

## 22.7 Calculating angles using trigonometry
## Homework 22J

| 1 | **a** | 37.7° | **b** | 40.8° | **c** | 41.8° |
|---|---|---|---|---|---|---|
| | **d** | 51.5° | **e** | 77.9° | **f** | 66.4° |
| | **g** | 51.3° | **h** | 28.8° | **i** | 56.3° |

| 2 | **a** | 37.7° | **b** | 46.2° | **c** 19.7° | | **d** 38.3° |
|---|---|---|---|---|---|---|
| | **e** | 47.1° | | **f** | 43.6° | **g** 40.1° |
| | **h** 24.6° | | | | | |

**i** 48.2°

## 22.8 Trigonometry without a calculator
## Homework 22K

**1a** $\cos x = \dfrac{A}{H}$

So Adjacent = 1

Hypotenuse = 2

So $\cos 60 = \dfrac{1}{2}$

**b** $\cos 30 = \dfrac{\sqrt{3}}{2}$

$\sin x = \dfrac{O}{H}$

$\sin 30 = \dfrac{1}{2}$

$\sin 60 = \dfrac{\sqrt{3}}{2}$

$\tan x = \dfrac{O}{A}$

$\tan 60 = \sqrt{3}$

$\tan 30 = \dfrac{1}{\sqrt{3}}$

$\tan 45 = 1$

$\cos 45 = \dfrac{1}{\sqrt{2}}$

$\sin 45 = \dfrac{1}{\sqrt{2}}$

| **2a** | $x$ = 12 cm | **b** | $x$ = 5.5 mm | | |
|---|---|---|---|---|---|

| **3a** | $x$ = 24.8 m | **b** | $x$ = 5 m | **c** | $x$ = 4 cm |
|---|---|---|---|---|---|

## 22.9 Solving problems using trigonometry
## Homework 22L

**1 a** 3.71m **b** 1.498m

**2 a** 41.4° **b** 23.8 m

**3 a** 14.9 m **b** 39.9 m

**4 a** 28.4° **b** 18.5 cm

**5 a** 53.6 m **b** 16.6 m

## Homework 22M

**1** 143.39 m

**2** 11.90 m

**3** 21.22 ft

**4** 86.2°

## 22.10   Trigonometry and bearings
## Homework 22N

**1.** 18.0 km

**2.** **a** 289 km **b** 345 km

**3.** **a** 60.9 km **b** 16.3 km

**4.** 1164°

## 22.11   Trigonometry and isosceles triangles
### Homework 22O

**1** **a** 57.2 cm **b** 7.00 cm **c** 16 cm
**d** 8.08 cm

**2** **a** 103 cm$^2$ **b** 103 cm2 **c** 22.4 cm$^2$
**d** 46.8 cm$^2$

## 23    Geometry and measure: Congruency and similarity

## 23.1 Congruent triangles
### Homework 23A

1    **a-b** A and B (AAS); C and E (ASA); D and F (SAS)

2    Angle A = angle D and angle C = angle F, AC = DF = 6 cm, so the triangles are congruent (ASA)

3    PR = ST, PQ = SU and RQ = TU so the triangles are congruent (SSS)

4    **a**    true                **b**    false                **c**    true

5    B and E, A and F, C and D

6    **a**    hexagon

**b**    **i** 5                **ii** 5                **iii** 5                **iv** 2

    **v**    5                **vi** 5                **vii** 5

## 23.2 Similarity
### Homework 23B

Check students own working, all angles should be the same.

**1d** SF 3

**2d** SF 2

**3d** SF 1.5

### Homework 23C

1    A and D

2    **A**    no                **b**        yes, SF = 2

3 a **i**    7                **ii**        2

**b**    **i**    2.8                **ii**        8.4

**c**    **i**    9.8                **ii**        58.8

**d**    **i**    1.2                **ii**        5 and 10.8

**e**    **i**    2                **ii**        8

**f**   **i**   3                    **ii**   2.5

**g**   **i**   1.25                 **ii**   10

**4**   **a**   10 and 19.5   **b**   12.03   **c**   12.6

**5**   $k = 8$

## Homework 23D

1.   3 m
2.   2 ft
3.   360 cm
4.   125 ft
5.   800 cm

## 24    Probability: Combined events

### 24.1 Combined events

### Homework 24A

**1  a**

| Score on second dice | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|
| | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | **Score on first dice** | | | | | |

**b**  7                        **c**  2 and 12

**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, BLUE), (2, BLUE), (3, BLUE), (4, BLUE), (5, BLUE), (6, BLUE)
(1, RED), (2, RED), (3, RED), (4, RED), (5, RED), (6, RED)
(1, PURPLE), (2, PURPLE), (3, PURPLE), (4, PURPLE), (5, PURPLE), (6, PURPLE)
(1, YELLOW), (2, YELLOW), (3, YELLOW), (4, YELLOW), (5, YELLOW), (6, YELLOW)
(1, GREEN), (2, GREEN), (3, GREEN), (4, GREEN), (5, GREEN), (6, GREEN)

**a**  $\dfrac{1}{30}$            **b**  $\dfrac{3}{30} = \dfrac{1}{10}$            **c**  $\dfrac{5}{30} = \dfrac{1}{6}$

**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** label at left for rows 2, 4, 6, 8, 10)

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

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

**5** **a** P(HH) = $\dfrac{1}{4}$

**b** P(TT) = $\dfrac{1}{4}$

**c** P(H or T) = $\dfrac{1}{2}$

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

**7** $\dfrac{4}{64} = \dfrac{1}{16}$

☐

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

## 24.2 Two-way tables

### Homework 24B

**1** **a**

|  | Portugal | Spain | Elsewhere | Total |
|---|---|---|---|---|
| July | 10 | 19 | 2 | 31 |
| August | 15 | 5 | 10 | 40 |
| September | 6 | 18 | 5 | 29 |
| Total | 31 | 52 | 17 | 100 |

**b** 29 **c** 52% **d** $\dfrac{15}{100} = \dfrac{3}{20}$

**2** **a**

|  | Biology | Chemistry | Physics | Total |
|---|---|---|---|---|
| Female | 18 | 15 | 14 | 47 |
| Male | 8 | 6 | 19 | 33 |
| Total | 26 | 21 | 33 | 80 |

**b** $\dfrac{33}{80}$ **c** 38.3%

**3** **a**

|        | Passed | Failed | Total |
|--------|--------|--------|-------|
| Male   | 8      | 11     | 19    |
| Female | 17     | 14     | 31    |
| Total  | 25     | 25     | 50    |

**b**   25                                    **c**   $\dfrac{7}{25}$

**d**   Females: $\dfrac{7}{31} = 0.548 > \dfrac{8}{19} = 0.421$

**4** **a**

|            | On time | Early | Late | Total |
|------------|---------|-------|------|-------|
| Taxi4U     | 410     | 11    | 29   | 450   |
| Cheap Eezy | 374     | 6     | 170  | 550   |
| Total      | 784     | 17    | 199  | 1000  |

**b**   Taxi4U 91.1%, Cheap Eezy 68%

**c**   No: $\dfrac{29}{450} < \dfrac{170}{550}$

**d**   55

**5**    **a**

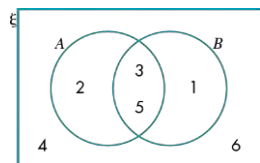|        | USA | Germany | China | Total |
|--------|-----|---------|-------|-------|
| Gold   | 10  | 18      | 22    | 50    |
| Silver | 18  | 16      | 9     | 43    |
| Bronze | 31  | 9       | 11    | 51    |
| Total  | 59  | 43      | 42    | 144   |

**b**   USA

**c**   Students own answer with reason eg. Germany as mostly gold and silver medals

### 24.3 Probability and Venn diagrams

### Homework 24C

**1a** P(A') = 0.78     **b**     P(B') = 0.51

**2 a**



**b**    **i**   P(A) = $\dfrac{3}{6} = \dfrac{1}{2}$       **ii**   P(B) = $\dfrac{3}{6} = \dfrac{1}{2}$       **iii**   P(A') = $\dfrac{3}{6} = \dfrac{1}{2}$

      **iv**   P(B') = $\dfrac{3}{6} = \dfrac{1}{2}$       **v**   P(A n B) = $\dfrac{2}{6} = \dfrac{1}{3}$       **vi**   P(A u B) = $\dfrac{4}{6} = \dfrac{2}{3}$
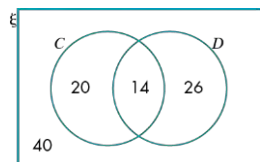
**3 a**
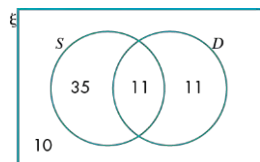


**b**    **i**   $\dfrac{46}{67}$       **ii**   $\dfrac{11}{67}$       **iii**   $\dfrac{57}{67}$

**4 a**



**b**    **i.**   $\dfrac{86}{100} = \dfrac{43}{50}$       **ii**   $\dfrac{40}{100} = \dfrac{2}{5}$       **iii**   $\dfrac{26}{100} = \dfrac{13}{50}$

**5**
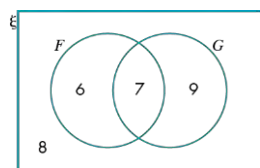


**a** $\dfrac{13}{30}$    **b** $\dfrac{9}{30} = \dfrac{3}{10}$    **c** $\dfrac{7}{30}$    **d** $\dfrac{6}{30} = \dfrac{1}{5}$

**6 a** $\dfrac{21}{224} = \dfrac{3}{32}$    **b** $\dfrac{98}{224} = \dfrac{7}{16}$    `    **c** $\dfrac{126}{224} = \dfrac{9}{16}$

**d** $\dfrac{36}{224} = \dfrac{9}{56}$    **e** $\dfrac{22}{224} = \dfrac{11}{112}$    **f** $\dfrac{32}{98} = \dfrac{16}{49}$

## 24.4 Tree diagrams

### Homework 24D

**1 a**
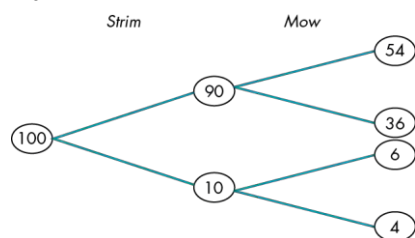


**b**    54    **c**    96

**2 a**
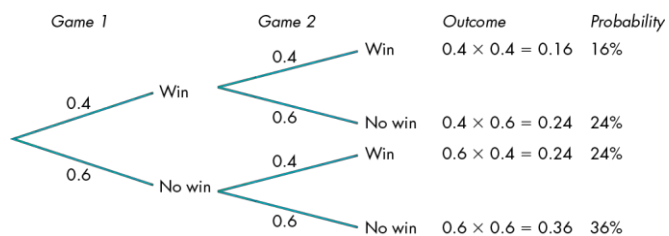


**b**    **i**  0.4 × 0.4 = 0.16    **ii**  0.4 × 0.6 + 0.6 × 0.4 = 0.48

**3 a**
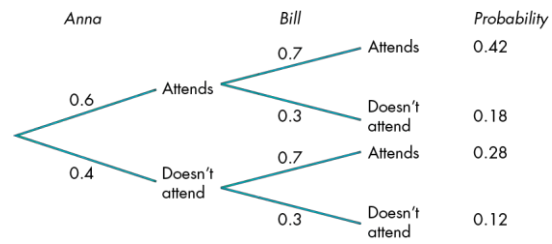


**b**   **i**   $0.4 \times 0.3 = 0.12$          **ii**          $1 - 0.12 = 0.88$

**4 a**   $\dfrac{3}{5} \times \dfrac{3}{10} = \dfrac{9}{50}$          **b**   $1 - \dfrac{9}{40} = \dfrac{41}{50}$

**5 a**   $\dfrac{36}{81} + \dfrac{9}{81} = \dfrac{45}{81} = \dfrac{5}{9}$          **b**   $\dfrac{6}{9} \times \dfrac{6}{9} + \dfrac{6}{9} \times \dfrac{3}{9} + \dfrac{3}{9} \times \dfrac{6}{9} = \dfrac{72}{81} = \dfrac{8}{9}$

## 25 Number: Powers and standard form
## 25.1 Powers (indices)

### Homework 25A

**1**  **a** 8  **b** 64  **c** 343
  **d** 1000  **e** 1728  **f** 81
  **g** 10 000  **h** 32  **i** 1 000 000
  **j** 256

**2**  **ai** 121  **ii** 1331  **iii** 14 641
  **b** The first and the last digit are both 1, and the numbers are palindromic; **c** They are not palindromic for other powers.

**3**  27 000 cm$^3$

**4**  **b** $8^2$ or $4^3$  **c** $3^3$  **d** $6^2$

**5**  **ai** 256
  **ii** −128
  **iii** −2048
  **iv** 16 384

**b** Odd index numbers give a negative answer where even index numbers give a positive answer.

### 25.2 Rules for multiplying and dividing powers

### Homework 25B

**1**  **a** $2^8$  **b** $2^8$  **c** $2^5$  **d** $2^3$  **e** $2^{10}$  **f** $2^2$  **g** $2^6$  **h** $2^{10}$  **i** $2^{21}$

**2**  **a** $x^{10}$  **b** $x^9$  **c** $x^7$  **d** $x^5$  **e** $x^7$  **f** $x^{12}$  **g** $x^{11}$

**3**  **a** $3^3$  **b** $3^4$  **c** $3^5$  **d** $3^4$  **e** $3^{-2}$  **f** $3^9$  **g** $3^2$

**4**  **a** $y^7$  **b** $y$  **c** $y^6$  **d** 1  **e** $y^{16}$  **f** $y^2$  **g** $y^2$

**5**  **a** $15a^8$  **b** $9a^2$  **c** $125a^{15}$  **d** $-15a^{10}$  **e** $35a^8$ **f** $-25$

**6**  **a** $6a$  **b** 5  **c** $3a^4$  **d** $6a^4$  **e** 19  **f** $10a^{-4}$

**7**  **a** $35a^8b^4$  **b** $25a^6b^4$  **c** $15a^{12}b^{-2}$  **d** $5a^4b^6$  **e** $19a^{-8}b^{10}$  **f** $2a^2b^{-8}$

**8**  **a** $7^{15}$  **b** $7^{15}$  **c** $7^3$  **d** $7^{-15}$  **e** $7^{15}$  **f** $7^0$

### Homework 25C

**1**  **a** 80 000  **b** 150 000  **c** 1000  **d** 250 000

**2**  **a** 0.25  **b** 0.02034  **c** 0.035  **d** 0.00125

**3**    **a** 81    **b** 810    **c** 8100    **d** 81 000

**4**    **a** 0.81    **b** 0.081    **c** 0.0081    **d** 0.000 81

**5**    **a** 2400    **b** 124 000    **c** 0.006 41    **d** 0.0429    **e** 0.002 408    **f** 0.0309    **g** 7 003 000

## 25.3 Standard form

### Homework 25D

**1**    **a** 1.27    **b** 0.127    **c** 0.0127    **d** 0.00127

**2**    **a** 121    **b** 1210    **c** 12100    **d** 121 000

**3**    **a** 250    **b** 31.2    **c** 0.004 32    **d** 24.3    **e** 0.020 719    **f** 5372    **g** 203
    **h** 1300    **i** 817 000    **j** 0.008 35    **k** 30 000 000    **l** 0.000 527

**4**    **a** $2 \times 10^2$    **b** $3.05 \times 10^{-1}$    **c** $4.07 \times 10^4$    **d** $3.4 \times 10^9$    **e** $2.078 \times 10^{10}$    **f** $5.378 \times 10^{-4}$    **g** $2.437 \times 10^3$
    **h** $1.73 \times 10^{-1}$    **i** $1.0073 \times 10^{-1}$    **j** $9.89 \times 10^{-1}$    **k** $2.7453 \times 10^2$    **l** $9.87354 \times 10^1$    **m** $5.4 \times 10^{-3}$    **n** $4.37 \times 10^{-3}$
    **o** $5.310\,45 \times 10^1$

**5**    $37 \times 10^3$, $3.75 \times 10^4$, $15 \times 2.3 \times 10^4$, 375 000

**6**    **a** $5.32 \times 10^3$    **b** $3 \times 10^2$    **c** $3.43 \times 10^{-1}$    **d** $2 \times 10^{-4}$    **e** $5.3 \times 10^2$    **f** $6 \times 10^5$    **g** $7 \times 10^3$
    **h** 1.3    **i** $2.3 \times 10^7$    **j** $3 \times 10^{-6}$    **k** $2.53 \times 10^6$    **l** $3.9 \times 10^2$    **m** $1.06 \times 10^2$    **n** $6 \times 10^{-1}$
    **o** $2.65 \times 10^6$

**7**    **a** $2.16 \times 10^{14}$    **b** $1.71 \times 10^9$    **c** $3.6 \times 10^9$    **d** $2.16 \times 10^6$    **e** 7.6    **f** $3.6 \times 10$    **g** $2.96 \times 10^{-4}$
    **h** $6.25 \times 10^{38}$    **i** $2.621\,44 \times 10^{-31}$

**8**    **a** 300 000 000 ms$^{-1}$    **b** $3 \times 10^8$ ms$^{-1}$

**9**    $3.162\,2400 \times 10^7$

**10**    $1.5 \times 10^7$ °C

**11**    $2 \times 10^{12}$ s

**12**    $1.25 \times 10 = 12.5$ min

**13**    $-5.3996 \times 10^7$

## 26      Algebra: Simultaneous equations and linear inequalities

### 26.1    Elimination method for simultaneous equations
**Homework 26A**

**1**      $x = 4, y = 3$
**2**      $x = 3, y = -4$
**3**      $x = -1, y = -2$
**4**      $x = -3, y = -4$
**5**      $x = -4, y = 4$
**6**      $x = 0, y = -1$
**7**      $x = 4, y = -2$
**8**      $x = 1, y = -3$

### 26.2 Substitution method for simultaneous equations
**Homework 26B**

**1**      $x = 4, y = 6$
**2**      $x = -8, y = 2$
**3**      $x = 6, y = -8$
**4**      $x = 8, y = 0$
**5**      $x = 2, y = -4$
**6**      $x = -10, y = 6$
**7**      $x = -10, y = 0$
**8**      $x = 6 , y = -6$

### 26.3 Balancing coefficients to solve simultaneous equations
**Homework 26C**

**1**      $x = 3, y = -1$
**2**      $x = -3, y = 5$
**3**      $x = 3, y = 0.5$
**4**      $x = 5, y = 1$
**5**      $x = 6, y = 5$
**6**      $f = 2, g = 9$

### 26.4    Using simultaneous equations to solve problems
**Homework 26D**

**1.**   6 and 14
**2.**   7 and 3
**3.**   Molly  is 33 years old and Jenson is 15 years old.
**4.**   Steve has £287.50
         Kath has £212.50
**5.**   Y10 score 8 goals and Y11 score 4 goals.
**6.**   5 and 3

### 26.5 Linear inequalities

**Homework 26E**

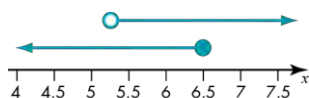**1**  **a**  $x < 5$  **b**  $t > 8$  **c**  $p \geq 8$
   **d**  $x < 3$  **e**  $y \leq 6$  **f**  $t > 9$
   **g**  $x < 13$  **h**  $y \leq 11$  **i**  $t \geq 37$
   **j**  $x < 10$  **k**  $x \geq 1$  **l**  $t \geq 7.5$

**2**  **a**  5, 4, 3, 2, 1  **b**  1  **c**  25, 16, 9, 4, 1
   **d**  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**  **a i** 2 **ii** 3
   **b i** 6 **ii** 15

**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 26F**

**1**  **a**  $x \geq 1$  **b**  $x < 2$  **c**  $x > -2$
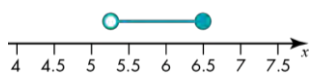   **d**  $x \leq 0$  **e**  $x > -5$  **f**  $x \geq -1$

**2**  **a**
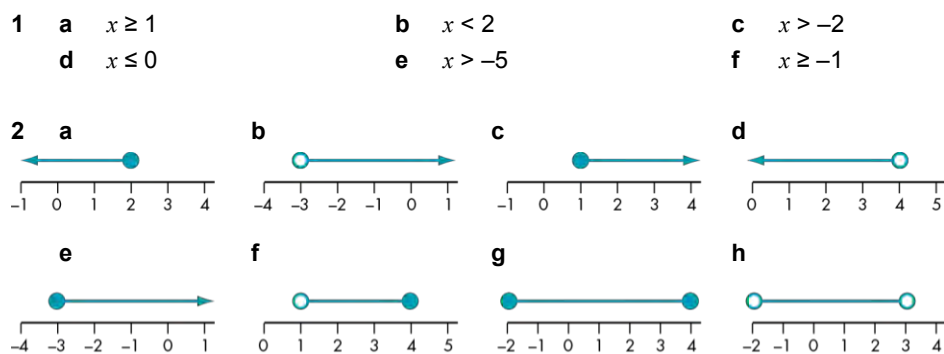


**3**  **a**  Because 2 CDs plus the DVD cost more than £20; $x > 5.25$.
   **b**  Because 2 CDs plus the lipstick is less than £20; $x \leq 6.50$.
   **c**



   **or**



   **d**  £6

**4**  **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**  $x \leq -1$  **i**  $x < 2$
   **j**  $x \leq 3$  **k**  $x > 24$  **l**  $x \geq 0$

**5**  Any two inequalities that overlap only on the integers 5, 6, 7 and 8; for example, $x \geq 5$ and $x < 9$.
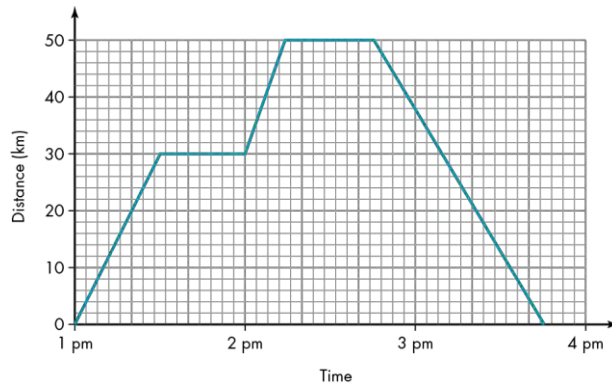
## 27    Algebra: Non-linear graphs

### 27.1 Distance-time graphs
**Homework 27A**

1  **a  i**    10.30 pm          **ii**   11.10 pm          **iii**   12.00 midnight
   **b  i**    50 km/h           **ii**   75 km/h           **iii**   50 km/h

2  **a**   20 km              **b**   40 km              **c**   60 km/h
   **d**   100 km/h

3
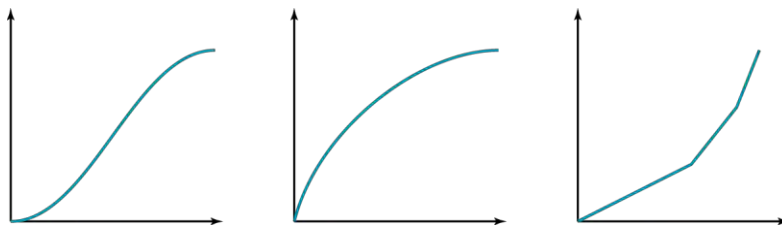


4    11 am

### Homework 27B

1        Container 1 to c
         Container 2 to b
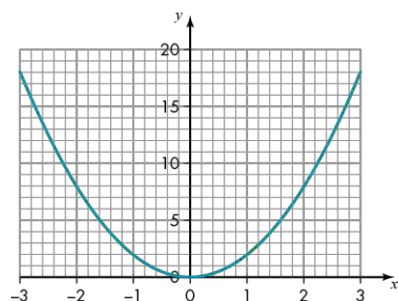         Container 3 to d
         Container 4 to a
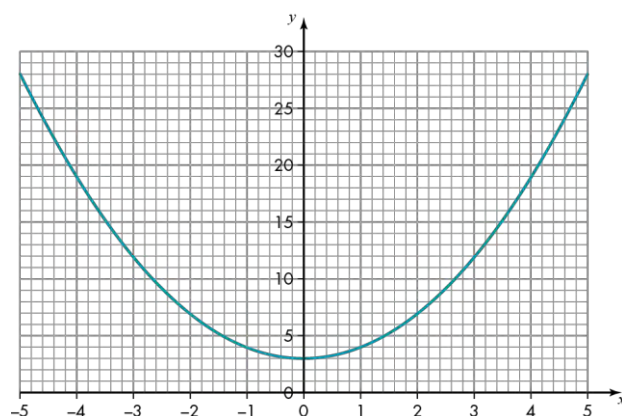
2

## 27.2 Plotting quadratic graphs

### Homework 27C

**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** 9.25      **c** ±2.6

**3 a**
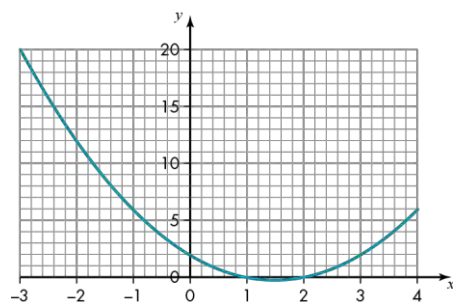


| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| $y = x^2 - 3x + 2$ | 20 | 12 | 6 | 2 | 0 | 0 | 2 | 6 |

**b** 8.75          **c** −0.15, 3.15

**4** **a**
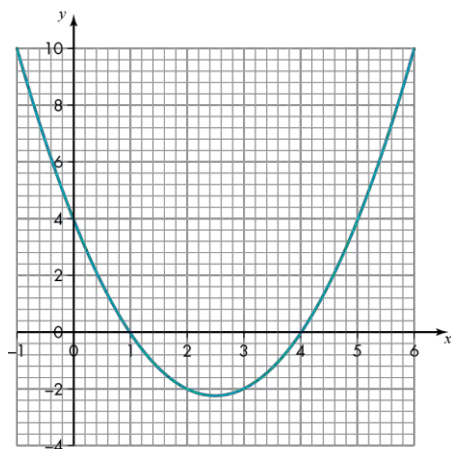


| $x$ | −1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| $y = x^2 - 5x + 4$ | 10 | 4 | 0 | −2 | −2 | 0 | 4 | 10 |

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

**5** B and C

## 27.3 Solving quadratic equations by factorisation

### Homework 27D

**1**  **a** $x = 2$, $x = 3$     **b** $x = -2$, $x = -3$     **c** $x = 4$, $x = -4$
**d** $x = -8$, $x = 2$

**2**  **a** $(x + 2)(x + 1)$ so $x = -2$ and $x = -1$.     **b** $(x + 3)(x + 4)$ so $x = -3$ and $x = -4$.
**c** $(x + 4)(x + 4)$ so $x = 0$ and $x = -4$.     **d** $(x + 8)(x + 7)$ so $x = -8$ and $x = -7$.
**e** $(x - 2)(x + 7)$ so $x = -2$ and $x = 7$.     **f** $(x + 10)(x - 4)$ so $x = -10$ and $x = 4$.
**g** $(x + 9)(x - 7)$ so $x = -9$ and $x = 7$.     **h** $(x - 6)(x - 5)$ so $x = 6$ and $x = 5$.
**i** $(x - 20)(x + 3)$ so $x = 20$ and $x = -3$.     **j** $(x - 14)(x - 6)$ so $x = 14$ and $x = 6$.

**3**  5 cm by 8 cm

## 27.4 The significant points of a quadratic curve

### Homework 27E

Check students graphs

**1**  **a** 2     **b** (−1.5, −0.25)     **c** $x = -2$ and $x = -1$
**2**  **a** 12     **b** (−3.5, −0.25)     **c** $x = -3$ and $x = -4$
**3**  **a** 16     **b** (−5, −9)     **c** $x = -8$ and $x = -2$
**4**  **a** 56     **b** (−7.5, −0.25)     **c** $x = -8$ and $x = -7$

| 5 | **a** | −14 | **b** | (−2.5, −20.25) | **c** | $x = 2$ and $x = -7$ |
|---|---|---|---|---|---|---|
| 6 | **a** | −40 | **b** | (−3, −49) | **c** | $x = -10$ and $x = 4$ |
| 7 | **a** | −63 | **b** | (−1, −64) | **c** | $x = -9$ and $x = 7$ |
| 8 | **a** | 30 | **b** | (5.5, −0.25) | **c** | $x = 6$ and $x = 5$ |
| 9 | **a** | −60 | **b** | (8.5, −132.25) | **c** | $x = 20$ and $x = -3$ |
| 10 | **a** | 84 | **b** | (10, −16) | **c** | $x = 14$ and $x = 6$ |

## Homework 27F

**1**

| | a | b | c |
|---|---|---|---|
| i | (0, 12) | $x = -2, x = -6$ | (−4, −4) |
| ii | (0, 48) | $x = -6, x = -8$ | (−7, −1) |
| iii | (0, 56) | $x = -7, x = -8$ | (−7.5, −0.25) |
| iv | (0, 27) | $x = 9, x = 3$ | (6, −9) |
| v | (0, 2) | $x = 1, x = 2$ | (1.5, −0.25) |
| vi | (0, −56) | $x = 8, x = -7$ | (0.5, −56.25) |
| vii | (0, −21) | $x = -7, x = 3$ | (−2, −25) |
| viii | (0, −10) | $x = 10, x = -1$ | (4.5, −30.25) |

| | | | |
|---|---|---|---|
| **ix** | $(0, -36)$ | $x = -6, x = 6$ | $(0, -36)$ |
| **x** | $(0, 12)$ | $x = 0.75, x = 4$ | $(\frac{19}{8}, -\frac{169}{16})$ |
| **xi** | $(0, -6)$ | $x = 2, x = -\frac{3}{2}$ | $(\frac{1}{4}, -\frac{45}{8})$ |
| **xii** | $(0, 9)$ | $x = \frac{3}{4}, x = 3$ | $(\frac{15}{8}, -\frac{81}{16})$ |

**2**

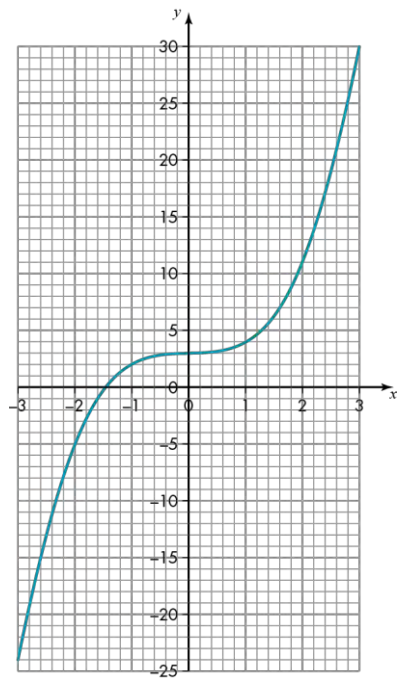| | | | |
|---|---|---|---|
| **i** | $(0, 3)$ | $x = -1, x = -\frac{3}{4}$ | $(-\frac{7}{8}, -\frac{1}{16})$ |
| **ii** | $(0, 10)$ | $x = -\frac{5}{2}, x = -\frac{2}{3}$ | $(-\frac{19}{12}, -\frac{121}{24})$ |
| **iii** | $(0, -21)$ | $x = -3, x = \frac{7}{2}$ | $(\frac{1}{4}, -\frac{169}{8})$ |
| **iv** | $(0, 3)$ | $x = \frac{1}{2}, x = \frac{3}{5}$ | $(\frac{11}{20}, -\frac{1}{40})$ |
| **v** | $(0, -28)$ | $x = -2, x = 7$ | $(\frac{5}{2}, -\frac{81}{2})$ |

## 27.5 Cubic and reciprocal graphs

## Homework 27G

**1 a**

| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $y$ | −27 | −8 | −1 | 0 | 1 | 8 | 27 |

**b**
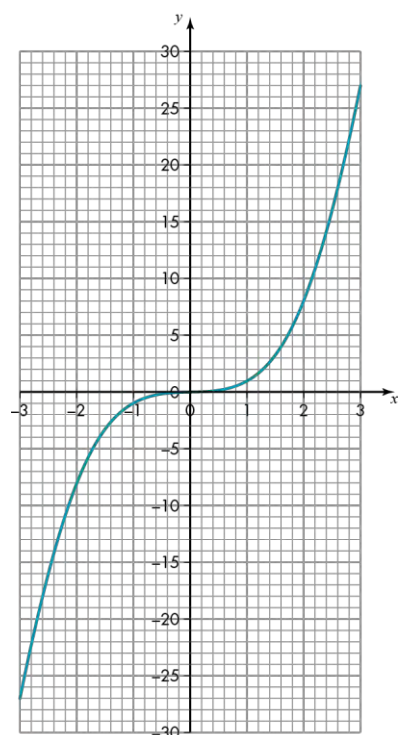


**2 a**

| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $y$ | −24 | −5 | 2 | 3 | 4 | 11 | 30 |

**b**



**3 a**

| $x$ | −3 | −2 | −1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $y$ | $-\dfrac{1}{3}$ | $-\dfrac{1}{2}$ | −1 | not possible | 1 | 0.5 | $\dfrac{1}{3}$ |

**b**