

**Exercises in KS3
Mathematics
Levels 5 - 6
R Joinson**

Sumbooks 5 Northway Chester CH4 8BB

Exercises in KS3 Mathematics - Levels 5 and 6

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Preface

The questions have been arranged, as far as possible, according to level 5 and level 6 of the National Curriculum. All level 5 questions are in the front of the book and all level 6 questions in the back. Pages are labelled L.5 or L.6 accordingly. There may be some overlap of the levels where I have found it unavoidable in order to keep the questions sensible.

I have included a blank master triangular spotty page for use with Enlargements.

The answers to Missing Blocks, 3-D Shapes, Drawing T's, Enlarging Letters and Enlarging Through a Point can be accommodated on the question sheets.

I would like to thank my wife Jenny and my daughters Abigail and Hannah for all the help and encouragement they have given me.

R Joinson

May 2001
Chester

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10's, 100's and 1000's

Do not use a Calculator

L.5

1) Multiply each of these by 10

- | | | | | | | |
|--------|---------|----------|---------|----------|-----------|-----------|
| a) 3 | b) 18 | c) 54 | d) 456 | e) 3.1 | f) 8.54 | g) 452.54 |
| h) 0.8 | i) 0.54 | j) 0.539 | k) 0.03 | l) 0.054 | m) 0.0043 | n) 0.0003 |

2) Multiply each of these by 100

- | | | | | | | |
|--------|----------|-----------|-----------|------------|----------|------------|
| a) 6 | b) 27 | c) 129 | d) 456 | e) 9.3 | f) 37.8 | g) 0.426 |
| h) 0.7 | i) 0.003 | j) 0.0032 | k) 0.0025 | l) 0.00023 | m) 0.004 | n) 0.03001 |

3) Multiply each of these by 1000

- | | | | | | | |
|--------|---------|---------|----------|-----------|----------|------------|
| a) 6 | b) 53 | c) 693 | d) 900 | e) 2.67 | f) 78.2 | g) 26.976 |
| h) 0.5 | i) 0.53 | j) 0.04 | k) 0.004 | l) 0.0475 | m) 0.001 | n) 0.00034 |

4) Divide each of these by 10

- | | | | | | | |
|--------|----------|---------|----------|---------|-----------|-------------|
| a) 5 | b) 62 | c) 459 | d) 6539 | e) 5.8 | f) 2.76 | g) 843.71 |
| h) 0.5 | i) 0.004 | j) 0.64 | k) 0.547 | l) 0.03 | m) 0.0046 | n) 0.000328 |

5) Divide each of these by 100

- | | | | | | | |
|--------|---------|----------|----------|---------|-----------|------------|
| a) 9 | b) 14 | c) 367 | d) 1853 | e) 6.8 | f) 23.74 | g) 2.9786 |
| h) 0.7 | i) 0.27 | j) 0.064 | k) 0.839 | l) 0.01 | m) 0.0002 | n) 0.00654 |

6) Divide each of these by 1000

- | | | | | | | |
|--------|----------|----------|----------|-----------|----------|------------|
| a) 2 | b) 49 | c) 386 | d) 4638 | e) 3.8 | f) 18.5 | g) 4.076 |
| h) 0.6 | i) 0.643 | j) 0.062 | k) 0.007 | l) 0.3061 | m) 0.003 | n) 0.01001 |

7) a) What is 2.76×100 ?

Use this answer to do each of these

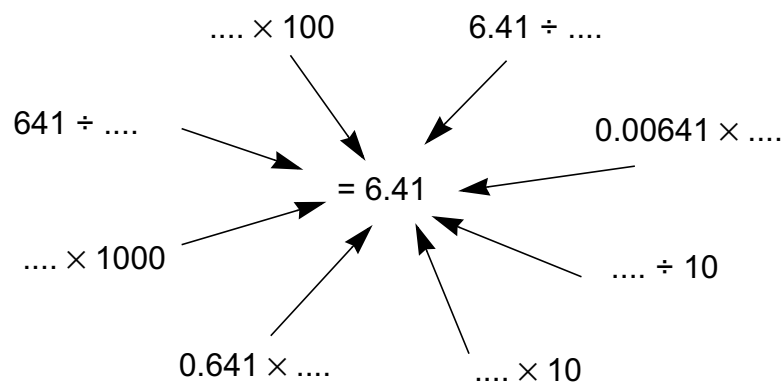
- b) 2.76×200 c) 2.76×50 d) 0.276×200 e) 27.6×50

8) a) What is $35.6 \div 1000$?

Use this answer to do these

- b) $35.6 \div 2000$ c) $35.6 \div 500$ d) $3.56 \div 200$ e) $356 \div 500$

9) Each of these gives an answer of 6.41. Fill in the missing values.



Rounding off Whole Numbers

L.5

1) The table shows the heights of some mountains to the nearest metre.

Mountain	Height in m to the nearest m	Height in m to the nearest 10m	Height in m to the nearest 100m
Ben Nevis	1344		
Snowdon	1086		
Scafell Pike	977		
Slieve Donard	852		

a) Write down their heights rounded to the nearest 10m and the nearest 100m.

b) There is another mountain which is not on the list.

It has a height of 1300m to the nearest 100m, and a height of 1310 to the nearest 10m.

Write down a possible height of the mountain to the nearest metre.

c) Two more mountains have different heights. They both have a height of 1050m to the nearest 10m, but their heights to the nearest 100m are different. What could their heights be?

2) The attendances at four football matches are given in the table below.

Ground	Attendance	Attendance to the nearest 10	Attendance to the nearest 100
Leeds Utd.	39,267		
Millwall	16,014		
Cardiff City	8,219		
Aberdeen	11,806		

a) Write down the attendances rounded to the nearest 10 and the nearest 100.

b) The game at Portsmouth had an attendance of 13,000 to the nearest hundred, and an attendance of 13,020 to the nearest 10.

Write down a possible attendance.

c) Two more games have different attendances. They both have an attendance of 15,500 to the nearest 100, but their attendances to the nearest 1000 are different. What could their attendances be?

d) Another game has an attendance of 18,000 to the nearest thousand, 18,000 to the nearest hundred and 18,000 to the nearest ten.

Complete this sentence by filling in the missing numbers.

The two attendances could be 17,△△6 and 18,△△2.

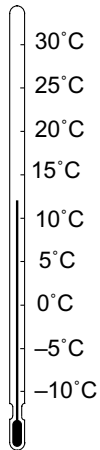
Negatives

L.5

- 1) Write down these temperatures in order of size, lowest first.

-10°C 12°C 7°C -6°C -14°C 4°C

2)



Use the diagram of a thermometer to answer these questions.

What temperature does it show?

The temperature is 5°C . It falls by 10°C . What will the new temperature be?

The temperature is -5°C . If it increases by 12°C , what will the new temperature be?

The temperature is -10°C . It rises by 20°C . What is the new temperature?

The temperature is 12°C . It falls by 15°C . What is the new temperature?

3)



The diagram shows a number line.

Write down the missing values.

- 4) The temperature of the items in a freezer is -18°C .

- A packet of peas is taken out. After half an hour their temperature has risen by 11°C . What is their new temperature?
- A packet of fish fingers is taken out. It is put in the fridge. The temperature of the fridge is 3°C . When the packet reaches the temperature of the fridge, what is its increase in temperature?

- 5) In a quiz show, contestants get 5 points for answering a question correctly and they lose 5 points if they get it wrong.

In the first round, David got 3 questions correct and no questions wrong. His score was 15.

In the same round, Simon got 3 questions wrong and no questions correct. His score was -15 .

- If Ann gets 2 questions right and 1 question wrong, what is her score?
- If Sian gets 1 question right and 2 questions wrong, what is her score?
- In the second round, Simon gets 2 questions correct and one wrong. What is his new score?
- In the second round, Sian gets all her three questions wrong. What is her new score?

Number Cards

L.5

In each of the questions below, use one of these eight cards to complete it.

+5	-3	+7	-1
-4	-9	0	+2

a) $\boxed{+5} + \boxed{} = 2$

b) $\boxed{-3} + \boxed{} = -3$

c) $\boxed{-9} + \boxed{} = -2$

d) $\boxed{0} + \boxed{} = -9$

e) $\boxed{+2} + \boxed{} = 9$

f) $\boxed{-4} + \boxed{} = -13$

g) $\boxed{+7} + \boxed{} = 6$

h) $\boxed{-3} + \boxed{} = -4$

i) $\boxed{+2} + \boxed{-9} + \boxed{} = -8$

j) $\boxed{-1} + \boxed{-4} + \boxed{} = -14$

k) $\boxed{-9} + \boxed{+2} + \boxed{} = -7$

l) $\boxed{+2} + \boxed{-3} + \boxed{} = 4$

Multiplication

Do not use a calculator

L.5

1) Multiply each of the following

a)
$$\begin{array}{r} 12 \\ \times 3 \\ \hline \end{array}$$

b)
$$\begin{array}{r} 16 \\ \times 5 \\ \hline \end{array}$$

c)
$$\begin{array}{r} 24 \\ \times 8 \\ \hline \end{array}$$

d)
$$\begin{array}{r} 34 \\ \times 6 \\ \hline \end{array}$$

e)
$$\begin{array}{r} 48 \\ \times 7 \\ \hline \end{array}$$

f)
$$\begin{array}{r} 67 \\ \times 9 \\ \hline \end{array}$$

g)
$$\begin{array}{r} 27 \\ \times 12 \\ \hline \end{array}$$

h)
$$\begin{array}{r} 37 \\ \times 18 \\ \hline \end{array}$$

i)
$$\begin{array}{r} 53 \\ \times 27 \\ \hline \end{array}$$

j)
$$\begin{array}{r} 63 \\ \times 36 \\ \hline \end{array}$$

k)
$$\begin{array}{r} 134 \\ \times 7 \\ \hline \end{array}$$

l)
$$\begin{array}{r} 643 \\ \times 3 \\ \hline \end{array}$$

m)
$$\begin{array}{r} 547 \\ \times 8 \\ \hline \end{array}$$

n)
$$\begin{array}{r} 545 \\ \times 5 \\ \hline \end{array}$$

o)
$$\begin{array}{r} 321 \\ \times 7 \\ \hline \end{array}$$

p)
$$\begin{array}{r} 560 \\ \times 9 \\ \hline \end{array}$$

q)
$$\begin{array}{r} 405 \\ \times 30 \\ \hline \end{array}$$

r)
$$\begin{array}{r} 569 \\ \times 50 \\ \hline \end{array}$$

s)
$$\begin{array}{r} 371 \\ \times 40 \\ \hline \end{array}$$

t)
$$\begin{array}{r} 430 \\ \times 90 \\ \hline \end{array}$$

u) 83×27 v) 94×45 w) 79×62 x) 532×34 y) 63×80 z) 406×84

- 2) There are 23 pupils in a class. The teacher hands out 6 sheets of paper to each pupil. How many sheets does she hand out altogether?
- 3) The number of sweets in a tube is 19. Sarah buys 16 tubes. How many sweets does she buy?
- 4) It says on a packet of seeds that it contains 150 seeds. How many seeds will there be in 12 packets?
- 5) The number of spots on a die is 21. How many spots are there on 19 dice?
- 6) Jake earns £5 per hour in his weekend job. Over a period of a month he works a total of 52 hours. What will be his total earnings for the month?
- 7) Mr Johnson's car will travel 16 kilometres using 1 litre of petrol. How many kilometres will it travel if it uses 27 litres?
- 8) Wall tiles are sold in packs of 25. James buys 17 packs. How many wall tiles is this?
- 9) A ream of paper contains 500 sheets. The mathematics department buys 16 reams. How many sheets is this?
- 10) Samantha's bus journey to and from school each day totals 9 miles. She calculates that over a period of a year she goes to school for 190 days. How many miles does she travel in a year?

Multiplying Decimals

Do not use a calculator

L.5

1) Multiply these numbers together

a)

$$\begin{array}{r} 5.7 \\ \times 4 \\ \hline \end{array}$$

b)

$$\begin{array}{r} 7.3 \\ \times 7 \\ \hline \end{array}$$

c)

$$\begin{array}{r} 8.4 \\ \times 6 \\ \hline \end{array}$$

d)

$$\begin{array}{r} 7.9 \\ \times 3 \\ \hline \end{array}$$

e)

$$\begin{array}{r} 8.8 \\ \times 9 \\ \hline \end{array}$$

f)

$$\begin{array}{r} 4.53 \\ \times 7 \\ \hline \end{array}$$

g)

$$\begin{array}{r} 6.93 \\ \times 5 \\ \hline \end{array}$$

h)

$$\begin{array}{r} 3.95 \\ \times 7 \\ \hline \end{array}$$

i)

$$\begin{array}{r} 0.82 \\ \times 8 \\ \hline \end{array}$$

j)

$$\begin{array}{r} 9.03 \\ \times 6 \\ \hline \end{array}$$

k)

$$\begin{array}{r} 17.5 \\ \times 2 \\ \hline \end{array}$$

l)

$$\begin{array}{r} 56.4 \\ \times 5 \\ \hline \end{array}$$

m)

$$\begin{array}{r} 65.4 \\ \times 4 \\ \hline \end{array}$$

n)

$$\begin{array}{r} 27.5 \\ \times 8 \\ \hline \end{array}$$

o)

$$\begin{array}{r} 37.9 \\ \times 9 \\ \hline \end{array}$$

p)

$$\begin{array}{r} 3.4 \\ \times 2.5 \\ \hline \end{array}$$

q)

$$\begin{array}{r} 4.8 \\ \times 6.2 \\ \hline \end{array}$$

r)

$$\begin{array}{r} 5.7 \\ \times 3.8 \\ \hline \end{array}$$

s)

$$\begin{array}{r} 9.0 \\ \times 5.7 \\ \hline \end{array}$$

t)

$$\begin{array}{r} 6.8 \\ \times 4.6 \\ \hline \end{array}$$

u)

$$\begin{array}{r} 1.34 \\ \times 12 \\ \hline \end{array}$$

v)

$$\begin{array}{r} 1.57 \\ \times 22 \\ \hline \end{array}$$

w)

$$\begin{array}{r} 3.45 \\ \times 39 \\ \hline \end{array}$$

x)

$$\begin{array}{r} 8.31 \\ \times 40 \\ \hline \end{array}$$

y)

$$\begin{array}{r} 7.03 \\ \times 83 \\ \hline \end{array}$$

- 2) There are 26 pupils in 8Y. They each bring £4.56 for the school trip. How much money will the form tutor collect from the class?
- 3) A pen costs £1.26. What is the cost of 9 pens?
- 4) A group of 54 pupils go to the theatre with their teachers. The cost of a ticket for each pupil is £1.50.
 - a) What is the cost for all 54 pupils?
 - b) There are 4 teachers with the party. The cost of a ticket for each of them is £2.95. What is the cost of the four tickets for the teachers?
 - c) What is the total cost for the whole group?
- 5) A length of string is cut into 8 equal pieces. If each piece measures 62.5cm, what was the original length of the string?
- 6) A factory makes radios. Each radio weighs 0.76kg.
 - a) What is the weight of 36 radios?
 - b) 36 radios are packed into large boxes to be sent off to the shops. If an empty box weighs 0.45kg, what is the weight of a box containing the radios?
- 7) A car can travel 13.64 kilometres on 1 litre of petrol. How far will the car travel with 24 litres?
- 8) 1 ounce is approximately 28.35 grammes. How many grammes make 16 ounces?

Division

Do not use a calculator

L.5

1) Divide each of the following.

- | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| a) $72 \div 6$ | b) $105 \div 7$ | c) $140 \div 4$ | d) $192 \div 8$ | e) $216 \div 9$ |
| f) $340 \div 4$ | g) $365 \div 5$ | h) $434 \div 7$ | i) $584 \div 8$ | j) $828 \div 9$ |
| k) $836 \div 4$ | l) $920 \div 5$ | m) $824 \div 8$ | n) $392 \div 7$ | o) $786 \div 6$ |
| p) $837 \div 9$ | q) $768 \div 6$ | r) $832 \div 8$ | s) $981 \div 9$ | t) $861 \div 7$ |

2) Divide each of the following. In each case there will be a remainder.

- | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| a) $47 \div 2$ | b) $85 \div 3$ | c) $93 \div 7$ | d) $123 \div 4$ | e) $253 \div 6$ |
| f) $354 \div 8$ | g) $384 \div 7$ | h) $465 \div 9$ | i) $742 \div 3$ | j) $687 \div 8$ |
| k) $635 \div 6$ | l) $898 \div 7$ | m) $545 \div 8$ | n) $484 \div 7$ | o) $854 \div 9$ |

3) Divide each of the following. Some will have remainders.

- | | | | | |
|------------------|------------------|------------------|------------------|------------------|
| a) $156 \div 12$ | b) $195 \div 13$ | c) $255 \div 15$ | d) $396 \div 18$ | e) $532 \div 19$ |
| f) $843 \div 22$ | g) $753 \div 24$ | h) $702 \div 26$ | i) $915 \div 27$ | j) $984 \div 35$ |
| k) $893 \div 32$ | l) $738 \div 43$ | m) $843 \div 37$ | n) $708 \div 36$ | o) $981 \div 47$ |

4) John has to tile the kitchen floor.

It measures 500 centimetres long by 400 centimetres wide.



The tiles are square and each side measures 20 centimetres.

- How many tiles will fit along the 500 centimetre side?
 - How many tiles will fit along the 400 centimetre side?
 - How many tiles will be needed altogether?
- 5) A bookshelf is 150 centimetres wide. Books which are 3cm thick are to be put on the shelf. How many books will the shelf hold?
- 6) Bill has to plant 800 plants at the garden centre. He puts 28 plants in each row.
- How many rows does he plant and how many are left over?
 - How many more plants will he need to make one more row?
- 7) At the sweet factory, 33 sweets are put into each packet. How many packets will 957 sweets fill?
- 8) A cinema will hold 456 people when it is full. If there are 38 rows of seats, how many seats are there in each row?
- 9) Claire wants to save £950 in order to buy a car. If she puts £40 each week into her bank, how many weeks will it take her to save up the money?

Division with Decimals

Do not use a calculator

L.5

- 1) Divide each of the following. Give your answers to 1 or 2 decimal places, whichever is appropriate.

a) $28.0 \div 5$	b) $38.00 \div 8$	c) $27 \div 5$	d) $31 \div 4$	e) $42 \div 8$
f) $41 \div 5$	g) $44.1 \div 2$	h) $50.4 \div 6$	i) $27 \div 4$	j) $14.4 \div 9$
k) $1.05 \div 5$	l) $132.6 \div 6$	m) $19.5 \div 6$	n) $41.84 \div 8$	o) $31.85 \div 7$
p) $0.4 \div 8$	q) $56.12 \div 4$	r) $112.5 \div 9$	s) $23.04 \div 9$	t) $1.26 \div 7$
u) $22.55 \div 5$	v) $104.23 \div 7$	w) $336.6 \div 6$	x) $235.77 \div 3$	y) $168.6 \div 4$

- 2) A length of wood measures 220 centimetres. Jane wants to cut it into 8 equal pieces. How long will each piece be?

- 3) £50 is shared equally between 8 people. How much do they each receive?

- 4) Stephen buys a pack of 8 oranges. It costs £1.52. He sells one of the oranges to his friend. He says he will charge him the same price as he paid. How much does he charge?

- 5) Robert travels to work and back each day for 5 days. At the end of the last day he finds that he has travelled a total of 92 miles.

- a) How far does he travel each day?
- b) What is the distance to his place of work?

- 6) Mr Jones has his newspaper delivered each day. On Sunday it costs 85p but on the other 6 days it is cheaper. His total bill for the week is £4.15. If his newspaper cost the same on each of the 6 days, how much will it cost on Monday?

- 7) Sarah has a plant. She notices that it grows twice as much on Tuesday as it does on Monday, and it grows twice as much on Wednesday as it does on Tuesday. At the end of Wednesday she found that it had grown a total of 19.6 centimetres over the three days.

- a) How much did it grow on Monday?
- b) How much did it grow on Tuesday?
- c) How much did it grow on Wednesday?

- 8) Hannah works in a bookshop. She has a space on her bookshelf measuring exactly 14.4 centimetres. She finds that 9 copies of the same book will fit into the space. What is the thickness of each book?

- 9) Eight friends go on a trip to London. The total cost of their outing is £418.16. If they share the cost equally, how much do they each pay?

- 10) One side of a square and one side of an equilateral triangle are equal. If the perimeter of the square is 7.4 metres, calculate the perimeter of the triangle.

Cancelling Fractions

L.5

Exercise 1

Put these fractions into their lowest terms.

- | | | | | | |
|----------------------|----------------------|-----------------------|----------------------|-----------------------|-----------------------|
| 1) $\frac{3}{9}$ | 2) $\frac{4}{10}$ | 3) $\frac{4}{8}$ | 4) $\frac{2}{8}$ | 5) $\frac{3}{6}$ | 6) $\frac{6}{10}$ |
| 7) $\frac{4}{12}$ | 8) $\frac{4}{20}$ | 9) $\frac{5}{15}$ | 10) $\frac{10}{18}$ | 11) $\frac{8}{10}$ | 12) $\frac{7}{14}$ |
| 13) $\frac{15}{20}$ | 14) $\frac{4}{24}$ | 15) $\frac{15}{25}$ | 16) $\frac{15}{30}$ | 17) $\frac{15}{40}$ | 18) $\frac{16}{40}$ |
| 19) $\frac{16}{48}$ | 20) $\frac{14}{42}$ | 21) $\frac{15}{50}$ | 22) $\frac{15}{100}$ | 23) $\frac{40}{100}$ | 24) $\frac{15}{150}$ |
| 25) $\frac{15}{105}$ | 26) $\frac{45}{100}$ | 27) $\frac{150}{200}$ | 28) $\frac{65}{100}$ | 29) $\frac{105}{300}$ | 30) $\frac{150}{500}$ |

31) Cancel down each of these fractions and say which have a value of $\frac{2}{3}$

$$\frac{12}{15}, \frac{8}{10}, \frac{7}{14}, \frac{6}{9}, \frac{6}{12}, \frac{8}{12}, \frac{10}{15}, \frac{14}{30}, \frac{12}{18}, \frac{12}{20},$$

$$\frac{4}{6}, \frac{5}{15}, \frac{16}{20}, \frac{18}{27}, \frac{14}{21}$$

32) Cancel down each of these fractions. List them in order of size, smallest first.

$$\frac{12}{30}, \frac{12}{15}, \frac{5}{25}, \frac{12}{20}$$

Exercise 2

In each case give your answer as a fraction in its lowest terms.

- In a school of 1000 pupils, 550 are girls and 450 are boys.
 - What fraction of the school are boys?
 - What fraction of the school are girls?
- An aeroplane flies from an airport in the UK to an airport in the USA. The total distance is 6,000 miles. It re-fuels after a distance of 4,500 miles. What fraction of the journey does it have left to do?
- A village needs to collect £5,000 to repair the church steeple. When it has collected £3,500, what fraction of the total will it have left to collect?
- Bill cuts a length of wood into two pieces. One measures 45cm and the other measures 65cm. What fractions has the wood been cut into?
- Jill carries out a survey of people. She asks them whether they want a new supermarket in the district. She interviews 200 people. 90 people say they want a supermarket, 80 people say they don't want one and the rest are undecided. What fraction of the sample
 - want the supermarket,
 - don't want the supermarket and
 - are undecided?

Mixed Fractions

L.5

Exercise 1

- 1) 25 students sit an examination. 15 pass and the remainder fail.
 - a) What fraction of the students pass?
 - b) What fraction of the students fail?
- 2) Gary walks from his home to the centre of town, a distance of 8 miles. When he has walked 2 miles he stops for a rest.
 - a) What fraction of the journey has he travelled when he stops?
 - b) What fraction of the journey has he got left?
- 3) ABRACADABRA
 - a) What fraction of this word is made up of A's?
 - b) What fraction of this word is made up of B's?
 - c) What fraction of this word is made up of C's?
 - d) What fraction of this word is made up of D's?
 - e) What fraction of this word is made up of R's?
- 4) A bunch of flowers is made up of 9 yellow roses, 8 red roses and 3 white roses.
 - a) What fraction of the bunch are yellow roses?
 - b) What fraction of the bunch are red roses?
 - c) What fraction of the bunch are white roses?

Exercise 2

- 1) Is $\frac{1}{16}$ bigger than $\frac{1}{8}$?
- 2) Is $\frac{1}{8}$ smaller than $\frac{1}{4}$?
- 3) Which is the smaller, $\frac{1}{4}$ or $\frac{1}{8}$?
- 4) How many $\frac{1}{4}$'s make $\frac{1}{2}$?
- 5) How many $\frac{1}{8}$'s make $\frac{1}{4}$?
- 6) How many $\frac{1}{8}$'s make $\frac{1}{2}$?
- 7) Write down these fractions in order of size, smallest to largest.
 $\frac{1}{3}$ $\frac{1}{8}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{5}$ $\frac{1}{7}$ $\frac{1}{12}$
- 8) There are 200 people in a cinema audience. 150 are adults and the rest are children. What fraction of the audience are children?
- 9) Tim sows a packet of seeds. There are 50 seeds in the packet. If 35 seeds grow into plants, what fraction of the packet is this?
- 10) 90g of water is mixed with 5g of salt until the salt is dissolved.
 - a) What fraction of the mixture is salt?
 - b) What fraction of the mixture is water?
- 11) An alloy is made by combining two metals, copper and zinc. 50g of copper is put with 12g of zinc. What fraction of the alloy is zinc?
- 12) A recipe needs 400g of flour, 150g of butter and 50g of sugar. When the three are mixed together, what fraction will be a) flour, b) butter and c) sugar?

Calculating a Fraction

L.5

Exercise 1

Work these out, without using a calculator.

- 1) $\frac{1}{2}$ of 20 2) $\frac{1}{2}$ of 10 3) $\frac{1}{3}$ of 9 4) $\frac{1}{3}$ of 21 5) $\frac{1}{6}$ of 30 6) $\frac{1}{6}$ of 36
- 7) $\frac{1}{4}$ of 20 8) $\frac{1}{4}$ of 40 9) $\frac{1}{5}$ of 15 10) $\frac{1}{5}$ of 25 11) $\frac{1}{10}$ of 40 12) $\frac{1}{10}$ of 80
- 13) $\frac{1}{2}$ of 16 apples 14) $\frac{1}{3}$ of 30 cm. 15) $\frac{1}{4}$ of 24 hours 16) $\frac{1}{5}$ of 30 cakes
- 17) $\frac{1}{10}$ of 20 days 18) $\frac{1}{3}$ of 18 loaves 19) $\frac{1}{4}$ of 40 mm. 20) $\frac{1}{5}$ of 25 oranges

Exercise 2

Work these out without using a calculator

- 1) $\frac{2}{5}$ of 20 2) $\frac{3}{5}$ of 25 3) $\frac{3}{8}$ of 24 4) $\frac{3}{7}$ of 21 5) $\frac{5}{6}$ of 18 6) $\frac{3}{4}$ of 20
- 7) $\frac{5}{7}$ of 28 8) $\frac{7}{10}$ of 30 9) $\frac{5}{8}$ of 32 10) $\frac{3}{10}$ of 40 11) $\frac{9}{10}$ of 50 12) $\frac{5}{12}$ of 60
- 13) $\frac{3}{4}$ of 40 apples 14) $\frac{3}{5}$ of 35 cakes 15) $\frac{2}{3}$ of 21 days
- 16) $\frac{5}{8}$ of 40 mm. 17) $\frac{4}{5}$ of £60 18) $\frac{7}{8}$ of 64 metres

Exercise 3

Use a calculator to work out each of the following.

- 1) $\frac{3}{7}$ of 154.7 metres 2) $\frac{1}{8}$ of 22 metres 3) $\frac{3}{4}$ of 25 metres 4) $\frac{5}{7}$ of 14.7kg
- 5) $\frac{2}{3}$ of 27.3kg 6) $\frac{7}{9}$ of 129.87kg 7) $\frac{3}{8}$ of 154 metres 8) $\frac{5}{12}$ of 16.8 metres
- 9) $\frac{3}{7}$ of 2.45 metres 10) $\frac{7}{15}$ of 7.5 litres 11) $\frac{4}{9}$ of 29.7 litres 12) $\frac{11}{15}$ of 97.5 litres

Exercise 4

- 1) If $\frac{1}{4}$ of a number is 6, what is the number?
- 2) If $\frac{1}{3}$ of a number is 12, what is the number?
- 3) 39 sweets are shared between two people. David gets $\frac{1}{3}$ of them and Karen gets the rest. How many do they each get?
- 4) $\frac{2}{5}$ of the pupils in a school are girls and the rest are boys.
 - a) What fraction of the school are boys?
 - b) If there are a total of 900 pupils in the school, how many are boys?
- 5) Tom earns £250 per week. He calculates that $\frac{3}{20}$ of this is taken from him in tax. How much tax will he pay?
- 6) A supermarket buys 240 cabbages. $\frac{3}{4}$ of these are sold at their full price. The remainder are reduced in price. How many are sold at full price?
- 7) At a football match, $\frac{3}{8}$ of the crowd support Manchester United. The rest support Chelsea. Altogether there are 60,000 people at the match. How many
 - a) Support Manchester United b) Support Chelsea?

Calculating Percentages

L.5

Exercise 1

Calculate each of the following without using a calculator

- | | | | |
|------------------|-----------------|-----------------|------------------|
| 1) 50% of £6.80 | 2) 10% of £9.50 | 3) 25% of £8.00 | 4) 75% of £10.00 |
| 5) 75% of £16.20 | 6) 15% of £4.00 | 7) 15% of £6.40 | 8) 5% of £4.20 |

Exercise 2

Calculate each of the following without using a calculator

- | | | | |
|----------------|------------------|------------------|------------------|
| 1) 8% of 700 | 2) 11% of 500 | 3) 17% of 400 | 4) 32% of 650 |
| 5) 47% of 900 | 6) 56% of 250 | 7) 65% of 620 | 8) 72% of 225 |
| 9) 83% of £16 | 10) 92% of £8 | 11) 43% of £12 | 12) 16% of £3.50 |
| 13) 87% of £14 | 14) 36% of £9.50 | 15) 45% of £4.40 | 16) 58% of £6.50 |

Exercise 3

Use a calculator to work these out

- | | | | |
|-----------------------|------------------------|------------------------|---------------------|
| 1) 17% of 33kg | 2) 23% of 48kg | 3) 78% of 97kg | 4) 66% of 26 metres |
| 5) 23% of 17 metres | 6) 79% of 24 metres | 7) 93% of 13.4 litres | |
| 8) 16% of 19.7 litres | 9) 27% of 27.6 litres | 10) 47% of 63.8 litres | |
| 11) 54% of 65.4kg | 12) 97% of 53.2 metres | 13) 43% of 240kg | |

Exercise 4

- 1) John sits an examination. There are 60 questions and he gets one mark for each question he gets correct. The maximum mark he can get is 60. However, he is told that his mark is 55%. How many questions did he get right?
- 2) In a plantation there are 2500 trees. 60% of them are coniferous. How many trees are coniferous?
- 3) In a sale, all items are reduced in price by 20%. A TV normally costs £210. Calculate
 - a) The amount by which it is reduced in price.
 - b) Its new price.
- 4) Value Added Tax (VAT) is added to the cost of most things we buy. If the VAT on items is 17.5%, calculate the tax added on to each of the following items.

a) a car costing £10,000	b) a bicycle costing £150	c) a game costing £20
--------------------------	---------------------------	-----------------------
- 5)
 - a) Calculate 10% of £36, without using a calculator.
 - b) Use this to write down 5% of £36.
 - c) Use this to write down $2\frac{1}{2}\%$ of £36.
 - d) Use these values to calculate $17\frac{1}{2}\%$ of £36.
 - e) VAT of $17\frac{1}{2}\%$ is added on to the cost of a badminton racket. What is its final cost if it costs £36 before VAT is added on?

Ratio and Proportion

L.5

- 1) A school has a total of 950 pupils. 400 pupils are boys and the rest are girls.
Complete the line below to show the ratio of the number of boys to the number of girls

Boys : Girls

.... :

- 2) In a competition there are 3 prize winners, 1st, 2nd and 3rd. The organisers have £60 to spend on the prizes. They decide to split the money up in the ratio 3:2:1. The 1st gets the most expensive prize and the 3rd gets the least expensive prize. How much money is spent on each prize?

- 3) A length of wood is cut into two smaller lengths in the ratio 3:2.

The smaller length is 60cm long.

- a) How long is the larger length?
- b) What was the length of the original piece of wood?

- 4) Two local primary schools join forces to have a school fair. There are 300 pupils in the first school and 400 in the second. They decide to share the proceeds in the same ratio as the number of pupils in each school.

- a) Which school gets the most money?
- b) Complete this statement for the ratio of pupils at the schools.

school 1 : school 2

= 300 : 400

= 3 :

- c) They make a profit of £350. How much money does each school get?

- 5) Miranda carries out a survey. She counts the different vehicles passing her school over a period of one hour in the morning. The numbers of vehicles she counted were
15 Buses, 60 Vans, 75 Lorries and 150 Cars.

- a) Complete this line to show the ratio of the number of vehicles.

Buses : Vans : Lorries : Cars

1 : : :

In the afternoon, she carries out another survey. This time the ratio of vehicles was

Buses : Vans : Lorries : Cars

1 : 3 : 5 : 7

- b) Altogether 320 vehicles passed her in the afternoon. How many were vans?

Checking

Do not use a calculator

L.5

1) $32 \times 27 = 864$

This can be estimated by rounding off each number to the nearest 10 then mentally multiplying.

i.e. $30 \times 30 = 900$

457×72 can be approximated to $500 \times 70 = 35,000$ by rounding off to the nearest 100 and the nearest 10 then calculating mentally.

In the same way, estimate the size of each of these.

- | | | | | |
|--------------------|---------------------|---------------------|--------------------|--------------------|
| a) 22×34 | b) 27×38 | c) 58×32 | d) 52×41 | e) 103×47 |
| f) 278×53 | g) 481×26 | h) 57×235 | i) 84×237 | j) 372×61 |
| k) 540×61 | l) 245×381 | m) 178×226 | n) 89×371 | o) 372×95 |

This method of estimating can be used for checking whether an answer is of the correct magnitude. In the estimates below, some are reasonable and some are wrong. Check these by estimating their size. Which are wrong?

- | | |
|--------------------------------------|---------------------------------------|
| (i) 38×43 estimate 1600 | (ii) 27×89 estimate 27,000 |
| (iii) 103×43 estimate 8,000 | (iv) 286×52 estimate 15,000 |
| (v) 76×52 estimate 400 | (vi) 324×56 estimate 1800 |
| (vii) 56×94 estimate 5,400 | (viii) 78×93 estimate 72,000 |
| (ix) 33×543 estimate 15,000 | (x) 184×86 estimate 18,000 |

2) Dividing can be done in a similar way but more estimates may have to be carried out.

e.g. $385 \div 7$

Call this $400 \div 7$

Estimate again and call it $400 \div 8 = 50$

So $385 \div 7$ gives an answer of about 50

In the same way, estimate these divisions.

- | | | | | |
|------------------|------------------|------------------|-------------------|-------------------|
| a) $145 \div 8$ | b) $341 \div 7$ | c) $583 \div 6$ | d) $935 \div 4$ | e) $527 \div 9$ |
| f) $364 \div 12$ | g) $629 \div 16$ | h) $672 \div 24$ | i) $729 \div 14$ | j) $841 \div 37$ |
| k) $735 \div 46$ | l) $538 \div 63$ | m) $724 \div 21$ | n) $1753 \div 57$ | o) $1427 \div 83$ |

Check which of these estimates are reasonable. Make a list of the wrong ones.

- | | |
|---------------------------------|---------------------------------|
| (i) $156 \div 7$ estimate 60 | (ii) $238 \div 8$ estimate 50 |
| (iii) $249 \div 11$ estimate 25 | (iv) $854 \div 19$ estimate 45 |
| (v) $673 \div 42$ estimate 30 | (vi) $736 \div 15$ estimate 50 |
| (vii) $643 \div 7$ estimate 90 | (viii) $732 \div 5$ estimate 14 |
| (ix) $528 \div 31$ estimate 1.8 | (x) $743 \div 6$ estimate 120 |

Inverse Operations

Do not use a calculator

L.5

- 1) Amy likes to check her work by doing inverse operations. This is what she does.

When she has done a subtraction like this

$$452 - 197 = 255$$

she does an inverse operation on it, like this

$$255 + 197 = 452$$

Check these subtractions by doing an inverse operation on them. Which are wrong?

a) $56 - 27 = 39$

b) $53 - 29 = 34$

c) $67 - 35 = 32$

d) $123 - 45 = 72$

e) $156 - 88 = 68$

f) $374 - 94 = 280$

g) $318 - 163 = 255$

h) $251 - 135 = 216$

i) $462 - 187 = 275$

j) $512 - 351 = 161$

k) $251 - 219 = 132$

l) $542 - 315 = 223$

- 2) When Amy checks a divide like this

$$1288 \div 56 = 23$$

she does a multiplication like this

$$56 \times 23 = 1288$$

Check these divisions by doing the inverse operation on them. Which are wrong?

a) $208 \div 8 = 26$

b) $238 \div 7 = 35$

c) $423 \div 9 = 47$

d) $420 \div 12 = 35$

e) $893 \div 19 = 45$

f) $874 \div 23 = 28$

g) $1026 \div 18 = 57$

h) $3393 \div 39 = 77$

i) $1736 \div 31 = 56$

j) $824 \div 8 = 113$

k) $3150 \div 15 = 210$

l) $4719 \div 33 = 143$

In questions 3, 4 and 5 write down the calculation needed to check the answer.

- 3) Nigel has a piece of wood measuring 2.4 metres long. If he cuts off 90cm, what length of wood is left?
- 4) Georgina buys 12 oranges for £2.76. How much does each orange cost?
- 5) Mr Green collects in the money for the school trip from the 27 pupils in his group. He collects the same amount of money from each student which amounts to a total of £148.50. How much does each pupil pay?
- 6) What two subtractions could Daniel be checking with this addition?

$$123 + 76 = 199$$
- 7) A piece of string is cut into 7 equal pieces. Rebecca does a calculation to find the length of each piece. She checks the calculation with this multiplication

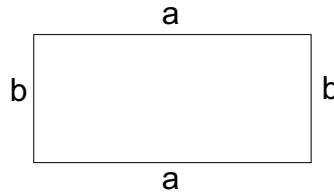
$$0.26 \times 7 = 1.82 \text{ metres}$$

 How long, in centimetres, was each of the seven pieces of string?

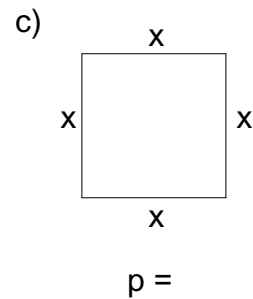
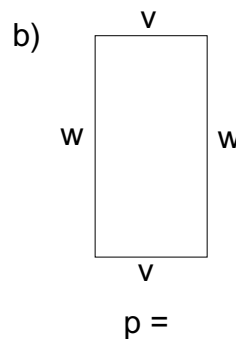
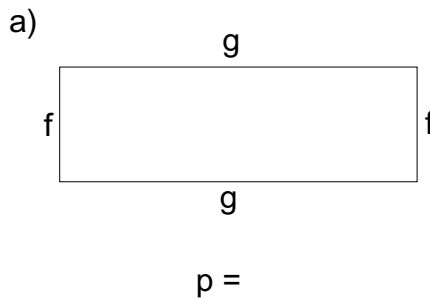
Adding Letters

L.5

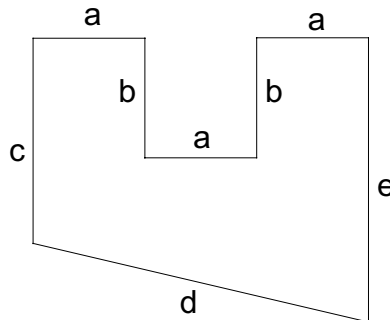
1) The perimeter of this rectangle is $p = 2a + 2b$



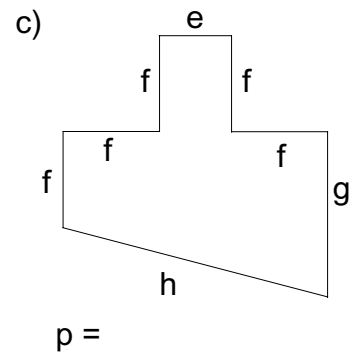
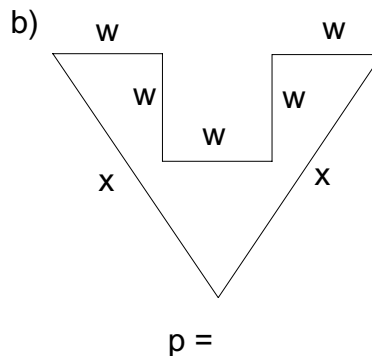
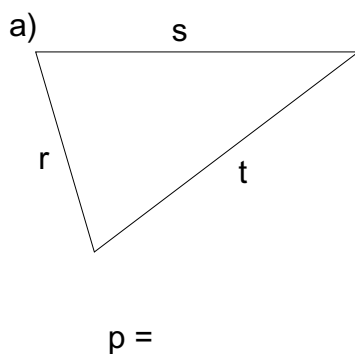
Write down an expression for each of these perimeters.
In each case write down the expression in its simplest form



2) The perimeter of this shape is $p = 3a + 2b + c + d + e$



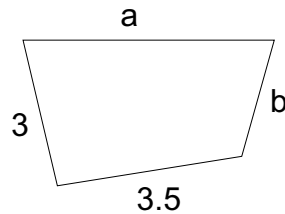
Write down expressions for the perimeters of these shapes.
In each case write down the expression in its simplest form.



Adding Letters and Numbers

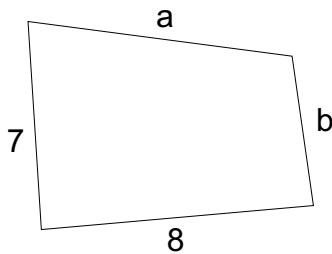
L.5

- 1) The perimeter of this shape is $p = a + b + 6.5$



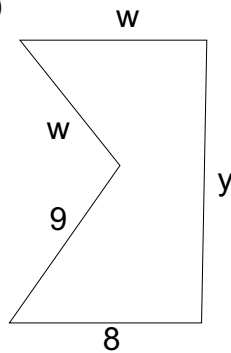
In the same way, write down the perimeters of these shapes.
Simplify each expression.

a)



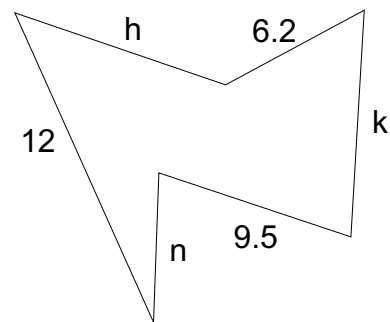
$p =$

b)



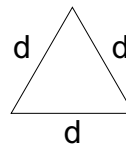
$p =$

c)



$p =$

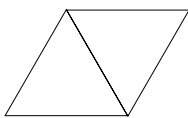
- 2) This is a tile in the shape of an equilateral triangle.
Each of its sides measures d centimetres.



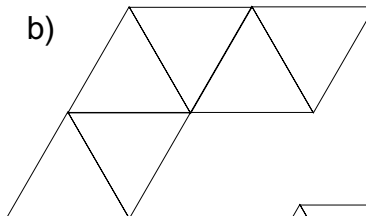
The perimeter of this tile is
 $p = 3d$ centimetres

Each of the following shapes are made up of these tiles.
Write down the perimeters of each of the shapes.
Ensure they are written in their lowest terms.

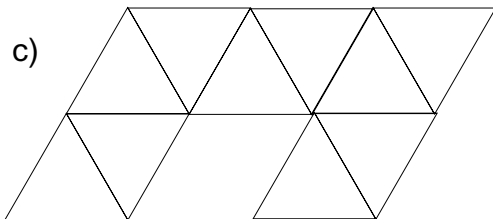
a)



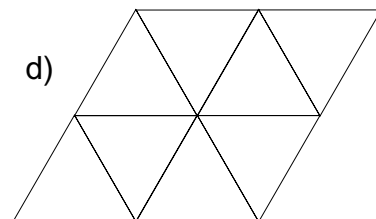
b)



c)



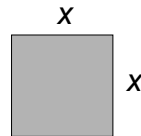
d)



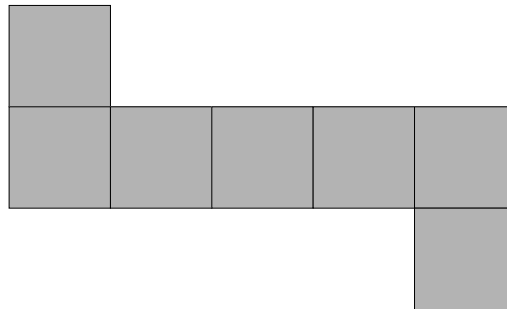
Perimeters of Tiles

L.5

- 1) This is a square tile. The length of each side is x centimetres.
The perimeter (p) of the tile is $p = 4x$ centimetres.



A number of these tiles are put together like this.

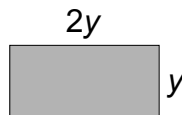


- a) Write down the perimeter (p) of this shape.

$p =$

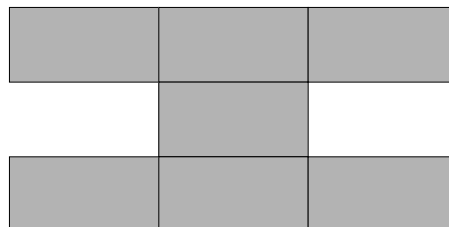
- b) If the perimeter of this shape is 32 cm, use your answer to part a) to write down an equation involving x .
c) Solve the equation to find the value of x .

- 2) This is a rectangular tile. Its length is twice as long as its width.



The perimeter of this tile is $p = 6y$

A number of these tiles are put together like this



- a) Write down an equation for the perimeter of this shape.

$p =$

- b) If the perimeter of this shape is 260 centimetres, use your answer to part a) to write down an equation involving y .
c) Solve the equation to find the value of y .
d) What are the dimensions of the tile?

Simplifying Expressions

L.5

1) Rewrite each of the following expressions in their simplest form.

The first one has been done for you.

- | | | | |
|-------------------|--------------------------|-----------------|-----------------|
| a) $3a + 4a = 7a$ | b) $7y + 2y$ | c) $6x - 2x$ | d) $n + n$ |
| e) $3n + n$ | f) $5p - p$ | g) $12y - 3y$ | h) $m - m$ |
| i) $5s - 2s$ | j) $4z - 4z$ | k) $2 \times a$ | l) $y \div y$ |
| m) $p \times p$ | n) $r \times r \times r$ | o) $z \times 2$ | p) $n + n + 3n$ |

2) Rewrite each of the following expressions in their simplest form.

- | | | |
|----------------------|----------------------|------------------------|
| a) $3p + 3 + p + 2$ | b) $4r - 3 + 2r + 7$ | c) $5a + 7 - a + 4$ |
| d) $5b + 5 - 3b - 7$ | e) $5n + 4 - 3n - 2$ | f) $9k - 6 + 3k + 4$ |
| g) $5c + 6 - 3c + 7$ | h) $4d - 3 + 5d - 2$ | i) $5t + 4s - 3t + 6s$ |

3) Look at these expressions then answer the questions about them.

n^2	$n \div n$	$2 \times n$	$n + 2$	$n - 2$
n^3	$2n$	$2n - n$	n	$\frac{n}{2}$

- Which two always give the same answer as $3n - n$?
- Which one always gives the same answer as $2 + n$?
- Which one always gives the same answer as $n \times n \times n$?
- Which one always gives the same answer as $n \div 2$?
- Which one always gives the answer 1?
- Which one always gives the same answer as $n \times n$?
- Which two always give the same answer as $3n - 2n$?
- Which two always give the same answer as $n + n$?
- Which one always gives the same answer as $x \div x$?

4) Look at these expressions.

n^2	$n \div n$	n^3	$2n$	$2n - n$	n	$\frac{n}{2}$
$n + 2$	$n \times n \times n$	$n \div 2$	1	$n \times n$	$2 + n$	$n + n$

Pairs of these will always give the same answer.

One pair is n^3 and $n \times n \times n$

Write down all the other pairs.

Brackets

L.5

1) Calculate the value of each of the following.

- | | | | |
|----------------|----------------|---------------|---------------|
| a) $2(4 - 2)$ | b) $3(2 + 7)$ | c) $6(3 - 1)$ | d) $6(5 + 2)$ |
| e) $7(3+1)$ | f) $4(12 - 8)$ | g) $4(5 - 6)$ | h) $8(2 - 4)$ |
| i) $3(-2 + 1)$ | j) $6(-3 - 2)$ | k) $3(6 - 6)$ | l) $2(5 - 7)$ |

2) Look at these expressions.

- | | | | |
|----------------|----------------|---------------|----------------|
| a) $2(x - 1)$ | b) $6x - 21$ | c) $2(3 + x)$ | d) $6 + 2x$ |
| e) $x^2 + 2x$ | f) $3(2x - 7)$ | g) $2x - 2$ | h) $3x$ |
| i) $6x - 2x^2$ | j) $2x(3 - x)$ | k) $x(x + 2)$ | l) $3(2x - x)$ |

Which pairs will always give the same answer?

3) Write down expressions equal to these but without the brackets.

- | | | | |
|----------------|-----------------|----------------|-----------------|
| a) $2(x - 3)$ | b) $5(2n - 6)$ | c) $2(3x - 4)$ | d) $3(3n - 5)$ |
| e) $6(4x + 3)$ | f) $4y(2 + 3y)$ | g) $2b(9 - b)$ | h) $3c(2c + 7)$ |
| i) $x(x + 4)$ | j) $2f(3 - 2f)$ | k) $y(4 - 2y)$ | l) $2x(3 - x)$ |

4) Write down each of the following expressions in their simplest form.

- | | | |
|----------------------------|--------------------------|----------------------------|
| a) $(2x + 3) + (2x + 2)$ | b) $(4x + 5) + (2x - 3)$ | c) $(5y + 6) + (2y - 3)$ |
| d) $(5a - 4) + (2a + 2)$ | e) $(3b - 4) + (2b + 6)$ | f) $(7a - 3) + (3a - 7)$ |
| g) $(6d + 3x) + (4d - 2x)$ | h) $(3x - 4) + (4x - 3)$ | i) $(2y - 2x) + (3y + 3x)$ |
| j) $(3x - 4) + (2x - 3)$ | k) $(4y - 3) + (3y - 2)$ | l) $(6x - 2) + (6 - 2x)$ |
| m) $(6 - 3a) + (4a - 3)$ | n) $(3b - 7) + (2a - 4)$ | o) $(6 + 3b) + (2a - 5)$ |

5) Write down these expressions in their simplest form without the brackets.

- | | | | |
|-----------------|-----------------|-----------------|-----------------|
| a) $6 - (-3)$ | b) $5 - (-4)$ | c) $7 - (-9)$ | d) $4 - (-6)$ |
| e) $3x - (-2x)$ | f) $7y - (-3y)$ | g) $3a - (-7a)$ | h) $7b - (-2b)$ |
| i) $4a - (-3)$ | j) $9 - (-2b)$ | k) $7 - (-5b)$ | l) $8 - (-4y)$ |

6) Simplify these as much as you can.

- | | | |
|-------------------------|-------------------------|-------------------------|
| a) $(3 + 2) - (1 - 4)$ | b) $(5 + 7) - (2 - 6)$ | c) $(3 + 4) - (1 - 8)$ |
| d) $(1 + 5) - (2 + 3)$ | e) $(7 + 3) - (5 + 2)$ | f) $(3 + 4) - (8 + 5)$ |
| g) $(-5 + 4) - (3 - 4)$ | h) $(7 + 3) - (-3 - 5)$ | i) $(5 - 3) - (-8 + 5)$ |
| j) $(3 - 7) - (-3 + 5)$ | k) $(1 + 5) - (-1 - 4)$ | l) $(4 - 8) - (-4 + 2)$ |

7) Simplify these as much as you can.

- | | | |
|--------------------------|--------------------------|--------------------------|
| a) $(5a + 2) - (3a + 2)$ | b) $(7x + 3) - (2x + 1)$ | c) $(4y + 5) - (y + 7)$ |
| d) $(7b + 5) - (4b - 2)$ | e) $(9y + 4) - (4y - 3)$ | f) $(9x + 3) - (5x - 4)$ |
| g) $(3b + 2) - (b - 5)$ | h) $(7y + 4) - (y + 5)$ | i) $(2a + 2) - (4a + 6)$ |
| j) $(3 + 2y) - (1 - 4y)$ | k) $(5 + 4b) - (2 - 7b)$ | l) $(1 + 3y) - (4 - y)$ |

Number Rules

L.5

In each of the following the last diagram shows the rule for the other two.
Complete the diagrams

a)

1		
2		
3		
4	5	6

2		
3		
4		
5	6	7

n		
n+1		
n+2		

b)

1	3	5
	7	
	9	
	11	

2	4	6
	8	

n	n+2	

c)

2		8
4	14	10
6		12

3		12
6		15
9		

n		
2n		

d)

2	4
	8
	16
	64

3	6
	12
	24

n	
16n	

e)

2		17
5		14
	8	11

10		19
	13	

n-6		n+9
	n	

Number Grids

L.5

- 1) Dewi investigates a number pattern. He puts a box around four numbers on the number grid and adds them together.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....

He enters all this information in the table shown below. The box highlights the numbers 14, 15, 24 and 25. Copy this table and complete it.

1st number	2nd number	3rd number	4th number	Sum of the numbers
14	15	24	25	78
28				
66				
		97		
			126	
n				

- 2) Indira carries out the same type of investigation but she uses a T box to find her numbers.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	.....	.....	.....	.....	.....	.....	.....	.....	.....

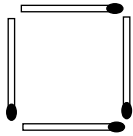
She enters all the information in the table below. Copy this table and complete it.

1st number	2nd number	3rd number	4th number	Sum of the numbers
22	23	24	33	102
27				
61				
		80		
			107	
			n	

Number Patterns

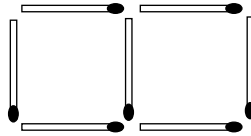
L.5

1) The diagram shows squares made from matchsticks.



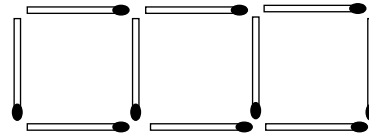
1 Square

4 Matchsticks



2 Squares

7 Matchsticks

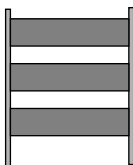


3 Squares

10 Matchsticks

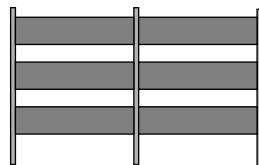
- How many matchsticks are needed to make 4 squares?
- How many matchsticks are needed to make 10 squares?
- Write in words how you calculate the number of matchsticks you need if you know the number of squares.
- Let s represent the number of squares and m the number of matchsticks.
Which of these shows the rule for calculating the number of matchsticks needed?
 $m = 4s + 1$ $m = 4s$ $m = 3s + 1$ $m = s + 3$ $m = 4s + 3$
- Use the rule to calculate the number of matchsticks needed to make 34 squares.
- How many squares are made with 61 matchsticks?
- If I have 75 matchsticks, how many squares can I make and how many matchsticks are left over?

2) The diagram shows fences made from posts and rails.



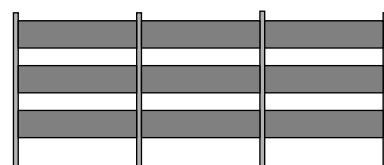
2 posts

3 rails



3 posts

6 rails



4 posts

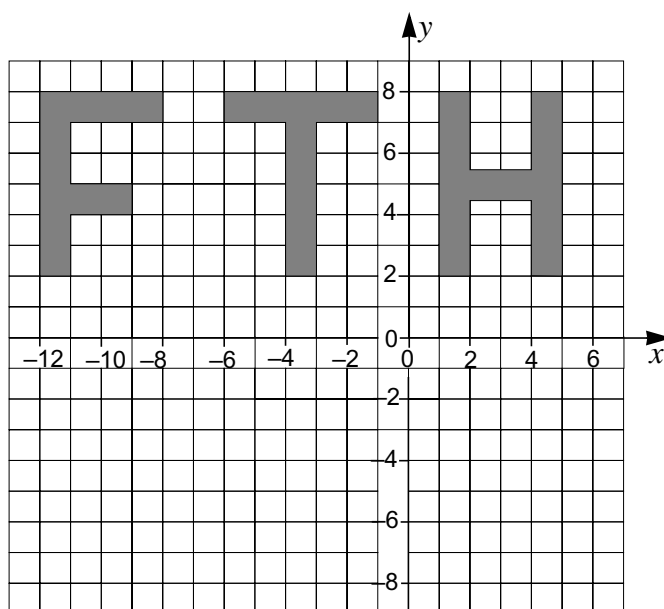
9 rails

- How many rails are needed with 5 posts?
- How many rails are needed with 10 posts?
- Explain in words how you can calculate the number of rails needed if you know the number of posts.
- Let r represent the number of rails needed and p the number of posts.
Which of these shows the rule for calculating the number of rails needed?
 $r = 3(p - 1)$ $r = 2(p - 1)$ $r = 4(p - 1)$ $r = 3p$ $r = 3p - 1$
- Use the rule to calculate the number of rails needed with 25 posts.
- How many posts are needed for a fence having 66 rails?

Negative Co-ordinates

L.5

- 1) a) Plot the points $A(-4,1)$, $B(-2,5)$, $C(2,5)$, $D(4,1)$, $E(2,-3)$, $F(-2,-3)$. The y axis needs to go from -4 to 6 and the x axis from -5 to 5 . Draw the shape.
 - b) What name is given to this shape?
 - c) Describe the vertical line of symmetry.
- 2) a) Plot the points $A(2,2)$, $B(3,5)$, $C(6,4)$ and $D(5,1)$. Both the axes needs to go from -6 to 6 . Draw the shape.
 - b) Reflect this shape about the y axis. Draw your result. What are the co-ordinates of the corners of this new shape?
 - c) Reflect the first shape about the x axis. Draw your result. What are the co-ordinates of this new shape?
- 3) Frank draws his initials on a sheet of square paper, as shown below. He also draws the reflection of them about the x axis.

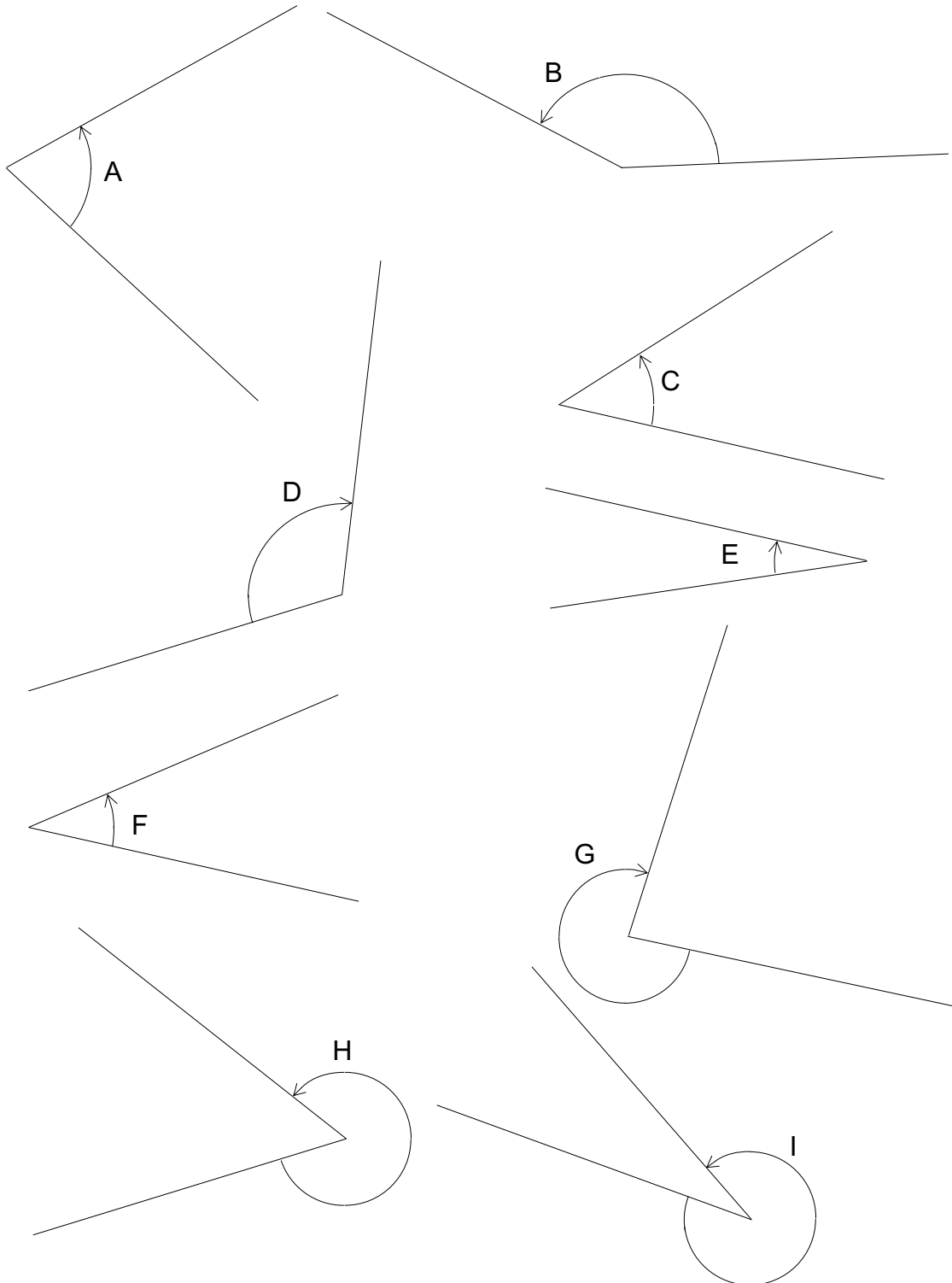


- a) Draw the initials and their reflection.
 - b) What are the co-ordinates of the reflection of the letter T?
- 4) Three corners of a square are represented by the co-ordinates $(-5,3)$, $(1,2)$ and $(0,-4)$
 - a) Plot these points.
 - b) What are the co-ordinates of the other point?
 - 5) Three corners of a triangle are $(-2,1)$, $(1,2)$ and $(-1,-2)$.
 - a) With an x axis of -7 to 4 and a y axis of -7 to 7 , plot and draw the triangle. These co-ordinates are multiplied by 3. The first becomes $(-6,3)$
 - b) What are the other two co-ordinates when multiplied by 3?
 - c) Show these three co-ordinates and sketch the triangle.
 - d) How many smaller triangles will fit into the larger one?
 - e) Draw these triangles in the larger one.

Angles

L.5

1) Measure each of these angles.



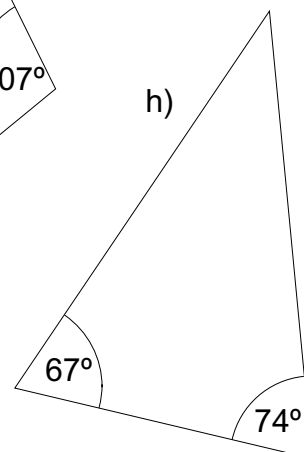
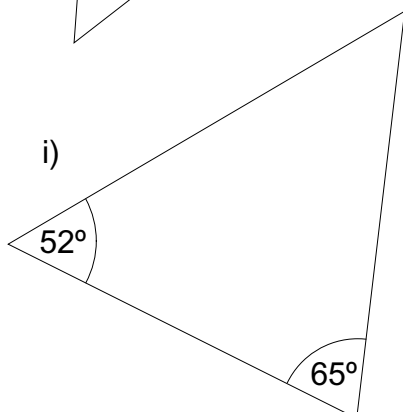
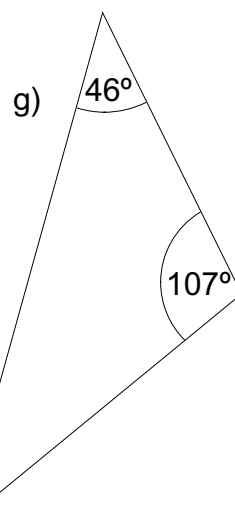
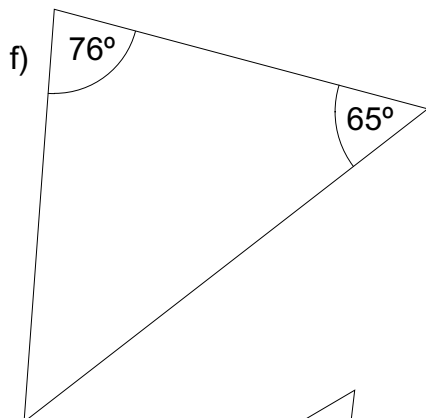
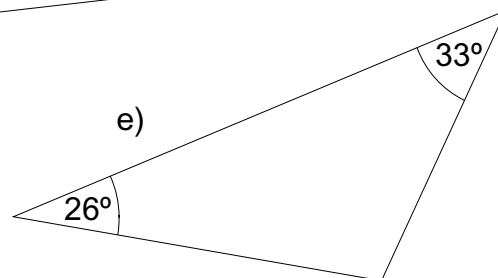
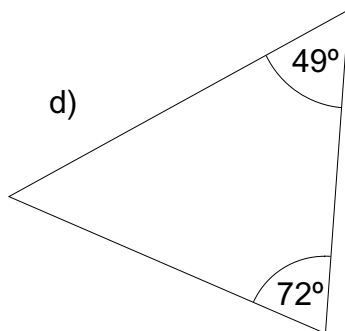
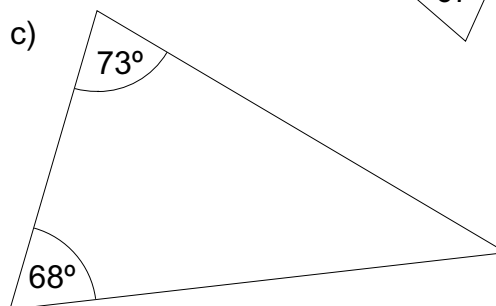
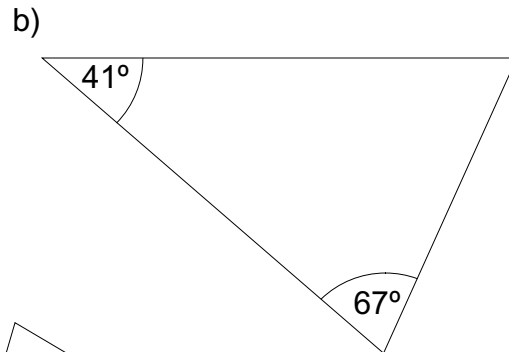
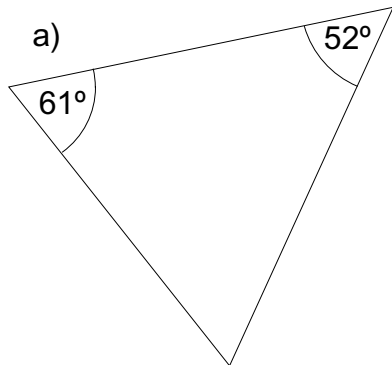
2) Draw these angles

- | | | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|
| a) 24° | b) 37° | c) 81° | d) 94° | e) 126° | f) 154° |
| g) 175° | h) 205° | i) 233° | j) 290° | k) 314° | l) 346° |

Triangles

L.5

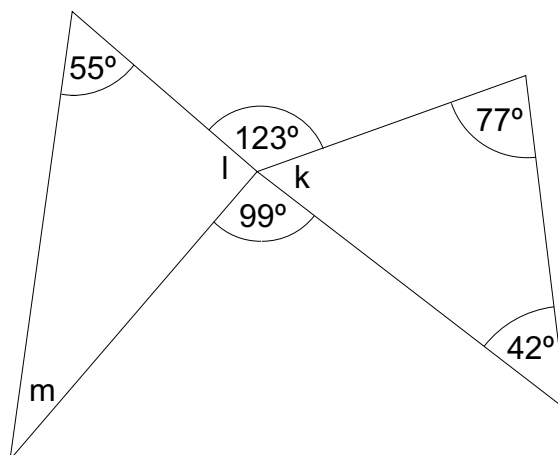
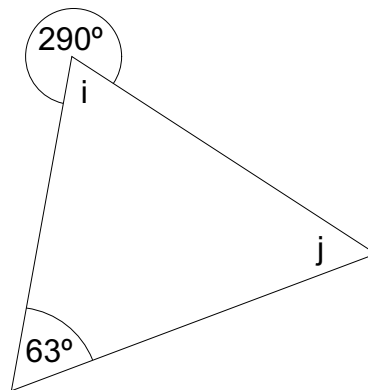
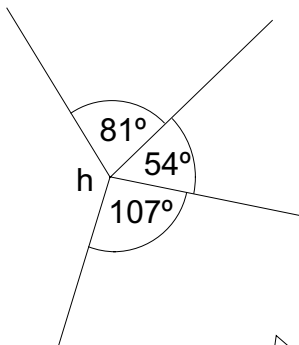
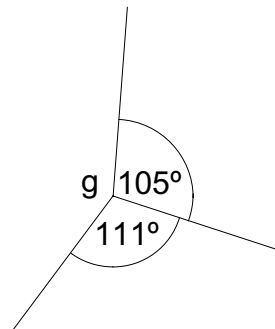
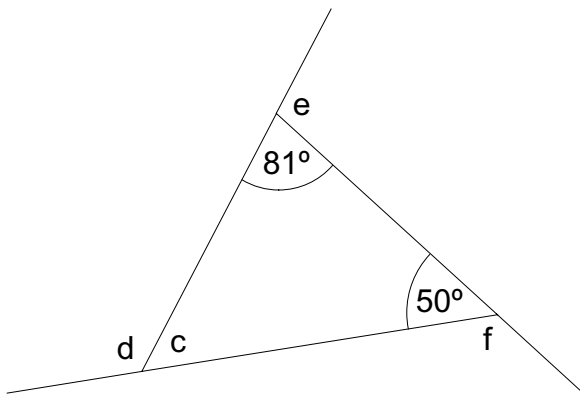
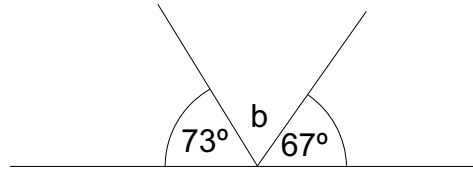
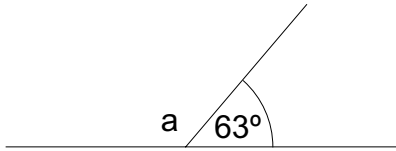
Calculate the size of the missing angle in each of these triangles.



Angles at a Point

L.5

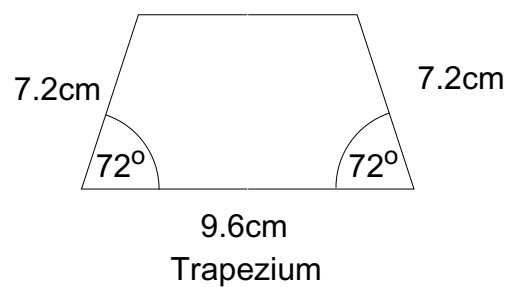
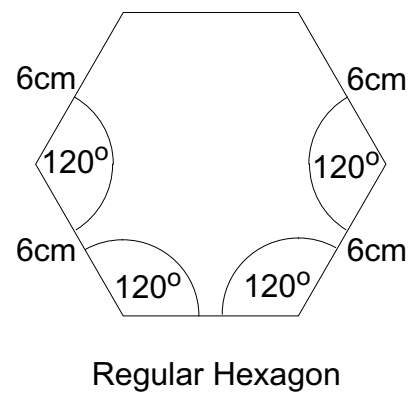
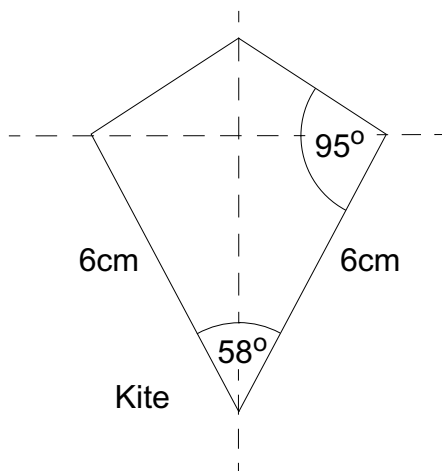
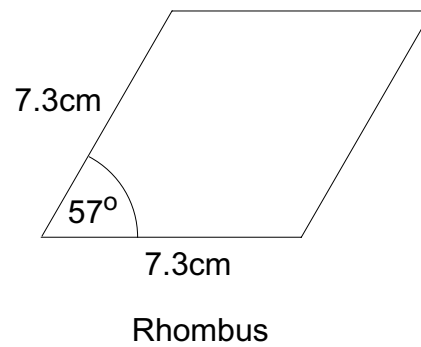
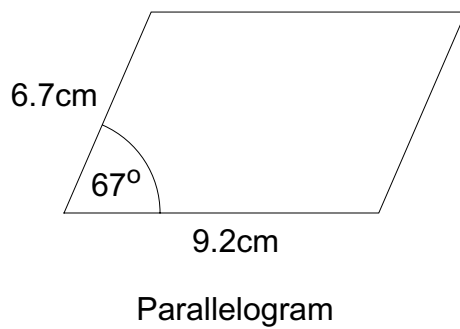
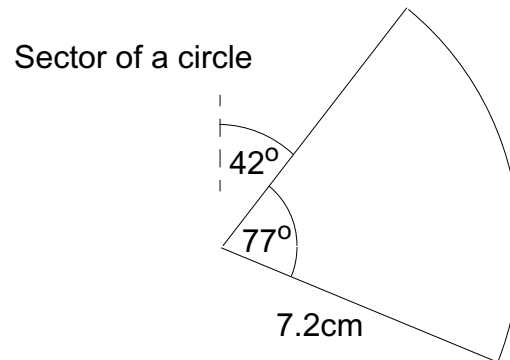
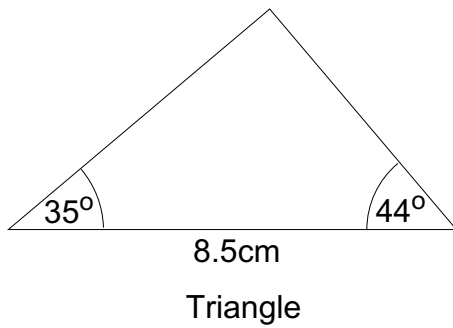
Calculate the sizes of the angles a to m below.



Drawings

L.5

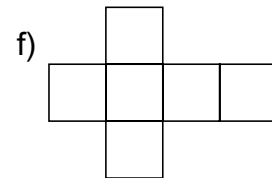
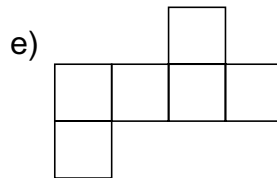
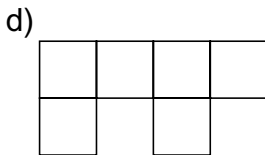
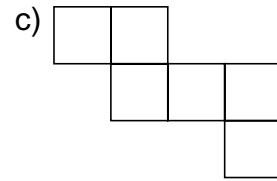
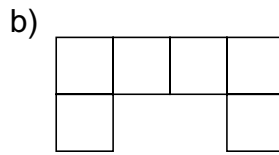
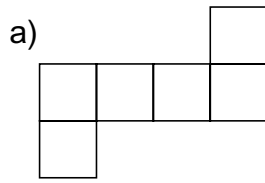
Draw the following shapes full size.



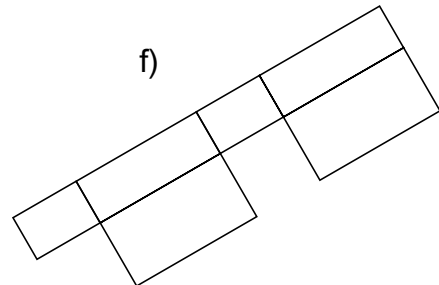
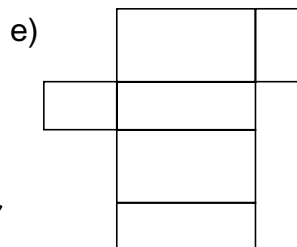
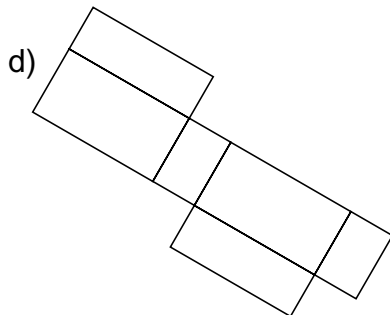
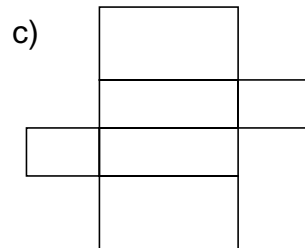
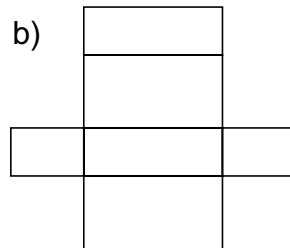
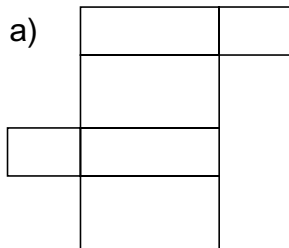
Making Shapes

L.5

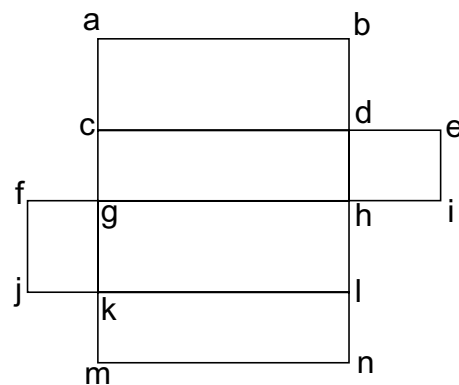
1) Which of these shapes will fold to make a cube?



2) Which of these shapes will fold to make a cuboid?



3) The diagram shows the net of a cuboid.

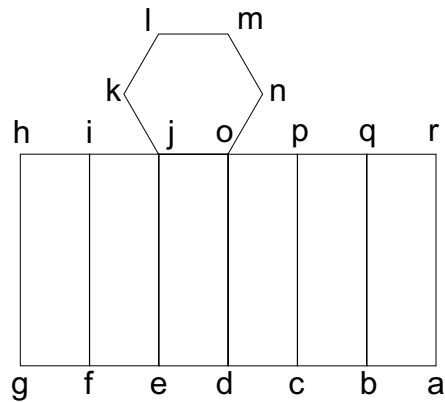


When it is folded to make the cuboid, corner j will touch corner m.
List the other corners that will touch.

Packages

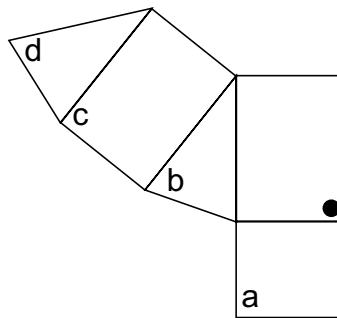
L.5

1) The diagram shows part of the net of an hexagonal prism.



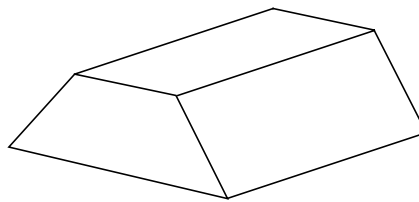
- What is the shape of the missing side?
- Which letters meet the corners of the missing shape?

2) This net will make a triangular prism when folded.

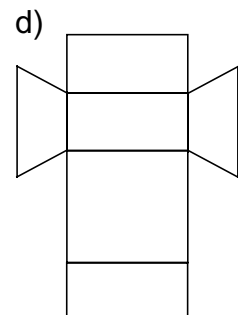
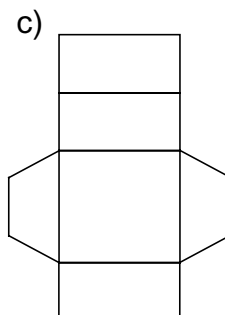
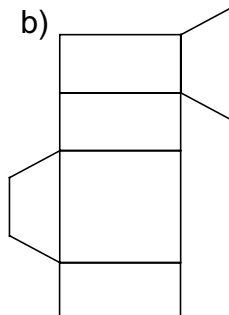
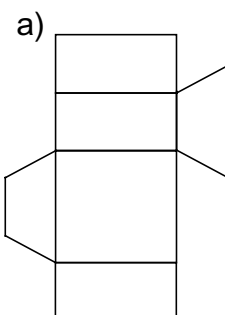


- How many edges will the prism have?
- Which corner will meet the ● when it is folded?
- How many corners will the prism have?

3)



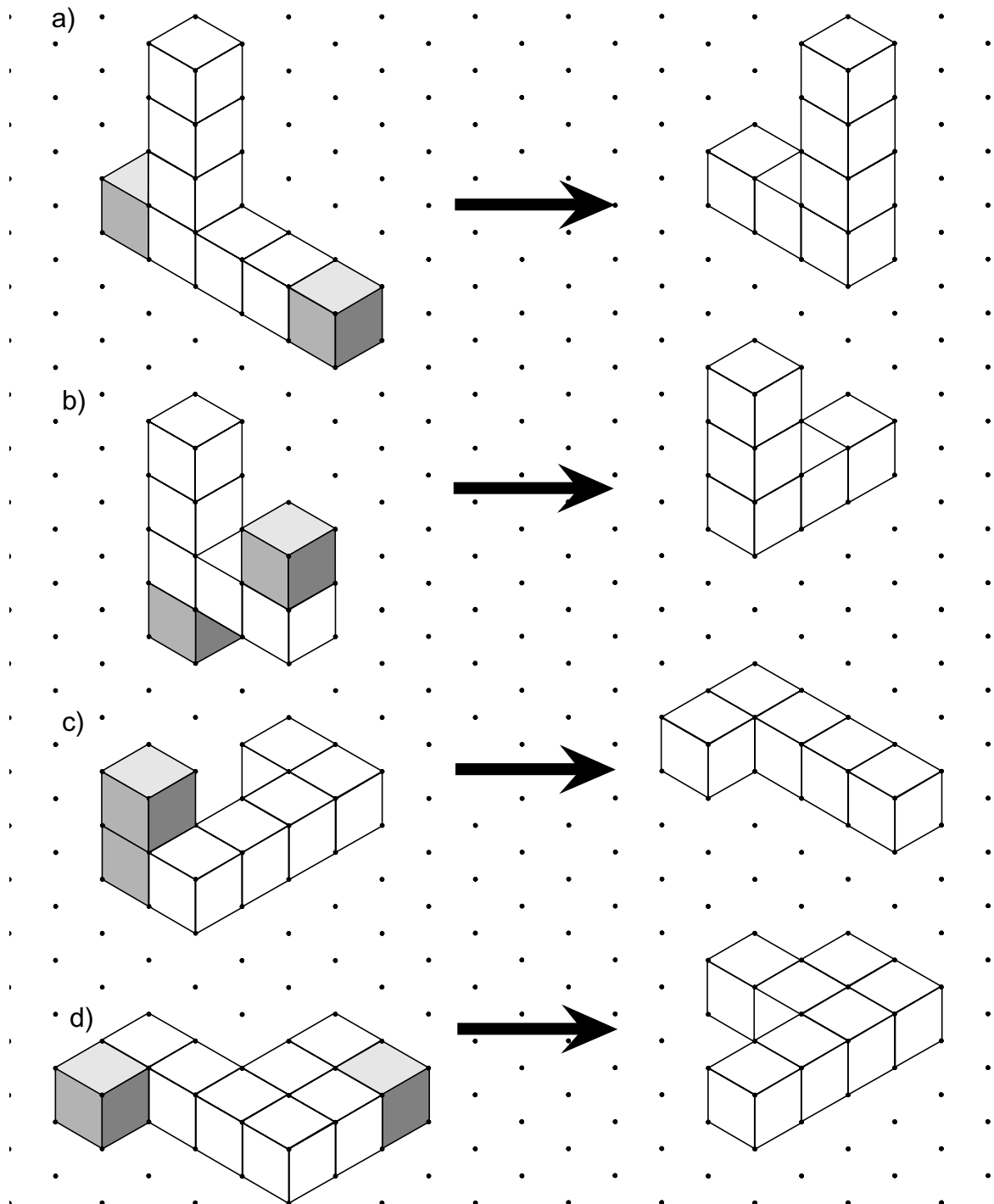
Which of the following nets will make this shape?



Missing Blocks

L.5

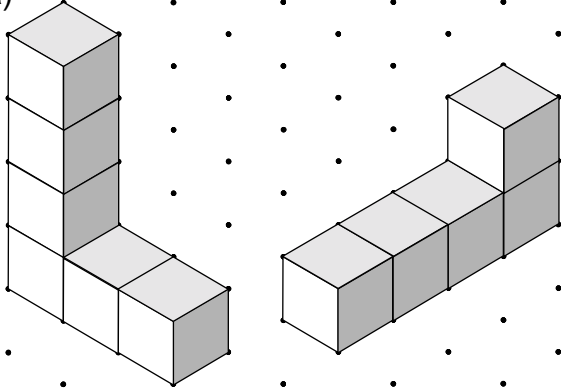
In each of the pair of diagrams below, both shapes are the same but viewed from different directions. The right hand view has two dark blocks missing. Put in the missing dark blocks.

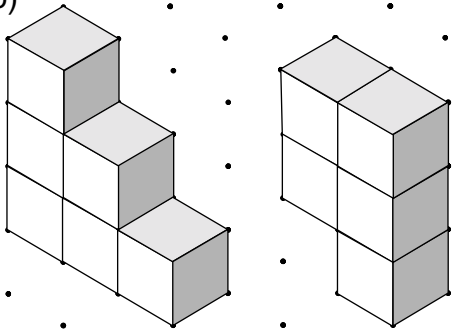


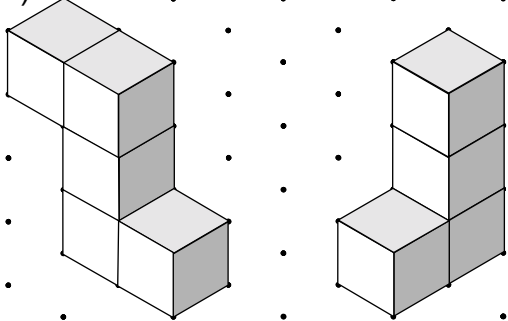
3-D Shapes

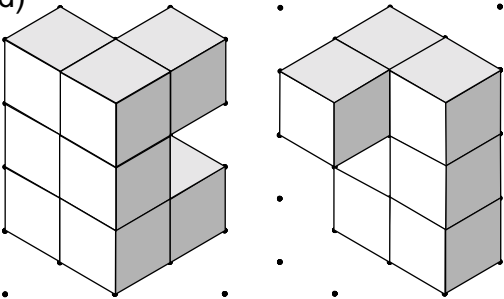
L.5

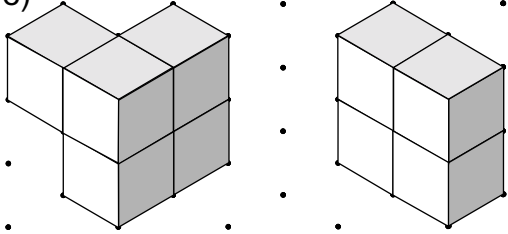
Each of the following pairs of diagrams show the same model viewed from different directions. The diagram on the right is incomplete. Complete it.

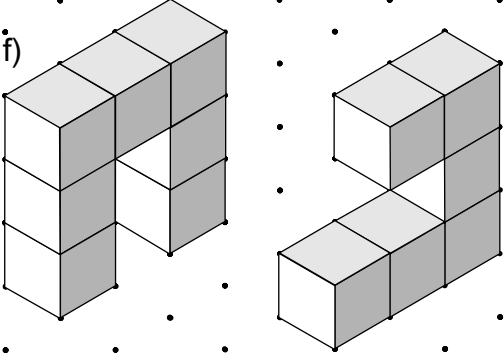
a) 

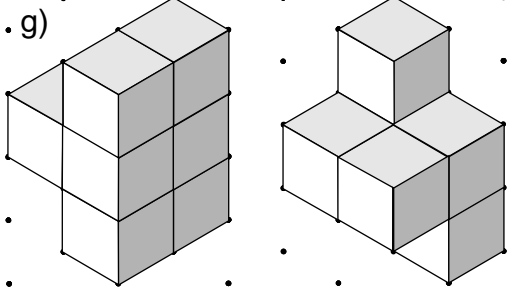
b) 

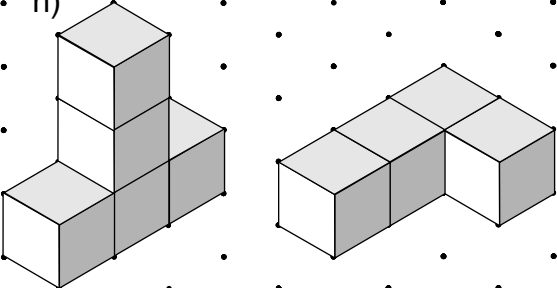
c) 

d) 

e) 

f) 

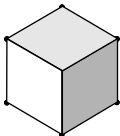
g) 

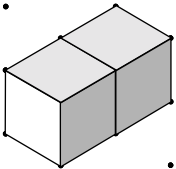
h) 

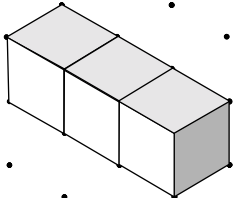
Enlargements

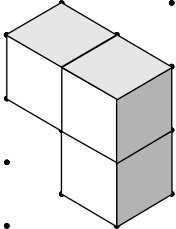
L.5

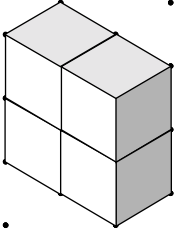
In each of the following, draw the shape enlarged. Make each diagram twice as high, twice as long and twice as wide as the original.

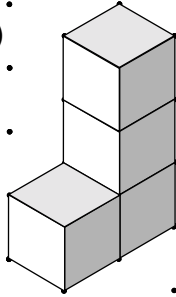
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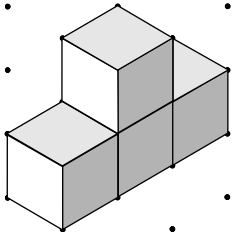
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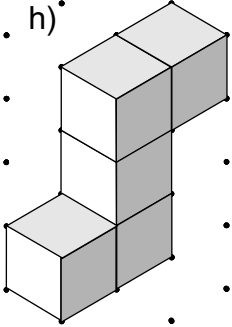
c) 

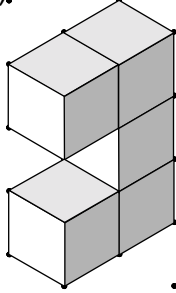
d) 

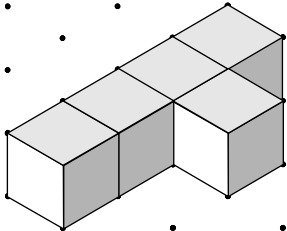
e) 

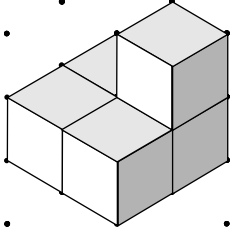
f) 

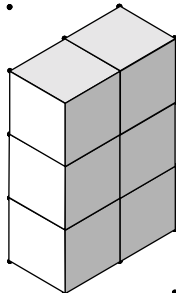
g) 

h) 

i) 

j) 

k) 

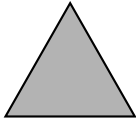
l) 

Rotational Symmetry

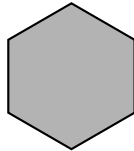
L.5

1) In each of the following diagrams, draw on the lines of symmetry and write down its order of rotational symmetry.

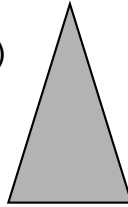
a)



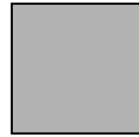
b)



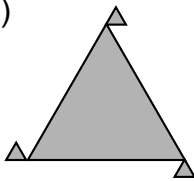
c)



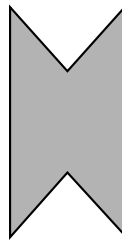
d)



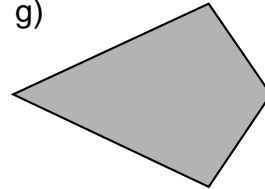
e)



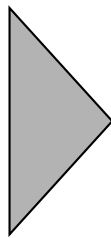
f)



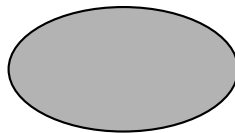
g)



h)



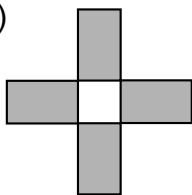
i)



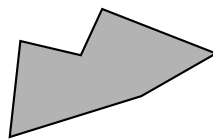
j)



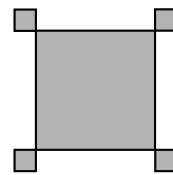
k)



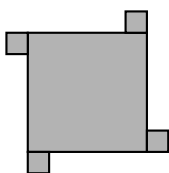
l)



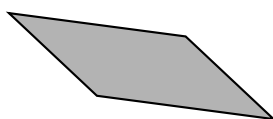
m)



n)



o)



p)



Metric and Imperial Measure

L.5

- 1) Adam buys some petrol. He buys 25 litres and says that he has approximately 5 gallons.
Ellen buys 36 litres of petrol. She says that she has 8 gallons.
 - a) How many litres of petrol does Adam call a gallon?
 - b) How many litres of petrol does Ellen call a gallon?

- 2) Navin makes cakes. He uses this recipe from an old cook book.

10 ounces of butter
10 ounces of sugar
1 pound of flour
2 eggs
 $\frac{1}{4}$ pint of milk

His needs to change these units into metric as he only has metric scales.
What measurements will he use?

- 3) Here are some distances between towns in miles. What would they be in kilometres?

Birmingham to Newcastle 210 miles
Aberystwyth to Norwich 290 miles
Edinburgh to London 390 miles
Belfast to Dublin 105 miles

- 4) Esther weighs 7 stone 12 pounds. She converts this into metric and gets 55kg.
 - a) How many pounds does she say makes 1 kilogram?She decides to be more accurate. This time she gets an answer of 50kg.
 - b) How many pounds does she say make 1 kilogram this time?

- 5) Toby's height is 5ft 4ins.
 - a) What is the approximate metric equivalent of 1 foot?
 - b) What is the approximate metric equivalent of 1 inch?
 - c) What is the approximate metric equivalent of 5ft 4ins?

- 6) Ashley goes to the supermarket to buy some potatoes for his mum. She says that she wants 12lbs of potatoes. When he gets there he finds that they are sold in bags of $2\frac{1}{2}$ kg, 5kg and 10kg. Which bag should he choose? Show all your calculations.

- 7) Milk is sold in 1, 2, 4 and 6 litre containers. Megan wants to buy 7 pints. Which size container should she buy?

Estimating Measures

L.5

1) Complete each of the following statements, putting in an appropriate measurement.

- a) The distance from Dundee to London is approximately 473 ... or 766 ...
- b) The height of a desk is approximately 70 ...
- c) Mr Pritchard's weight is 105 ...
- d) The length of time it takes Stuart to clean his teeth is about 150 ...
- e) The weight of a tin of beans is 450 ...
- f) Antonia's swimming pool contains approximately 8,800 ... or 40,000 ... of water.
- g) The length of the stem of a daffodil is 500 ...
- h) A book is 17 ... thick.
- i) The glass contains 180 ... of lemonade.

2) Complete each of the following statements by putting in an approximate value. You are allowed a wide margin, so long as the answer makes sense.

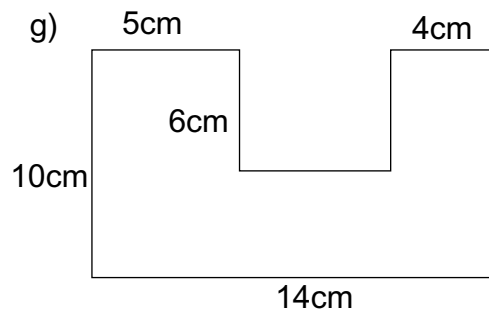
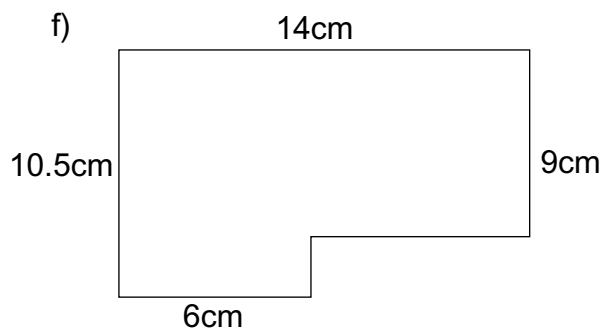
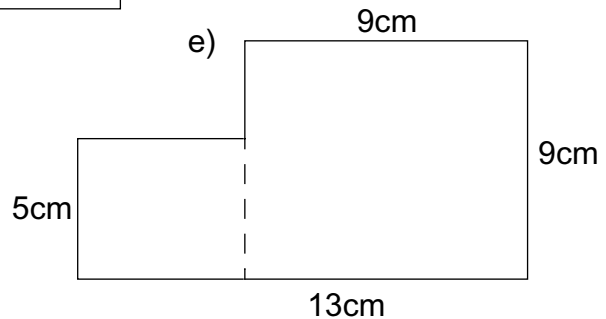
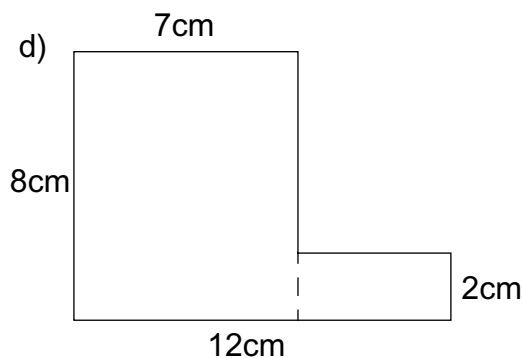
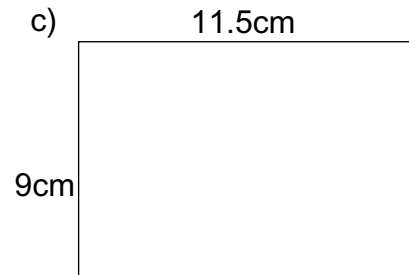
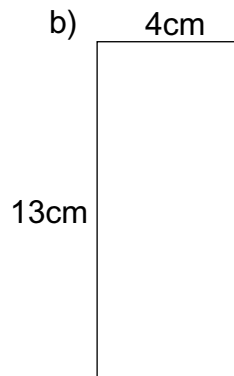
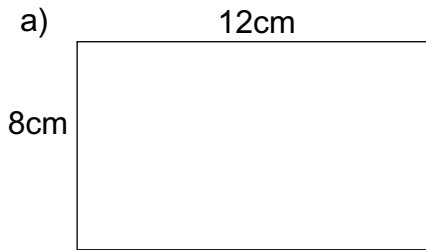
- a) The height of the classroom is approximately ... centimetres.
- b) A glass contains about ... millilitres of orange squash.
- c) A bucket contains about ... litres of water when full.
- d) Mrs Douglas weighs ... kg. Her 14 year old daughter, Hester, weighs ... kg.
- e) Alex filled up his bath with ... litres of water.
- f) Janine lives about 2km from school. She walks home most days. It takes her about ... minutes. Sometimes her dad picks her up in the car. This time it takes her only ... minutes to get home.
- g) A bottle contains 2 litres of lemonade. This will fill about ... glasses?
- h) Martha lives in a house with a small front garden. She says that the distance from the front door to the garden gate is ... metres.
- i) Sam and his friends go into town by bus. They watch a film at the cinema, go to a cafe for a drink then buy a CD. They then go home by bus. All this takes them about ... hours

Area and Perimeter

Do not use a calculator

L.5

1) Calculate the area and perimeter of these shapes.



2) A field is in the shape of a rectangle. It measures 94 metres by 221 metres.

a) What is its area in square metres?

b) If 10,000 square metres make 1 hectare, what is its area in hectares?

3) The driveway to a house has to be re-surfaced. The cost is £56 per square metre. What is the cost for a drive measuring 16 metres by 5 metres?

4) A room measures 4 metres by 6 metres. Carpet costs £24 per square metre and underlay costs £4.50 per square metre. Anna covers the floor with underlay first, then carpet on top of it. What is the total cost?

5) Square wall tiles measure 10cm by 10cm. How many are needed to cover an area of 1 square metre?

Mean

L.5

1) Calculate the mean value and the range of each of these sets of numbers.

a) 5, 6, 5, 7, 8, 4, 6, 5, 8, 4, 5, 3, 7, 9, 8

b) 1.2, 3.4, 2.3, 4.5, 2.8, 5.6, 4.5, 6.7, 8.1, 5.5

c) 345, 349, 340, 341, 346, 346, 345, 347, 349, 342, 339, 341, 338, 346, 346

2) Lizzie has to calculate the mean of these numbers

541, 548, 551 539, 548, 542, 543, 538, 546, 550, 540, 548, 542, 542, 548, 538

She says 'Because the numbers are big and near to one another the average can be calculated like this'

Starting with 540 she says the first is 1 above 540, the second is 8 above, the third is 11 above, the next is 1 below and so on.

So she finds the sum of these differences like this

$$1 + 8 + 11 - 1 + 8 + 2 + 3 - 2 + 6 + 10 + 0 + 8 + 2 + 2 + 8 - 2 = 64$$

She says the average of the big numbers is 540 + the average of the differences

$$\text{i.e. } 540 + (64 \div 16) = 540 + 4 = 544$$

a) Asif now tries it with his numbers.

765, 768, 765, 769, 768, 762, 767, 764, 769, 770, 772, 764, 760, 768

He then makes a list of the differences from 760

$$5 + 8 + 5 + \dots$$

Finish off Asif's list and calculate the mean of the big numbers.

b) In the same way, calculate the mean of these numbers

601, 604, 608, 603, 604, 602, 603, 605, 601, 608

3) Helen played 5 games in a competition. Her mean score for the 5 games was 7.

a) What was her total score for the 5 games?

b) In her next game she scored 1. What was her new mean score for the 6 games?

c) There are 7 games in the competition. In order to qualify for the next round, her average for all 7 games has to be greater than 7. What is the minimum score she must get in the 7th game to qualify?

4) a) What is the mean and range of these numbers?

3, 4, 5, 6, 7, 5, 4, 6, 5

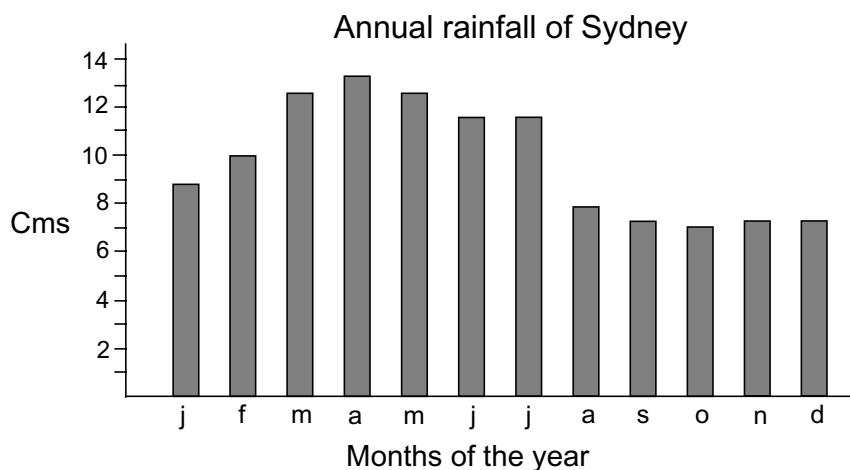
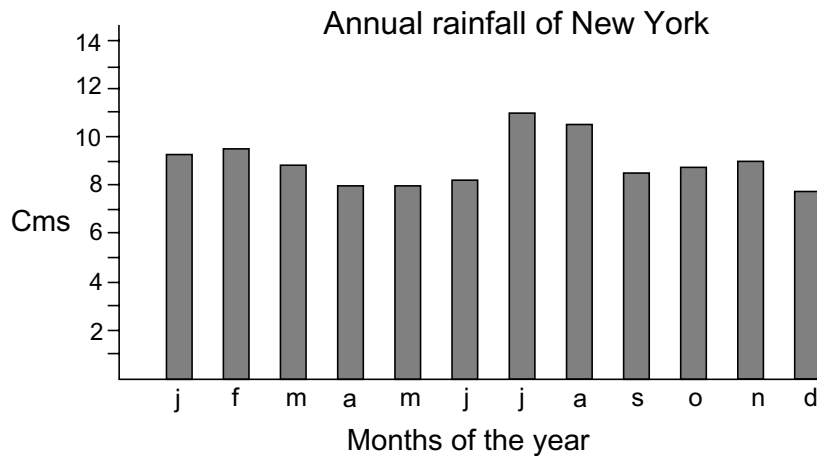
b) These numbers have a mean of 4 and a range of 3. Two of the numbers are missing. What are they?

5, 3, 4, 3, ..., ...

Rainfall

L.5

The bar charts below show the annual rainfall for New York and Sydney

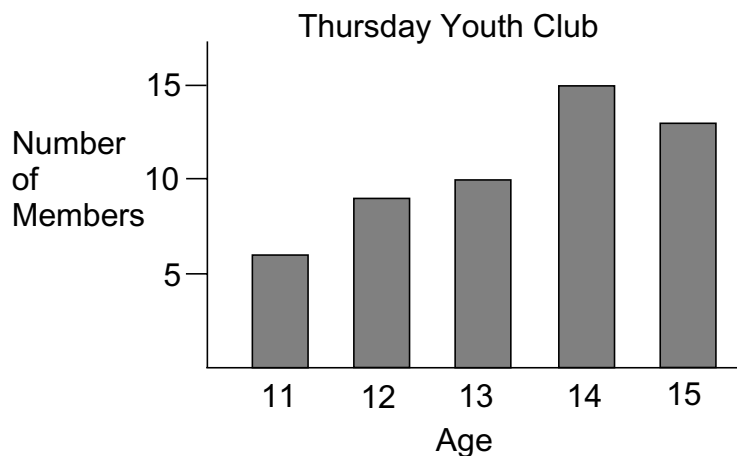
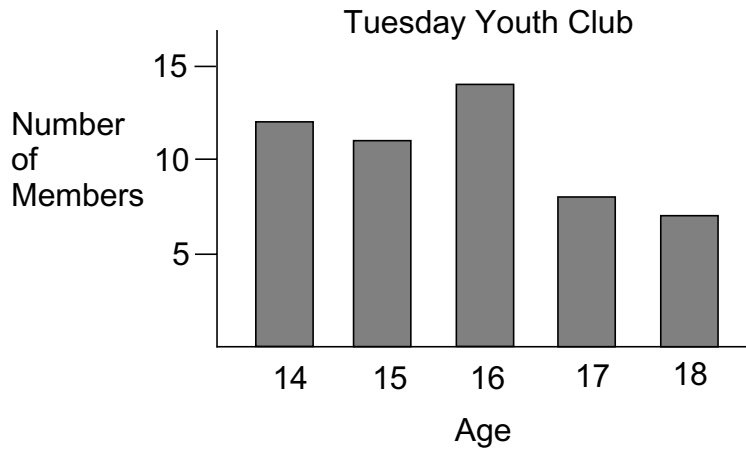


- Which city is the wettest, New York or Sydney?
- Which month is the wettest in New York?
- Which month is wettest in Sydney?
- Which city has the highest mean amount of rain per month? Explain how you know without calculating it.
- What is the range of the monthly rainfall for the year in New York?
- What is the range of the monthly rainfall for the year in Sydney?
- Which consecutive three months are the wettest in Sydney?
- Which consecutive three months are the wettest in New York?
- Which consecutive three months are the driest in Sydney?
- Which consecutive three months are the driest in New York?

Youth Club

L.5

The diagrams below show the attendances at the junior and senior youth clubs.

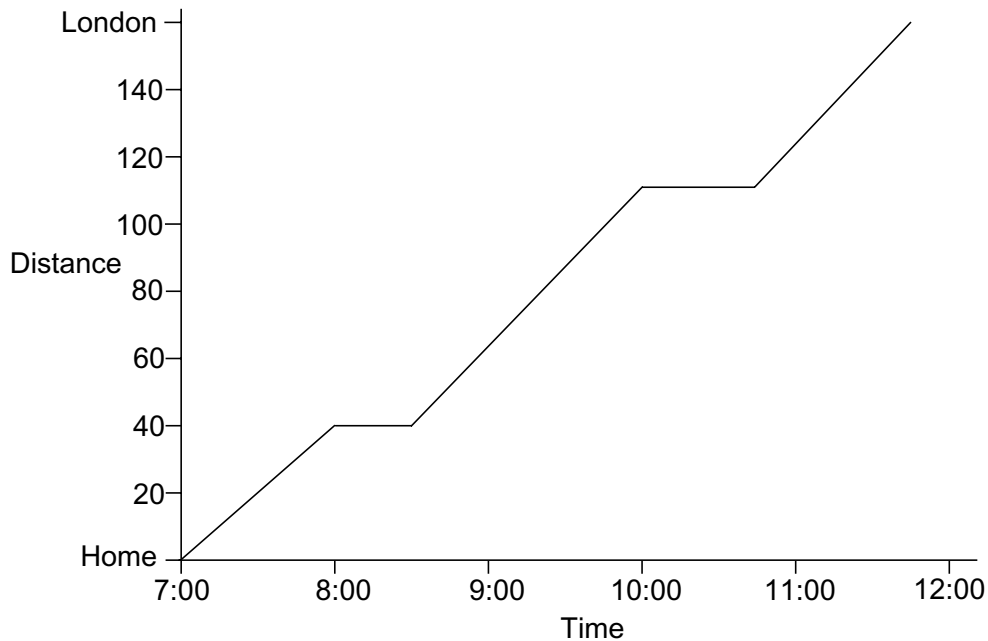


- On what day is the senior youth club?
- How many members attended the Tuesday youth club?
- How many members attended the Thursday youth club?
- What is the modal age of the members of the Tuesday youth club?
- What is the modal age of the members of the Thursday youth club?
- What is the range of the ages for each day?
- What is the minimum age a member must be to be able to go to the senior youth club?
- Four fifteen year olds transfer to the senior youth club from the junior youth club. What affect does this have on the mode and range of each club?

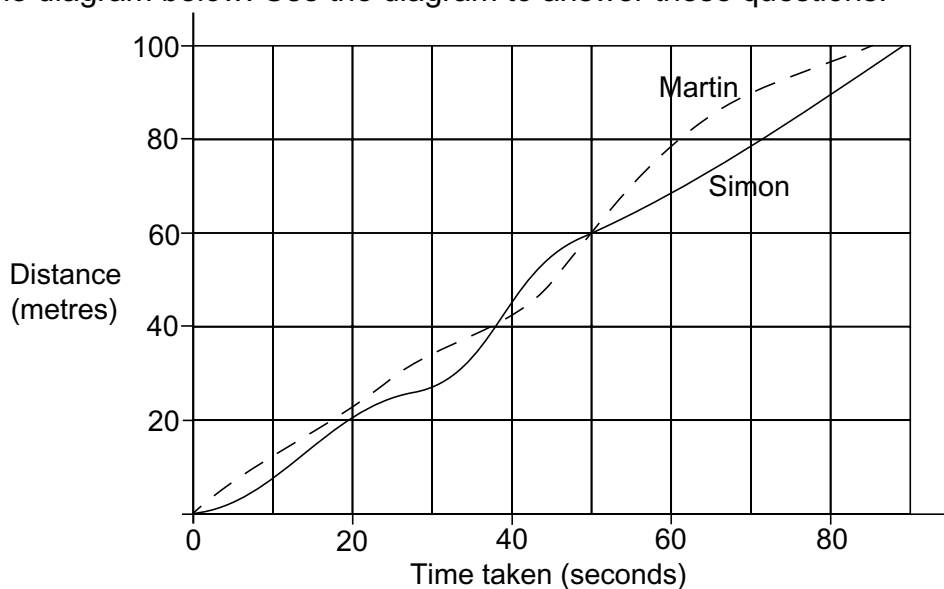
Moving

L.5

- 1) Stefan travels from his home to London by coach, a distance of 160 miles.



- a) If he begins his journey at 7 o'clock, at what time does he arrive in London?
The coach makes two stops on the way.
- b) (i) At what times does the bus stop? (ii) For how long do the stops last?
- c) How far from home is Stefan when the bus makes the stops?
- 2) Two swimmers, Simon and Martin, compete in a 100m race. Their progress is shown in the diagram below. Use the diagram to answer these questions.

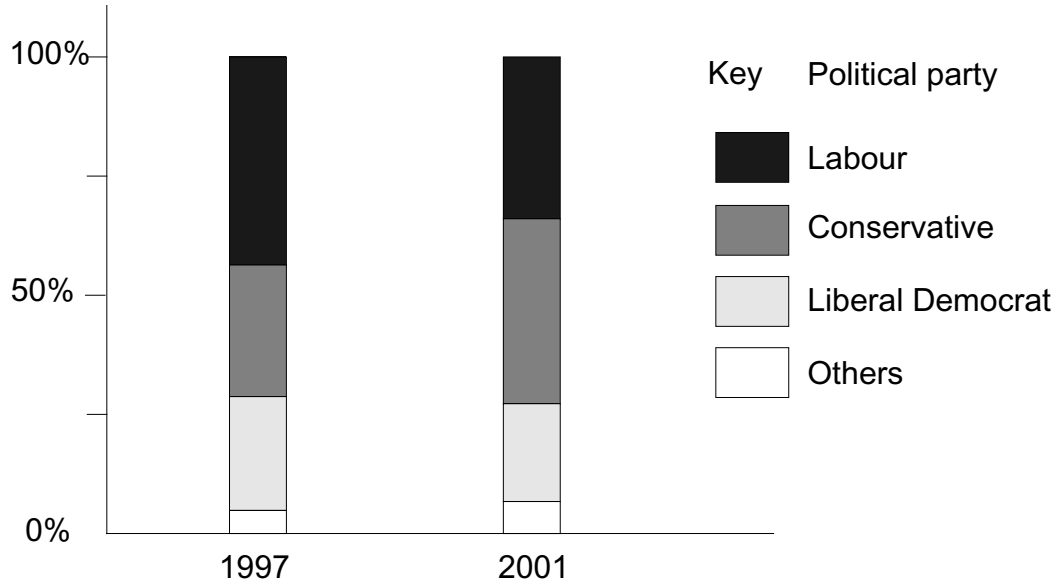


- a) Which swimmer was in the lead first?
- b) What happened at the 40 metre mark?
- c) At what time did Martin take over the lead?
- d) Who won and in what time? Give your answer correct to the nearest second.

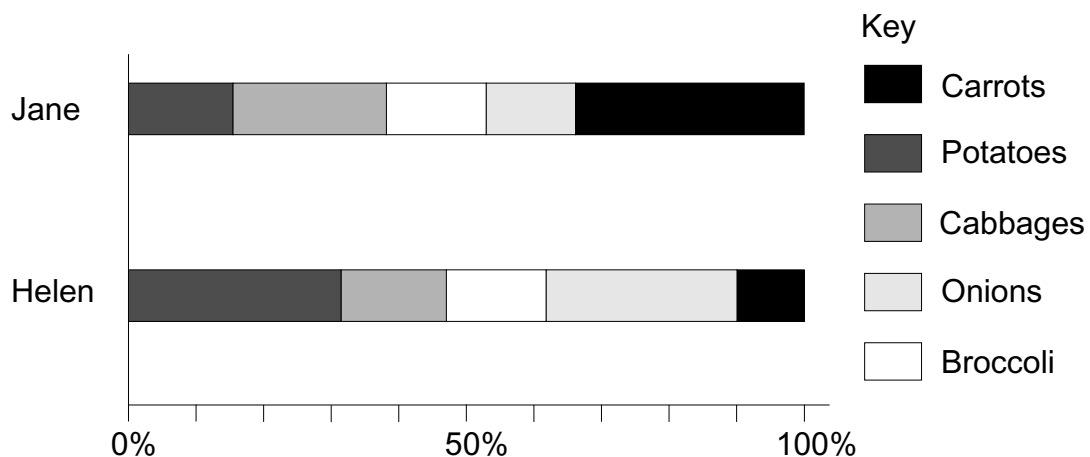
Percentage Bars

L.5

- 1) The diagram shows how people in a town voted in two elections. One in 1997 and the other in 2001.



- Which political party got the most votes in 1997?
 - Which political party got the most votes in 2001?
 - Which parties percentages of the votes were smaller in 2001 than in 1997?
 - What was the approximate Labour share of the votes in 1997?
 - Approximately by what percentage did the Labour share of the vote go down between 1997 and 2001?
- 2) Jane and Helen both have an allotment where they grow vegetables. Both allotments are the same size. The diagram below shows how they are divided up.

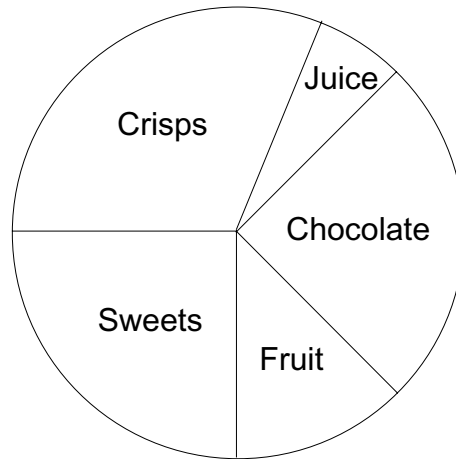


- Who grows the most potatoes?
- Who grows the most cabbages?
- Approximately what percentage of Jane's allotment is given over to carrots?
- Approximately what percentage of Helen's allotment is given over to broccoli?
- The area of each allotment is 400 square metres. What area do each of them allocate to potatoes?

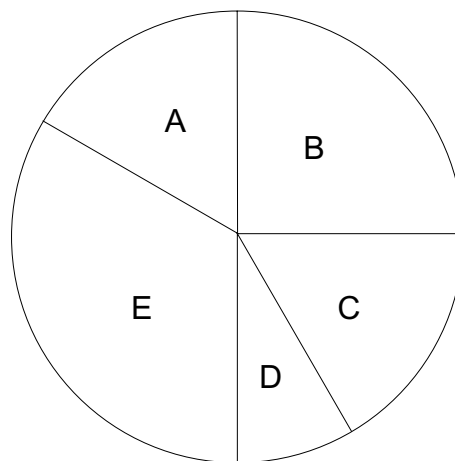
Reading Pie Charts

L.5

- 1) Gina is in charge of the tuck shop. She sells crisps, sweets, fruit, juice and chocolate. The pie chart below shows her sales for Monday.



- What did she sell most of?
 - What did she sell least of?
 - What two items did she sell equal amounts of?
 - Which item made up about 30% of her sales?
- 2) Clara surveys the cars in a car park. She writes down the colour of each car.



When she represents these colours on a pie chart it looks like this. However she has forgotten to put in the colour of the car.

She knows that one third of the cars are blue and a quarter are white. There are the same number of black and red cars. The final area is a mixture which she labels 'others'.

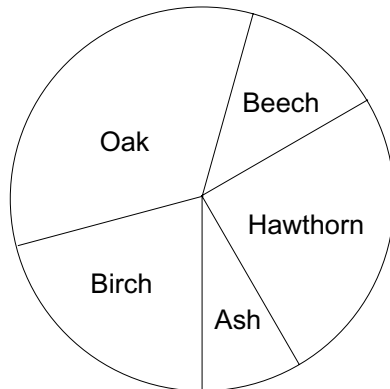
- Which area represents the 'other' colours?
- Which areas represent the four colours of the cars?
- If there were 30 white cars, how many cars were there altogether?
- How many blue cars were in the car park?

Comparing Pie Charts

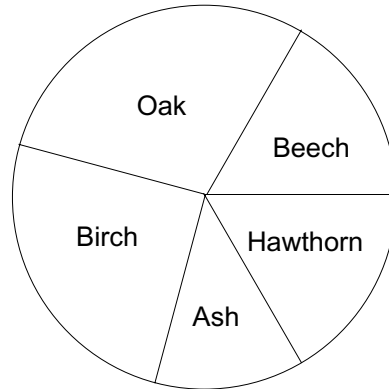
L.5

- 1) Robert lives near two farms. One is owned by Mr Williams and the other by Mr Jones. As part of his school exams he does a survey of the trees on the two farms. He shows his results on these two pie charts.

Farmer Williams

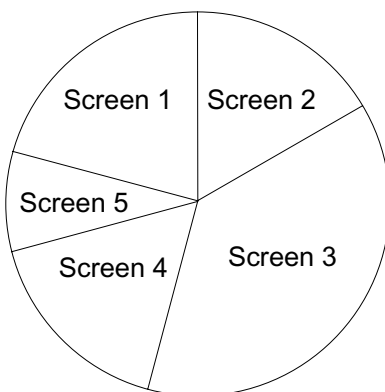


Farmer Jones

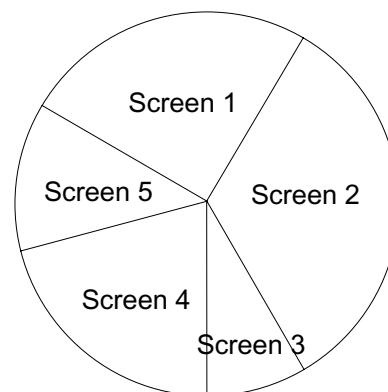


- Which was the most common tree on both farms?
 - Robert's friend David looks at the two charts. He says that he can tell from the charts that farmer Jones has the greatest number of Ash trees. Explain why he is wrong to say this.
 - Farmer Williams has more Beech trees than farmer Jones. What can you say about the total number of trees farmer Williams has?
- 2) The local cinema has 5 screens. The pie charts show which films the public went to see on Saturday and the following Monday. The same films were shown on both days.

Saturday



Monday

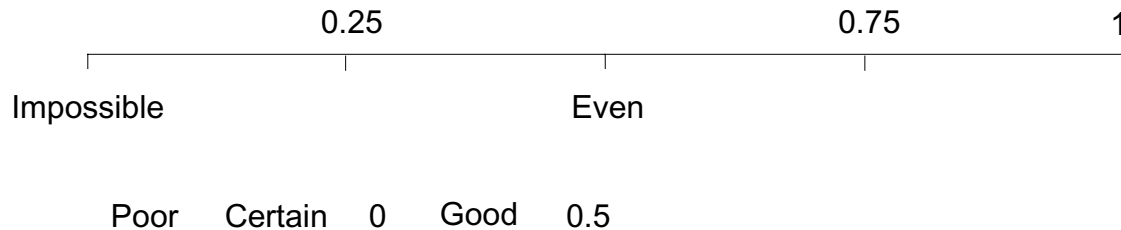


- More people went to see the film at screen 5 on Saturday than Monday. What does this tell you about the total number of people who went to the cinema on these two days?
- Screen 3 shows a children's film. What do the diagrams tell you about the number of people who go to see it?

Chances

L.5.

- 1) The number line represents the probability of something happening. Some words and numbers have been left out. Make a copy of the line and put in the words and numbers.



- 2) A coin is tossed once. What is the probability of it coming down heads? Give your answer as a fraction, decimal and a percentage.
- 3) Alan tosses a coin 10 times. He records his results. He gets 6 heads and 4 tails. Nicola tosses the same coin and gets 4 heads and 6 tails. David says that they should both have got 5 heads and 5 tails, so there is something wrong with the dice. Is David correct? Explain your answer.
- 4) Joel does a survey of the vehicles going down his high street. These are his results.

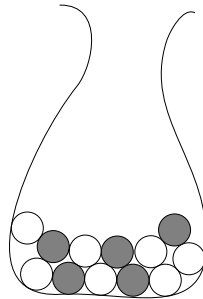
Vehicle	Number
Motorbike	3
Car	27
Bus	1
Bicycle	12
Lorry	2
Van	4

- a) Which vehicle is most likely to go past next? Explain your answer.
- b) Which vehicle is least likely to go past next? Explain your answer.
- 5) A bag contains 10 counters. 5 are green, 3 are red and 2 are white. Each counter has an equal chance of being taken from the bag.
- a) What is the probability of taking a red counter?
- b) What is the probability of taking a green counter?

Taking a Chance

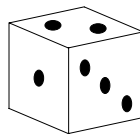
L.5

- 1) A bag contains 12 marbles. Five are red and seven are white.



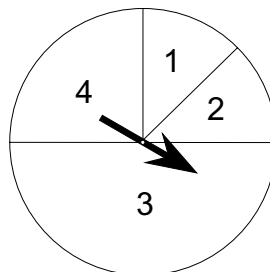
The marbles are thoroughly mixed up and one is taken out at random.

- What colour is the marble most likely to be?
 - What is the probability that it is red?
 - What is the probability that it is white?
 - Which is the largest fraction, the answer to part b or the answer to part c?
- 2) A dice has the numbers 1 to 6 on it.



Hugh says that the dots on opposite faces always add up to the same number.

- What do the dots on opposite faces add up to?
 - The dice is rolled on the table. What is the probability of the number 4 being on the top?
 - Explain why the probability of a 4 being on the top is the same as the probability of a 3 being on the top.
 - Hugh plays a game where he wins if the dice shows a number greater than 2. What is the probability that he wins?
- 3)



- What is the probability of getting a 1 with this spinner?
- What is the probability of getting a 3 with this spinner?
- What is the probability of getting a 4 with this spinner?
- What is the probability of getting a number less than 4?
- What is the probability of getting a multiple of 2?

Spinners

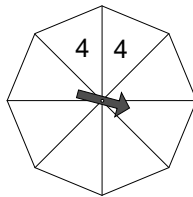
L.5.

1) The diagram shows two spinners.



- What is the probability of getting a 4 on spinner number 1?
- What is the probability of getting a 4 on spinner number 2?
- Which is more likely, getting a 5 on spinner 1 or getting a 5 on spinner 2?
Explain your answer.

2) David designs a spinner. He has to use the numbers 1 to 4. The spinner has 8 sides.



He must obey the following rules.

- It is more likely to spin a 4 than a 3.
- 3 and 2 have an equally likely chance.
- 4 is 3 times more likely than 1.
- 3 is twice as likely as 1.

Complete the spinner for David.

3) John has two spinners, both with the numbers 1, 2, and 3 on. He spins both together and adds together the results.



The table below shows his results

		Spinner 1		
Spinner 2	+	1	2	3
	1	2	3	4
	2	3	4	5
	3	4	5	6

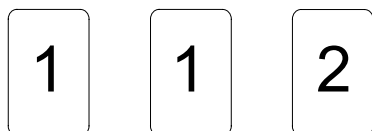
- How many different outcomes are there?
- What is the probability of getting a total of 6?
- What is the probability of getting a total of 5?
- What is the probability of getting a total of 4?

Take a Card

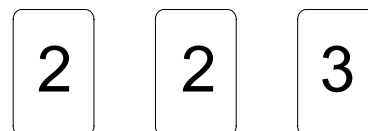
L.5

1) Joanne and Bob both have 3 cards.

Joanne's cards



Bob's cards



They each shuffle their cards and select one at random. They then add together the numbers on the two cards.

The table below shows the results that can be obtained.

		Bob's cards			
		+	2	2	3
Joanne's cards	1	3	3	4	
	1	3	3	4	
	2	4	4	5	

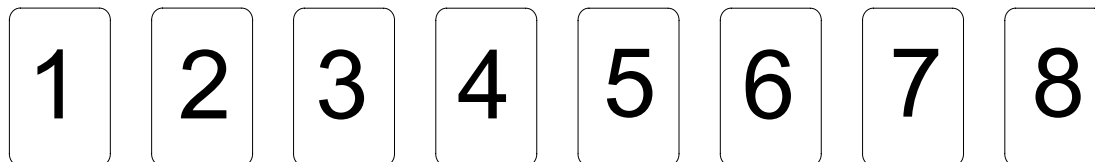
For example. If Bob gets a 2 and Joanne gets a 1 then their result will be 3.

- What is the probability that their result is 3?
- What is the probability that their result is 5?
- What is the probability that their result is less than 5?

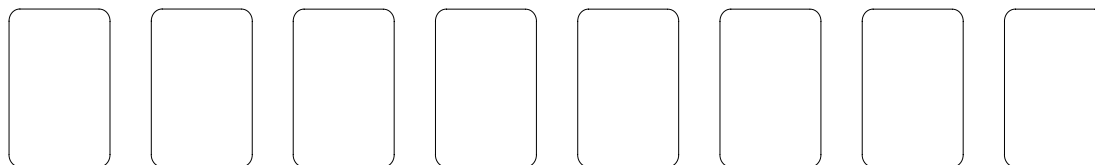
Complete these two sentences

- The probability that the result is greater than is $\frac{5}{9}$.
- The probability that the result is less than is zero.
- Bob says 'The result can only be 3, 4 or 5. This means that the probability of getting a 4 is $\frac{1}{3}$.' Explain why Bob is wrong.

2) Alan has 8 cards numbered 1 to 8.



He shuffles the cards and places them face down on a table, like this.



- What is the probability that the first card in the row is the number 4?
- What is the probability that the last card in the row is less than 6?
- What is the probability that the 4th card along has the number 4 on it?

Different Outcomes

L.5

1) Damian rolls a fair dice. He wants to check the probability of the number 3 appearing on the top of the dice.

a) What is the theoretical probability that the number 3 appears on the top of the dice?

He writes down the number which appears on the top of the dice. He does this 60 times.

b) How many times would you expect the dice to show a number 3?

Damian wants to calculate the probability of the 3 appearing on the dice by using the experimental data he gets.

c) How should he do this?

d) He finds that the 3 appears 9 times. What is the probability he calculates?

Dawn says that she can get a more accurate answer by doing the experiment 600 times.

e) How many times would you expect the dice to show a number 3?

f) She finds that the 3 appears 96 times. What is the probability she calculates?

g) Whose value is closest to the theoretical value, Damian's or Dawn's? Explain your answer.

2) Leslie carries out an experiment. He counts the number of lorries and the total number of vehicles that pass his school. After every half hour he puts his figures onto a table. This is his table

Half hour	Number of lorries	Number of vehicles	Probability of a lorry
1st	9	150	0.06
2nd	11	110	
3rd	13	104	
4th	21	140	
5th	8	125	

He uses the numbers he gets to calculate the probability that the next vehicle to pass will be a lorry. He puts this down in the final column.

a) How does he calculate this probability?

b) Calculate the other probabilities.

Angela says that she can calculate the probability for the whole table.

She does this and gets 0.0985691 on her calculator.

c) How does she calculate this probability?

d) She says that the probability that the next vehicle to pass will be a lorry is about 0.1. Is she correct? Explain your answer.

Trial and Improvement

L.6

- 1) Gareth wants to make two broaches, one circular and one square. They have to be the same area. The circular broach has a diameter of 3.2cm.



- a) Calculate the area of the round broach, correct to the nearest square centimetre.
 b) Gareth knows that the area of the square broach is $x \times x$ square centimetres.
 (x is the length of one side of the square in centimetres)

He begins to calculate its length like this

Length of side	Area of square	
2cm	4cm^2	Too small
3cm	9cm^2	Too large
2.5cm		

Finish off his calculations. Give your answer correct to the nearest millimetre.
 Explain why you chose this value.

- 2) Jack wants to calculate a solution to the equation $x^2 = x + 5$.

These are some of his calculations.

Finish them off, finding an answer correct to 1 decimal place.

Explain why you chose this value

x	x^2	$x + 5$	Difference
2	4	7	3
2.2	4.84	7.2	2.36
2.4			
2.6			
2.7			

Negatives

L.6

- 1) Two numbers multiplied together make -20 .
If one of the numbers is 5 what is the other?
- 2) Two numbers multiplied together make -24 .
If one of the numbers is -4 what is the other?
- 3) Two numbers multiplied together make -30 .
If the numbers make 1 when added, what are the numbers?
- 4) Two numbers multiplied together make -48 .
If the numbers make 8 when added, what are the numbers?
- 5) The square of 7 is 49.
The square of another number is also 49. What number is it?
- 6) In each of the questions below, use one of these eight cards to complete it.

$+4$	-5	$+6$	-7
-8	$+1$	-3	0

- a) $\boxed{+4} - \boxed{} = 3$
- b) $\boxed{-3} - \boxed{} = -4$
- c) $\boxed{+6} - \boxed{} = 2$
- d) $\boxed{+1} - \boxed{} = -5$
- e) $\boxed{-8} + \boxed{+4} - \boxed{} = -4$
- f) $\boxed{-7} - \boxed{-5} - \boxed{} = 1$
- g) $\boxed{+1} + \boxed{-7} - \boxed{} = 1$

Fraction Problems

L.6

- 1) Tara earns £140 per week. She spends $\frac{1}{5}$ of it on food and $\frac{2}{5}$ on rent.
 - a) How much does she spend on food?
 - b) How much does she spend on rent?

- 2) Edwin and Polly share a job. The total pay for the job is £250 per week. They are paid according to the amount of time they work. Edwin works for 24 hours and Polly works for 16 hours.
 - a) What fraction of the week did Edwin work?
 - b) What fraction of the week did Polly work?
 - c) How much per week is Edwin paid?
 - d) How much per week is Polly paid?

- 3) Nicholas earns £320 per week. He has an increase in pay of £20.
 - a) What is his pay rise as a fraction of his old wages?Louisa also has a pay rise of £20. Her new wage is £380.
 - b) What is her pay rise as a fraction of her old wages?

- 4) Harriet has 400 beads, all of the same shape. $\frac{3}{8}$ of them are blue and the remainder are red.
 - a) What fraction of the beads are red?
 - b) How many red beads has she?

- 5) Matthew travels by coach to Prague in the Czech Republic. On the first day he travels 700 kilometres, and on the second day he travels 800 kilometres.
 - a) What is his total journey?
 - b) What fraction of the journey did he do on the first day?
 - c) What fraction of the journey did he do on the second day?Matthew travelled back home along the same route. This time he took three days. On the first day he completed $\frac{2}{5}$ of the journey. On the second day he completed a further $\frac{1}{3}$ of the journey.
 - d) What fraction of the journey did he do on the third day?
 - e) How many kilometres did he do on each of the three days?

- 6) A large tank will hold 8,000 litres of water when full.
 - a) If it is only $\frac{3}{16}$ full, how much water is in it?A further 2,500 litres are added to the tank.
 - b) What fraction of the tank is now full?Oliver has to put more water into the tank until it is $\frac{9}{10}$ full.
 - c) How much more water will he put into it?

Percentage Calculations

L.6

- 1) Naomi counts 550 flowers in her garden. 18% of them are blue and the remainder are red.
 - a) What percentage of the flowers are red?
 - b) How many red flowers are in the garden?

- 2) Alice earns £250 per week. She spends 15% of it on food and 35% on rent.
 - a) How much does she spend on food?
 - b) How much does she spend on rent?

She has an increase in pay of £15.

 - c) What is her pay rise as a percentage of her wages?

Her friend Kim also has a pay rise of £15. Her new wage is £215.

 - d) What is her pay rise as a percentage of her old wages?

- 3) Brian and Ruth win £600 on a lottery. They agree to share the money according to the amount of money they spent on the ticket. Brian's share of the ticket was 55p and Ruth's share was 45p.
 - a) What percentage of the ticket price did Brian pay?
 - b) What percentage of the ticket price did Ruth pay?
 - c) How much of the prize will Brian get?
 - d) How much of the prize will Ruth get?

- 4) Victor travels by coach to Rome. On the first day he travels 600 kilometres, and on the second day he travels 900 kilometres.
 - a) What is his total journey?
 - b) What percentage of the journey did he do on the first day?
 - c) What percentage of the journey did he do on the second day?

Victor travelled back home along the same route. This time he took three days. On the first day he completed 28% of the journey. On the second day he completed a further 35% of the journey.

 - d) What percentage of the journey did he do on the third day?
 - e) How many kilometres did he do on each of the three days?

- 5) A library has 11,000 books when full.
 - a) 15% of the books are in the travel section. How many is this?

A further 5,500 books are in the fiction section.

 - b) What percentage of the books are in the fiction and travel sections combined?

On a particular day Alan the librarian estimates that 18% of the books are out on loan.

 - c) How many books are left in the library?

Fractions, Decimals and Percentages

L.6

1) Change the following decimals into percentages.

- a) 0.8 b) 0.4 c) 0.7 d) 0.65 e) 0.74 f) 0.94 g) 0.345
 h) 0.05 i) 0.532 j) 0.043 k) 0.021 l) 0.030 m) 0.063 n) 0.904

2) Change each of the following percentages into fractions. Simplify the fractions.

- a) 50% b) 60% c) 75% d) 25% e) $33\frac{1}{3}\%$
 f) $66\frac{2}{3}\%$ g) 15% h) 45% i) 35% j) 72%
 k) 91% l) 24% m) 64% n) $62\frac{1}{2}\%$ o) $57\frac{1}{2}\%$

3) Change the following fractions into decimals

- a) $\frac{1}{2}$ b) $\frac{1}{4}$ c) $\frac{1}{5}$ d) $\frac{1}{8}$ e) $\frac{1}{10}$ f) $\frac{1}{100}$ g) $\frac{1}{200}$ h) $\frac{1}{50}$

4) Change each of these fractions into (i) decimals and (ii) percentages

- a) $\frac{2}{5}$ b) $\frac{3}{5}$ c) $\frac{3}{4}$ d) $\frac{3}{10}$ e) $\frac{3}{100}$ f) $\frac{1}{4}$ g) $\frac{1}{40}$ h) $\frac{2}{10}$
 i) $\frac{7}{10}$ j) $\frac{3}{20}$ k) $\frac{9}{20}$ l) $\frac{3}{8}$ m) $\frac{3}{40}$ n) $\frac{13}{20}$ o) $\frac{1}{25}$ p) $\frac{23}{25}$

5) In each of the following, four of the values are equal to each other. Which are they?

- | | | | | | |
|-------------------|-----------------|----------------|------------------|-----------------|-------------------|
| a) $\frac{7}{10}$ | 0.375 | $\frac{7}{20}$ | 0.720 | $\frac{3}{8}$ | $37\frac{1}{2}\%$ |
| 71% | $\frac{17}{20}$ | 38% | 56% | 0.3750 | 27% |
| b) $\frac{3}{5}$ | 0.035 | 37% | $\frac{3}{7}$ | 73% | 0.731 |
| 65% | 0.600 | $\frac{1}{60}$ | 60% | 0.6 | $\frac{1}{6}$ |
| c) $\frac{2}{7}$ | 0.071 | 0.27 | $\frac{27}{100}$ | 0.654 | 27% |
| $\frac{54}{200}$ | 54% | 0.876 | 0.027 | $\frac{6}{54}$ | $2\frac{7}{10}\%$ |
| d) 63% | $\frac{3}{16}$ | 0.603 | $\frac{6}{13}$ | 36% | 0.72 |
| $\frac{9}{25}$ | 0.925 | 0.036 | 0.36 | $\frac{18}{50}$ | 40% |

6) In each of the following, calculate which fraction is the larger.

- a) $\frac{1}{7}$ and $\frac{3}{20}$ b) $\frac{1}{9}$ and $\frac{11}{100}$ c) $\frac{3}{17}$ and $\frac{4}{25}$ d) $\frac{7}{16}$ and $\frac{9}{20}$

Ratios

L.6

- 1) Ewan has to do a survey of the trees in a plantation. He counts them and these are his results

Oak 15, Ash 45, Beech 60 and Horse Chestnut 90

He writes these down as ratios

Oak	Ash	Beech	Horse Chestnut
1	.....	.....	.....

- a) Complete the line of ratios.

Ewan cuts down 10 Oak, 15 Ash, 25 Beech and 35 Horse Chestnut trees.

- b) Complete the new line of ratios.

Oak	Ash	Beech	Horse Chestnut
1	.....	.....	.....

- c) What percentage of the trees are now Beech?

- 2) Duncan works in a kiosk selling drinks, ice cream and sweets. On a warm day in June he finds that 60% of his sales are for drinks, 25% are for ice cream and the rest are for sweets.

- a) Complete the ratios below

Sweets : Ice Cream : Drinks
3 : :

The next day is colder. He finds that his sales of drinks are down by $\frac{3}{4}$, his sales of ice cream are down by $\frac{1}{5}$ and his sales of sweets remain the same.

- b) Complete this ratio line for the second day.

Sweets : Ice Cream : Drinks
3 : :

- c) What percentage of his sales on the second day are for drinks?

- 3) Sally carries out a survey. She counts the different vehicles that pass her school during half an hour in the morning. These were her results.

50 cars, 20 lorries, 10 vans and 5 buses.

- a) Complete the line below to show the ratio.

Buses : Vans : lorries : Cars
1 : : :

She does a second survey in the afternoon. This time the number of buses remains the same, the number of vans increase by 50%, the number of lorries decrease by 50% and the number of cars increase by 30%

- b) What is the total number of vehicles passing Sally over the second period?

- c) Complete this line to show the ratios for the second survey.

Buses : Vans : lorries : Cars
1 : : :

Adding and Subtracting Fractions

Do not use a calculator

L.6

1) Add and subtract these fractions.

a) $\frac{1}{2} + \frac{1}{4}$

b) $\frac{1}{2} + \frac{3}{4}$

c) $\frac{1}{2} - \frac{1}{4}$

d) $1 + \frac{1}{4}$

e) $1 + 1\frac{1}{4}$

f) $2\frac{1}{4} - 1\frac{1}{4}$

g) $1\frac{1}{4} - \frac{3}{4}$

h) $\frac{3}{4} + \frac{3}{4}$

i) $1\frac{3}{4} - \frac{3}{4}$

j) $2\frac{1}{4} - 1\frac{1}{2}$

k) $4\frac{1}{2} + 2\frac{1}{4}$

l) $3\frac{3}{4} + 2\frac{1}{4}$

m) $6\frac{1}{4} - 2\frac{1}{2}$

n) $2\frac{1}{2} - 1\frac{3}{4}$

o) $1\frac{3}{4} + 3\frac{1}{2}$

p) $3\frac{1}{2} - 2\frac{3}{4}$

2) Add and subtract these fractions.

a) $\frac{3}{5} + \frac{1}{5}$

b) $\frac{3}{10} + \frac{4}{10}$

c) $\frac{3}{8} + \frac{4}{8}$

d) $\frac{3}{6} + \frac{2}{6}$

e) $\frac{2}{20} + \frac{1}{20}$

f) $\frac{1}{10} + \frac{6}{10}$

g) $\frac{9}{10} - \frac{2}{10}$

h) $\frac{7}{16} - \frac{2}{16}$

i) $\frac{5}{12} + \frac{2}{12}$

j) $\frac{7}{15} - \frac{3}{15}$

k) $\frac{8}{21} - \frac{4}{21}$

l) $\frac{6}{18} + \frac{7}{18}$

m) $\frac{14}{24} - \frac{7}{24}$

n) $\frac{13}{17} + \frac{3}{17}$

o) $\frac{14}{15} - \frac{3}{15}$

p) $\frac{7}{10} + \frac{2}{10}$

3) Cancel down these fractions into their lowest terms.

a) $\frac{3}{9}$

b) $\frac{3}{12}$

c) $\frac{2}{8}$

d) $\frac{4}{8}$

e) $\frac{4}{20}$

f) $\frac{5}{20}$

g) $\frac{12}{24}$

h) $\frac{7}{21}$

i) $\frac{10}{15}$

j) $\frac{15}{36}$

k) $\frac{15}{50}$

4) Change these pairs of fractions into fractions having the same denominator.

a) $\frac{4}{20}$ and $\frac{4}{5}$

b) $\frac{3}{12}$ and $\frac{1}{6}$

c) $\frac{5}{15}$ and $\frac{4}{5}$

d) $\frac{1}{2}$ and $\frac{4}{5}$

e) $\frac{3}{4}$ and $\frac{1}{5}$

f) $\frac{2}{7}$ and $\frac{3}{4}$

g) $\frac{4}{9}$ and $\frac{3}{6}$

h) $\frac{2}{12}$ and $\frac{2}{9}$

i) $\frac{2}{11}$ and $\frac{1}{3}$

j) $\frac{5}{7}$ and $\frac{4}{21}$

k) $\frac{7}{10}$ and $\frac{2}{5}$

l) $\frac{3}{16}$ and $\frac{5}{12}$

5) Add together these pairs of fractions (simplify wherever necessary)

a) $\frac{1}{15} + \frac{4}{5}$

b) $\frac{1}{8} + \frac{3}{4}$

c) $\frac{5}{9} + \frac{1}{3}$

d) $\frac{3}{10} + \frac{1}{4}$

e) $\frac{1}{8} + \frac{3}{20}$

f) $\frac{7}{15} + \frac{1}{3}$

g) $\frac{1}{14} + \frac{1}{7}$

h) $\frac{6}{20} + \frac{1}{4}$

i) $\frac{7}{8} + \frac{1}{12}$

j) $\frac{3}{7} + \frac{1}{4}$

6) Subtract these pairs of fractions (simplify wherever necessary)

a) $\frac{11}{15} - \frac{1}{5}$

b) $\frac{9}{14} - \frac{1}{7}$

c) $\frac{17}{20} - \frac{1}{10}$

d) $\frac{7}{8} - \frac{1}{16}$

e) $\frac{6}{7} - \frac{1}{2}$

f) $\frac{13}{15} - \frac{1}{20}$

g) $\frac{17}{18} - \frac{3}{4}$

h) $\frac{5}{9} - \frac{1}{4}$

i) $\frac{7}{10} - \frac{1}{2}$

j) $\frac{5}{6} - \frac{3}{20}$

More Fractions

Do not use a calculator

L.6

1) Add together these pairs of fractions.

Write down your answers in their simplest form

a) $\frac{11}{20} + \frac{3}{5}$

b) $\frac{9}{10} + \frac{1}{5}$

c) $\frac{11}{20} + \frac{3}{5}$

d) $\frac{7}{8} + \frac{3}{16}$

e) $\frac{4}{7} + \frac{3}{4}$

f) $\frac{4}{5} + \frac{13}{20}$

g) $\frac{17}{20} + \frac{1}{4}$

h) $\frac{5}{7} + \frac{1}{2}$

i) $\frac{6}{11} + \frac{3}{4}$

j) $\frac{7}{10} + \frac{13}{25}$

k) $\frac{9}{15} + \frac{5}{6}$

l) $\frac{7}{12} + \frac{3}{4}$

m) $\frac{5}{11} + \frac{2}{3}$

n) $\frac{9}{10} + \frac{1}{2}$

o) $\frac{5}{8} + \frac{9}{16}$

p) $\frac{13}{15} + \frac{1}{3}$

q) $\frac{11}{14} + \frac{3}{7}$

r) $\frac{9}{20} + \frac{3}{4}$

s) $\frac{5}{8} + \frac{7}{12}$

t) $\frac{5}{9} + \frac{2}{3}$

2) Add and subtract these fractions.

a) $1\frac{11}{15} + \frac{2}{5}$

b) $1\frac{9}{20} - \frac{3}{5}$

c) $1\frac{9}{20} + \frac{2}{5}$

d) $1\frac{7}{9} - \frac{5}{18}$

e) $2\frac{4}{5} - \frac{1}{4}$

f) $2\frac{3}{5} + \frac{7}{20}$

g) $2\frac{13}{20} - \frac{1}{2}$

h) $2\frac{5}{6} + \frac{1}{2}$

i) $2\frac{3}{11} + 2\frac{1}{4}$

j) $2\frac{7}{20} - 1\frac{13}{40}$

k) $2\frac{7}{12} + 2\frac{1}{6}$

l) $2\frac{5}{6} - 1\frac{3}{5}$

m) $\frac{4}{11} + 3\frac{1}{3}$

n) $3\frac{9}{14} - 2\frac{1}{7}$

o) $2\frac{3}{8} - \frac{7}{16}$

p) $6\frac{2}{5} + 2\frac{2}{3}$

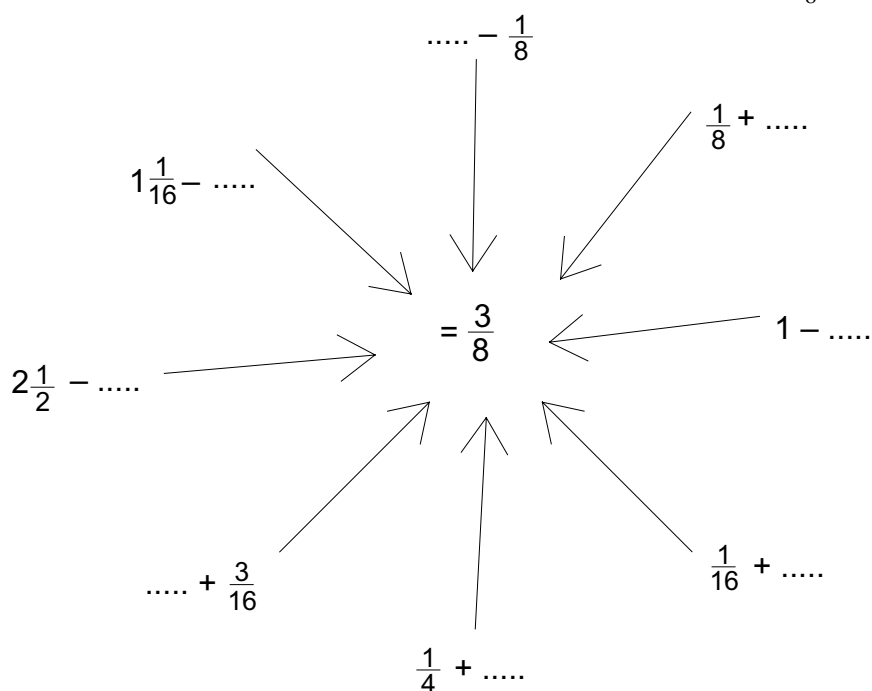
q) $2\frac{11}{15} - 1\frac{3}{5}$

r) $5\frac{11}{20} + \frac{1}{4}$

s) $3\frac{7}{10} + 3\frac{7}{15}$

t) $4\frac{5}{11} - 1\frac{1}{2}$

3) Fill in the missing numbers in the following. All the answers are $\frac{3}{8}$.



Numbers for Letters

L.6

- 1) Mrs Wilson sells plants and trees at her roadside stall. Plants are sold for £3 each and the trees for £5 each. She uses the equation $T = 3x + 5y$ to calculate the total amount of money she earns during one day. x represents the number of plants sold and y represents the number of trees sold.
 - a) On one day she sold 17 plants and 11 trees. Calculate how much money she earned.
 - b) Calculate the amount of money she earns if she sells 7 trees and 15 plants.
 - c) On another day she sold 20 plants and earned £90. Calculate how many trees she sold.
 - d) On the next day she earned £100 and sold 5 trees. Calculate how many plants she sold.

- 2)
 - a) If $T = 3x + 7y$ calculate T when $x = 4$ and $y = 6$
 - b) If $T = 4x + 6y$ calculate T when $x = 7$ and $y = 9$
 - c) If $T = 9x + 3y$ calculate T when $x = 9$ and $y = 11$
 - d) If $T = 7x + 4y$ calculate T when $x = 20$ and $y = 32$
 - e) If $T = 2x + 5y$ calculate x when $T = 19$ and $y = 3$
 - f) If $T = 4x + 3y$ calculate x when $T = 38$ and $y = 6$
 - g) If $T = 4x + 7y$ calculate y when $T = 50$ and $x = 2$
 - h) If $T = 5x + 10y$ calculate y when $T = 105$ and $x = 5$

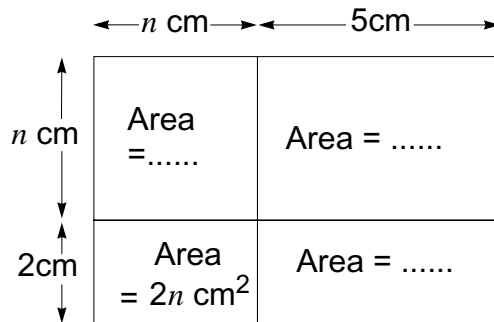
- 3)
 - a) If $T = 4x - 3y$ calculate T when $x = 5$ and $y = 2$
 - b) If $T = 5x - 2y$ calculate T when $x = 2$ and $y = 3$
 - c) If $T = 9x - 5y$ calculate T when $x = 5$ and $y = 6$
 - d) If $T = 5x - 5y$ calculate T when $x = 23$ and $y = 19$
 - e) If $T = 7x - 2y$ calculate x when $T = 12$ and $y = 1$
 - f) If $T = 5x - 3y$ calculate x when $T = 35$ and $y = 5$
 - g) If $T = 5x - 7y$ calculate y when $T = 11$ and $x = 5$
 - h) If $T = 10x - 10y$ calculate y when $T = 30$ and $x = 7$

- 4) The formula for calculating the area of a circle is $A = \pi r^2$. 'A' represents the area, 'r' represents the radius of the circle and $\pi = 3.142$. Calculate -
 - a) the value of A when $r = 4$
 - b) the value of A when $r = 5.23$
 - c) the value of r when $A = 113.112$
 - d) Phoebe gets a value of 13.684 for A when $r = 2$. When she checks it she finds that it is wrong. What is her mistake and what should the answer be?

Multiplying a Bracket by a Bracket

L.6

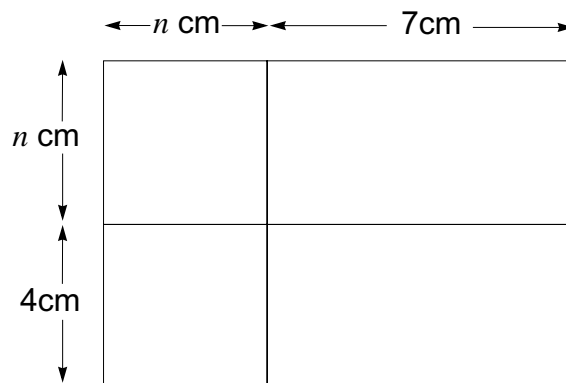
- 1) The area of this rectangle is $(n + 5) \times (n + 2) \text{ cm}^2$



It is split up into four smaller rectangles. The area of one of these rectangles has been written down.

- What are the areas of the other three small rectangles?
- The total area of the large rectangle is the sum of these smaller rectangles.
What is the sum of the areas of the four smaller rectangles? Write down your answer in its simplest form.
- What is $(n + 5)(n + 2)$ when multiplied out?

- 2) This rectangle measures $(n + 7) \text{ cm}$ by $(n + 4) \text{ cm}$.



- Write down the areas of the four smaller rectangles.
- Add together these four areas and simplify your answer.
- Complete this equation $(n + 7)(n + 4) = \dots$

- 3) In each of the following, draw rectangles to represent the two expressions.

Use the diagrams to calculate the area of the large rectangle.

Simplify your answer to find the product of the two expressions.

- $(n + 3)$ and $(n + 6)$
- $(n + 10)$ and $(n + 2)$
- $(2n + 3)$ and $(n + 2)$
- $(3n + 5)$ and $(n + 1)$

Finding the Missing Expression

L.6

- 1) Each of these expressions has been simplified. Part has been left out each time. Write down what is missing.

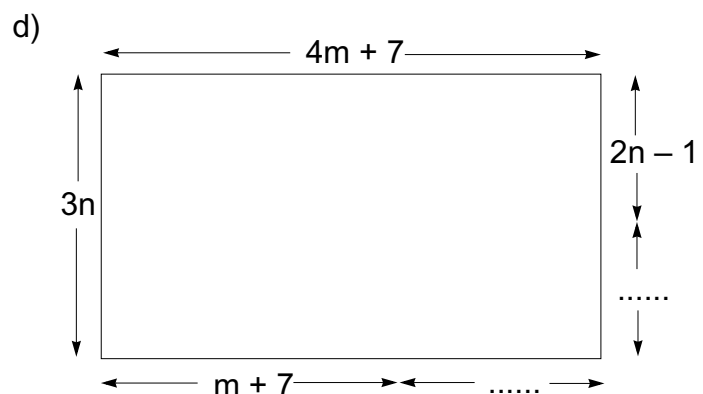
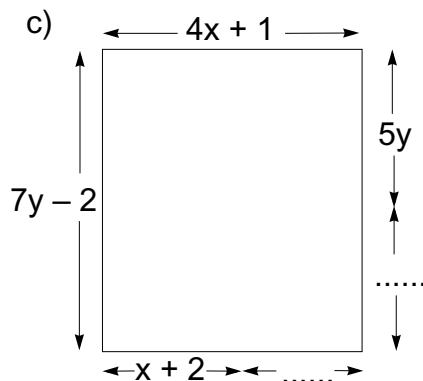
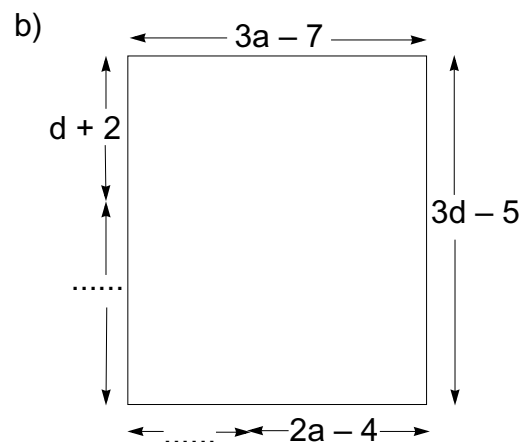
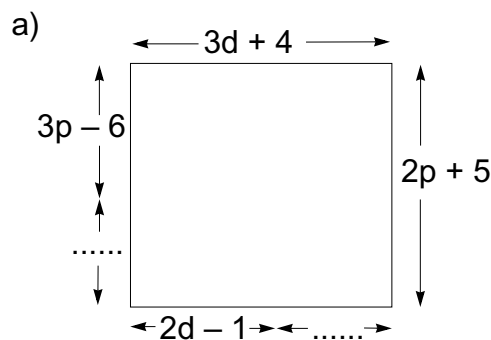
a) $2a + 5 + \dots = 2a + 6$	b) $6d + 7 + \dots = 6d + 10$	c) $7a + 5 - \dots = a + 5$
d) $4x - 3 + \dots = 4x + 7$	e) $5y - 6 + \dots = 7y - 6$	f) $3x + 6 - \dots = 3x + 5$
g) $5p + 5 - \dots = 5 - 2p$	h) $7r + 3 - \dots = 3 + 3r$	i) $6f - 5 - \dots = -5 - f$
j) $6g - 6 + \dots = 6g + 3$	k) $k + 5 - \dots = 5 - k$	l) $3m - 4 - \dots = -4 - m$

- 2) Fill in the blanks in each of the following. The first has been done for you.

a) $5a + 4 = 2a + \dots$	Answer is $2a + 3a + 4$	
b) $7b + 5 = 3b + \dots$	c) $5y + 7 = 2y + \dots$	d) $7x + 6 = 4x + \dots$
e) $5y - 6 = 2y - 2 + \dots$	f) $7c - 5 = 4c + \dots$	g) $7w - 4 = w + 1 + \dots$
h) $3c + 2 = 4c - 2 + \dots$	i) $5w + 7 = 3w + \dots$	j) $4s - 3 = s + \dots$
k) $4x + 3 = 5x + \dots$	l) $3y - 5 = 4y - \dots$	m) $6a - 5 = 9a - \dots$

- 3) Write down an expression for each of the missing lengths in each of these rectangles.

Write down each expression as simply as possible.



Making Magic Squares

L.6

1) This is a rule for working out magic squares.

a) Check that each line, column and diagonal will give $3n$.

$n + 3$	$n - 2$	$n - 1$	$\rightarrow n + 3 + n - 2 + n - 1 = 3n$
$n - 4$	n	$n + 4$	\rightarrow
$n + 1$	$n + 2$	$n - 3$	\rightarrow

\swarrow \downarrow \downarrow \downarrow \searrow

This magic square shows the numbers when $n = 5$.

8	3	4	$= 15$
1	5	9	
6	7	2	

Check that each line, column and diagonal adds up to 15.

b) What are the numbers in a magic square when $n = 7$?

c) Make up some of your own magic squares using this rule.

2) This is another rule for magic squares.

a) Complete all the small squares in terms of n

	$n + 4$		$\rightarrow n + 1 + n + 4 + n - 5 = 3n$
$n - 6$	n		\rightarrow
$n + 5$		$n - 1$	\rightarrow

\swarrow \downarrow \downarrow \downarrow \searrow

b) Use the rule above to complete these magic squares

	12	

	18	

		10

10		

3) Using the ideas you have gained from questions 1 and 2, invent a rule to calculate a $3n$ magic square.

Tiling Patterns

L.6

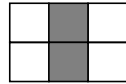
1) These patterns are made from grey and white square tiles.

1st pattern



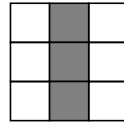
1 grey
2 white

2nd pattern



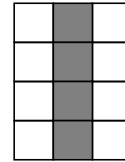
2 grey
4 white

3rd pattern



3 grey
6 white

4th pattern

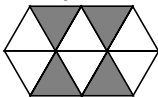


4 grey
8 white

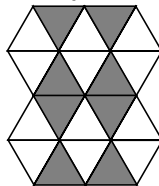
- In this sequence, by how many does the grey tile increase each time?
- By how many does the white tile increase each time?
- How many tiles will be needed for the 8th pattern?
- How many white tiles will be needed for the n th pattern?

2) These patterns are made from grey and white triangular tiles.

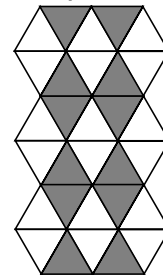
1st pattern



2nd pattern



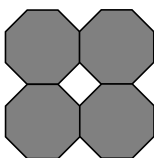
3rd pattern



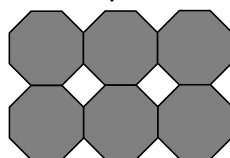
- In this sequence, by how many tiles do the grey tiles increase each time?
- By how many do the white tile increase each time?
- How many tiles will be needed for the 8th pattern?
- How many tiles will be needed for the n th pattern?
- A pattern has 78 white tiles in it. How many grey tiles will it have?

3) These patterns are made from square and octagonal tiles.

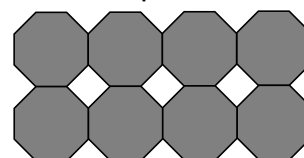
1st pattern



2nd pattern



3rd pattern

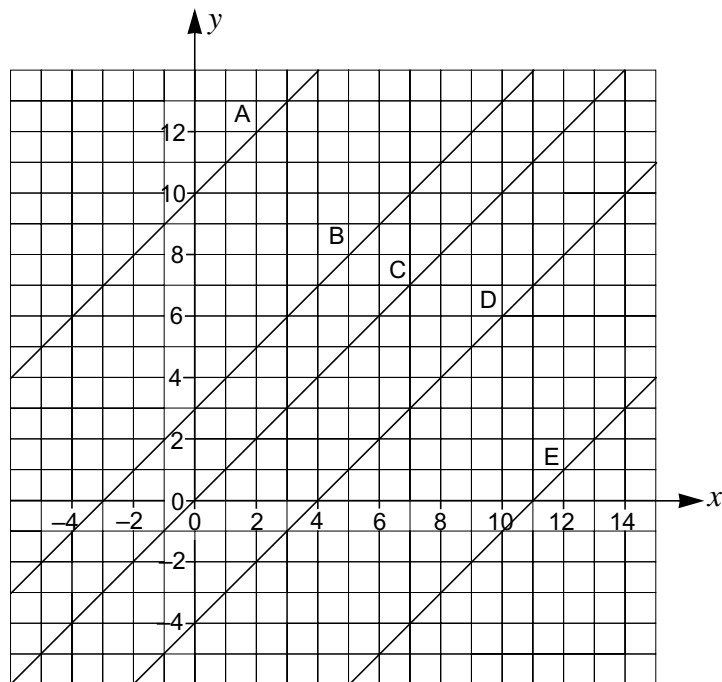


- In this sequence, by how many does the octagonal tile increase each time?
- By how many does the square tile increase each time?
- How many octagonal tiles will be needed for the 8th pattern?
- How many square tiles will be needed for the 8th pattern?
- How many octagonal tiles will be needed for the n th pattern?
- How many square tiles will be needed for the n th pattern?
- What is the total number of tiles needed for the n th pattern?

Equations of Parallel Lines

L.6

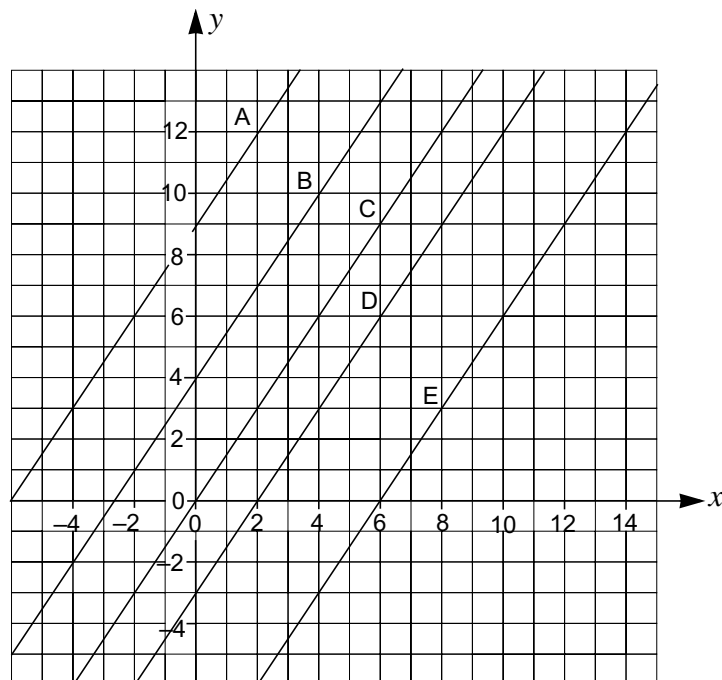
1)



The equation which represents line A is $y = x + 10$

What are the equations of the other lines?

2)



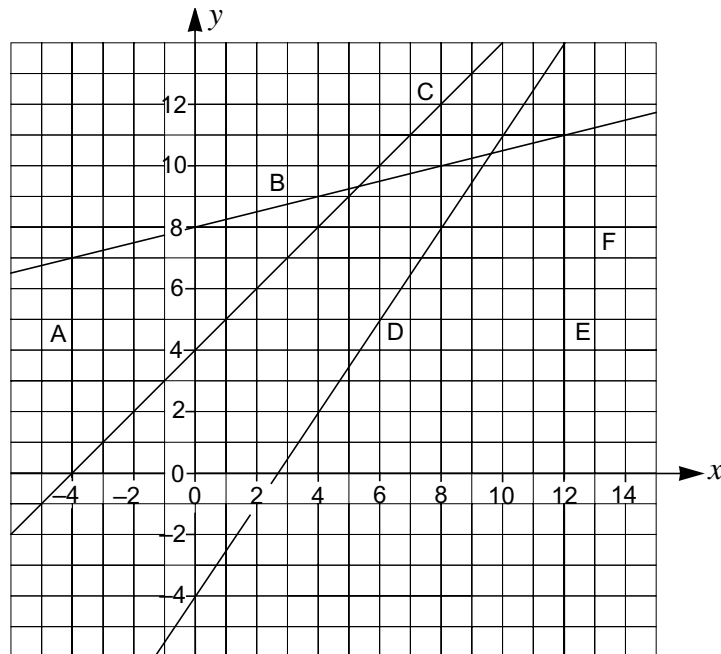
The equation of line A is $y = \frac{3}{2}x + 9$

What are the equations of the other lines?

Graphs of Equations

L.6

1)



Which line has the equation

a) $y = \frac{3}{2}x - 4$

b) $x = 12$

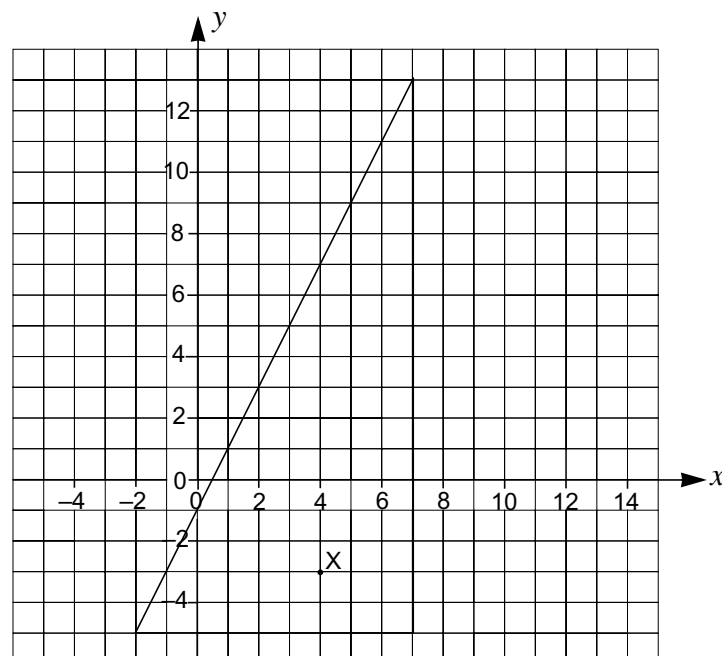
c) $y = x + 4$

d) $y = \frac{1}{4}x + 8$

e) $x = -4$

f) $y = 8$

2)



The diagram shows a rectangle with one of its diagonals.

a) What are the equations of the four sides of the rectangle?

b) What is the equation of the diagonal?

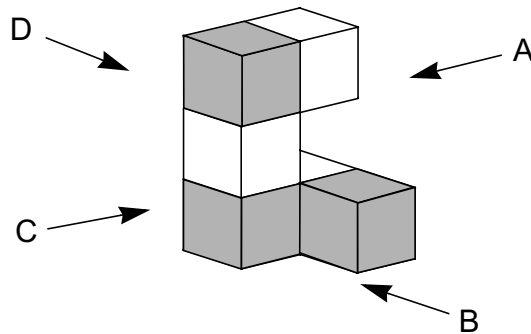
c) Draw a line parallel to this diagonal through the point X.

d) What is the equation of this line?

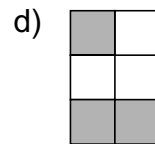
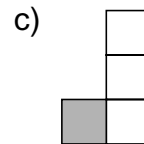
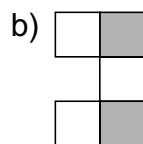
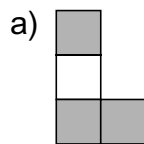
Viewing Shapes

L.6

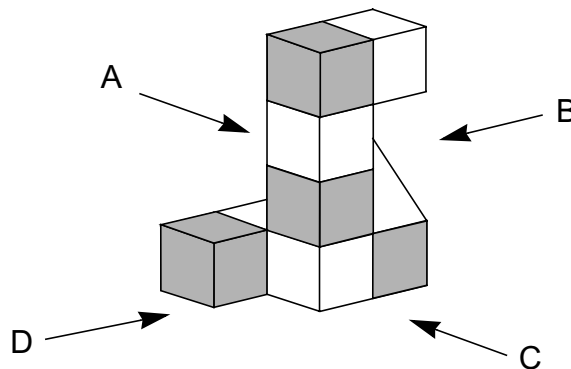
1) The diagram shows a shape made from 3 white and 3 red cubes.



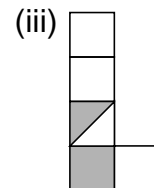
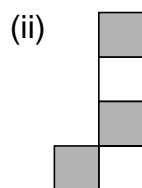
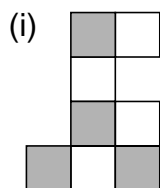
The diagrams below are views from the four directions A, B, C and D. Which is which?



2) This shape is made from four red cubes and $4\frac{1}{2}$ white cubes.



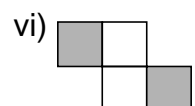
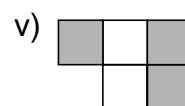
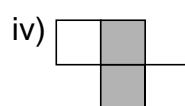
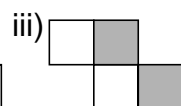
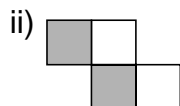
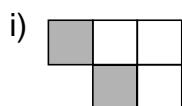
Three views are shown from three different directions. One view is missing.



a) Which views are shown?

b) Draw the view which is missing.

c) Two of the diagrams below show a view looking down on the top of the shape. Which are they?

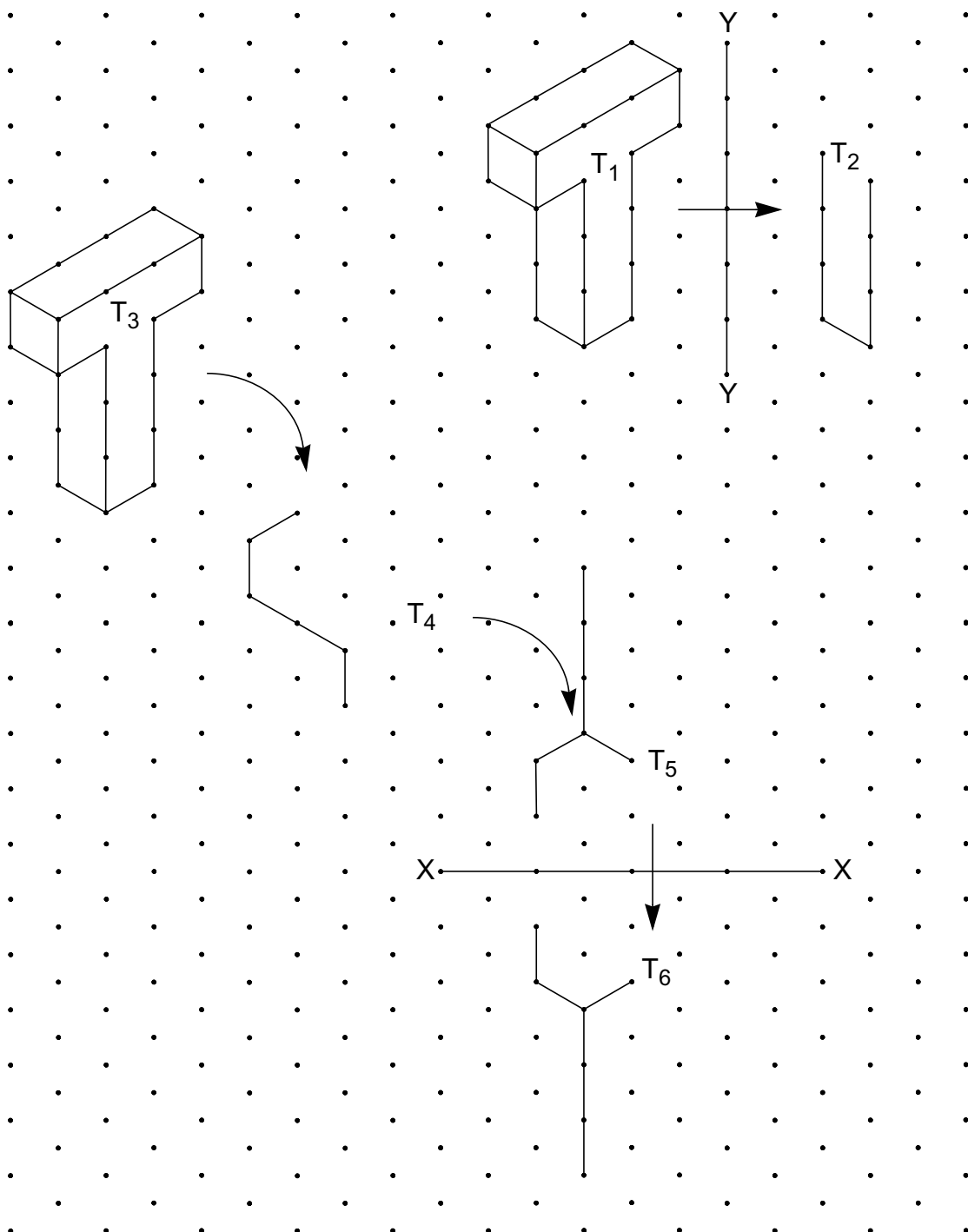


Drawing T's

L.6

Complete the drawings for these transformations.

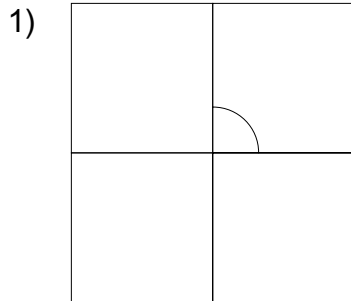
- T_1 is reflected across the line Y-Y to make T_2 . Complete T_2 .
- T_3 is rotated $\frac{1}{4}$ of a turn to make T_4 . Complete T_4 .
- T_4 is rotated $\frac{1}{4}$ of a turn to make T_5 . Complete T_5 .
- T_5 is reflected across the line X-X to make T_6 . Complete T_6 .



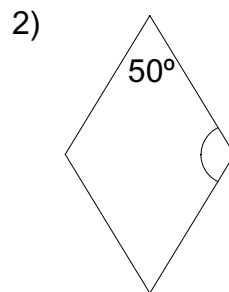
Properties of Quadrilaterals

L.6

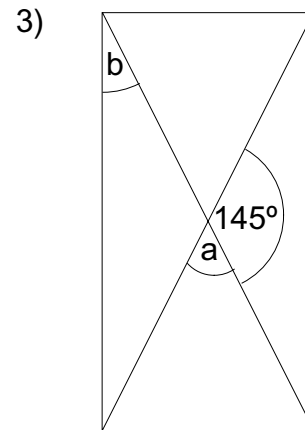
In each of the following shapes calculate the sizes of the unknown angles.



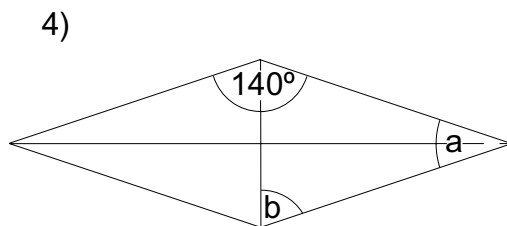
Four identical square tiles are put together.



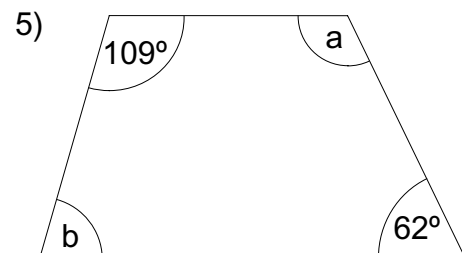
In this tile, all four sides are of equal length



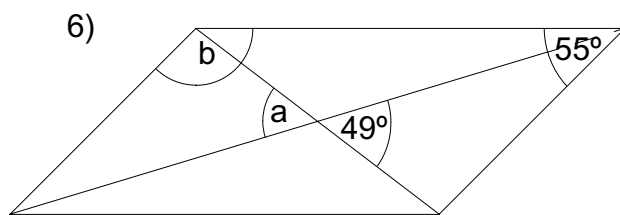
In this shape, opposite sides are parallel and equal in length and corner angles are 90°



In this shape, all four sides are equal in length

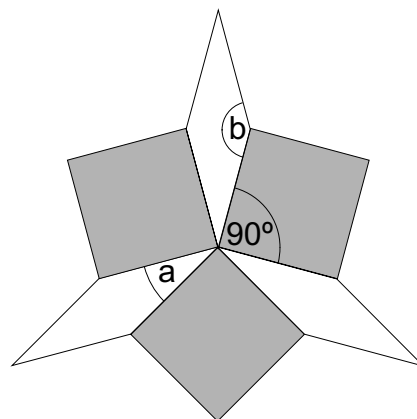


The top and bottom sides of this quadrilateral are parallel



The opposite sides of this quadrilateral are parallel

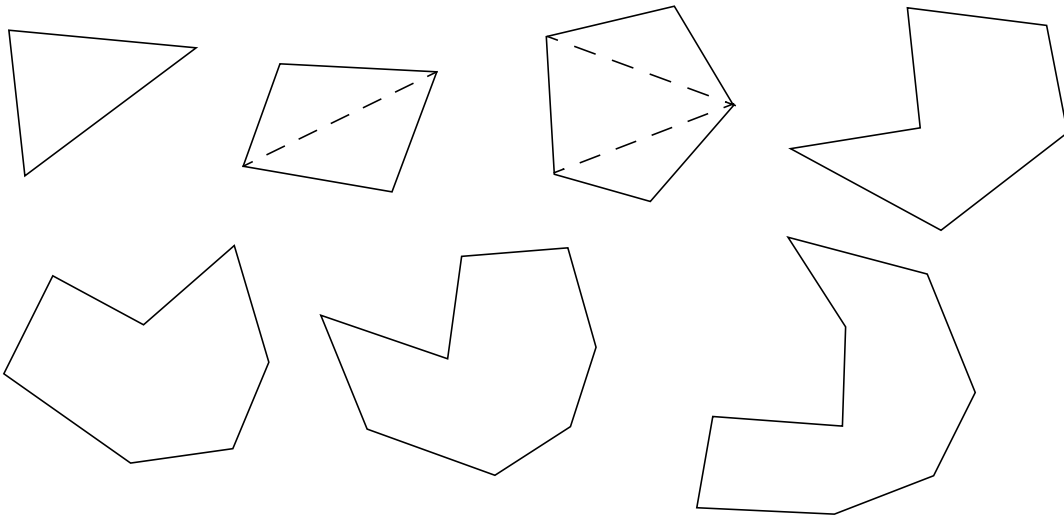
- 7) This shape is made from three identical white tiles and three identical grey tiles. All the sides of the tiles are equal in length.



Angles of Polygons

L.6

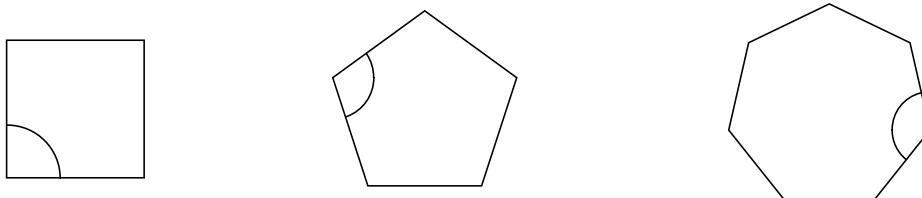
1) The diagram shows a number of polygons.



Use these polygons to complete this table. The first two lines have been done.

Diagram name	Number of sides	Number of triangles x	$x \times 180^\circ$	Sum of interior angles
Triangle	3	1	180°	180°
Quadrilateral	4	2	360°	360°
	5			
	6			
	7			
	8			
	9			
	n			

2) In a regular polygon, all the interior angles are equal.

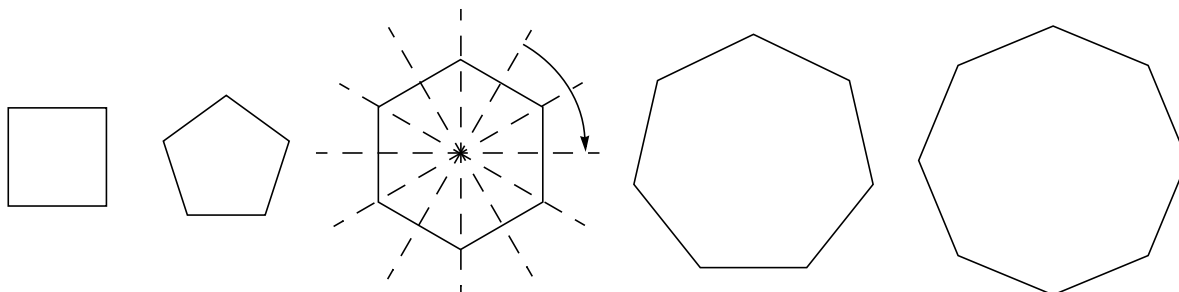


- Mary knows what the sum of the interior angles of her regular polygon are. What does she have to do to calculate one of the interior angles?
- If a regular polygon has n sides, what is the rule for calculating one of the interior angles?
- Calculate the interior angles of these regular polygons.
 - Hexagon
 - Octagon
 - Decagon

Symmetry of Polygons

L.6

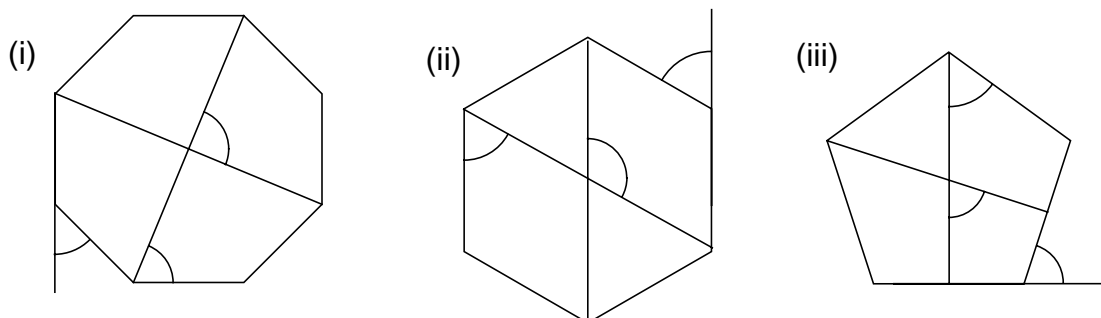
- 1) The diagram shows 5 regular polygons. The hexagon has all of its lines of symmetry shown.



Complete the table below for other regular polygons.

Name of regular polygon	Lines of symmetry	Order of rotational symmetry
Hexagon	6	6
Square		
Equilateral triangle		
Octagon		
Heptagon		
Pentagon		

- 2) Three regular polygons are shown below. Each diagram shows two lines of symmetry and the exterior angle is marked.



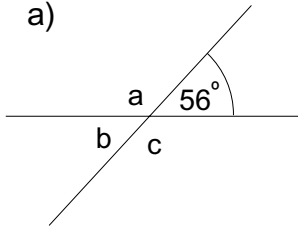
- a) Use the rule $x = \frac{180^\circ(n-2)}{n}$ to calculate the interior angle for each shape.
- b) Use this angle to help calculate the three other angles marked. In each case explain how you do the calculation.

Intersecting and Parallel Lines

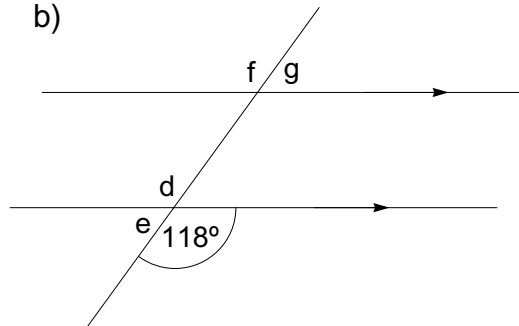
L.6

In questions a to f calculate the sizes of the marked angles

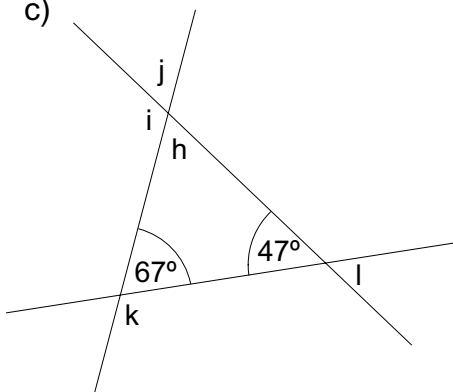
a)



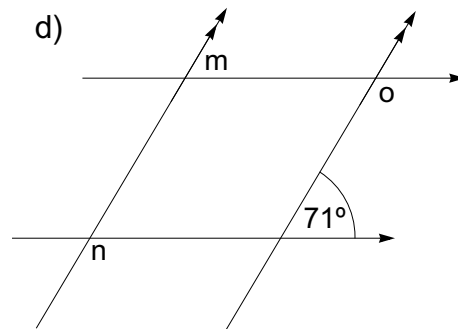
b)



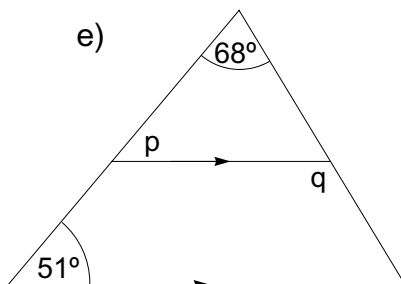
c)



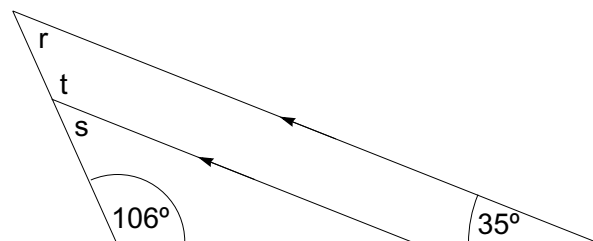
d)



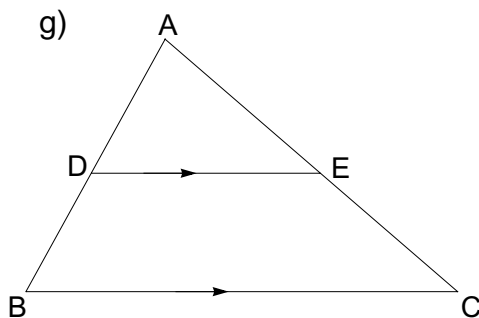
e)



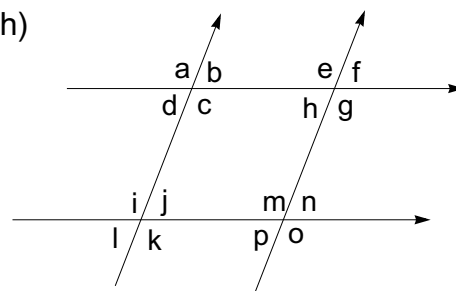
f)



g)



h)



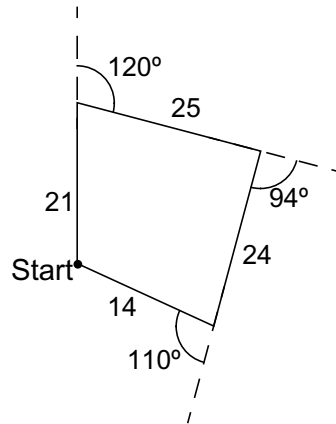
- (i) Which angle corresponds with angle AED?
- (ii) Which angle is the corresponding angle to ADE?
- (iii) What can you say about these corresponding angles?

- (i) Which angle is vertically opposite to angle a?
- (ii) What property do vertically opposite angles have?
- (iii) Which angle is the alternate angle to angle d?
- (iv) What can you say about these alternate angles?

Computer Instructions

L.6

1) The diagram below shows a quadrilateral.

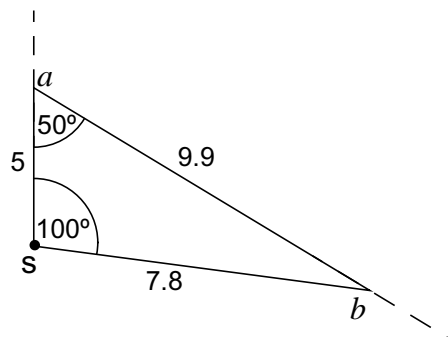


The instructions for drawing this are as follows

```
FORWARD 21
TURN RIGHT 120
FORWARD 25
TURN RIGHT 94
FORWARD 24
TURN RIGHT ....
FORWARD ....
```

- Complete the instructions by filling in the final two numbers
- Write instructions for drawing a similar quadrilateral with sides double those of the first one.

2) Emily wants to use the computer to draw this triangle. Two of the interior angles are shown.

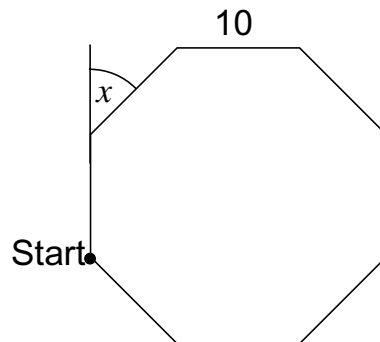


- What are the sizes of the exterior angles marked a and b ?
- Write a program, beginning at point s , which will draw this shape.
- Write a program which will draw an equilateral triangle with sides of 6cm.

Drawing an Octagon

L.6

The diagram below shows a regular octagon.



- a) What is the size of the exterior angle x ?
 b) Lewis has to draw this shape onto a computer. This is how he starts. Finish it off.

```
FORWARD 10
TURN RIGHT ....
FORWARD 10
TURN RIGHT ....
FORWARD 10
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
```

Nicole says that these instructions can be made easier by using a repeat instruction.

```
REPEAT 8 [FORWARD 10, TURN RIGHT ....]
```

- c) Complete these instructions.
 d) What will these instructions draw?

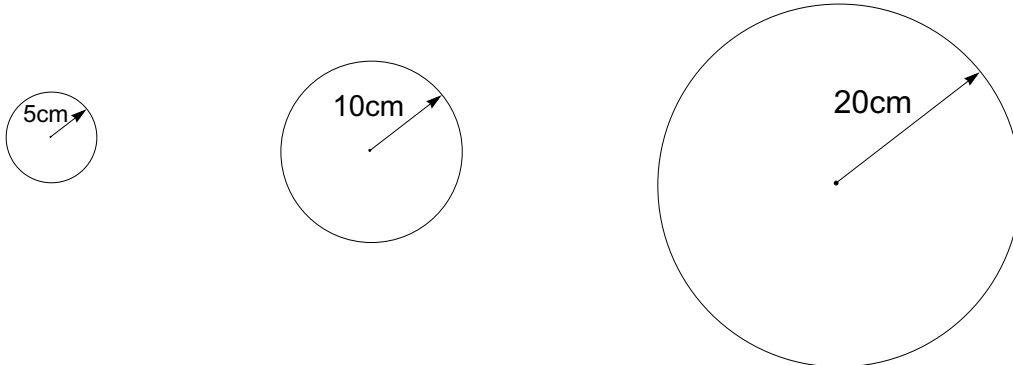
```
REPEAT 6 [FORWARD 10, TURN RIGHT 60]
```

- e) What instructions will Nicole write down to draw an equilateral triangle with sides of 10 cm?
 f) What instructions will Nicole write down to draw a square with sides of 10cm?

Area and Circumference of a Circle

L.6

- 1) a) Calculate the areas of these three circles (use $\pi = 3.142$)



- b) How many times bigger than the 5cm circle is the 10cm circle?
 c) How many times bigger than the 5cm circle is the 20cm circle?
 d) Write down the missing numbers in this ratio.

Area of 5cm circle : Area of 10cm circle : Area of 20cm circle

1 : :

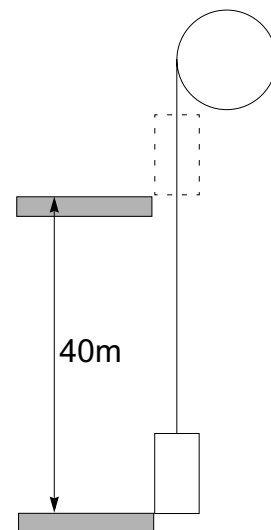
- e) Calculate the circumferences of the three circles.
 f) Write down the missing numbers in this ratio.

Circum. of 5cm circle : Circum. of 10cm circle : Circum. of 20cm circle :

1 : :

- 2) A pulley is used to move a lift between the ground floor and the top floor of a block of flats (see diagram). The 2 floors are 40 metres apart and the radius of the pulley is 1 metre.

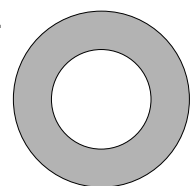
- a) Calculate the circumference of the pulley.
 b) Approximately how many revolutions will the pulley make in raising the lift from the ground floor to the top floor?



- 3) a) A circle has a circumference of 200cm.
 Calculate its radius.
 b) What is its area?

- 4) A garden pond is in the shape of a circle with a diameter of 3 metres. A concrete path is made around the pond. The width of the path is 1 metre (see the diagram).

- a) Calculate the area of the pond correct to the nearest m^2
 b) What is the outside diameter of the concrete path?
 c) Calculate the area of the concrete path and pond combined, to the nearest m^2
 d) What is the approximate area of the concrete path?



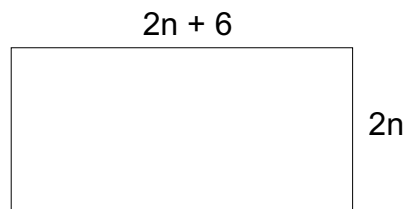
Areas of Rectangles

L.6

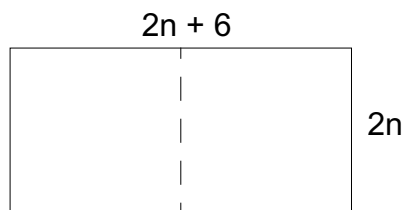
- 1) Annette cuts a rectangle from a sheet of paper. She calls the length of the smaller side $2n$ centimetres.

The larger side is 6cm longer so she calls that $2n + 6$ centimetres.

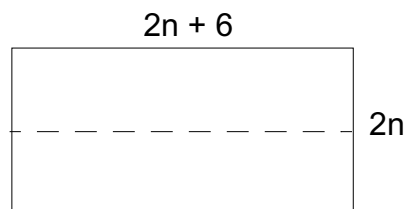
What is the area of Annette's rectangle?



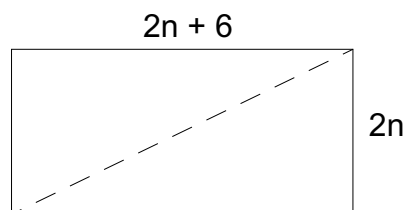
- 2) Annette cuts a similar rectangle in half down its middle.



- a) What is the length of each side of the half?
 - b) Use these values to calculate the area of one half of the rectangle.
- 3) Graham makes a similar rectangle. He cuts it in half, but this time along its length.



- a) What is the length of each side of the half?
 - b) Use these values to calculate the area of one half of the rectangle.
- 4) Dylan makes another rectangle. He cuts it in half, this time along its diagonal making two right angled triangles.

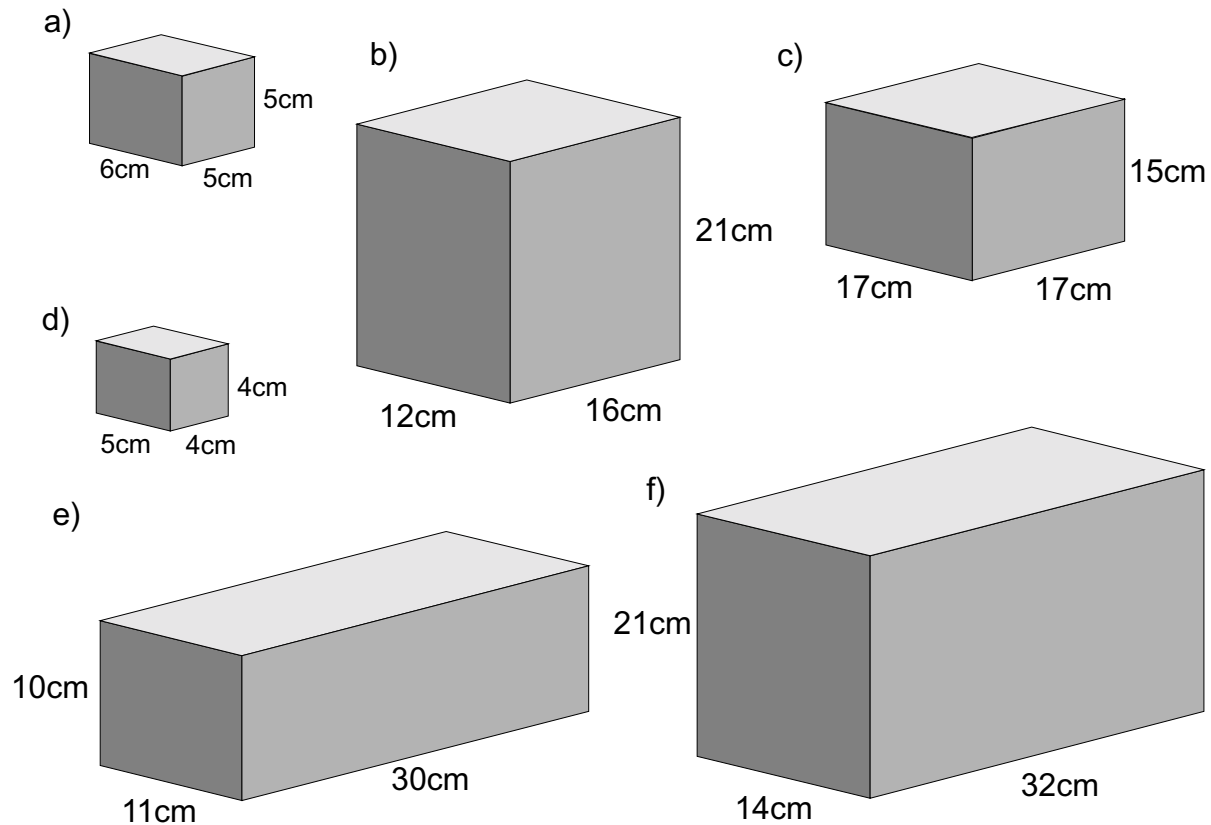


- a) What is the area of the rectangle?
- b) What is the area of half of the rectangle?
- c) What is the area of one of the triangles?

Volumes

L.6.

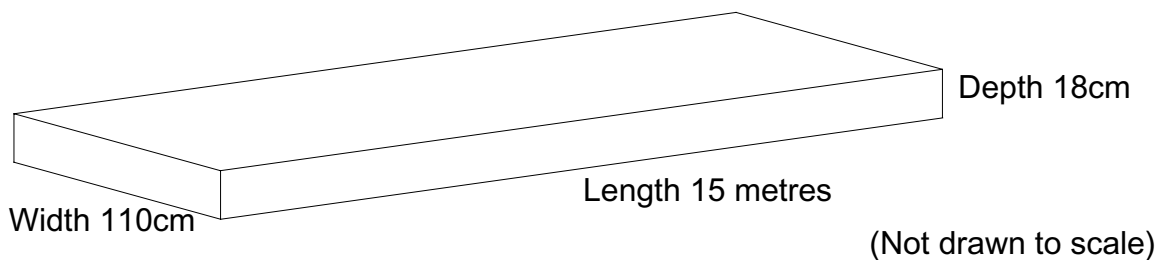
1) (i) Calculate the volumes of these cuboids.



(ii) Which of the cuboids have a capacity greater than 1 litre?

2) An open bucket is in the shape of a cuboid. It's length is 25cm, it's width is 20cm and it's depth is 30cm. It is to be filled with water. How many litres will it hold?

3) The diagram shows a garden pathway. It is to be made from concrete to the dimensions shown.



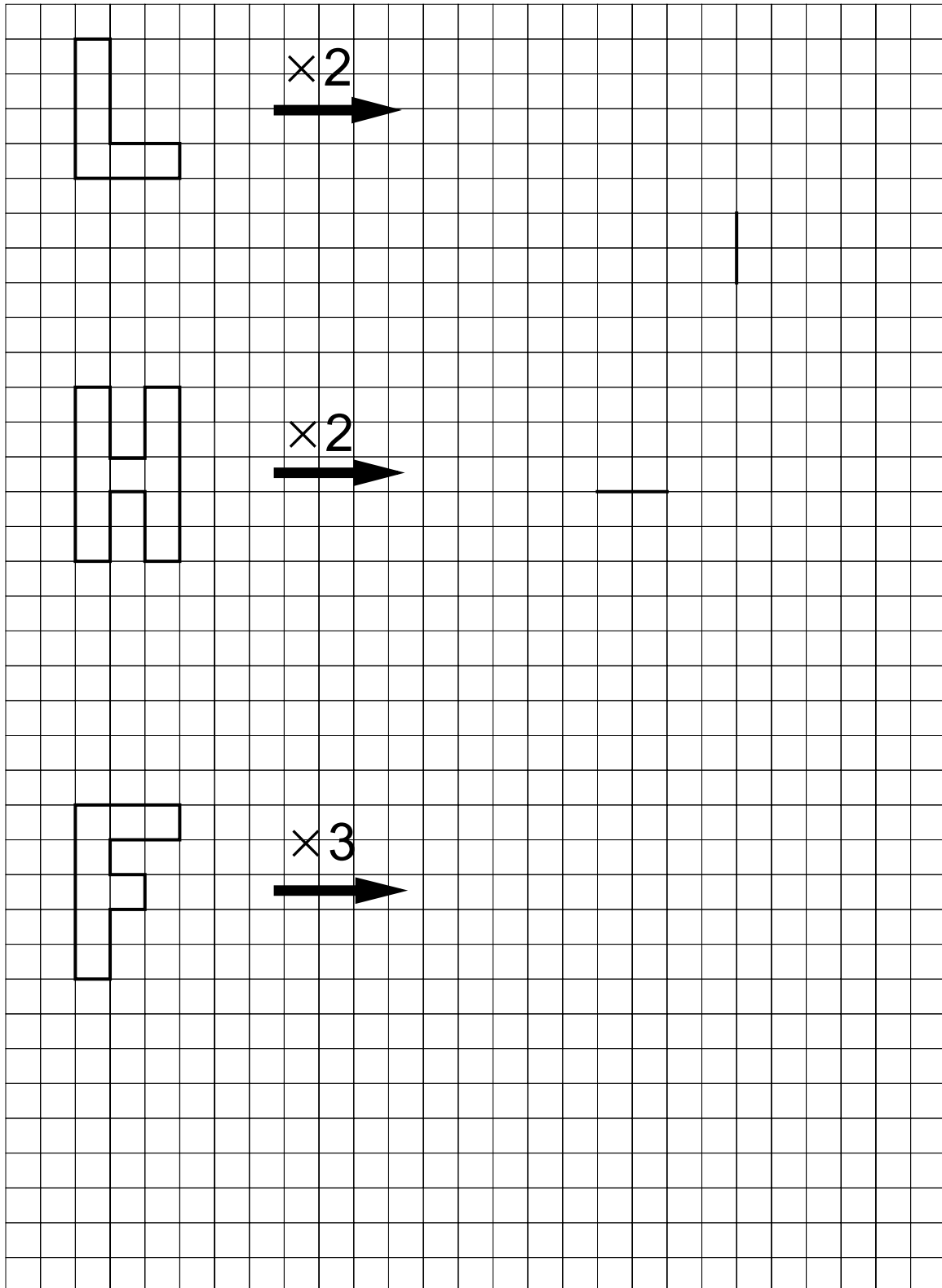
a) Write down the depth and the width as a decimal part of a metre.

b) Calculate the volume of the concrete needed to make the pathway.

Enlarging Letters

L.6

Enlarge each of the following diagrams by the scale factor given.
Each diagram has been started.



Enlarging Through a Point

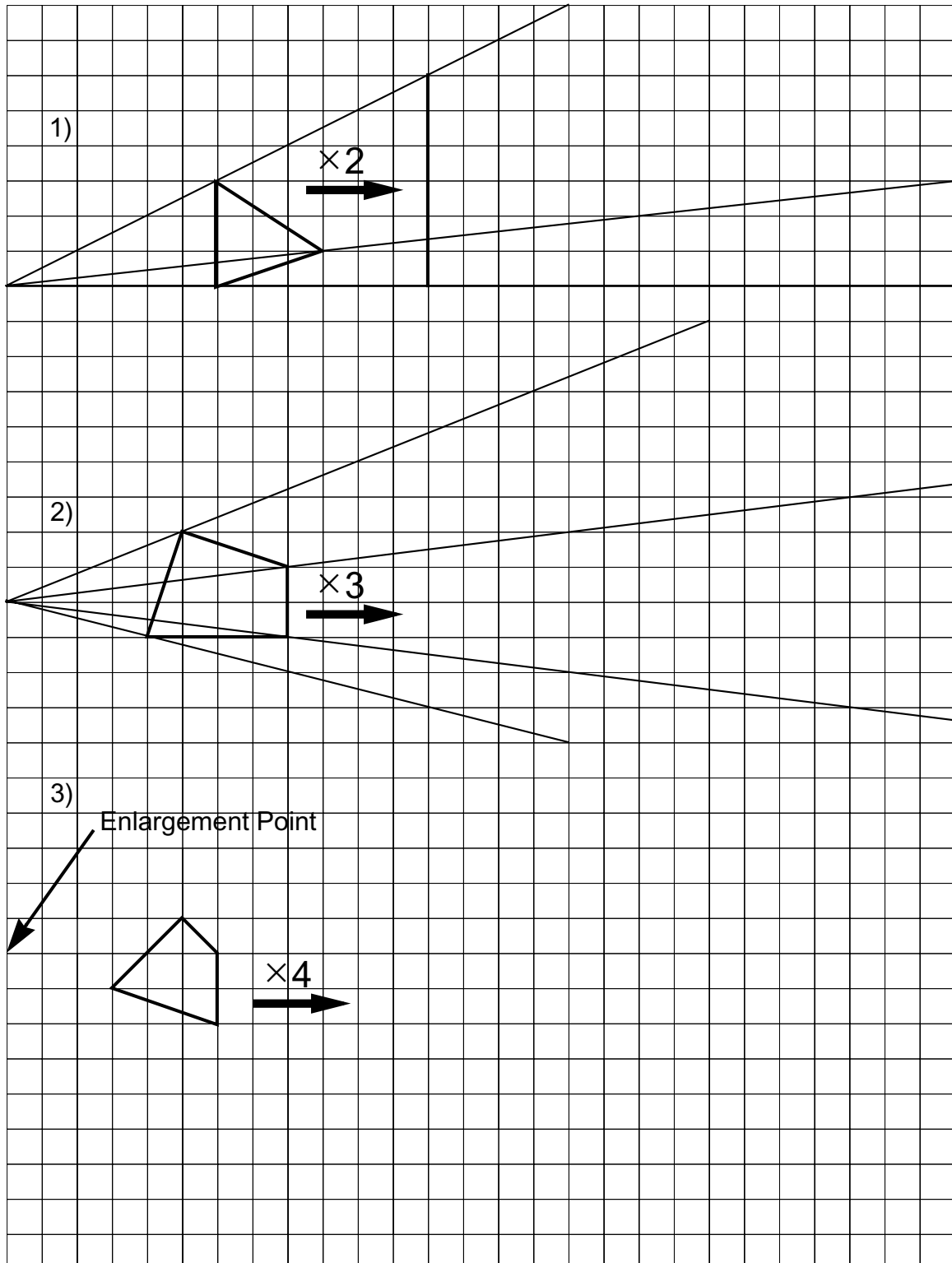
L.6

Enlarge the following shapes, using the scale factor given, through the points indicated.

Question 1 has been started for you.

Question 2 has the construction lines drawn.

Question 3 has only the enlargement point indicated.



Continuous Data

L.6

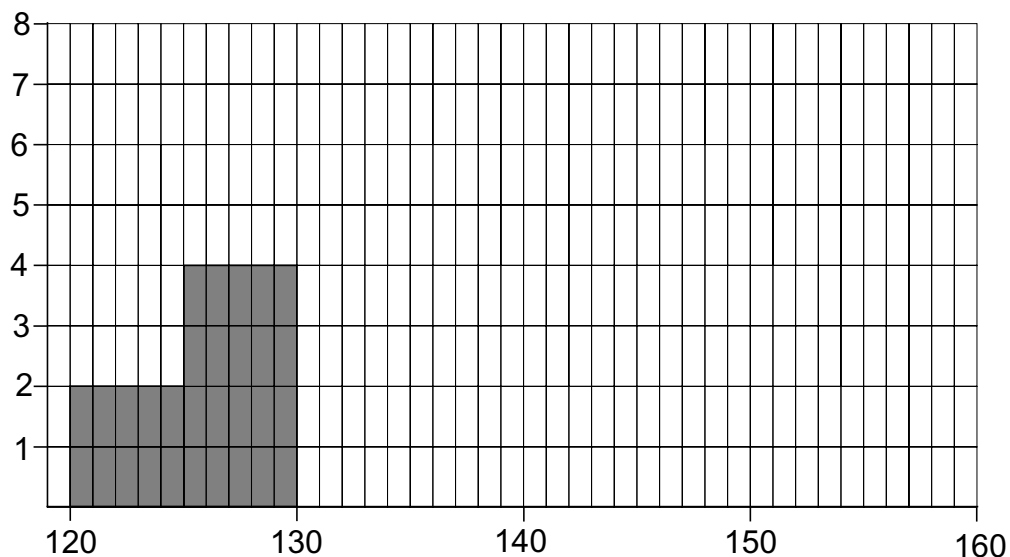
The following frequency table gives the heights of pupils in a class. The h represents the height of the pupils.

Class Interval	Frequency
$120 \leq h < 125$	2
$125 \leq h < 130$	4
$130 \leq h < 135$	6
$135 \leq h < 140$	8
$140 \leq h < 145$	5
$145 \leq h < 150$	3
$150 \leq h < 155$	1

- How many pupils are in the class?
- What does the $<$ sign mean?
- What does the \leq sign mean?
- What does the line $120 \leq h < 125$ mean?
- One of the pupils has a height of 145 cm. Which group has she been put into?
- How many pupils are less than 125 centimetres in height?
- How many pupils are less than 145 cm?
- How many pupils are 140cm or more in height?

Jo wants to show this data on a bar chart. She says that the bars will have to touch because the numbers carry on from each other (they are continuous). She thinks that the first bar should go from 120cm to 125cm, the second from 125 to 130 and so on. The last one should be 150 to 155.

This is the start of her chart. Copy what she has done and finish it off.



Pupils Weights

L.6

Julian carries out a survey of the pupils in his group. He weighs each of the pupils and records their masses. These are the results in kilograms.

45.1, 47.5, 53.8, 39.0, 41.8, 56.3, 38.9, 53.7, 43.7, 45.0, 42.4, 51.1, 59.6, 63.4, 47.5, 53.5, 50.9, 67.3, 52.5, 47.4, 54.5, 49.3, 51.3, 71.6, 38.4, 55.0, 63.3, 53.0, 45.1, 48.8

He then puts the values into this frequency table.

a) Copy and complete the table.

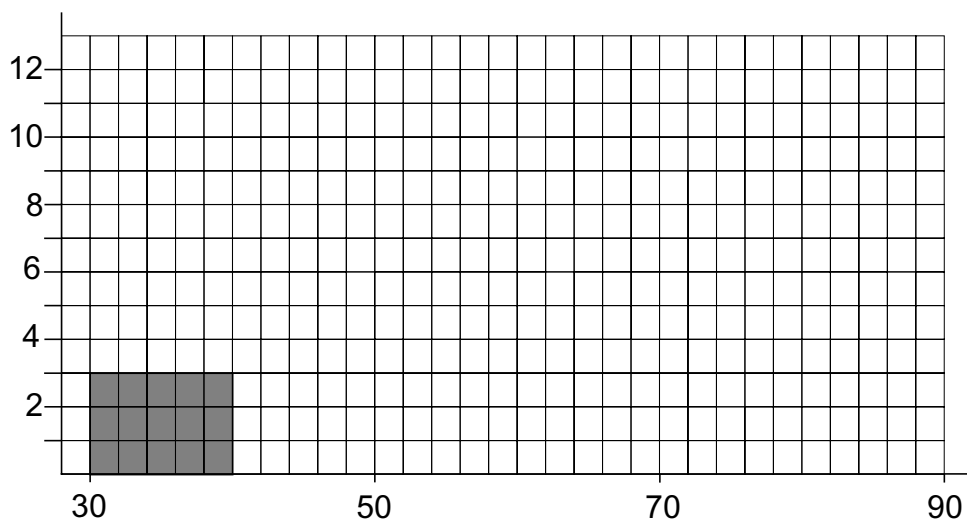
Weight	Tally	Frequency
$30 \leq w < 40$		
$40 \leq w < 50$		

b) How many pupils weigh less than 60 kilograms?

c) How many pupils weigh 40kg or more?

d) How many pupils have a weight which is greater than 40kg and less than 60kg?

Julian shows this data as a bar chart, like this.



e) Complete Julian's bar chart.

Julian decides that his chart will look better if he changes the class intervals to $30 \leq w < 35$, $35 \leq w < 40$ and so on.

f) How many bars will there be in Julian's diagram?

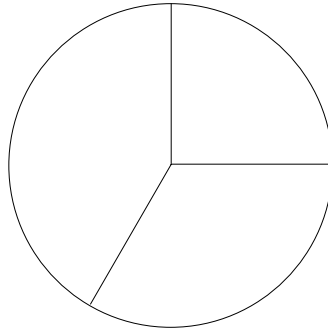
Constructing a Pie Chart

L.6

- 1) A car manufacturer says that $\frac{1}{4}$ of its cars are red, $\frac{1}{3}$ are silver, $\frac{1}{10}$ are white and the remainder are 'other' colours.

Alison draws a pie chart to show this.

- a) Copy her chart and complete it.



- b) What angle at the centre of the chart represents 'other'?
- 2) The sales at a supermarket are shown in the following table. Steve draws a pie chart containing this information. He calculates the angle he needs for each department and puts them in the table.

Department	Percentage	Angle needed
Fruit and Vegetables	20%	
Delicatessen	5%	
Frozen Foods	10%	
Household Goods	15%	
Butcher	10%	
General Groceries	40%	

- a) Finish his calculations for the angles needed.
- b) Use these angles to draw a pie chart.
- 3) The table shows the number of withdrawals from a library during one week in May.

Library withdrawals for 1 week	
Type of Book	Number
Fiction	200
Non Fiction	100
Children's	150
Videos	50

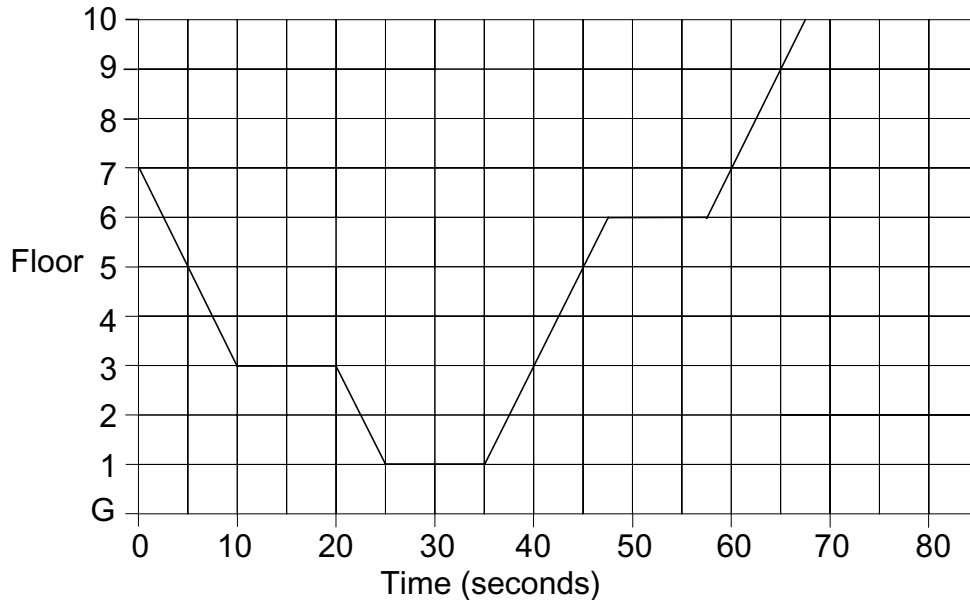
Amanda draws a pie chart of this information.

- a) What angle at the centre of the pie chart is needed to represent Fiction?
- b) Draw the pie chart.

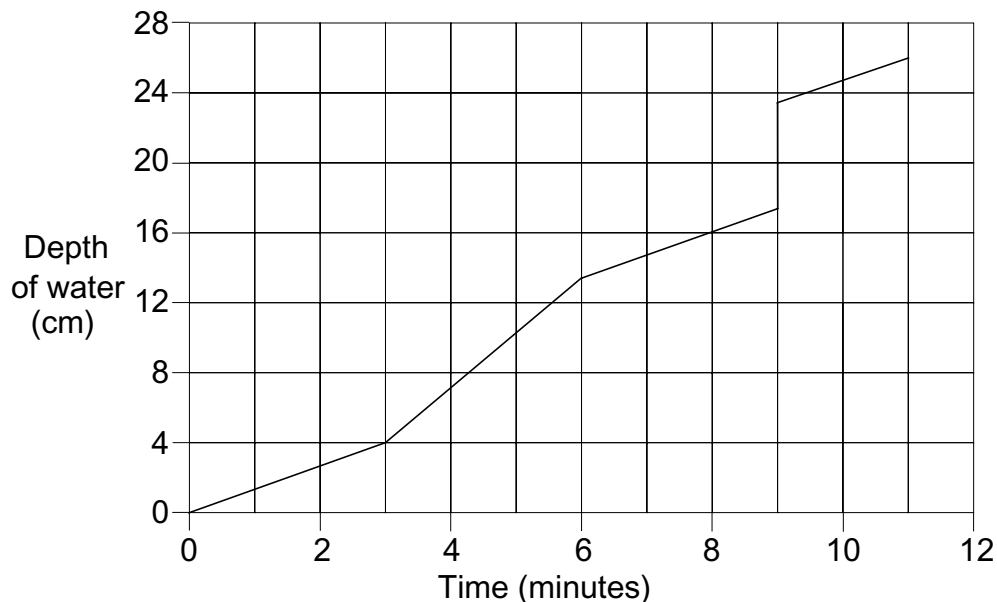
Distance and Time

L.6

- 1) Olive gets into a lift at the 7th floor. She wants to go to the 10th floor, but has to travel to other floors first. The diagram is a graph of her journey.



- Which other floors did the lift stop at before arriving at the 10th floor?
 - For how long does the lift stop at each floor?
 - If the lift were to travel from the ground floor to the 10th floor without stopping, how long would it take?
- 2) The graph shows the height of water in a bath Mrs Riley runs for her young daughter. Use the graph to answer these questions.



- When was the second tap turned on?
- When did Mrs Riley's daughter get in the bath?
- When was the water turned off?
- If Mrs Riley fills the bath to a depth of 20cm before putting her daughter in, for how long must she run both taps?

Scatter Diagrams

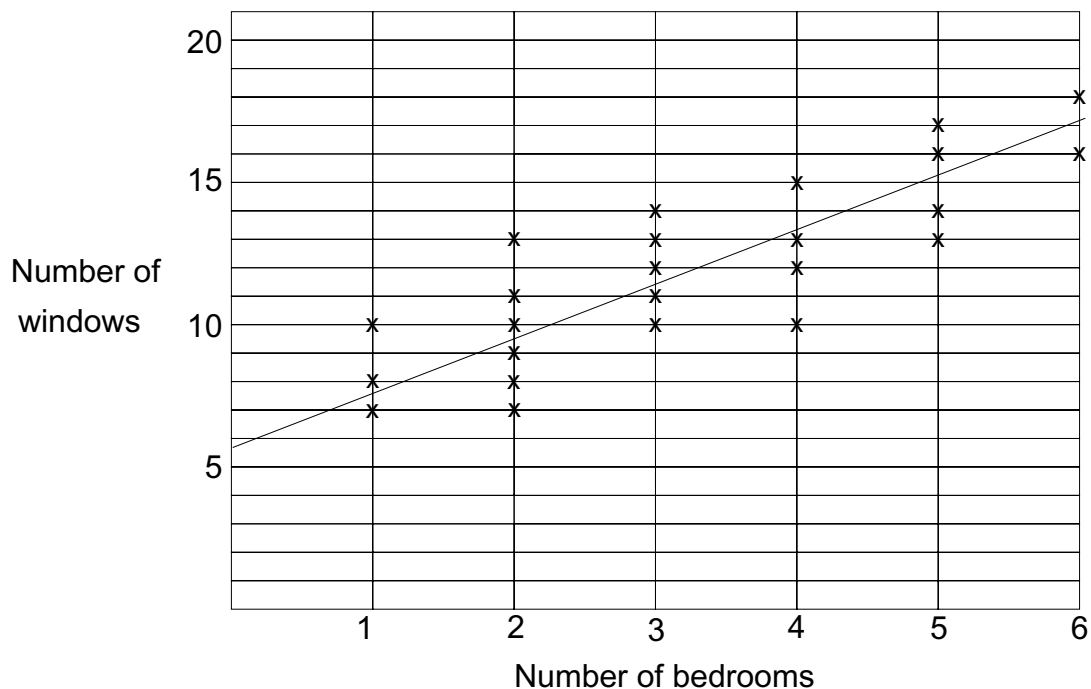
L.6

- 1) The graphs below show three things plotted against the age of the pupils in years 7 to 11. They are (i) distance of their home from school, (ii) the time it takes to run a race and (iii) the amount of time spent doing homework.



Which descriptions do the three graphs best fit?

- 2) Wendy does a survey of the houses in her village. She counts the number of windows in each house and the number of bedrooms they have. The diagram below shows her results.



Use the diagram and the line of best fit to answer these questions.

- What does the graph tell you about the relationship between the number of bedrooms and the number of windows in a house?
- Another house was visited. It had 12 windows in it. How many bedrooms would you expect it to have?
- How many windows would you expect a four bedroomed house to have?

Dice

L.6

- 1) Lydia has two dice, a blue one and a red one. She says that there are 36 different outcomes of the numbers on the top when the two dice are rolled. She writes down these outcomes in the table below. She writes down the number on the blue dice before the number on the red dice.

		Red Dice					
		1	2	3	4	5	6
Blue Dice	1	1,1					
	2						
	3						3,6
	4			4,3			
	5						
	6						

- Copy and complete the table.
 - What is the probability of her getting 4,4?
 - Which pairs of numbers will give her a total of 5?
 - What is the probability of her getting a total of 5?
 - What is the probability of her getting a total of less than 5?
 - What is the most likely total that she could get?
- 2) The table below shows the totals that can be obtained when two special dice are rolled. The table shows some of the numbers on the dice and some of the totals.

		First Dice					
		+	1		1		
Second Dice		3				5	
	2						
		3			4		
	4		5			7	
				6			9
				7			

- Complete the table of numbers.
- What is the probability that a total of 3 is obtained when the dice are rolled?
- What is the probability that the total obtained is not 3?

Choosing

L.6

- 1) In a pub lottery there are 5 balls numbered 1 to 5. A ball is withdrawn and not replaced. A second is then withdrawn. The table below shows some of the outcomes that are likely to happen.

		Second Ball				
		1	2	3	4	5
First Ball	1		1,2	1,3	1,4	1,5
	2	2,1				
	3					
	4					
	5					

- Complete the table.
 - How many different outcomes are there?
Each contestant has two numbers. Michael has 4 and 2.
 - What is the probability that he wins? (the order that the balls are withdrawn is not important).
 - What is the probability of him not winning?
- 2) A bag contains 1 red, 1 white and 1 black ball. Two balls are to be withdrawn together.
- List all the different ways the balls can be taken from the bag.
 - What is the probability of withdrawing a red and a white ball?
 - What is the probability of not withdrawing a red and white ball?
- 3) In a bag there are red marbles and blue marbles.
Ralph is told that the probability of getting a blue marble from the bag is $\frac{1}{4}$.
- What is the probability of getting a red marble?
He takes a marble from the bag and it is red.
 - What is the smallest number of marbles there can now be left in the bag?
He takes another marble from the bag. It is blue.
 - What is the smallest number of marbles there can now be in the bag?
He takes a third marble from the bag. It is blue.
 - What is the smallest number of marbles there can now be in the bag?
He is told that there were 9 red marbles in the bag before he took any from it.
 - What was the total number of marbles in the bag originally?

On the Road

L.6

- 1) Andrea stops at a motorway service station for breakfast. She has a choice between egg, bacon, beans and tomatoes. Each portion costs £1 and she has £3 to spend. She chooses 3 different items.
- List all the breakfasts she can choose.
 - If she chose 2 portions of the same item, what other breakfasts could she choose?
 - If she set no restriction on what she bought for £3, how many different types of breakfast could she choose?
- 2) Rhoda stops off at a motorway service station for breakfast. There are 5 items to choose from on the menu. They are egg, bacon, beans, tomatoes and toast. Each item costs £1 and Rhoda has £3 to spend. She buys 3 different items. If she buys egg she must buy toast with it. She must have tomatoes. List all the different breakfasts she can choose from.
- 3) A car hire company calculates the probability of one of its cars breaking down during the year. Copy this table and fill in the missing probabilities.

	Probability of breaking down	Probability of not breaking down
1 year old car	0.002	
2 year old car	0.01	
3 year old car	0.017	

- 4) BangerKing hires cars to the public. The table shows the availability of their cars on a particular day.

	Probability
Available and on hire	
Available but not on hire	0.32
Broken down	0.14

- Complete the probability table.
- On another day the probability that a car is available is 0.68. What is the probability that a car is broken down?

