Brilliant Maths Revision

GREEN PACK

Grade 4

Name:

If you complete this pack, you can trade it in for the next grade up – ask your maths teacher

Index Notation

1) a) Simplify $d \times d \times d \times d$
   b) Simplify $t \times t^2$
   c) Simplify $m^5 \div m^3$

2) a) Simplify $(2x^2)^3$
   b) Simplify $3x^2 \times 4x^5y^4$

3) a) Simplify $t^4 \times t^5$
   b) Simplify $x^8 \div x^5$
   c) Simplify $(c^4)^3$

4) a) Simplify $x^6 \times x^2$
   b) Simplify $\frac{x^8}{x^3}$
   c) Simplify $(2t)^3$
   d) Simplify $3x^2y \times 4x^5y^4$

5) a) Simplify $x^3 \times x^4$
   b) Simplify $t^7 \div t^3$
   c) Simplify $4x^2y^4 \times 3xy^2$

6) a) Simplify $x \times x \times x \times x$
   b) Simplify $2x \times 3y$

Introduction to Bounds

1) A silver necklace has a mass of 123 grams, correct to the nearest gram.
   a) Write down the least possible mass of the necklace.
   b) Write down the greatest possible mass of the necklace.

2) Each of these measurements was made correct to one decimal place.
   Write the maximum and minimum possible measurement in each case.

a) 4.6 cm	b) 0.8 kg	c) 12.5 litres	d) 25.0 km/h
e) 10.3 s	f) 36.1 m	g) 136.7 m/s	h) 0.1 g

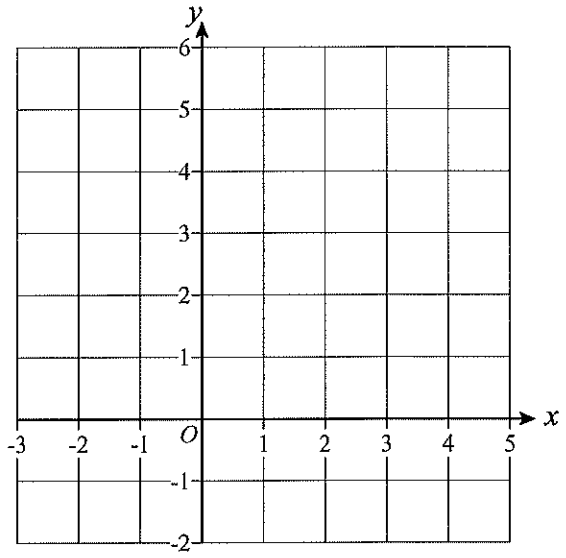
3) Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.
   a) Write down the least possible length of each side.
   b) Write down the greatest possible length of each side.
   c) Write down the greatest possible perimeter of the octagon.

4) A girl has a pen that is of length 12 cm, measured to the nearest centimetre.
   Her pencil case has a diagonal of length 12.5 cm, measured to the nearest millimetre.
   Explain why it might not be possible for her to fit the pen in the pencil case.

5) A square has sides of length 7 cm, correct to the nearest centimetre.
   a) Calculate the lower bound for the perimeter of the square.
   b) Calculate the upper bound for the area of the square.

Midpoint of a Line on a Graph

1) Find the midpoint of A and B where A has coordinates (-2, 5) and B has coordinates (4, -1).



2) Find the midpoint of A and B where A has coordinates (2, 0) and B has coordinates (8, 6).

3) Find the midpoint of A and B where A has coordinates (-4, -2) and B has coordinates (2, 4).

4) Find the midpoint of A and B where A has coordinates (-3, -2) and B has coordinates (7, 5).

5) Find the midpoint of A and B where A has coordinates (2, -5) and B has coordinates (7, 4).

6) Find the midpoint of A and B where A has coordinates (-7, -4) and B has coordinates (-2, -1).

7) The midpoint of A and B is at (1, 3).
The coordinates of A are (-2, 4).
Work out the coordinates of B.

8) The midpoint of A and B is at (3.5, 2.5).
The coordinates of A are (2, 5).
Work out the coordinates of B.

Expanding and Simplifying Brackets

1) Expand these brackets

a) $2(x + 3)$

b) $3(2x + 4)$

c) $5(3p - 2q)$

d) $4(x^2 + 2y^2)$

e) $6(r - r^2)$

2) Expand these brackets

a) $x(x - 2)$

b) $x(3x + 5)$

c) $p(3p - 7q)$

d) $y(y + 6y^2)$

e) $x(r + r^2)$

3) Expand these brackets

a) $2x(x - 5)$

b) $4x(2x + 3)$

c) $5p(4p - 2q)$

d) $2y(3y + 4x^2)$

e) $x(x + r^2)$

4) Expand these brackets

a) $x(x^2 - 2)$

b) $3x(2x^3 + 1)$

c) $5p^2(4p - 2)$

d) $2y^2(3y^3 + 4y)$

e) $2xy(x + y^2)$

5) Expand and simplify

a) $2(x + y) + 3(x + y)$

b) $3(2x + y) + 2(5x + 3y)$

c) $5(x + y) + 3(2x + y)$

d) $3(2c + d) + 2(c + d)$

e) $4(2p + q) + 3(2p + q)$

6) Expand and simplify

a) $2(x + y) + 3(x - y)$

b) $5(2x + y) + 2(3x - 2y)$

c) $4(x - y) + 3(2x + y)$

d) $6(2c - d) + 2(c - d)$

e) $2(5p - q) + 3(p - 2q)$

7) Expand and simplify

a) $3(x + 2y) - 3(x - y)$

b) $5(2x - y) - 2(3x - 2y)$

c) $7(x - 2y) - 3(2x + y)$

d) $6(2x - y) - 2(x + 2y)$

e) $2(5p - q) - (p - 3q)$

Solving Equations

1) Solve $2x - 3 = 17$

2) Solve $3x + 2 = 14$

3) Solve $5x - 7 = 33$

4) Solve $4x + 7 = 19$

5) Solve $x + x + x + x = 20$

6) Solve $x + 3x = 24$

7) Solve $2(x + 3) = 8$

8) Solve $2(3x - 4) = 22$

9) Solve $5(t - 1) = 20$

10) Solve $3(2x + 5) = 36$

11) Solve $2x + 7 = x + 11$

12) Solve $5y - 2 = 3y + 10$

13) Solve $2x + 1 = 5x - 20$

14) Solve $p - 3 = 3p - 11$

15) Solve $2d + 5 = 20 - 3d$

16) Solve $4 - e = 2e - 8$

17) Solve $2(x + 3) = x + 9$

18) Solve $x - 7 = 3(2x - 4)$

19) Solve $5(x + 3) = 2(x + 6)$

20) Solve $4(2y + 1) = 2(12 - y)$

21) Solve $7 - 3x = 2(x + 1)$

22) Solve $\frac{x}{2} = 5$

23) Solve $\frac{x}{5} = 6$

24) Solve $\frac{2x}{3} = 4$

25) Solve $\frac{5x}{2} = 15$

26) Solve $\frac{x - 2}{3} = 1$

27) Solve $\frac{x + 5}{2} = 7$

28) Solve $\frac{2x + 1}{4} = 2$

29) Solve $\frac{5x - 3}{3} = 4$

30) Solve $\frac{x + 2}{3} = x + 4$

31) Solve $\frac{3x - 1}{4} = 2x - 3$

32) Solve $\frac{4x + 3}{5} = \frac{2x - 1}{2}$

Rearranging Simple Formulae

1) Make c the subject of the formula.

$a = b + cd$

2) Make t the subject of the formula.

$u = v + 2t$

3) Make n the subject of the formula.

$M = 3n + 5$

4) Make z the subject of the formula.

$x = 3y + z$

5) $r = 5s + 3t$

a) Make t the subject of the formula.

b) Make s the subject of the formula.

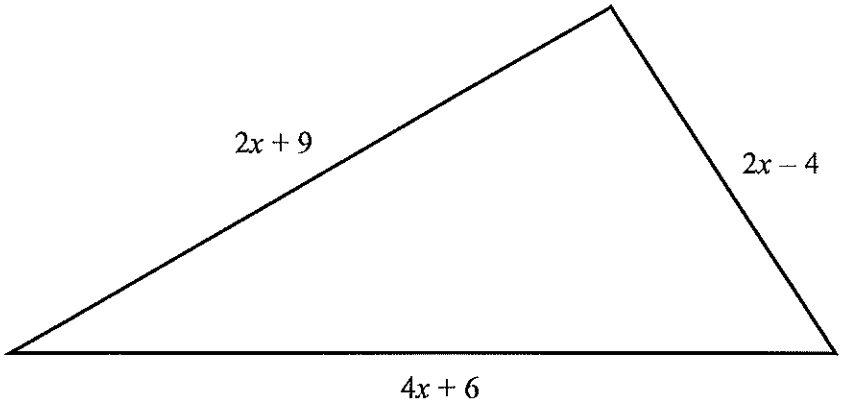
6) Rearrange $y = 3x + 1$ to make x the subject.

7) Rearrange $y = \frac{1}{2}x + 2$ to make x the subject.

8) Rearrange $y = \frac{1}{3}x + 1$ to make x the subject.

Forming Formulae and Equations

1)



In the diagram, all measurements are in centimetres.

The lengths of the sides are

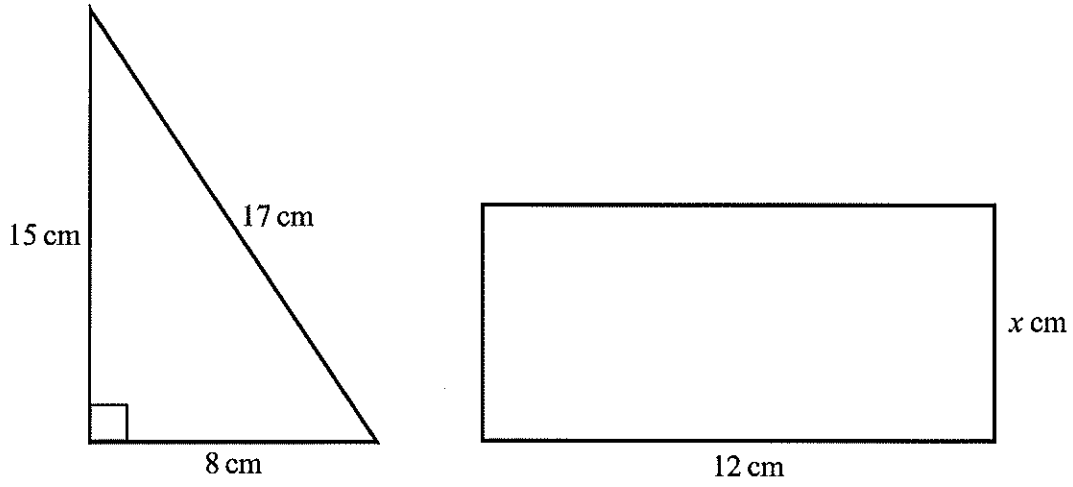
$2x + 9$
$2x - 4$
$4x + 6$

a) Find an expression, in terms of x, for the perimeter of the triangle.
Give your expression in its simplest form.

The perimeter of the triangle is 39 cm.

b) Find the value of x.

2) The diagram shows a right-angled triangle and a rectangle.



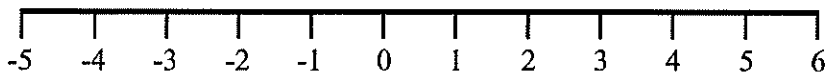
The area of the right-angled triangle is equal to the area of the rectangle.

Find the value of x.

Inequalities on a Number Line

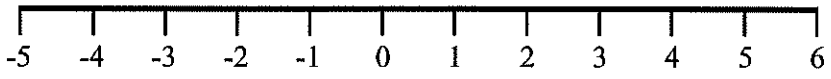
1) Represent this inequality on the number line

$-3 < x \leqslant 2$

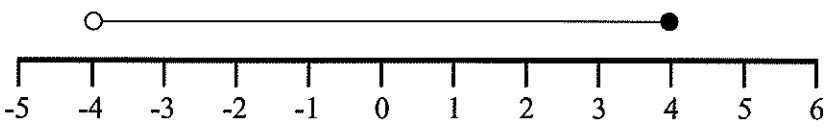


2) Represent this inequality on the number line

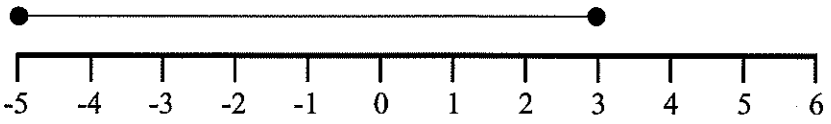
$-1 \leqslant x < 5$



3) Write down the inequality shown



4) Write down the inequality shown



5) If y is an integer, write down all the possible values of

$-2 < y \leqslant 5$

6) If x is an integer, write down all the possible values of

$-9 < x < -5$

Solving Linear Inequalities

1) Solve

a) $3x-1>5$

b) $7y+2\leq 30$

c) $\frac{x}{2}-3\geq 2$

d) $5+2x>7$

e) $8<5p-2$

f) $\frac{y}{3}+5\geq 3$

g) $\frac{2x}{3}-5\geq -3$

h) $6x-5>2x+3$

i) $3p-9<6-2p$

j) $5-3y<2y-10$

2) a) Solve the inequality

$2z+2\geq 7$

b) Write down the smallest **integer** value of z which satisfies the inequality

$2z+2\geq 7$

3) $5x+2y<10$

x and y are both integers.

Write down two possible pairs of values that satisfy this inequality.

$x =$ ....., $y =$ .....

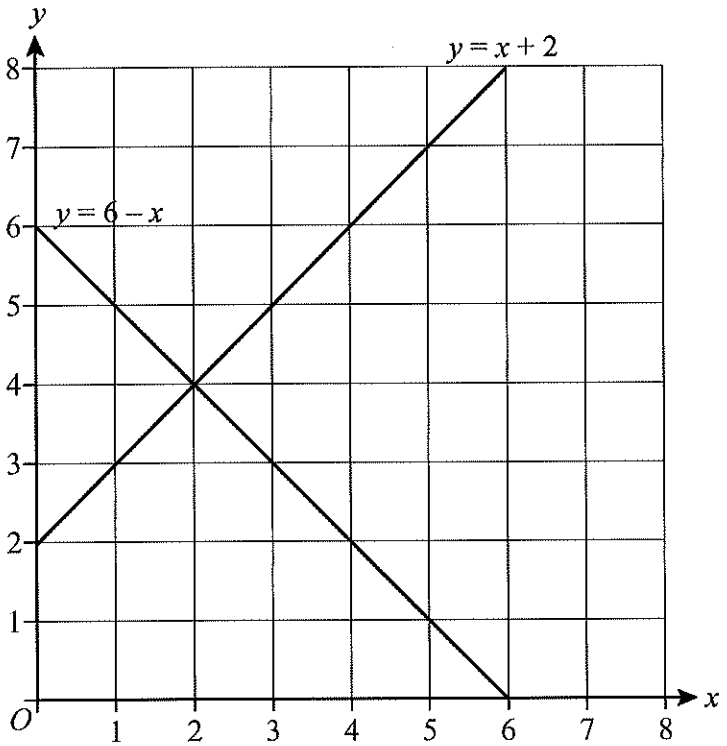
and

$x =$ ....., $y =$ .....

Simultaneous Equations Graphically

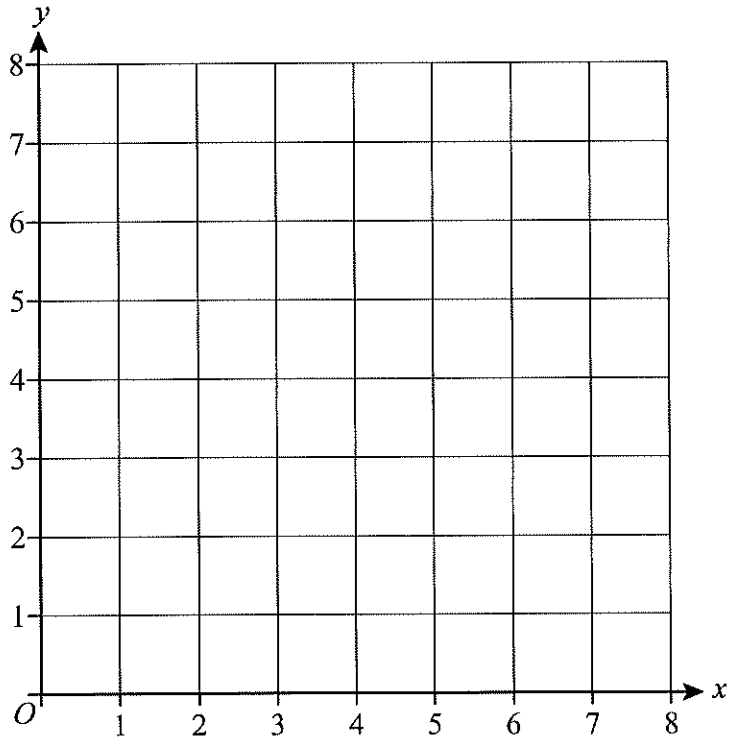
1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.

Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$



2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$

Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$



Fibonacci Sequences

1) Write down the next two terms of the Fibonacci sequence that begins

1, 1, 2, 3, 5, 8, 13, . . .

2) If the first three Fibonacci numbers are $x_1 = 1, x_2 = 1, x_3 = 2,$

what is the least value of n for which $x_n > 60$?

3) If the first three Fibonacci numbers are $x_1 = 1, x_2 = 1, x_3 = 2,$

what is the value of n for which $x_n + x_{n+1} = 89$?

4) If the first three Fibonacci numbers are $x_1 = 1, x_2 = 1, x_3 = 2,$

what is the value of n for which $x_n + x_{n+1} + x_{n+2} = 68$?

5) If the first three Fibonacci numbers are $x_1 = 1, x_2 = 1, x_3 = 2,$

what is the value of n for which $x_{n-1} + x_n = 144$?

6) If the first three Fibonacci numbers are $x_1 = 1, x_2 = 1, x_3 = 2,$

what is the least value of n for which $\frac{x_{n+1}}{x_n} = 1.619$ correct to three decimal places?

Compound Units

1) Jane runs 200 metres in 21.4 seconds.

Work out Jane's average speed in metres per second.
Give your answer correct to 1 decimal place.

2) A car travels at a steady speed and takes five hours to travel 310 miles.

Work out the average speed of the car in miles per hour.

3) A plane flies 1440 miles at a speed of 240 mph.

How long does it take?

4) A marathon runner runs at 7.6 mph for three and a half hours.

How many miles has he run?

5) A car takes 15 minutes to travel 24 miles.

Find its speed in **mph**.

6) A cyclist takes 10 minutes to travel 2.4 miles.

Calculate the average speed in mph.

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7) An ice hockey puck has a volume of 113 cm^3.

It is made out of rubber with a density of 1.5 grams per cm^3.

Work out the mass of the ice hockey puck.

8) An apple has a mass of 160 g and a volume of 100 cm^3.

Find its density in g/cm^3.

9) A steel ball has a volume of 1500 cm^3.

The density of the ball is 95 g/cm^3.

Find the mass of the ball **in kg**.

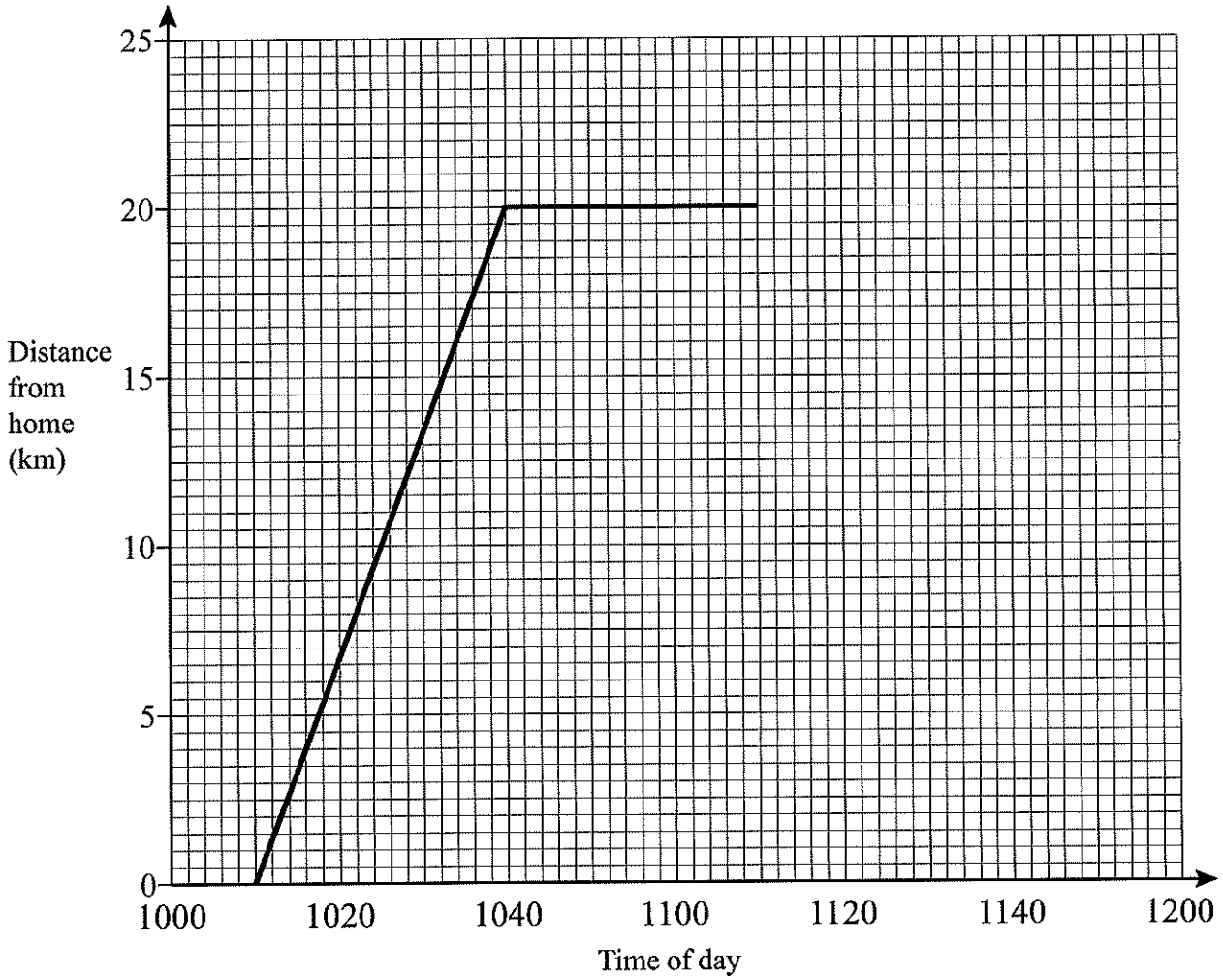
10) The mass of a bar of chocolate is 1800 g.

The density of the chocolate is 9 g/cm^3.

What is the volume of the bar of chocolate?

Distance-Time Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.



a) At what time did Sarah leave home?

b) How far was Sarah from home at 1030?

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house.

Sarah returned home at a steady speed.
She arrived home at 11 50

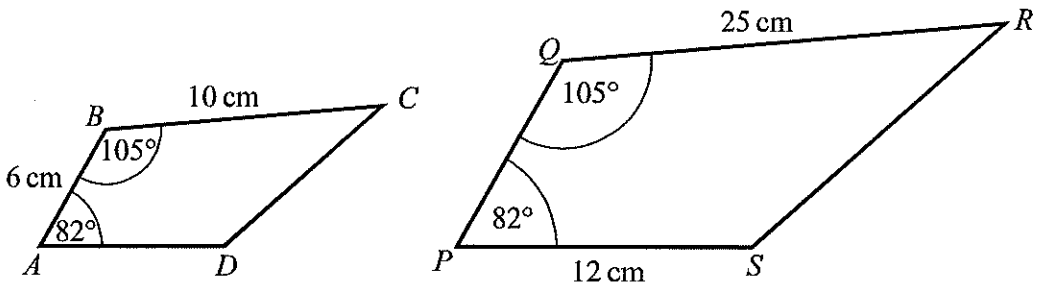
d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour.

f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour.

Similar Shapes

1)

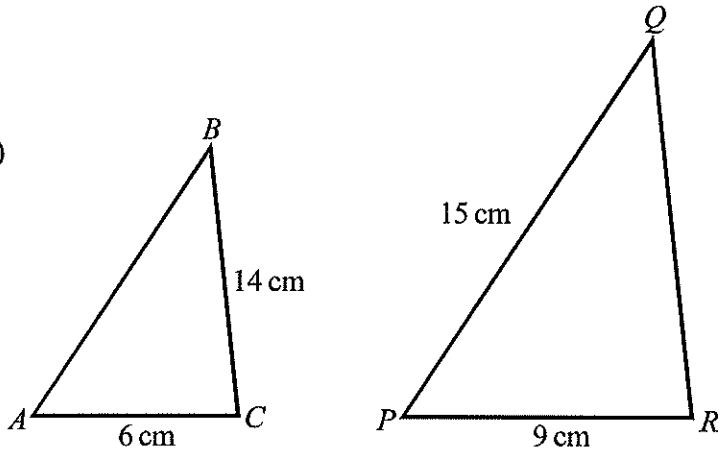


ABCD and *PQRS* are mathematically similar.

a) Find the length of *PQ*.

b) Find the length of *AD*.

2)



Triangles *ABC* and *PQR* are mathematically similar.

Angle *A* = angle *P*.

Angle *B* = angle *Q*.

Angle *C* = angle *R*.

AC = 6 cm.

BC = 14 cm.

PR = 9 cm.

PQ = 15 cm

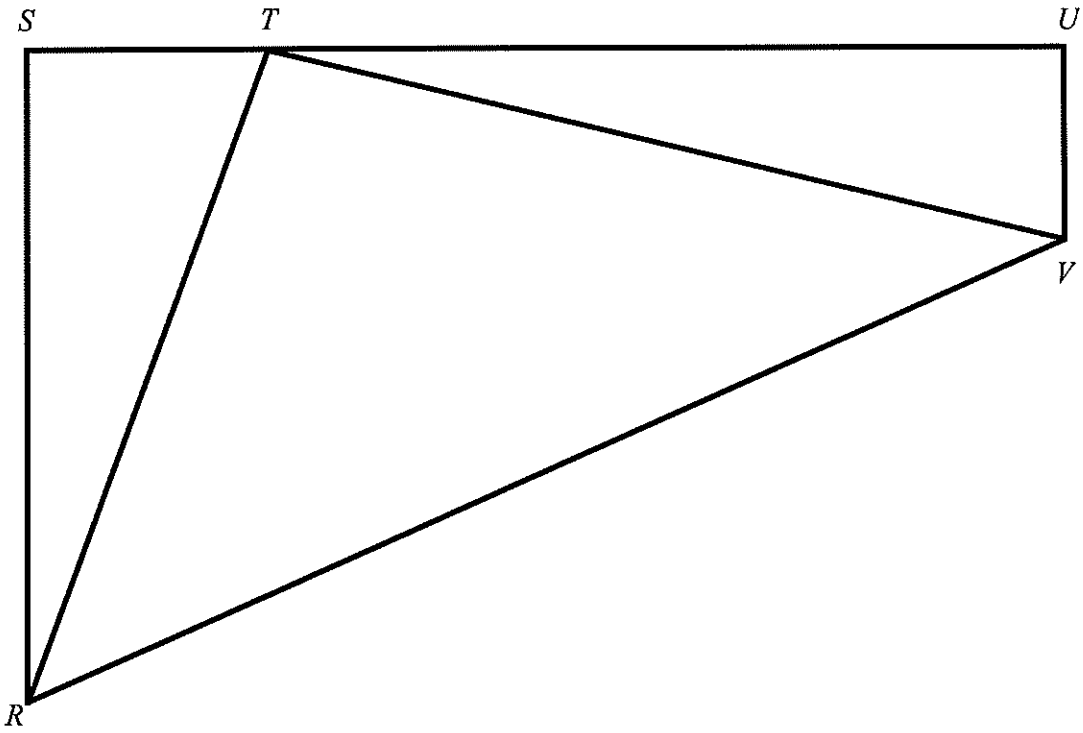
a) Work out the length of *QR*.

b) Work out the length of *AB*.

Bisecting an Angle

1) Using ruler and compasses, bisect angle *ABC*.

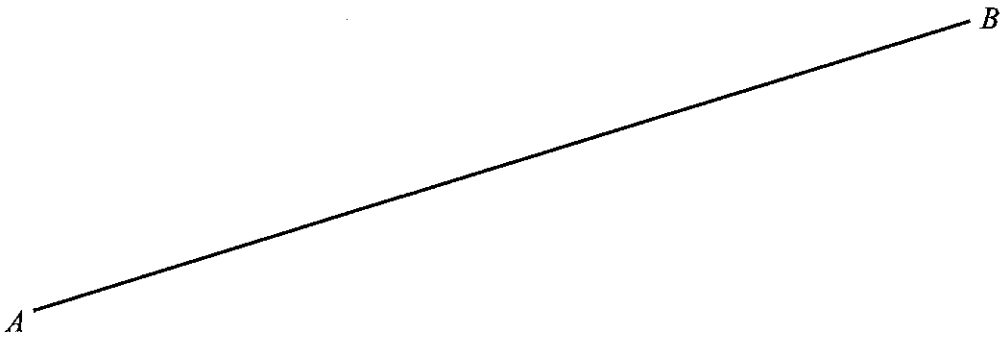
2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral *RSTUV*



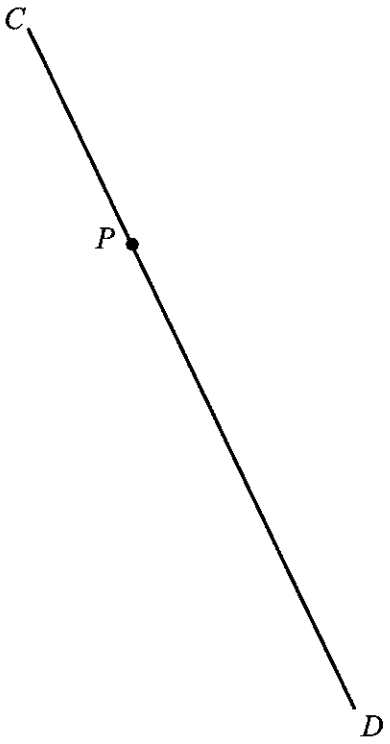
There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

Constructing Perpendiculars

1) Use ruler and compasses to bisect the line segment AB.
You must show all construction lines.



2) Use ruler and compasses to **construct** the perpendicular to the line segment CD that passes through the point P.
You must show all construction lines.



Drawing a Triangle Using Compasses

1) The diagram shows a sketch of triangle *ABC*.

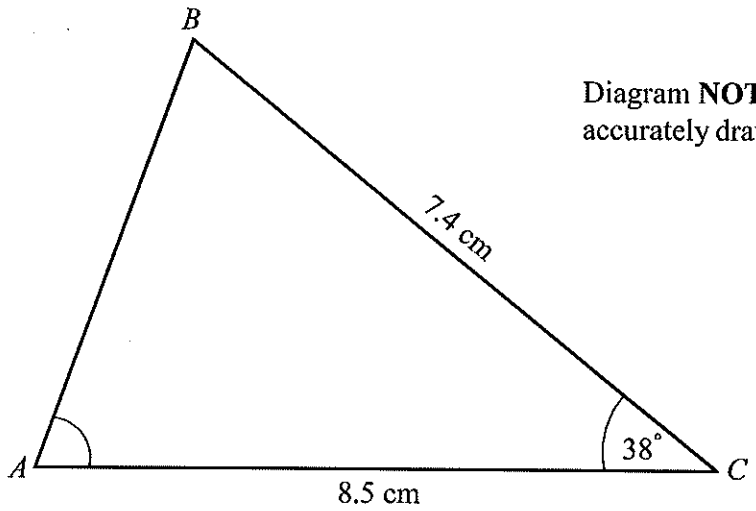


Diagram **NOT** accurately drawn

BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram.

2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.
You must show all construction lines.

3) The diagram shows a sketch of triangle *PQR*.

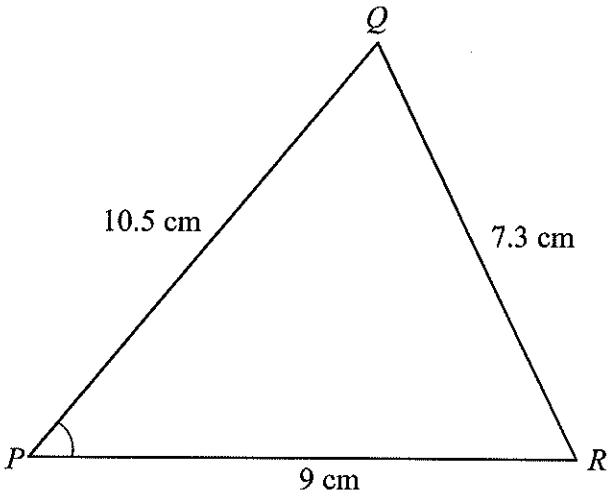


Diagram **NOT** accurately drawn

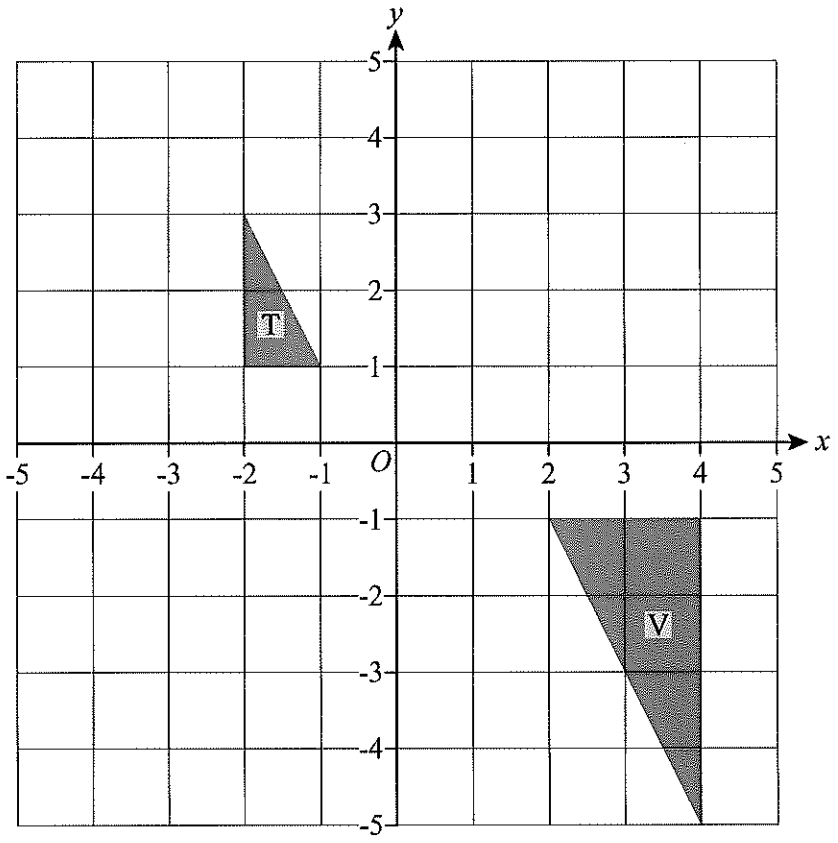
a) Use ruler and compasses to make an accurate drawing of triangle *PQR*.

b) Measure angle *P*.

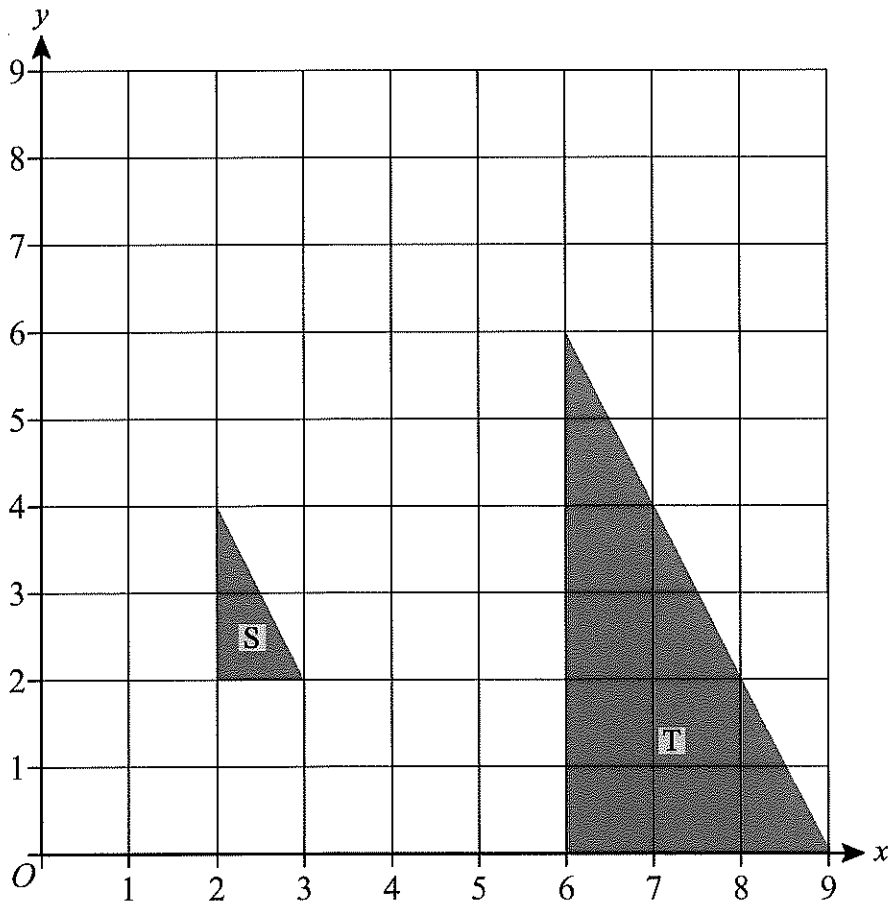
Enlargements

1) a) Enlarge triangle T by scale factor 2 using point (-5, 2) as the centre of enlargement.
Label your new triangle U.

b) Enlarge triangle V by scale factor a half using the point (-2, -3) as the centre of enlargement.
Label your new triangle W.



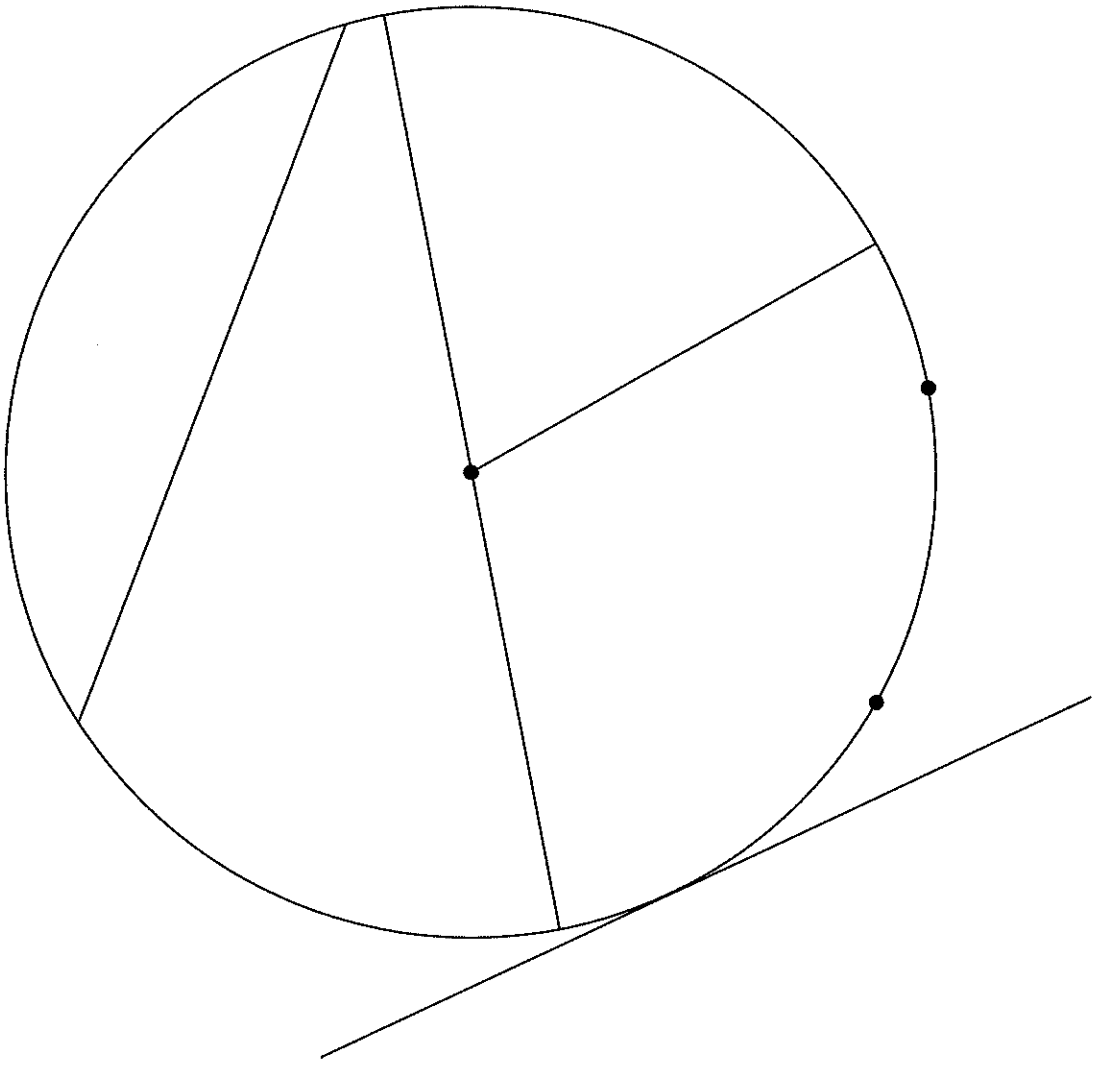
2) Describe fully the single transformation which maps triangle S to triangle T.



Tangents, Arcs, Sectors and Segments

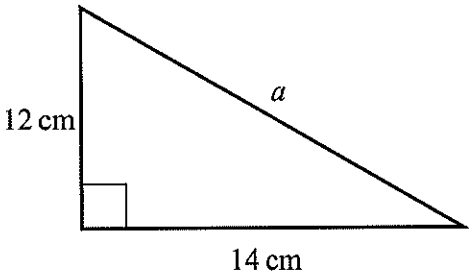
Tangent
Radius
Minor sector
Minor segment
Arc
Diameter
Chord
Circumference

On the diagram, mark on all of the words from the box in an appropriate place.

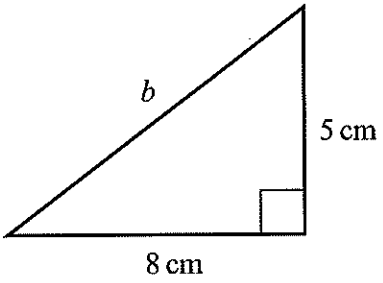


Pythagoras' Theorem

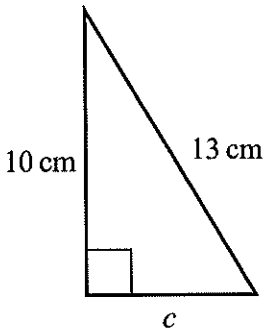
1) Find the length of side a.
Give your answer to 1 decimal place.



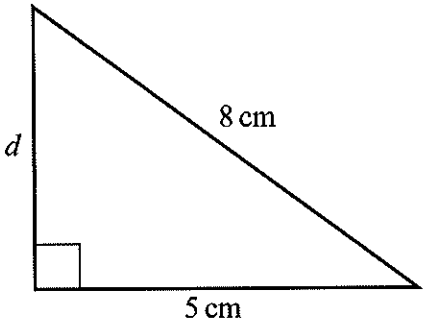
2) Find the length of side b.
Give your answer to 1 decimal place.



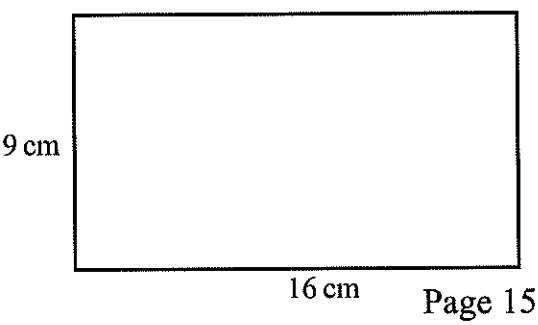
3) Find the length of side c.
Give your answer to 1 decimal place.



4) Find the length of side d.
Give your answer to 1 decimal place.

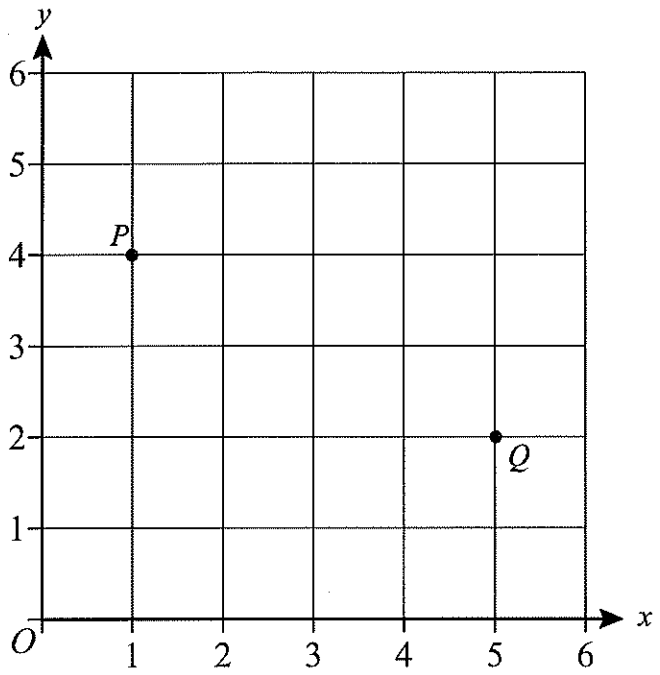


5) Find the length of the diagonal of this rectangle.
Give your answer to 1 decimal place.

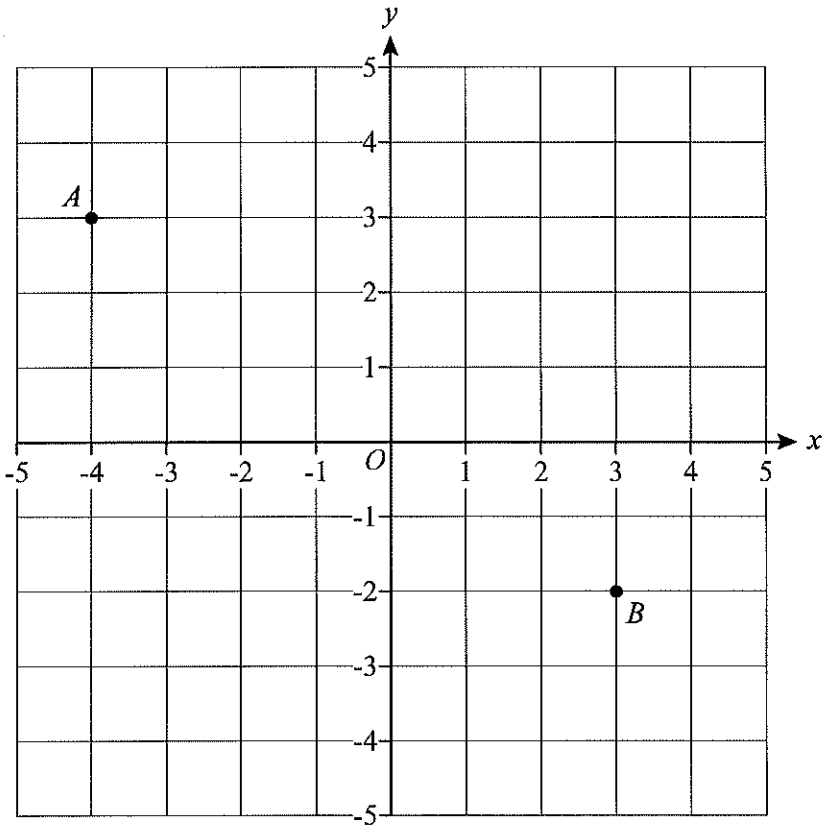


Pythagoras' Theorem

1) Points P and Q have coordinates (1, 4) and (5, 2).
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place.

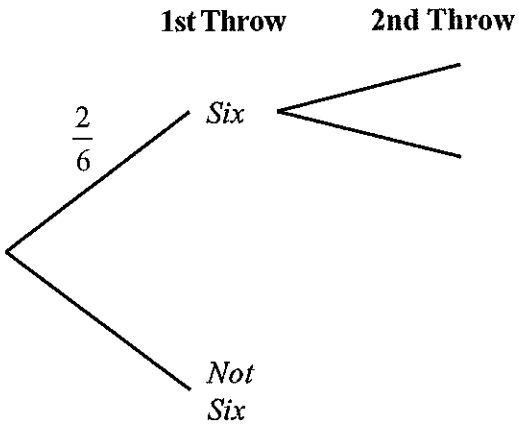


2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place.



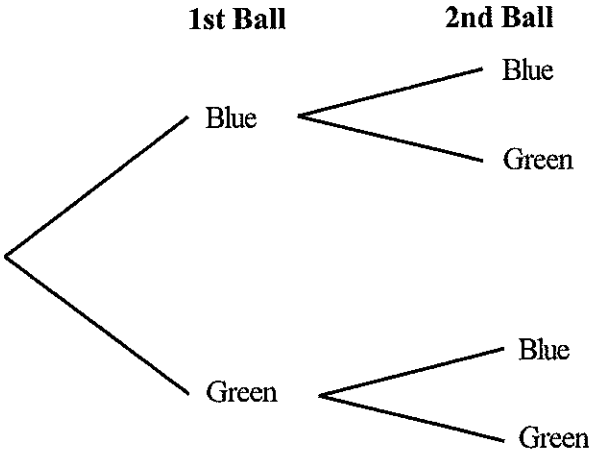
Simple Tree Diagrams

1) Lucy throws a biased dice twice.
Complete the probability tree diagram to show the outcomes.
Label clearly the branches of the tree diagram.



2) A bag contains 10 coloured balls.
7 of the balls are blue and 3 of the balls are green.
Nathan is going to take a ball, replace it, and then take a second ball.

a) Complete the tree diagram.



b) Work out the probability that Nathan will take two blue balls.

c) Work out the probability that Nathan will take one of each coloured balls.

d) Work out the probability that Nathan will take two balls of the same colour.

Sampling Populations

1) In a school there were 800 students who regularly had a school dinner.

The Headteacher of the school wanted to know whether the students liked the dinners.

a) What is the main advantage of asking a sample of the students whether they like school dinners rather than asking all of them?

b) The Headteacher asked 100 KS3 students whether they liked the dinners and 40 of them said they did.

Use this information to estimate how many of the 800 students liked school dinners.

c) In finding your answer to part b), what assumption have you made?

d) What could be done to make your estimate more accurate?

2) A park-keeper wanted to know how many fish there were in the park pond.

He went to the pond early one morning and used his fishing rod to catch 20 fish.
The bait he used was maggots.

Then, he marked each of the fish with a white dot on their tail and released them.

A week later, he used his fishing rod and maggots to catch another 20 fish.

He found that 4 of these 20 fish had the white dot on their tails.

a) Use this information to estimate how many fish there are in the pond.

b) In finding your estimate, what assumption have you made?

Time Series

The table on the right shows the sales figures for a manufacturing company over the course of 15 years.

a) Complete the time series graph to show this information.

b) What is the range of the sales figures?

c) Comment on the trend over the course of 15 years.

Year	Sales (£M)
2000	10
2001	5
2002	10
2003	25
2004	22.5
2005	50
2006	27.5
2007	15
2008	35
2009	55
2010	50
2011	25
2012	45
2013	62.5
2014	57.5