Evaluating Expressions and Collecting Like terms (no calculator allowed!)

1. If $p = 5$, $q = 7$, $r = 10$ and $s = 2$, evaluate:

a) $p + q$

b) $r - s$

c) $4q$

d) $5r$

e) $\dfrac{r}{2}$

f) $5s$

g) pq

h) qrs

i) $\dfrac{qr}{s}$

j) r^2

k) $p + qr$

l) $3(p + s)$

m) $(r - s)^2$

n) $\dfrac{p+q}{s}$

o) $\sqrt{pqr}$
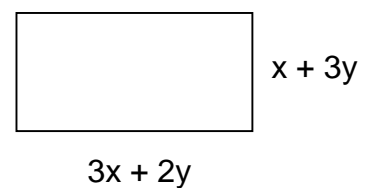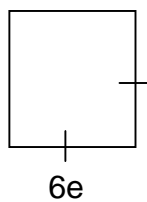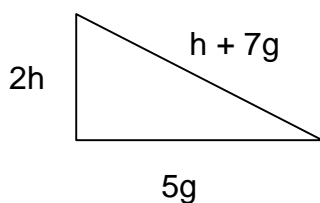
2. If $a = 2$, $b = 4$ and $c = 12$, find the value of:

a) $3a$

b) $b + c$

c) $c - a$

d) $\dfrac{c}{b}$

e) ab

f) b^2

g) abc

h) $\dfrac{b}{c}$

i) $\dfrac{ab}{8}$

j) $c + 3a$

3. Collect the like terms to simplify these expressions:

a) $2a + 4a$

b) $5g - 3g + g$

c) $12h + 6h - 9h$

d) $4t + 3s + 6t$

e) $5x + 6y + 7x$

f) $8g + 4h - 7g$

g) $6f + 4r - 2f - 3r$

h) $9z - 5w + 8w + 2z$

4. Give an expression for the perimeter of these shapes:

a)

2h   h + 7g   5g

6e

x + 3y   3x + 2y

Expanding Brackets

1. Expand each of the brackets below:

    a) $5(x - 8)$ b) $11(g + 3)$ c) $7(2s - 3)$ d) $9(4w + 5d)$

    e) $10(7d + 5n)$ f) $9(8x - 3y)$ g) $a(2 + 3t)$ h) $x(x - 8)$

    i) $7(2a + 3b - 9c)$ j) $2x(5x - 6y - z)$

2. Expand the brackets and then simplify by collecting like terms:

    a) $2(x + 8) + 6$ b) $5(3t - 7) + 8t$ c) $8(5x - 2) - 6x$ d) $9(3y + 4z) - 12z$

    e) $4 + 2(x + 8)$ f) $6w + 7(2 - w)$ g) $6c + 8(2 - 3c)$ h) $4(2x + 7) + 3(5x - 1)$

Factorising

1. Factorise each of the following:

    a) $7a + 14$ b) $8d - 32$ c) $11y + 66$ d) $9z + 54$

    e) $12y - 6$ f) $8t - 20$ g) $15g + 55h$ h) $21y - 36$

    i) $2a + ab$ j) $x + xy$ k) $10z - cz$ l) $8f + f^2$

2. Factorise:

    a) $2ab + 4ay$ b) $3gh - 9h$ c) $7st + 21 sy$ d) $30x - 12xy$

    e) $8x^2 + 32x$ f) $12d^2 - 60d$ g) $20g^2 + 50gh$ h) $15x^2 + 25xy$

Sequences

Find the rule for each sequence shown and the missing value from each table:

1.

No. of red (r)	1	2	3	4		13
No. of black (b)	5	11	16	21		

2.

No. of tables (t)	1	2	3	4		10
No. of chairs (c)	3	11	19	27		

3.

No. of posts (p)	1	2	3	4		20
No. of slats (s)	1	4	7	10		

4.

No. of green (g)	1	2	3	4		50
No. of purple (p)	2	8	14	20		

5.   A metal fence is made by joining iron bars as shown below:

1 Section   2 Sections   3 Sections
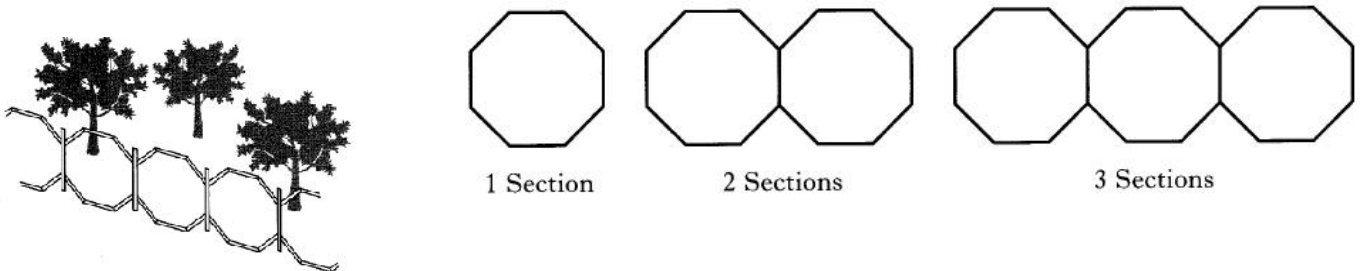
a) Copy and complete the table below:

No. of sections (s)	1	2	3	4		12
No. of iron bars (b)	8		22			

b) Find a formula for calculating the number of iron bars (b) when you know the number of sections(s).

c) A fence has been made by joining 176 iron bars. How many sections are in this fence?

6.   Jenni is making a wallpaper border using stars and dots as shown.
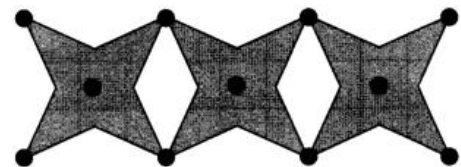

a) Copy and complete the table below:

No. of stars (s)	1	2	3	4		12
No. of dots (d)			11			

b) Write down a formula for calculating the number of dots (d) when you know the number of starts (s).

c) How many stars would be needed to make a border which contained 122 dots?

Gradient

1.   State the gradient of each line shown below. Give your answers as **fractions in their simplest form**:

a)

10 cm

25 cm

b)

16 cm

10 cm

c)

5cm

15 cm

d)

18 cm

18 cm

e)

9 cm

12 cm

f)

16 cm

32 cm
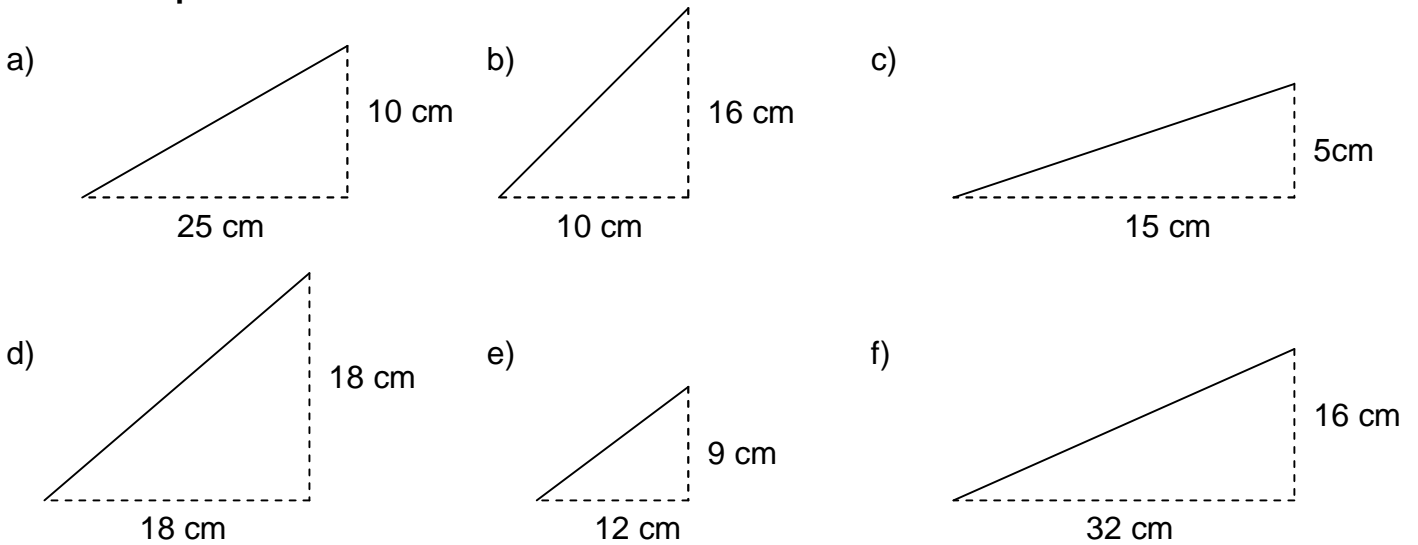
2.   For each pair of diagrams, find the gradient as a decimal. Use your answers to determine which slope is the steepest.
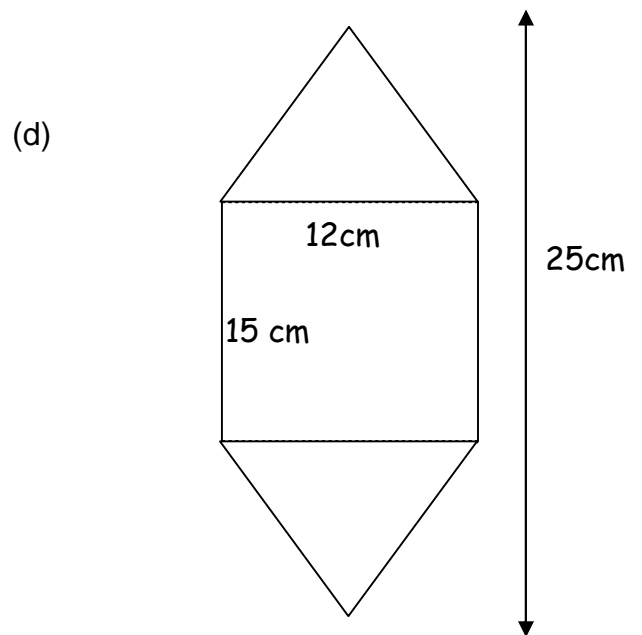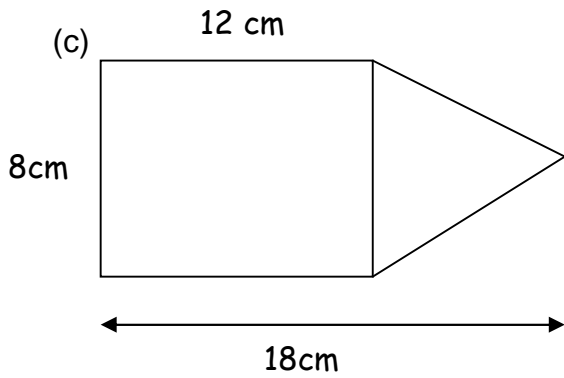
a)

7 m   **A**

50 m

B   20 m

150 m

b)   60 m

A

240 m

88 m

B

320 m

c)

480 m   **A**
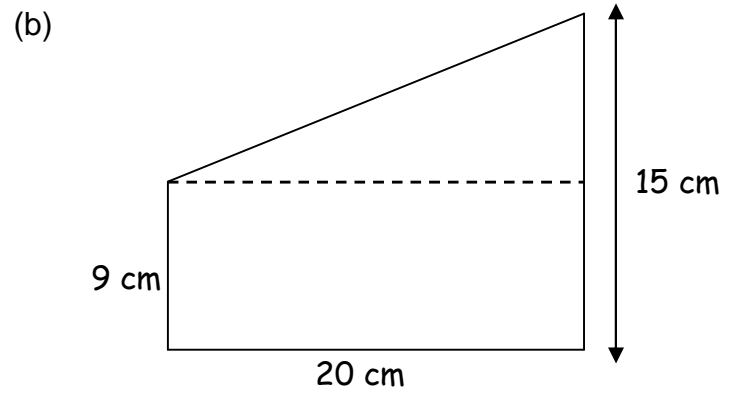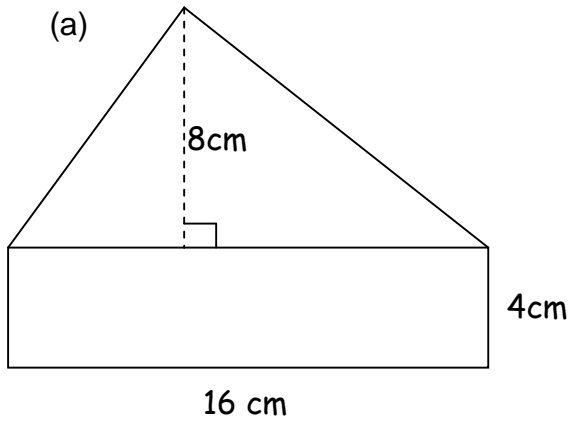
1.2 km

1.12 km

B

2.8 km
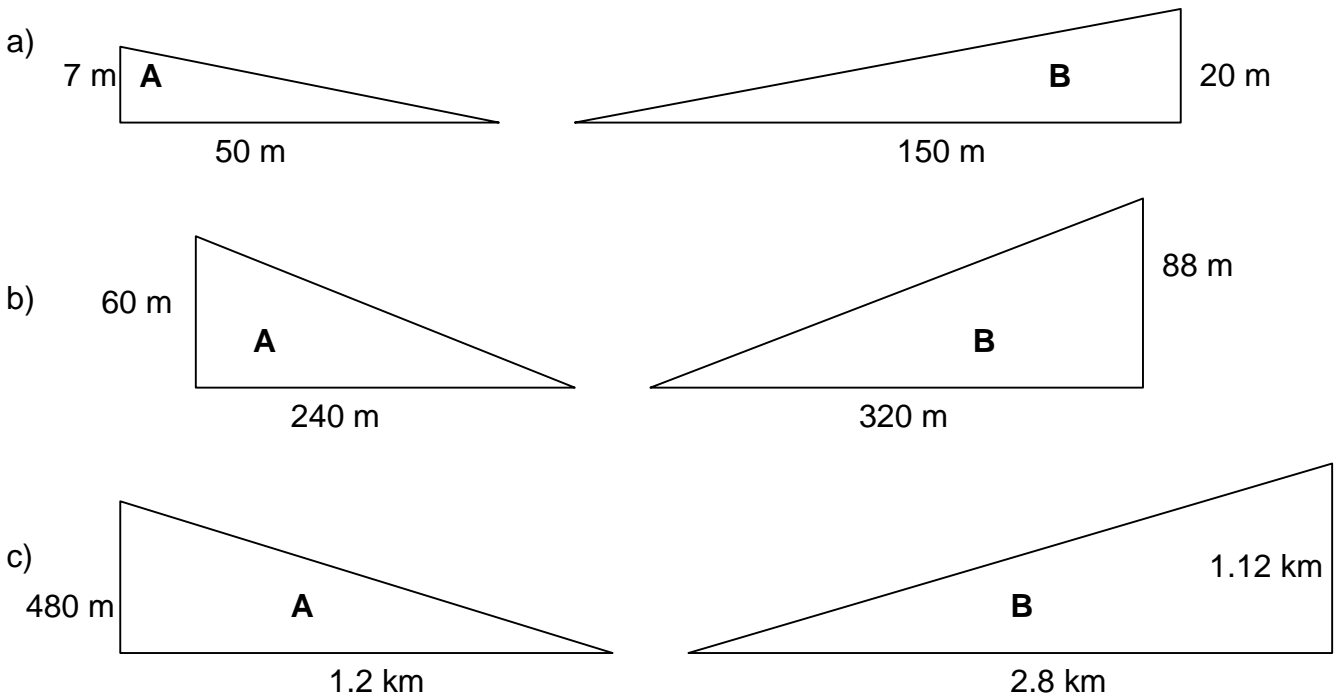
3.   A wheelchair ramp is to be built. Guidelines state that the ramp must have a gradient of less than 0.3. Does the plan below fit the guidelines – justify your answer.
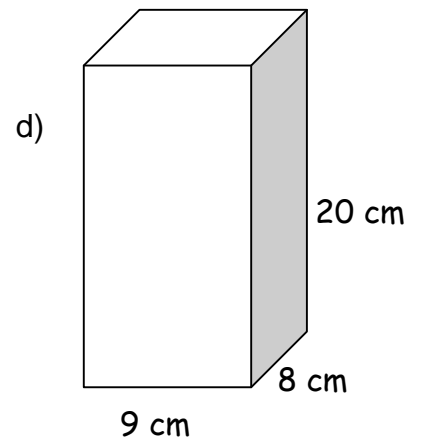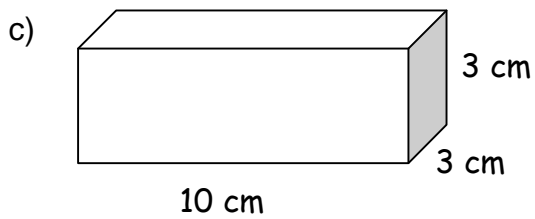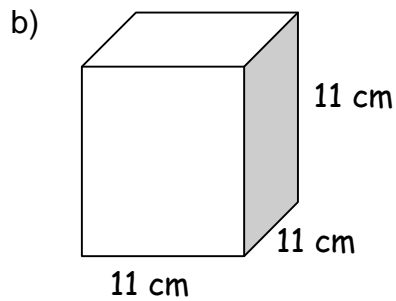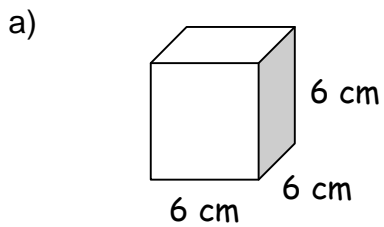
94 cm

3.6 m
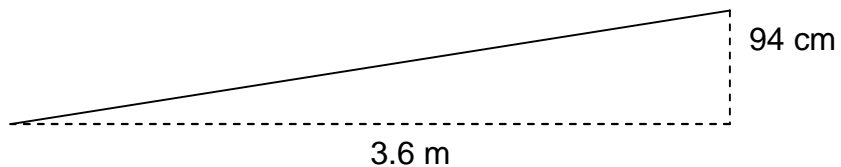
Area

1. Calculate the total area of the shapes below:-

(a)

8cm

4cm

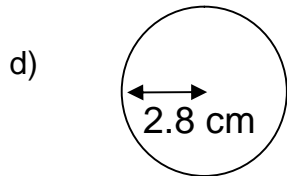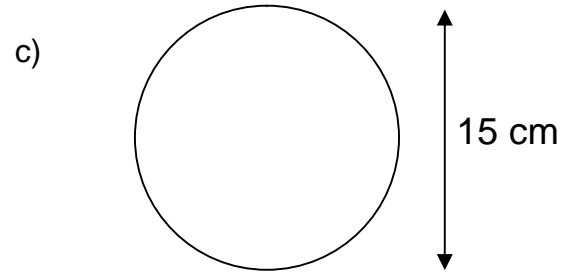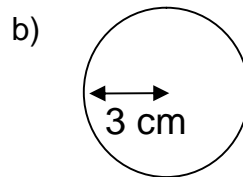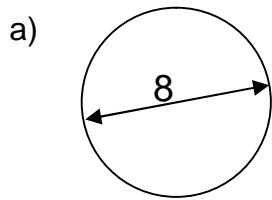16 cm

(b)

9 cm

15 cm

20 cm

(c)

12 cm

8cm

18cm

(d)

12cm

15 cm

25cm

2. Calculate the surface area of each cube or cuboid below:

a)

6 cm

6 cm

6 cm

b)

11 cm

11 cm

11 cm

c)

3 cm

3 cm

10 cm

d)

20 cm

8 cm

9 cm

Circles – Circumference   **C =   d**

1.   Find the circumference of each circle below:

a)   8

b)   3 cm

c)   15 cm

d)   2.8 cm

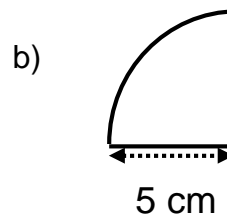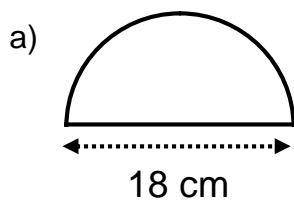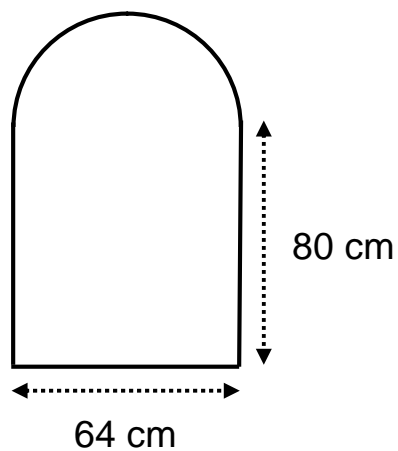2.   A bike has wheels with a diameter of 60 cm.

a) Find the circumference of the wheel.

b) Calculate how far the bike will travel if the wheel rotates 200 times.

3.   Find the <u>perimeter</u> of each of the shapes below:

a)   18 cm

b)   5 cm   I

4.   An arched window needs sealant to go completely around the edge of it. Find the length
      of the sealant required.

80 cm

64 cm

Circles – Area $A = \pi r^2$

1.   Find the area of each circle below:

a)

7 cm

b)

5 cm

c)

12 cm

d)

8 cm
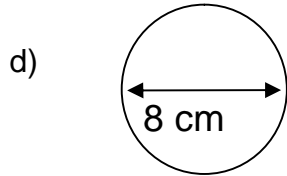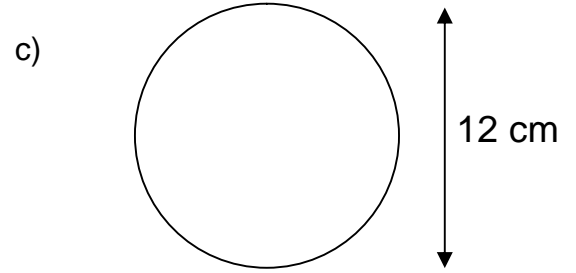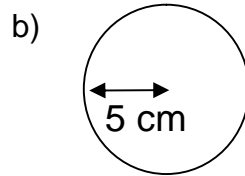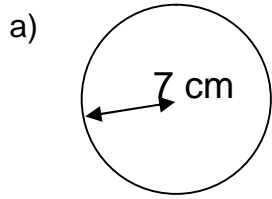
2.   A circular table top has a radius of 1.5 m.
        Find the area of the table top.

3.   Find the <u>area</u> of each of the shapes below:

a)

10 cm

b)

6 cm
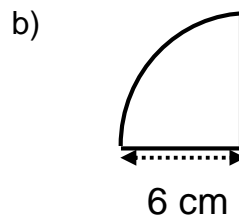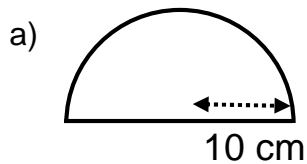
4.   The view of a tunnel is shown below.
        a)   Find the area of the face of the tunnel.

7 m

5 m

4.8 m

        b) If 1m^2 requires 25 bricks, how many bricks will be needed to face the tunnel?

Fractions

1. Copy and complete each addition/subtraction:

   a) $\dfrac{3}{8} + \dfrac{2}{7}$

   b) $2\dfrac{1}{6} + \dfrac{3}{5}$

   c) $\dfrac{8}{9} - \dfrac{2}{3}$

   d) $5\dfrac{2}{5} + 4\dfrac{3}{20}$

   e) $6\dfrac{5}{9} + 3\dfrac{5}{6}$

   f) $8\dfrac{7}{8} + 2\dfrac{3}{4}$

   g) $9\dfrac{2}{7} - 4\dfrac{3}{4}$

   h) $10\dfrac{3}{10} - 4\dfrac{5}{6}$

2. A rectangular garden has the measurements shown below:
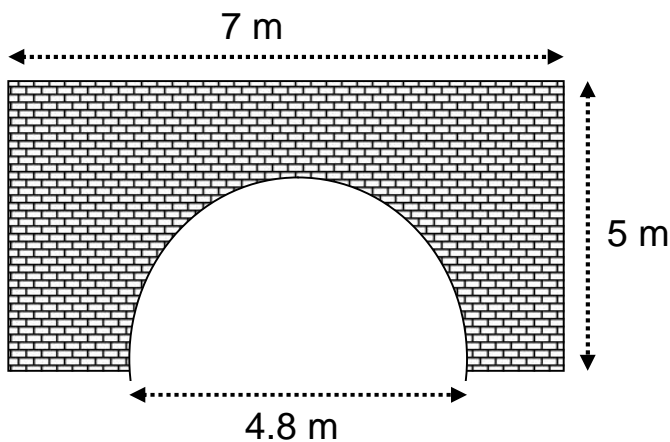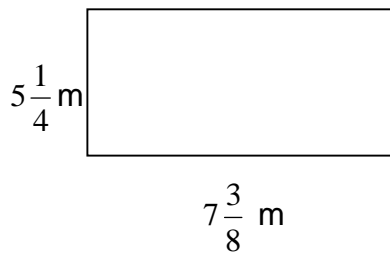

   $5\dfrac{1}{4}$ m

   $7\dfrac{3}{8}$ m

   Find the perimeter of the garden.

3. Copy and complete these multiplications. **Give your answers in simplest form.**

   a) $\dfrac{2}{9} \times \dfrac{4}{7}$

   b) $\dfrac{2}{7} \times \dfrac{5}{6}$

   c) $\dfrac{3}{8} \times \dfrac{16}{27}$

   d) $\dfrac{14}{15} \times \dfrac{10}{21}$

   e) $\dfrac{2}{3} \times \dfrac{3}{8} \times \dfrac{4}{5}$

   f) $\dfrac{9}{10} \times \dfrac{2}{3} \times \dfrac{5}{11}$

   g) $\dfrac{4}{99} \times \dfrac{22}{35} \times \dfrac{25}{32}$

   h) $1\dfrac{1}{3} \times \dfrac{3}{8}$

   i) $4\dfrac{1}{2} \times \dfrac{2}{3}$

   j) $5\dfrac{3}{5} \times 1\dfrac{7}{8}$

   k) $4\dfrac{4}{9} \times 5\dfrac{2}{5}$

   l) $3\dfrac{6}{7} \times 2\dfrac{4}{5}$

4. Copy complete these divisions. **Give your answers in simplest form.**

   a) $\dfrac{2}{9} \div \dfrac{1}{3}$

   b) $\dfrac{5}{6} \div \dfrac{5}{9}$

   c) $\dfrac{7}{12} \div \dfrac{21}{32}$

   d) $\dfrac{5}{16} \div \dfrac{3}{4}$

   e) $2\dfrac{2}{3} \div 1\dfrac{1}{3}$

   f) $5\dfrac{1}{2} \div 3\dfrac{1}{5}$

   g) $8\dfrac{2}{5} \div 1\dfrac{1}{6}$

   h) $4\dfrac{2}{5} \div 3\dfrac{1}{3}$

Percentages – Non-Calculator

1.   Copy and complete the table below:

Percentage	Fraction (in simplest form)	Decimal
25%		
40%		
	$\dfrac{7}{100}$	
		0.48
	$\dfrac{1}{3}$	

2.   Calculate:

a) 20% of £450

b) 75% of 240 kg

c) $33\dfrac{1}{3}$% of 591

d) 70% of 460 m

e) 30% of 37 g

f) 5% of £13

3.   I am charged interest at a rate of 15% on the balance on my credit cards.

   If I have spent £2400 on my card, calculate:

   a) How much interest I owe.

   b) How much I now owe in total.

4.   Dave earns £32 000 a year. He unfortunately receives a pay cut of 2%.

   a) Calculate how much less he now earns.

   b) His new salary.

5.   Paul scores the following marks in his class tests.

   Physics   13 out of 20
   Maths   29 out of 50
   Chemistry   17 out of 25

   Change each mark to a percentage. In which test did he score best?

Percentages – Calculator

1. Calculate:

   a) 23% of £620
   b) 78% of 2460 kg
   c) 8% of 610

2. Trevor pays National Insurance at a rate of 12% of his salary.
   If Trevor earns £18 600 a year, calculate how much of his salary goes to national insurance.

3. Gary can save 18% on his car insurance if he changes to MoneyPro Insurance. His current insurance costs him £550 a year. Calculate:

   a) How much money Trevor will save by changing companies.
   b) How much his insurance quote will be this year.

4. Diane changes £460 into Euros at a rate of £1 = 1.24 euros.
   a) Calculate how many euros Diane should receive.
   b) If she has to pay the travel agent 2% commission on her purchase, how many euros will she actually receive?

5. Mark puts his savings of £4000 into a fixed rate savings account offering him 3% interest per annum. Calculate how much interest Mark should receive if he withdraws his money after 7 months.

6. How much interest should be paid on savings of £12 000 placed in an account at an APR of 4.8% for 5 months.

7. I bought a painting for £460. Since then its value has increased and it is now worth £520. Calculate my percentage profit if I were to sell it at this price. Answer to 1 decimal place.

8. Bill earns £2400 a month before taxes and other deductions. If my net (take-home) pay is £1750, calculate what percentage of Bill's wages go to tax etc.

Pythagoras

1. For each triangle below find the length of the longest side:

a)

8 m
x
15 m

b)

6.9 cm
2.1 cm
x
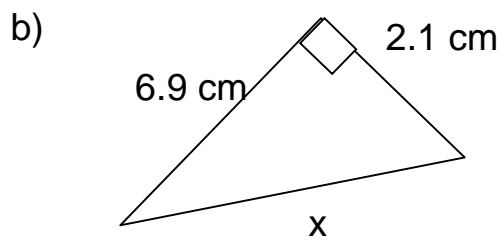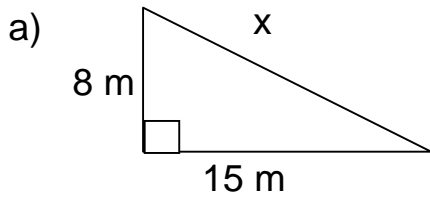
2. For each triangle below, find the length of the shorter side marked.

a)

25 m
x
9 m

b)

1.8 m
3.2 m
x
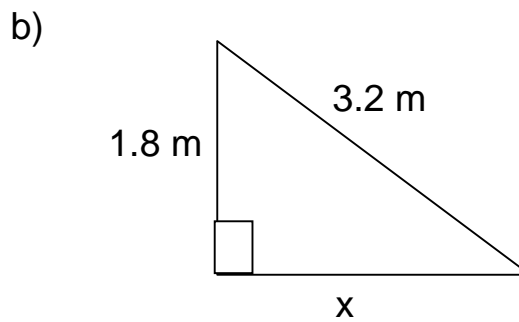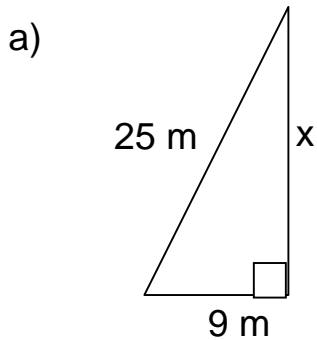
3. Find the length of the sloping roof of the shed below:

3.4 m
3.5 m
2.9 m
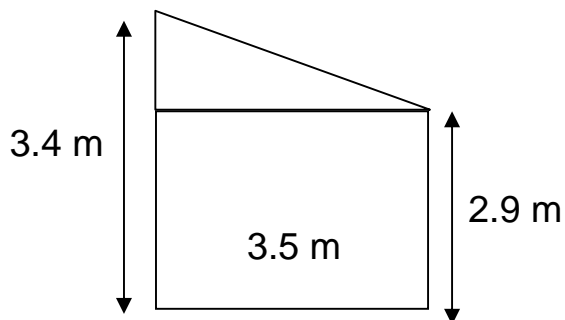
4. A flagpole snaps and falls over into the position shown.

height

2·4 m

4·5 m
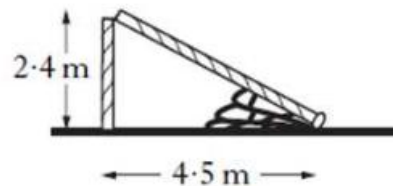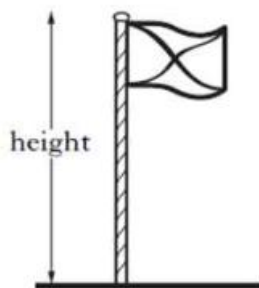
Calculate the height of the flagpole before it fell over.

Do not use a scale drawing.

Ratio and Proportion

1.   Write each ratio below in its simplest form:

   a) 24 : 32   b) 63 : 27   c) 480 : 360   d) 15 : 35

   e) 4 : 8 : 14   f) 28 : 35 : 56   g) 24mm : 3cm

   h) £1.40 : 60p   i) 2 Kg : 400g

2.   The ages of a mother and daughter are in the ratio 7 : 5. If the mother is 48 years old, how old is the daughter?

3.   A paint was made by mixing 12 tins of white paint and 9 tins of green paint. How many tins of white paint need to be mixed with 15 tins of green paint?

4.   Divide £135 in the ratio 3 : 7

5.   To make buttered scones, four parts flour to one part fat is needed. The total weight of the ingredients is 725 g. Find how much flour and how much fat is needed for this recipe.

6.   The sides of a triangle are in the ratio 2 : 4 :5. The triangle has a perimeter of 44 cm. Find the length of each side.

7.   A box of chocolates weighing 250g costs £4.80. How much should be charged for a 400g box of the same chocolates?

8.   300 grams of flour is used to make 12 scones.

   a) How many grams of flour would be needed to make 30 scones?

   b) If I have only 200 grams of flour, how many scones can I make?

9.   If I can travel 36 km in 15 minutes, how far can I travel in an hour if I stay at the same speed?

10.   Daisy's heart beats 17 times in 15 seconds. What is her pulse rate in beats/minute?

Similarity

1. Find the missing lengths, x assuming that each of the shapes below are similar:

a)

9

12

13.5

x

b)

12

10

6

x

c)

4

10

x

18
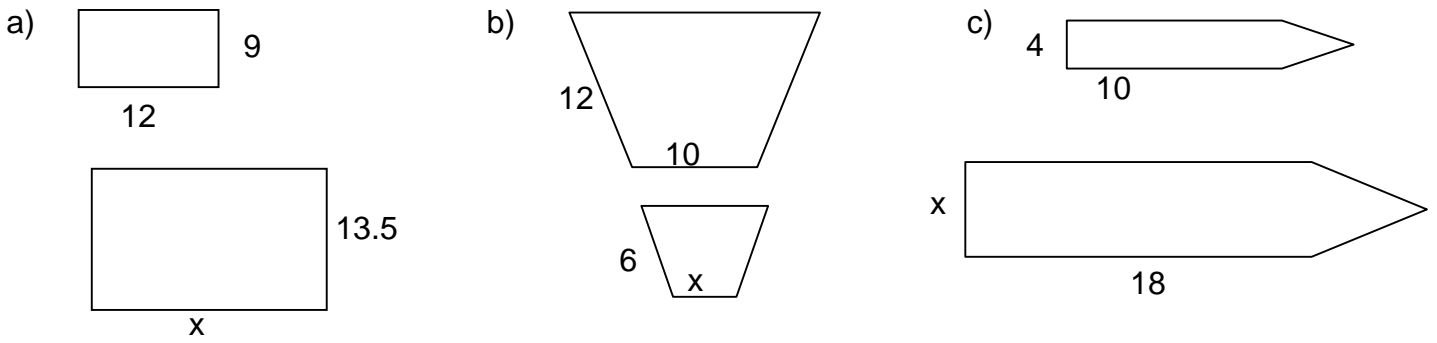
2. Which of the triangles below are similar? State how you know.

A

32⁰

29⁰

B   29⁰

119⁰

109⁰

32⁰   C
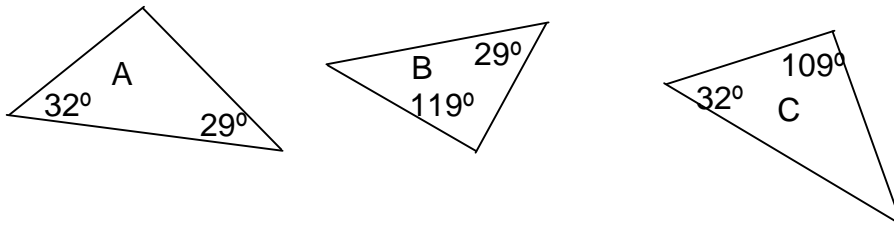
3. In the triangles below, find the missing dimension x.

a)

16 42⁰

18

40 42⁰

x

b)

x

24

8

12

c)

28

x

10

20
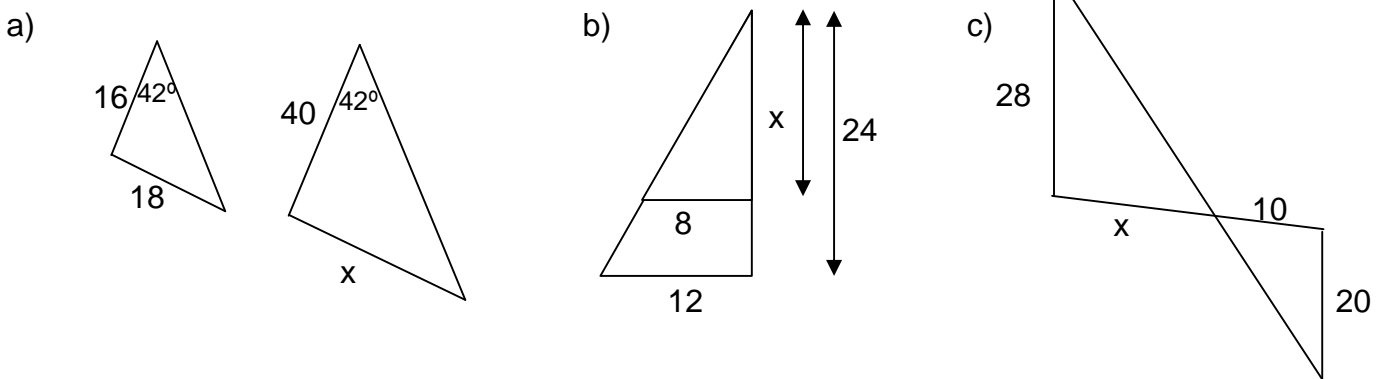
4. Use the information given to find the area of the shape on the right assuming each shape is similar.

a)

9 cm

Area =
41 cm²

18 cm

b)

16 cm

Area =
182 cm²

8 cm

24.8 cm

c)

8 cm

Area =
30 cm²
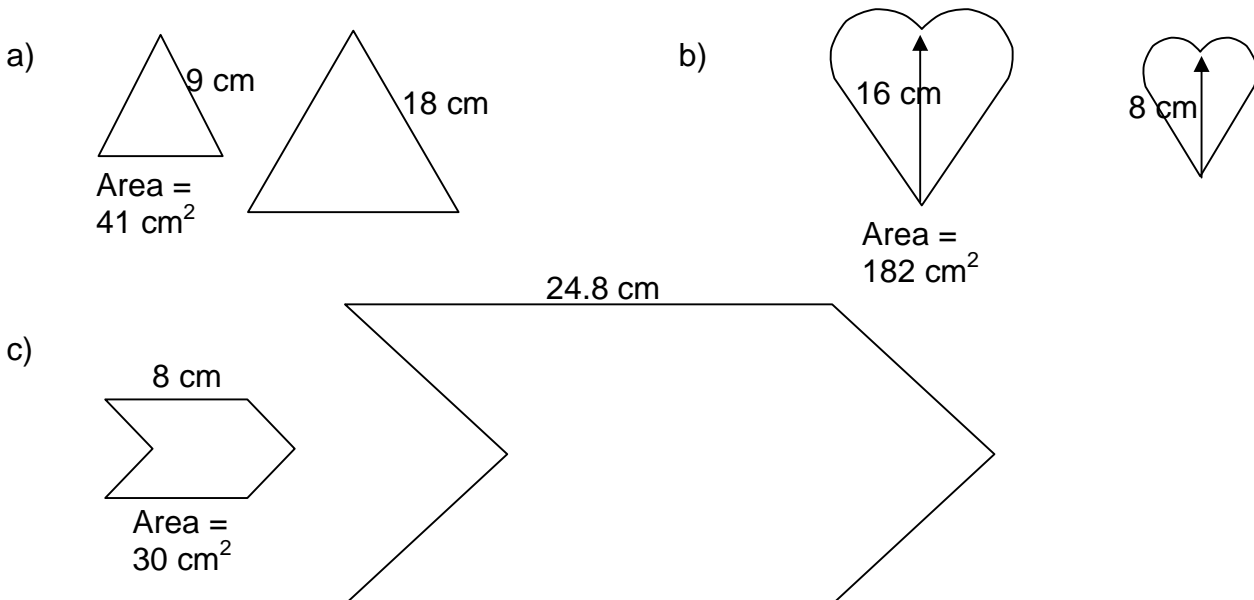
Angles and Circles

1. Copy and complete each diagram, filling in as many missing angles as you can:

a)

102⁰

b)

110⁰

125⁰

c)

39⁰

65⁰

d)

86⁰

71⁰
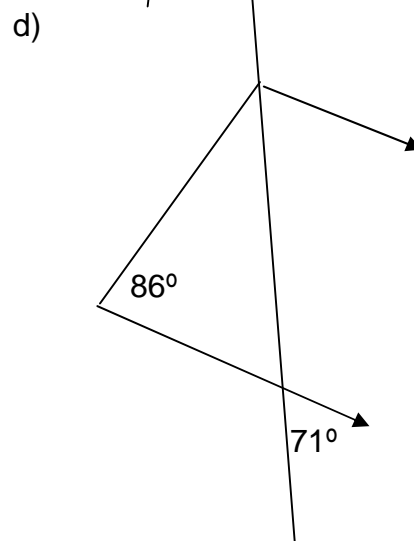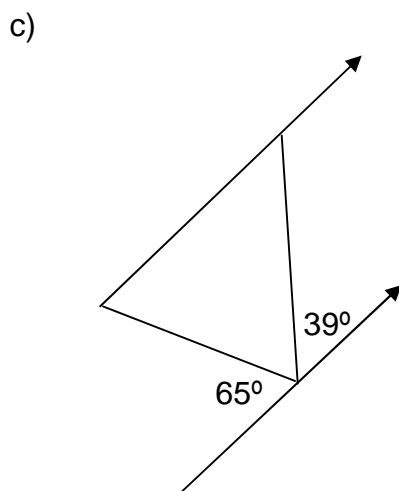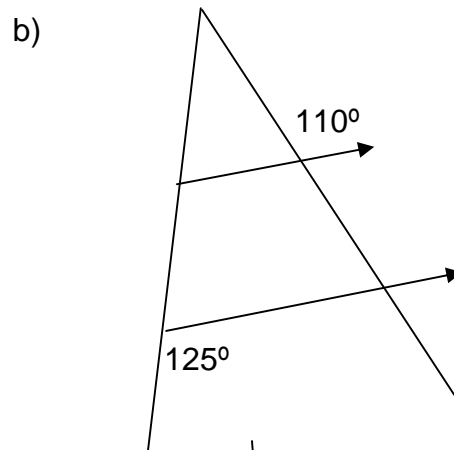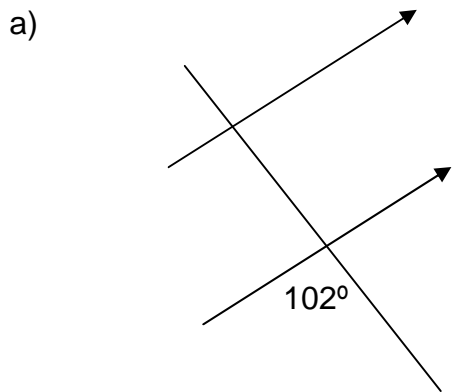
2. Use your knowledge of angles in circles to find the missing angles marked x:

a)

x^0

28⁰

b)

x^0

59⁰

c)

51⁰

x^0

d)

124⁰

x^0

e)

x^0

48⁰
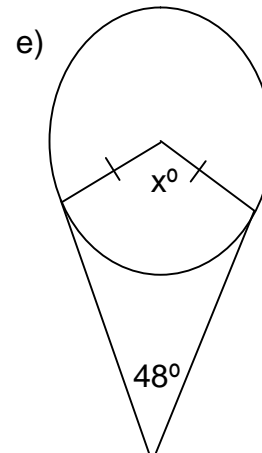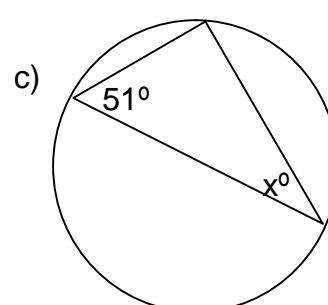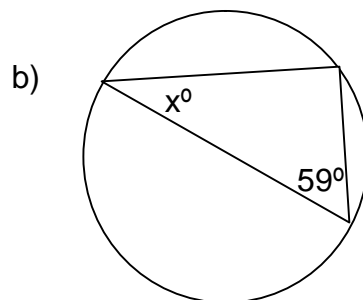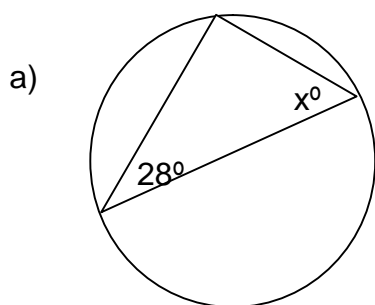
Averages

1.   Find the mean, median, mode and range of the data sets below. Be sure to label each answer clearly.

   a) 12, 14, 20, 11, 10, 10, 20, 18, 22, 9

   b) 125, 230, 360, 360, 180

2.   Showing all working and **without using a calculator**, find the mean of each set of data, giving your answers correct to 2 decimal places:

   a)   4, 6, 2, 7, 3, 4   b)   2, 2, 8, 7, 4, 5, 6, 4, 6

   c)   3, 5, 7, 2, 8, 4, 10   d)   3, 7, 2, 5, 8, 4, 12, 6

3.   Copy and complete the table below:

Amount of pocket money (£)	Frequency
5	1
6	2
7	6
8	4
9	3
10	4
Total	

   a) Calculate the mean amount of pocket money received.
   b) State the modal amount of pocket money.
   c) What is the probability that a pupil selected at random receives more than £8?

4.   Three pupils have a mean score of 18. If John scored 11, and Gary scored 17, what did the final pupil Dave score?

5.   In a survey on the cost of petrol the following results were found:

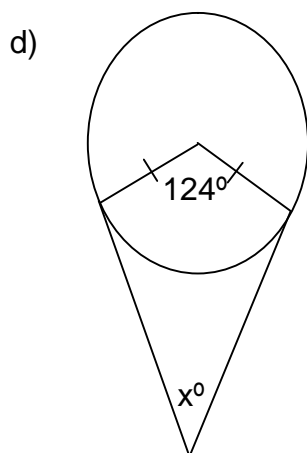   In town: Average cost = 138 pence   Range of prices = 4 pence
   In rural areas: Average cost = 142 pence   Range of prices = 7 pence.

   Give **two** statements to compare the prices in towns and rural areas.

Scatter Plots

For each question below, set up suitable axes and plot the results on a scatter plot.
Mark on the line of best fit.
Use your line of best fit to answer the questions given.

1.   The results of a maths exam are compared to those of a physics exam. They are shown below:

Maths Score (%)	25	40	50	75	60	10	90	85	60
Physics Score (%)	45	50	60	80	60	15	90	95	65

   a) Describe the correlation shown.

   b) If a pupil scored 40% on the maths test, what result would you predict for him on the physics test?

   c) If a pupil scored 70% in physics, what result would you predict for her for maths?

2.   The results of a fitness survey are shown below:

Hours of fitness/week	2	3	4	5	5	6	7	10	12
Resting pulse	84	78	74	70	72	70	68	67	64

   Note: draw your vertical axis from 60 to 80.

   a) Describe the correlation shown.

   b) If a pupil did 8 hours of exercise a week, what would you predict his resting pulse to be?

   c) If a pupil had a resting pulse of 75, how many hours of exercise do you think they do a week?

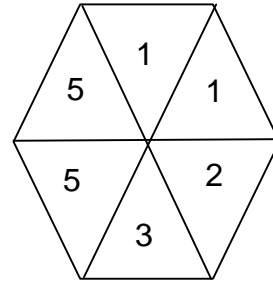   d) What other factors might influence the resting heart rate of pupils?

Probability

1.   A spinner as shown is spun round and allowed to come to a natural stop. What are the chances that the spinner lands on:
      a) a 5
      b) and even number
      c) a number less than 3
      d) a prime number
      If the spinner is spun 300 times, how many times would you expect to get:
      e) a 5
      f) a number over 1
      g) an odd number.

2.   Two coins are flipped and the results noted. List all possible outcomes for the two coins in a table as shown:

Coin 1	Coin 2
H	

      Use your table to state the probability of getting two tails when you flip two coins.

3.   A bag contains three different coloured marbles: 7 blue, 8 red and 3 green.
      A marble is selected at random from the bag. State the probability that it is:
      a) Blue   b) Not red?

      The first marble out of the bag is red. The selection process is repeated. What is the probability of the next marble selected being:
      c) Blue   d) Red

4.   From the graph shown,

      a) Which group has the highest probability of being involved in a fatal accident?

      b) Which group seems to be the least likely to have a fatal accident?

Number of Drivers
in Fatal Crashes
1988
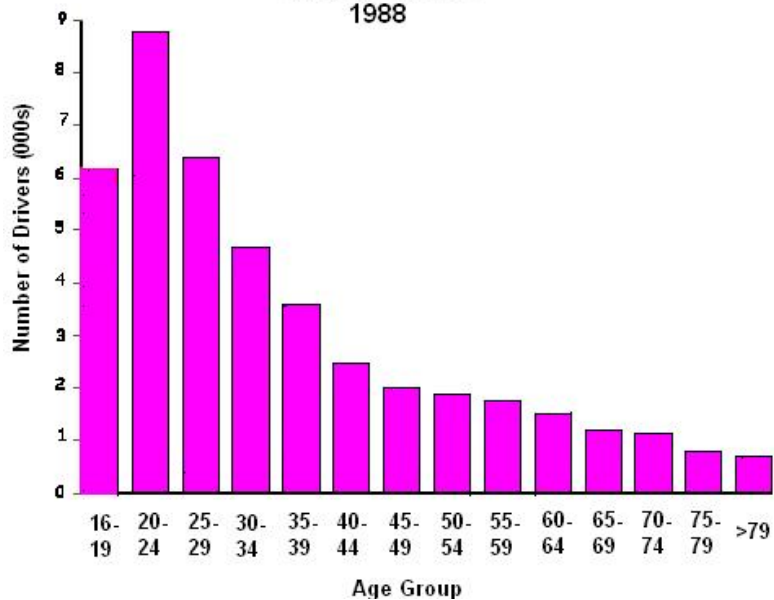
5.   The grades of a class are given in the table below;

Grade	Number of pupils
A	8
B	10
C	7
D	3
E	1

      What is the probability that a student selected at random will have ;
      a) an A Grade   b) a grade less than a C?

Negative Numbers

1.   Copy and complete these calculations:

a) 5 + (-8)

b) (-9) + 21

c) (-13) – 8

d) 7 – (-4)

e) (-9) – (-4)

f) 6 x (-3)

g) (-24) ÷ (-8)

h) (-8) x (-2) ÷ (-4)

2.   If a = 10, b = (-5) and c = (-2), evaluate:

a) ab

b) abc

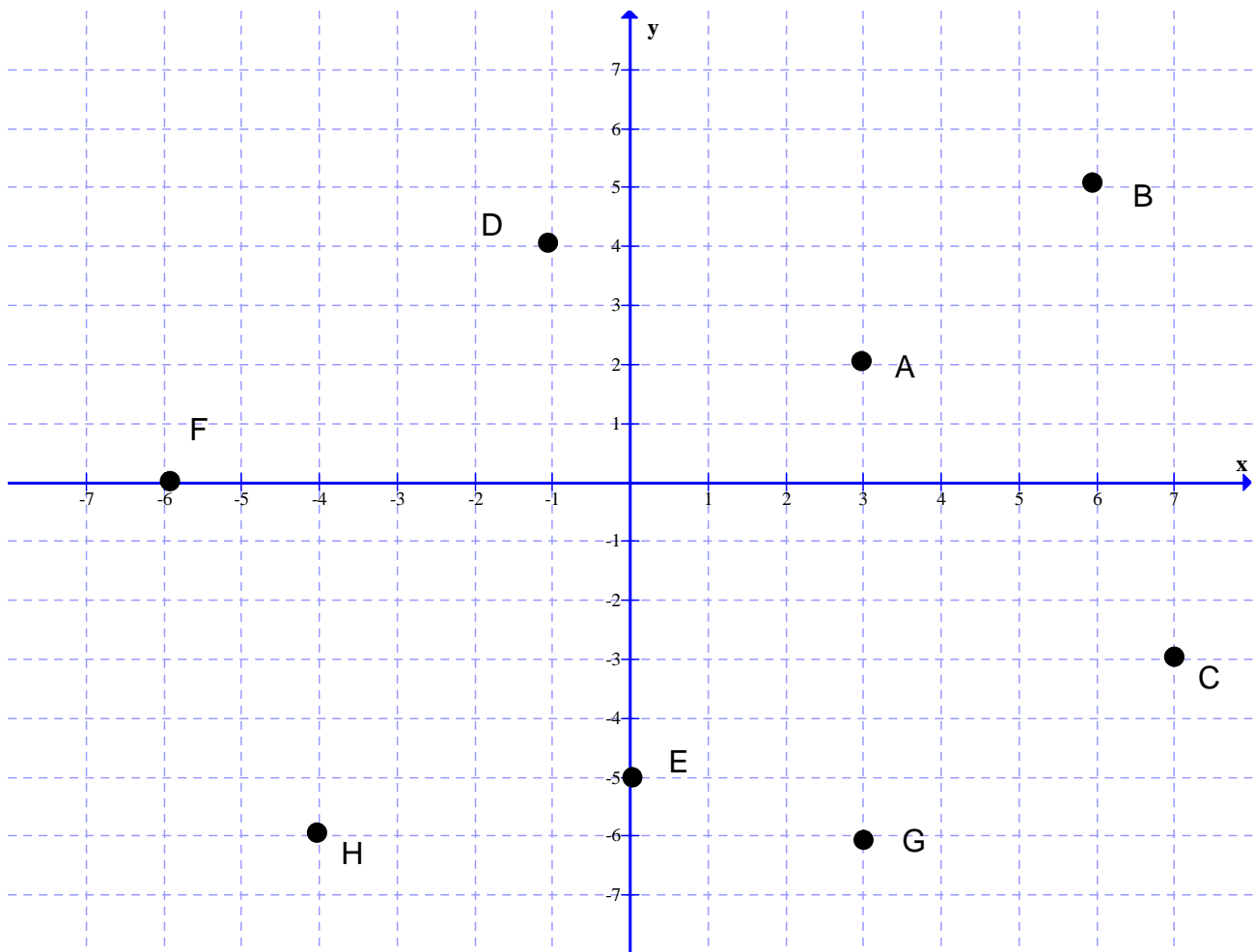c) b + c

d) a – c

e) a + bc

f) b^2

g) a – 3c

h) $\dfrac{bc}{a}$

3.   Name the coordinates marked on the grid below:

Negative Numbers Further Examples

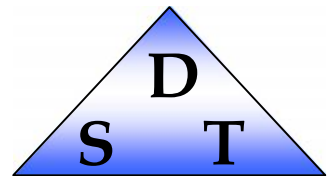1.   Copy each example and complete the calculation:

a) 6 + (-4)   b) 5 – 9   c) 12 – 20   d) (-8) + 2

e) (-4) + 12   f) (-11) – 2   g) (-8) + 15   h) (-9) – 13

i) 6 – (-4)   j) 2 – (-8)   k) (-5) – (-3)   l) (-12) – (-6)

2.   Copy each example and complete the calculation:

a) 5 x (-3)   b) (-8) x 4   c) (-9) x (-2)   d) (-6) x 2

e) (-27) ÷ (-3)   f) 36 ÷ (-6)   g) (-8) ÷ (-4)   h) (-40) ÷ (-8)

i) $(-4)^2$ j) $(-8)^2$ k) $\dfrac{(-6) \times 2}{(-3)}$ l) $\dfrac{(-9) \times (-4)}{(-12)}$

Speed, Distance, Time
1.   In each example below find the average speed.

Question	Distance travelled	Time taken
a)	360 miles	12 hours
b)	540 km	3 hours
c)	280 metres	20 seconds
d)	64 km	1 hour 15 minutes
e)	2460 miles	12 hrs 30 minutes
f)	3270 miles	48 hours 45 minutes

2.   In each example below find the time for the journey giving your answer in hours and minutes.

Question	Distance travelled	Average Speed
a)	256 miles	64 mph
b)	95 miles	38 mph
c)	110 miles	40 mph
d)	**1300 miles**	400 mph

3.   In each example below find the distance travelled.

Question	Average Speed	Time taken
a)	44 mph	6 hours
b)	60 mph	2½ hours
c)	72 mph	1¼ hours
d)	68 mph	5¾ hours

4.   It takes Simon 4 hours and 12 minutes to travel 252 miles. What is his average speed for this journey?

5.   Grace runs at an average pace of 9 kmph for 2 hours and 36 minutes. How far does she get in this time?

6.   How long would it take a train to cover 430 miles if it can average a speed of 50 mph? Answer in hours and minutes.

Straight Lines

Copy and complete each of the tables below in your jotter. Draw a graph and plot the sets of points. Join them to make a straight line graph and label each line clearly.

1.

x	-3	0	2
y = x + 4			

2.

x	-4	0	6
y = ½ x			

3.

x	-3	0	1
y = 2x + 3			

4,

x	-1	0	2
y = 3x - 5			

5.

x	-2	0	4
y = 6 - x			

6.

x	-4	0	5
y = 3 - x			

7.

x	-2	0	4
y = 1.5x + 2			

8.

x	-4	0	2
y = 2.5x - 1			

9.   Name each line below:
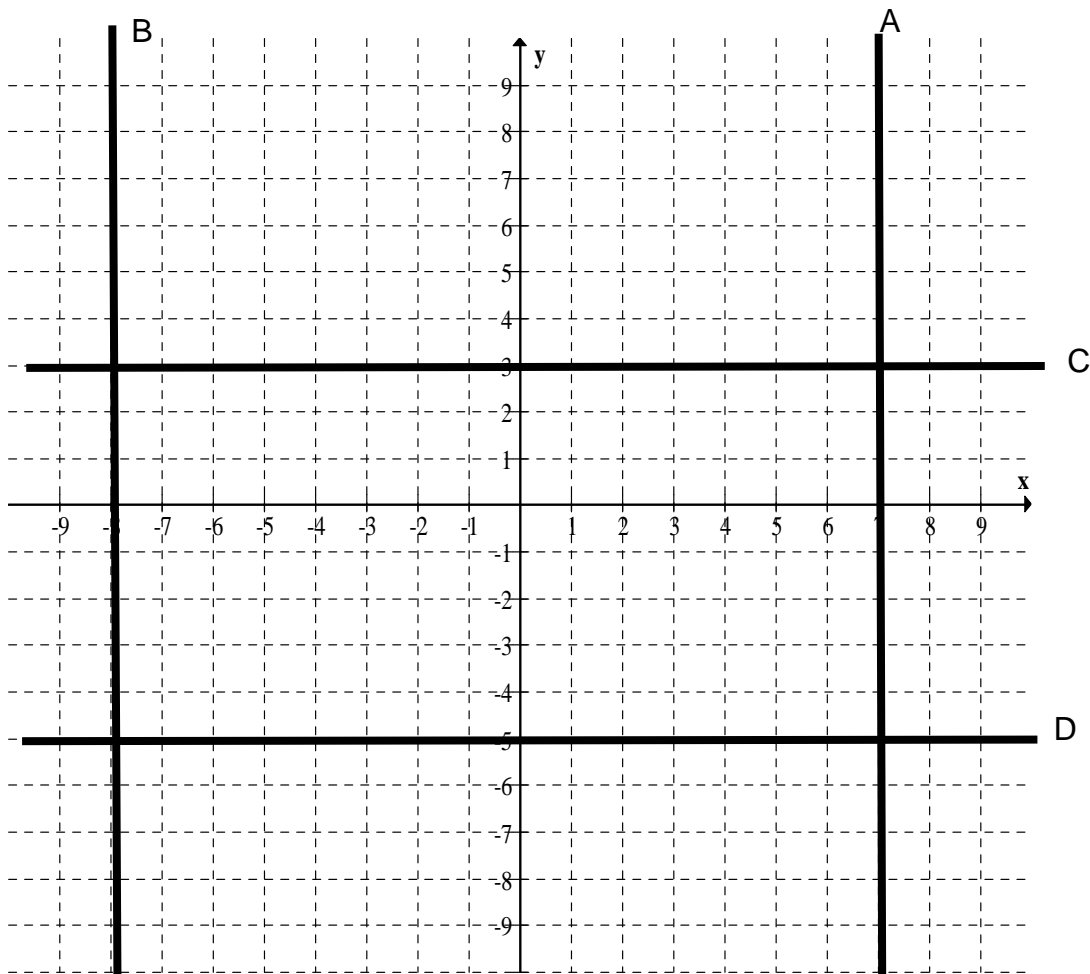
Solving Equations

1. For each question below, solve for x:

    a) 5x + 8 = 23   b) 6x + 2 = 44   c) 10x − 9 = 41

    d) 8x − 7 = 81   e) 9x + 12 = 120   f) 7x − 13 = 57

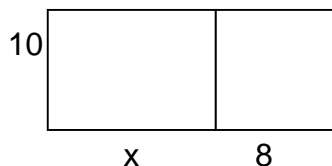   g) 8 + 3x = 20   h) 5 + 7x = 54   i) 18 = 8x − 6

2. Create an equation for each problem and then solve it to find x.

    a) I think of a number, x. Multiplying it by 3 and then adding 15 gives an answer of 42. What was my number?

    b) I think of a number, x. Multiplying it by 7 and then subtracting 5 gives an answer of 51. What was my number?

    c) The area of the shapes below is 100 cm2.

Solving Equations with a Variable on Both Sides

1. Solve for x:

    a) 5x + 3 = 2x + 9   b) 7x + 8 = 5x + 24   c) 9x + 11 = 4x + 66

    d) 6x − 1 = 4x + 13   e) 9x − 2 = 5x + 14   f) 11x − 6 = 8x + 18

    g) 4x - 8 = 10 − 2x   h) 7x + 8 = 48 - 3x   i) 9x - 7 = 4 − 2x

    j) 15 + 3x = 5x + 7   k) 3(4x + 2) = 2(x + 8) l) 4(5x − 1) = 4(4x + 5)

2. I think of a number. Multiplying it by 5 and subtracting 8 gives the same answer as tripling it and adding 4. Create an equation to represent this problem and solve it to find out what number I thought of.

Solving Equations With Brackets

1. Solve each of the following equations for x. Show each step in your working clearly.

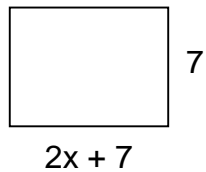   a) 5(8x − 9) = 35   b) 7(2x + 5) = 91   c) 10(3x − 8) = 190

    d) 8(2x + 9) = 56   e) 3(5x + 6) = -12   f) 5(6 - 7x) = -75

2.   The area of the rectangle is 84cm^2. Create an equation and then solve it to find x.

$$2x + 7$$

7

3.   I think of a number, x. When I subtract 5 from it and then triple the result I get an answer of 21.   Create an equation and then solve it to find x.

4.   Gary is x years old. Sarah is 4 years older. Kevin is three times Sarah's age. The total of all of their ages is 76 years. Create an equation and then solve it to find out how old each person is.

Changing the Subject

1.   Change the subject to y:

a) $y + 8 = z$

b) $y - 12 = g$

c) $d + y = f$

d) $ah + y = b$

e) $h = g - y$

f) $4y = t$

g) $by = x$

h) $cxy = p$

i) $yz = ab$

j) $\dfrac{y}{9} = m$

k) $\dfrac{y}{k} = d$

l) $\dfrac{y}{m} = f$

m) $\dfrac{ay}{k} = p$

n) $\dfrac{2y}{7} = g$

o) $\dfrac{y}{w} = \dfrac{r}{k}$

p) $\dfrac{y}{wx} = \dfrac{s}{j}$

q) $\dfrac{g}{f} = \dfrac{y}{d}$

r) $\dfrac{p}{f} = \dfrac{q}{y}$

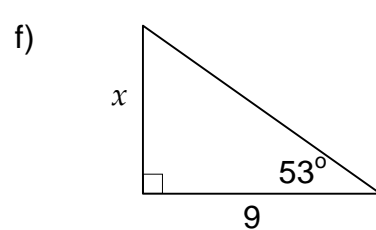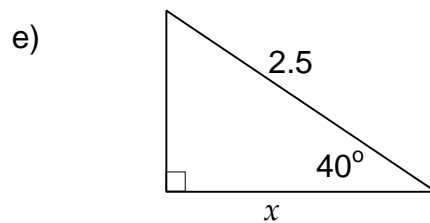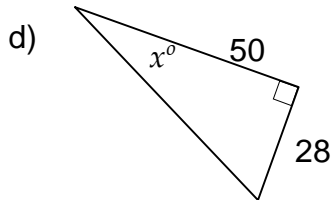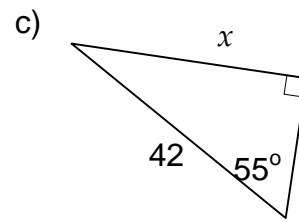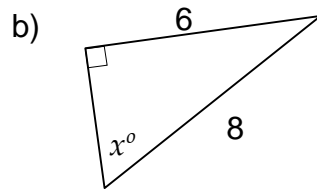s) $ay + b = c$

t) $fy - n = x$

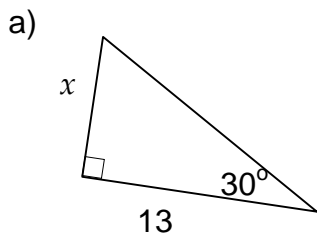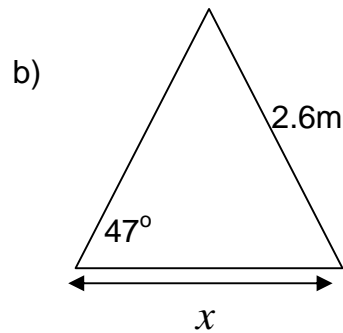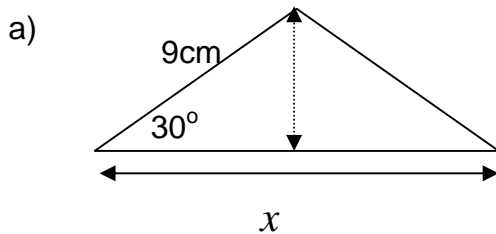u) $\dfrac{y - h}{w} = k$

v) $\dfrac{y}{w} - p = f$

w) $\dfrac{y}{g} + h = p$

x) $\dfrac{y + t}{b} = e$

Trigonometry

1. Find the size of angles and sides marked with a letter x in each diagram

a)

b)
6

8
x^o

c)
x

42 55°

d)
x^o 50

28

e)
2.5

40°

x

f)
x

53°

9

2. Find the length of the bases of these isosceles triangles

a)
9cm

30°

x

b)
2.6m

47°

x

3. A girl is flying a kite from a string of length 46m.

The string is taut, and is being held 1m above the ground.

Calculate the height of the kite above the ground if the angle of elevation is 36°
between the string and the horizontal.