

# Brilliant Maths Revision

## GREEN PACK

### Grade 6

Name:

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

1) Find the value of:

a)  $2^3$

b)  $3^{-2}$

c)  $5^{-1}$

d)  $10^{-4}$

2) Find the value of:

a)  $2^3 \times 4^{-1}$

b)  $10^{-2} \times 2^{-4}$

c)  $5 \times 5^{-3}$

d)  $8 \times 2^{-3}$

3) Write these numbers in order of size.

Start with the smallest.

$3^2$   $3^{-1}$   $0.3$   $3^0$   $3^{-2}$   $-3$

4) If  $2^x = \frac{1}{64}$ , find the value of  $x$ .

## The Difference of Two Squares

1) Factorise

a)  $x^2 - 16$

c)  $y^2 - 9$

e)  $x^2 - \frac{1}{4}$

b)  $a^2 - b^2$

d)  $x^2 - 1$

f)  $x^2 - \frac{1}{9}$

2) Factorise

a)  $x^2 - 4y^2$

c)  $9x^2 - 16y^2$

e)  $4x^2 - 25y^2$

b)  $9a^2 - b^2$

d)  $\frac{1}{4}x^2 - y^2$

f)  $x^2 - \frac{1}{9}y^2$

3) Simplify

a)  $\frac{y^2 - 4}{y + 2} \times \frac{5}{y + 5}$

b)  $\frac{3}{2x + 1} \times \frac{4x^2 - 1}{x - 2}$

c)  $\frac{12x^2 + 8x}{9x^2 - 4}$

d)  $\frac{25a^2 - 16b^2}{10ab - 8b^2}$

4) Solve

a)  $4x^2 - 16 = 0$

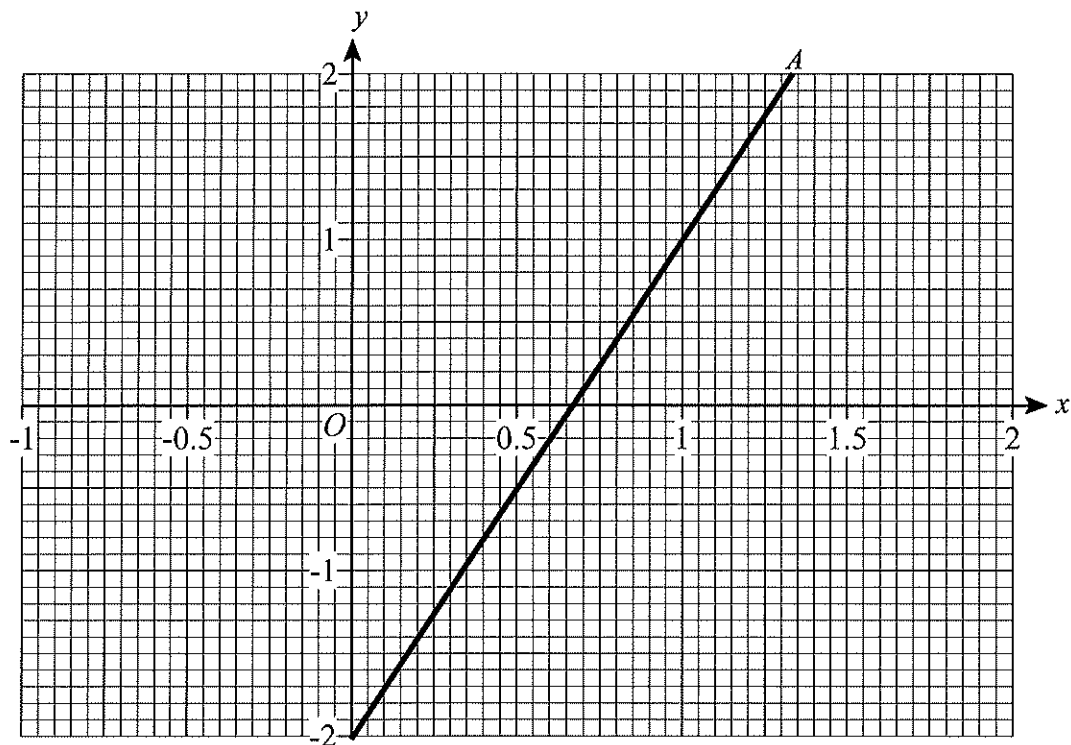
c)  $49x^2 = 121$

b)  $25x^2 = 1$

d)  $9x^2 - 9 = 7$

## Finding the Equation of a Straight Line

1) Find the equation of line  $A$  on the grid below.



2) A straight line passes through points  $(0, 4)$  and  $(3, 13)$ .  
What is its equation?



3) A straight line passes through points  $(0, 7)$  and  $(2, -1)$ .  
What is its equation?



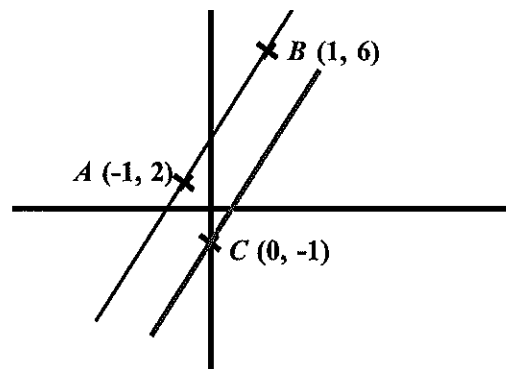
4) A straight line is parallel to  $y = 3x - 2$  and goes through  $(1, 8)$ .  
What is its equation?



5) A straight line is parallel to  $y = 2x + 5$  and goes through  $(5, 6)$ .  
What is its equation?



6)  $A$  is the point  $(-1, 2)$ .  
 $B$  is the point  $(1, 6)$ .  
 $C$  is the point  $(0, -1)$ .  
Find the equation of the line which passes through  $C$   
and is parallel to  $AB$ .



## Simultaneous Equations Algebraically

1) Solve

$$\begin{aligned}4x + 3y &= 6 \\5x - 3y &= 21\end{aligned}$$

2) Solve

$$\begin{aligned}4x + 3y &= 19 \\3x - 5y &= 7\end{aligned}$$

3) Solve

$$\begin{aligned}3x + 5y &= 13 \\2x + 3y &= 8\end{aligned}$$



4) Solve

$$\begin{aligned}x + 4y &= 5 \\4x - 2y &= 11\end{aligned}$$



5) Solve

$$\begin{aligned}2a + b &= 3 \\4a - 5b &= 20\end{aligned}$$

6) Solve

$$\begin{aligned}5x + 3y &= 4 \\3x + 4y &= 9\end{aligned}$$



7) Solve

$$\begin{aligned}6x - 2y &= 13 \\2x + 3y &= -3\end{aligned}$$



8) Solve

$$\begin{aligned}3a - 2b &= 14 \\4a + 3b &= 13\end{aligned}$$



9) Solve

$$\begin{aligned}5x + 4y &= 5 \\2x + 7y &= 29\end{aligned}$$

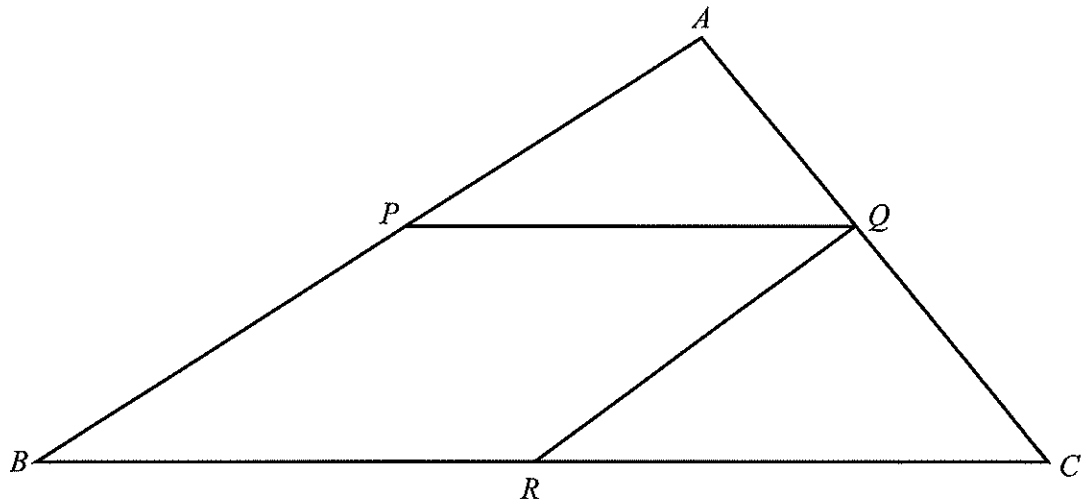


10) Solve

$$\begin{aligned}6x - 4y &= 39 \\2x + y &= 6\end{aligned}$$

## Congruent Triangles

1)

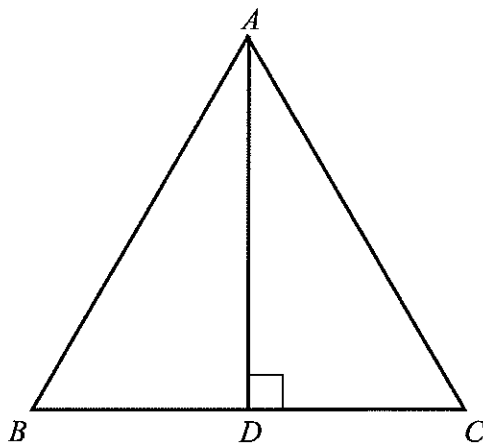


The diagram shows a triangle  $ABC$ .

$PQRB$  is a parallelogram where  
 $P$  is the midpoint of  $AB$ ,  
 $Q$  is the midpoint of  $AC$ ,  
 and  $R$  is the midpoint of  $BC$ .

Prove that triangle  $APQ$  and triangle  $QRC$  are congruent.  
 You must give reasons for each stage of your proof.

2)



$ABC$  is an equilateral triangle.

$D$  lies on  $BC$ .

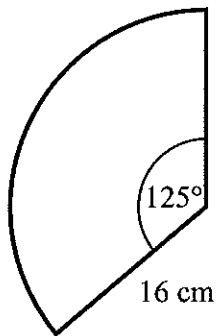
$AD$  is perpendicular to  $BC$ .

a) Prove that triangle  $ADC$  is congruent to triangle  $ADB$ .

b) Hence, prove that  $BD = \frac{1}{2} AB$



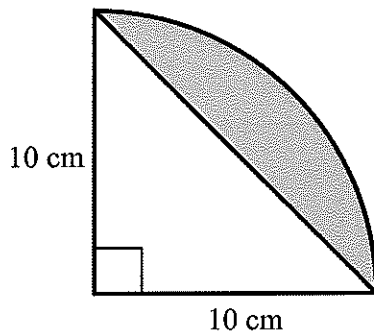
- 1) This sector of a circle has radius 16 cm.



- Find the area of the sector.
- Find the perimeter of the sector.



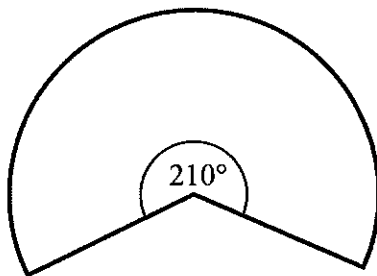
- 2) A quadrant of a circle is shown.



Work out the area of the shaded section.



- 3) The diagram shows a sector of a circle.



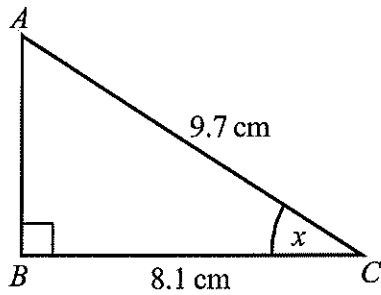
The arc length is 47.6 cm.

Work out the radius.

## Trigonometry



1)

 $ABC$  is a right-angled triangle.

$AC = 9.7$  cm

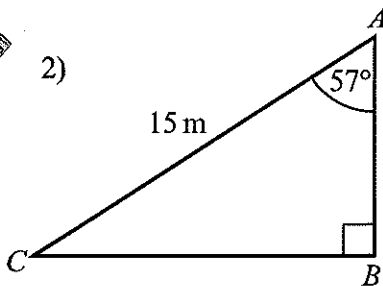
$BC = 8.1$  cm

Calculate the size of the angle marked  $x$ .

Give your answer correct to three significant figures.



2)

 $ABC$  is a right-angled triangle.

$AC = 15$  m

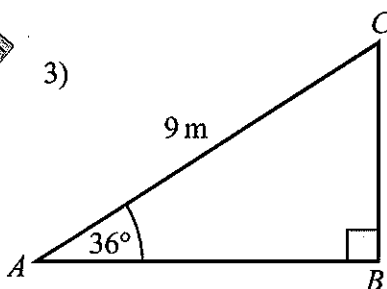
Angle  $CAB = 57^\circ$

Calculate the length of  $AB$ .

Give your answer correct to three significant figures.



3)

 $ABC$  is a right-angled triangle.

$AC = 9$  m

Angle  $CAB = 36^\circ$

Calculate the length of  $AB$ .

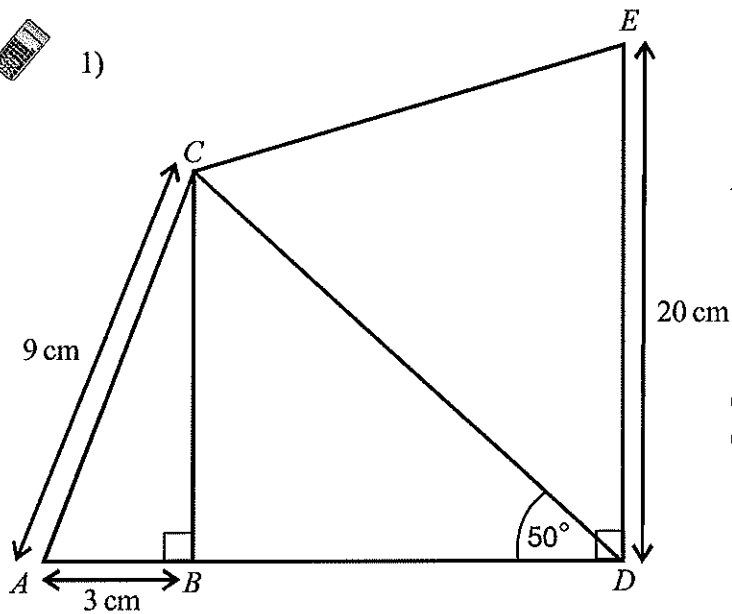
Give your answer correct to three significant figures.



# Trigonometry



1)

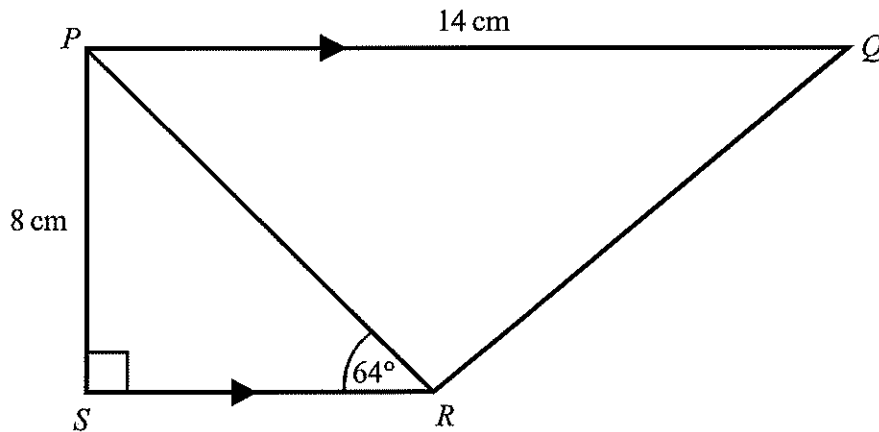


$AC = 9 \text{ cm}$   
 $AB = 3 \text{ cm}$   
 $DE = 20 \text{ cm}$   
 Angle  $ABC = \text{angle } CBD = \text{angle } BDE = 90^\circ$

Calculate the length of  $CD$ .  
 Give your answer to 3 significant figures.



2)



$PQRS$  is a trapezium.  
 $PQ$  is parallel to  $SR$ .  
 Angle  $PSR = 90^\circ$   
 Angle  $PRS = 64^\circ$   
 $PQ = 14 \text{ cm}$ .  
 $PS = 8 \text{ cm}$ .

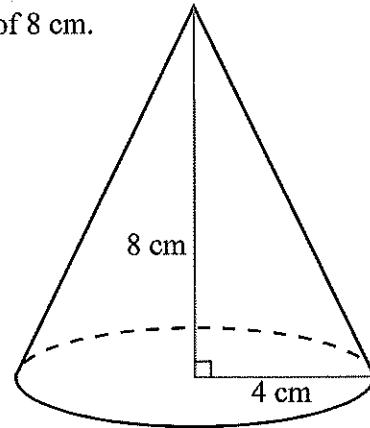
Work out the length of  $PR$ .  
 Give your answer correct to 3 significant figures.

## Spheres and Cones



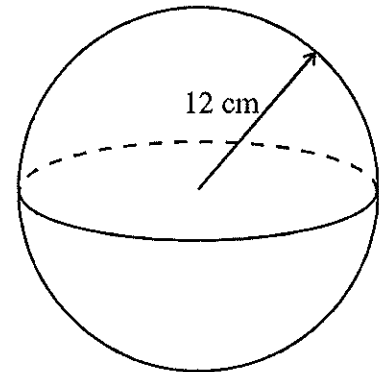
1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

- Calculate the volume of the cone.  
Take  $\pi$  to be 3.142.  
Give your answer correct to 3 significant figures.
- Use Pythagoras' Theorem to find the slant height of the cone.  
Give your answer correct to 1 decimal place.
- Find the curved surface area of the cone.  
Take  $\pi$  to be 3.142.  
Give your answer correct to 3 significant figures.



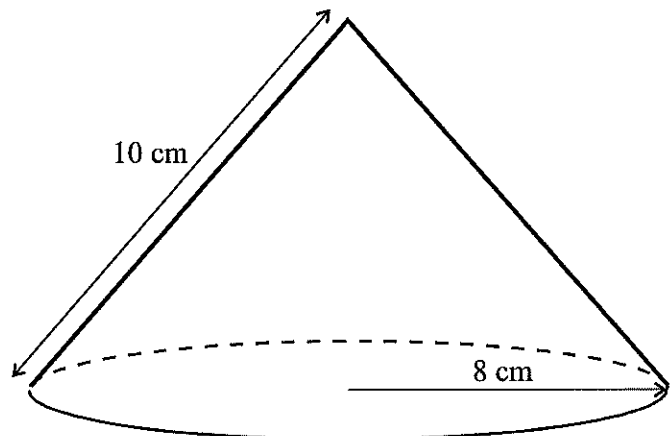
2) A sphere has a radius of 12 cm.

- Calculate the volume of the sphere.  
Take  $\pi$  to be 3.142.  
Give your answer correct to 3 significant figures.
- Find the curved surface area of the sphere.  
Take  $\pi$  to be 3.142.  
Give your answer correct to 3 significant figures.



3) A cone has a base radius of 8 cm and a slant height of 10 cm.

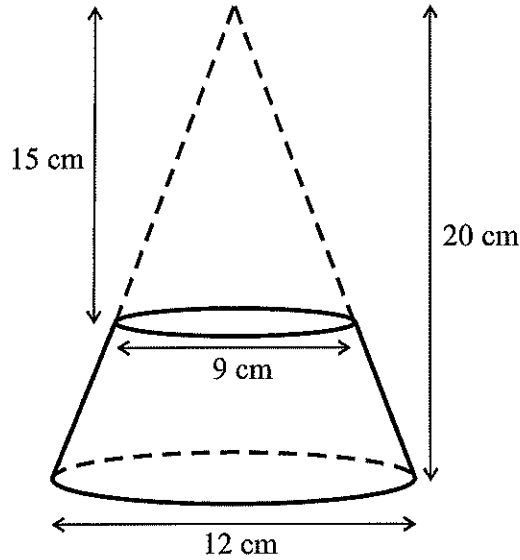
Calculate the volume of the cone.  
Leave your answer in terms of  $\pi$ .



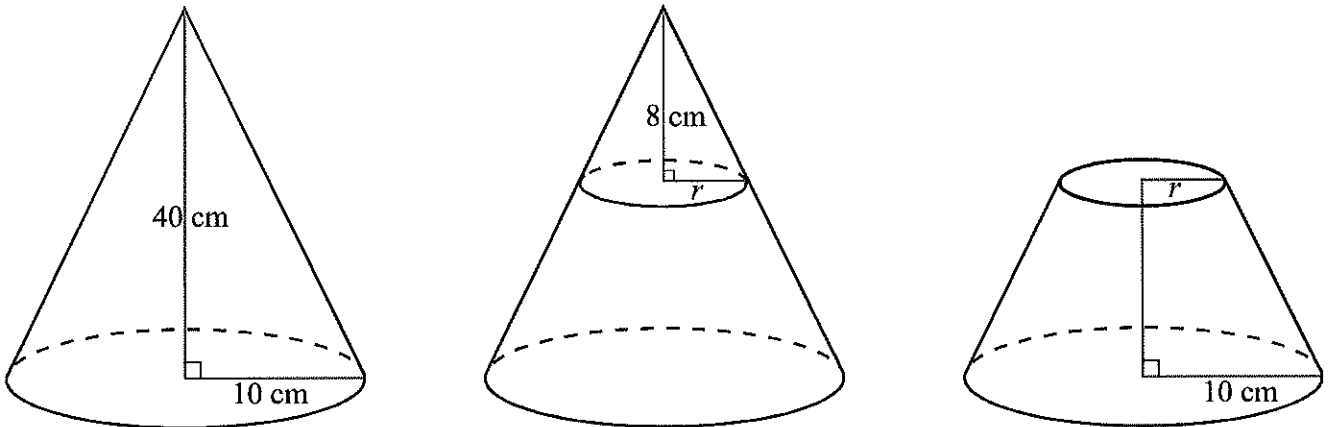


- 1) A frustum is made by removing a small cone from a similar larger cone.

Work out the volume of the frustum.



- 2) The diagram shows a cone of height 40 cm and base radius 10 cm. A smaller cone of height 8 cm is removed to form a frustum.



- a) Work out the radius  $r$  of the base of the smaller cone.

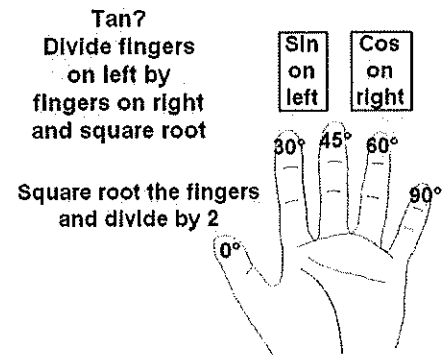
Calculate, to the nearest  $\text{cm}^3$

- b) The volume of the larger cone.  
c) The volume of the smaller cone.  
d) The volume of the frustum.

## Exact Trigonometric Values

1) Write down the exact values of:

- a)  $\sin 0^\circ$
- b)  $\sin 30^\circ$
- c)  $\sin 45^\circ$
- d)  $\sin 60^\circ$
- e)  $\sin 90^\circ$



2) Write down the exact values of:

- a)  $\cos 0^\circ$
- b)  $\cos 30^\circ$
- c)  $\cos 45^\circ$
- d)  $\cos 60^\circ$
- e)  $\cos 90^\circ$

3) Write down the exact values of:

- a)  $\tan 0^\circ$
- b)  $\tan 30^\circ$
- c)  $\tan 45^\circ$
- d)  $\tan 60^\circ$

- 1) A bag contains 7 green and 3 yellow balls.  
A ball is taken from the bag at random and not replaced.  
Another ball is taken from the bag at random.
  - a) Draw a tree diagram to show all the possibilities.
  - b) What is the probability that both balls are different colours?
  
- 2) A box contains 5 red counters and 3 blue counters.  
A counter is taken from the box at random and not replaced.  
Another counter is taken at random.
  - a) Draw a tree diagram to show all the possibilities.
  - b) What is the probability of choosing at least one blue counter?
  - c) What is the probability of choosing two counters of the same colour?
  - d) What is the probability of choosing two counters of different colours?
  
- 3) A box contains 4 red counters and 3 blue counters.  
A counter is taken from the box at random and not replaced.  
A second counter is taken from the box at random and not replaced.  
A third counter is taken from the box.
  - a) Draw a tree diagram to show all the possibilities.
  - b) What is the probability that all three counters are the same colour?
  - c) What is the probability that exactly two of the counters are red?

## Stratified Sampling



- 1) The table below shows the number of employees in each section of a company.

Department	Managerial	Sales	Technical	Production
Number of employees	18	45	288	549

A survey on job satisfaction is to be carried out.

- a) Explain why a simple random sample of employees is unsuitable.  
b) A stratified random sample of 100 is used. Complete the table below to show how many employees from each department will be included.

Department	Managerial	Sales	Technical	Production
Number of employees in sample				



- 2) MathsWatch High-School has 798 pupils.  
The size of each year group is shown below.

Year Group	Boys	Girls
7	77	72
8	74	79
9	72	74
10	93	107
11	85	65

The headteacher wants to find out the opinions of the pupils on changing the timing of the school day. A stratified sample of 80 pupils is taken.

- a) Complete the table below to show the numbers of pupils to be sampled.

Year Group	Boys in Sample	Girls in Sample
7		
8		
9		
10		
11		

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

Year Group	Boys in Sample who answered YES	Girls in Sample who answered YES
7	2	3
8	3	5
9	2	1
10	1	4
11	0	1

- b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question.

Write each recurring decimal as an exact fraction,  
in its lowest terms.

a)  $0.\dot{5}$

b)  $0.\dot{7}$

c)  $0.\dot{4}$

d)  $0.\dot{2}\dot{4}$

e)  $0.\dot{7}\dot{5}$

f)  $0.\dot{8}\dot{2}$

g)  $0.\dot{6}\dot{1}\dot{7}$

h)  $0.\dot{2}\dot{1}\dot{6}$

i)  $0.\dot{7}\dot{1}\dot{4}$

j)  $0.\dot{3}\dot{2}\dot{4}$

k)  $0.\dot{7}\dot{2}\dot{3}\dot{5}\dot{7}$

l)  $0.\dot{6}\dot{5}\dot{2}\dot{1}\dot{4}$

## Product of Three Binomials

- 1) Expand and simplify:
  - a)  $x(x + 2)(x + 3)$
  - b)  $x(x + 4)(x + 7)$
  - c)  $x(x + 1)(x + 9)$
  
- 2) Expand and simplify:
  - a)  $x(x + 5)(x - 2)$
  - b)  $x(x - 4)(x + 3)$
  - c)  $x(x + 8)(x - 3)$
  
- 3) Expand and simplify:
  - a)  $(x + 1)(x + 5)(x + 2)$
  - b)  $(x - 3)(x - 2)(x - 1)$
  - c)  $(x - 2)(x + 5)(x - 1)$
  
- 4) Expand and simplify:
  - a)  $(x - 4)(x + 4)(x - 2)$
  - b)  $(x - 3)(x - 1)(x + 3)$
  - c)  $(x + 6)(x + 2)(x - 6)$
  
- 5) Expand and simplify:
  - a)  $(2x - 1)(x + 3)(x + 1)$
  - b)  $(x + 5)(2x - 3)(3x + 1)$
  - c)  $(2x - 1)(3x - 2)(4x - 3)$





1) The equation

$$x^3 - x = 29$$

has a solution between 3 and 4

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

2) The equation

$$x^3 - 4x = 25$$

has a solution between 3 and 4

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

3) The equation

$$x^3 - 2x = 68$$

has a solution between 4 and 5

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

4) The equation

$$x^3 + 4x = 101$$

has one solution which is a positive number.

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.



- 1) A sequence is defined by the term-to-term rule

$$u_{n+1} = u_n^2 - 3u_n$$

Given that  $u_1 = 2$ , find  $u_2$ ,  $u_3$  and  $u_4$ .



- 2) A sequence is defined by the term-to-term rule

$$x_{n+1} = \frac{x_n - 1}{1 + 3x_n}$$

Given that  $x_1 = 3$ , find  $x_2$ ,  $x_3$  and  $x_4$ .



- 3)  $x_{n+1} = 4 - \frac{1}{x_n}$

Use a starting value of  $x_1 = 1$  to find a solution to  $x_{n+1} = 4 - \frac{1}{x_n}$  to 1 decimal place.

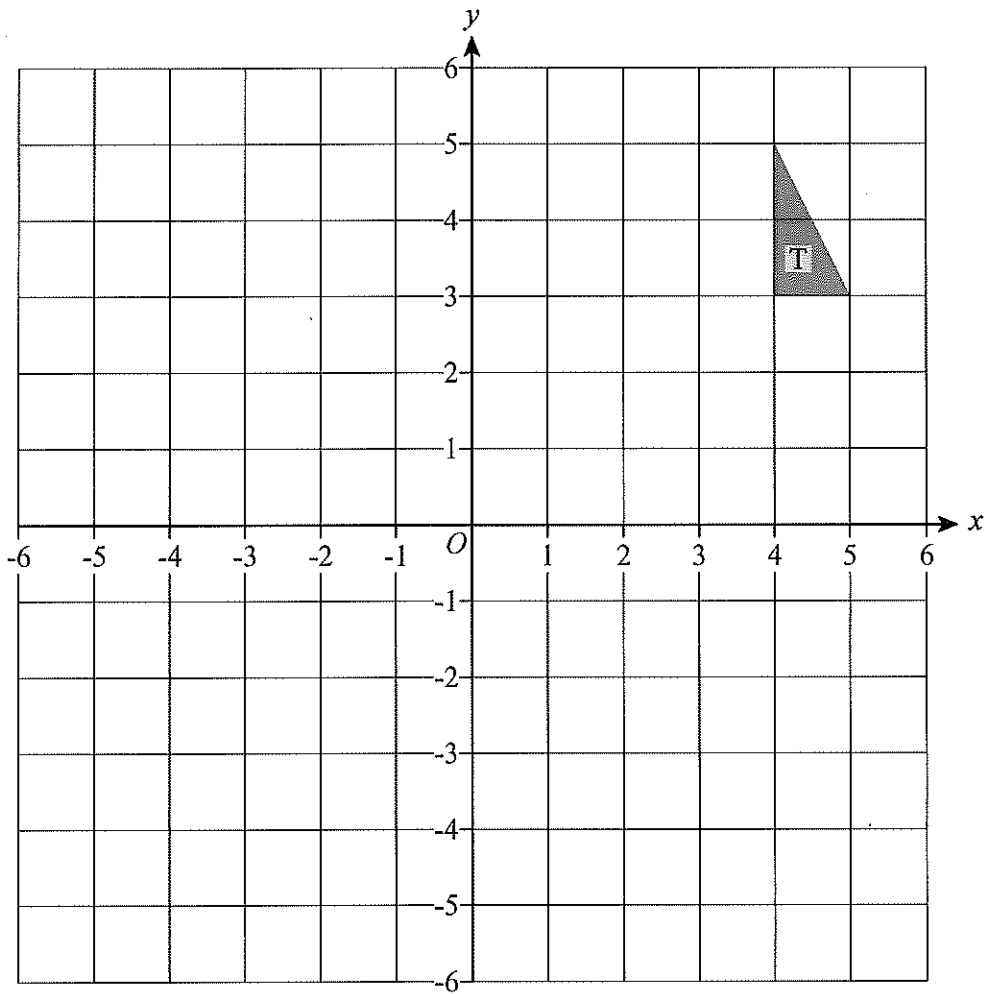


- 4)  $x_{n+1} = 3 + \frac{2}{x_n^2}$

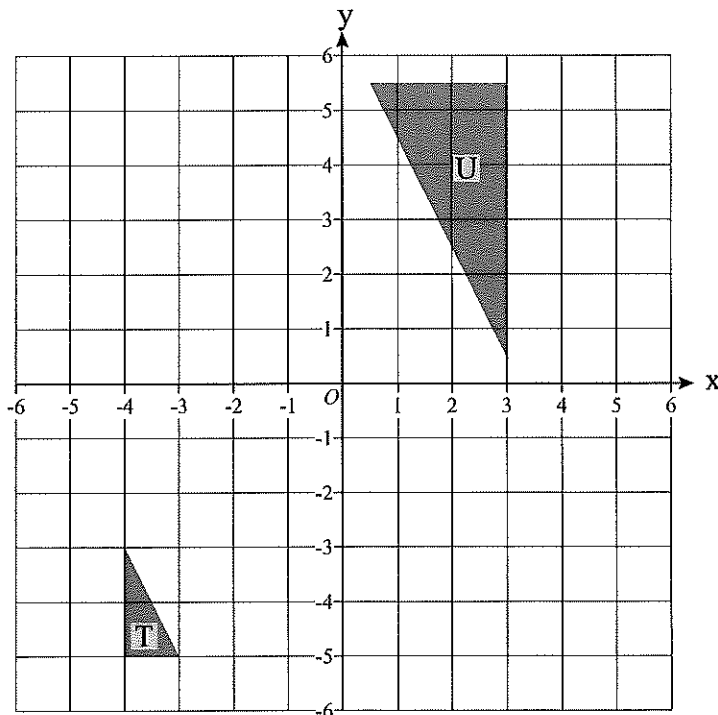
Use a starting value of  $x_1 = 1$  to find a solution to  $x_{n+1} = 3 + \frac{2}{x_n^2}$  to 1 decimal place.

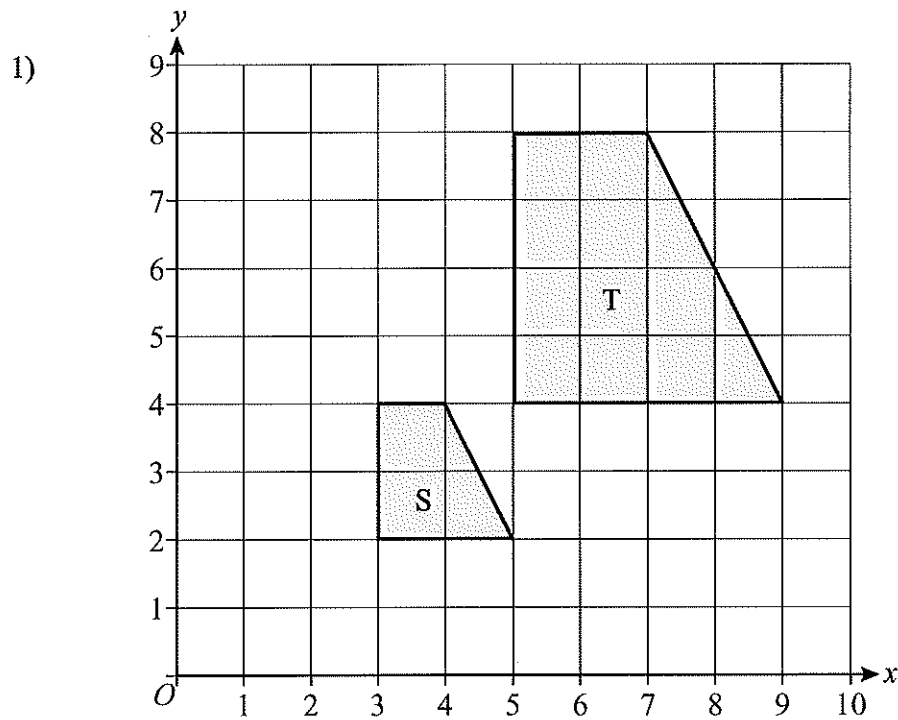
## Enlargement - Negative Scale Factor

- 1) Enlarge triangle T by scale factor  $-2$  using coordinates  $(2, 2)$  as the centre of enlargement.

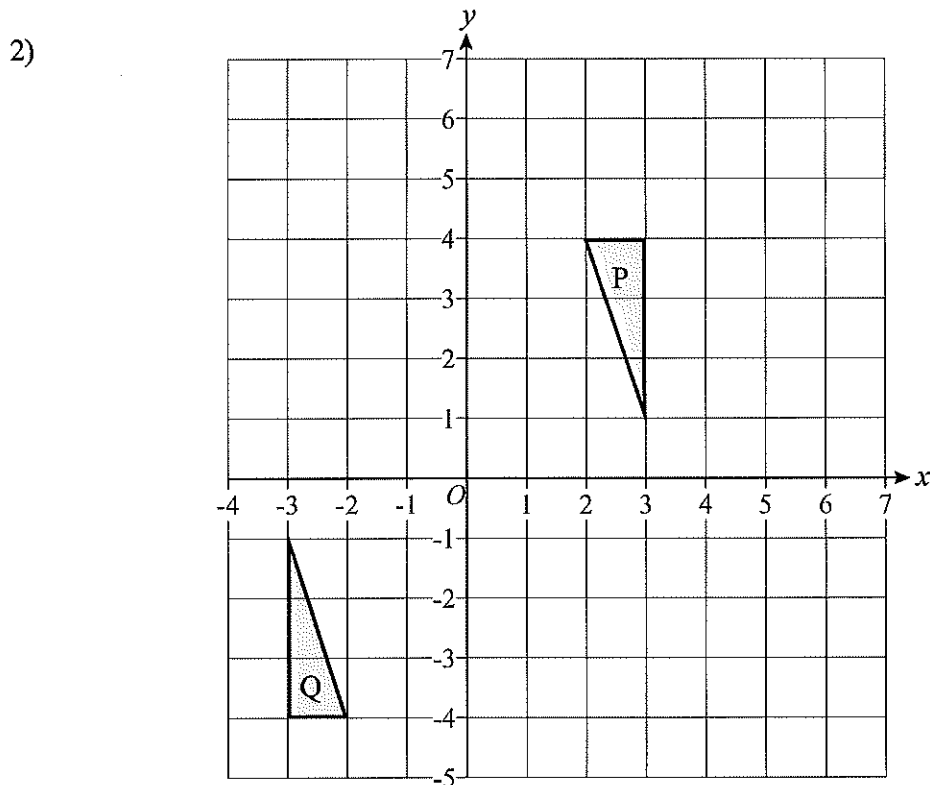


- 2) Describe fully the single transformation which maps triangle T to triangle U.





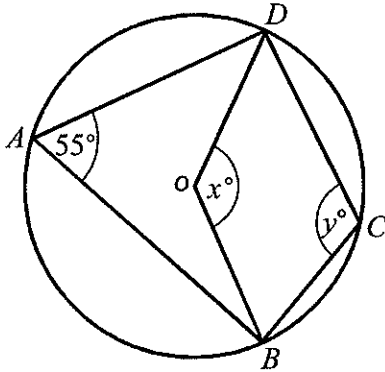
Describe fully the single transformation which maps shape S onto shape T.



Triangle P and triangle Q are drawn on the grid.

- Describe fully the single transformation which maps triangle P onto triangle Q.
- Translate triangle P by the vector  $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$   
Label the new triangle R.

1)



In the diagram,  $A$ ,  $B$ ,  $C$ , and  $D$  are points on the circumference of a circle, centre  $O$ .

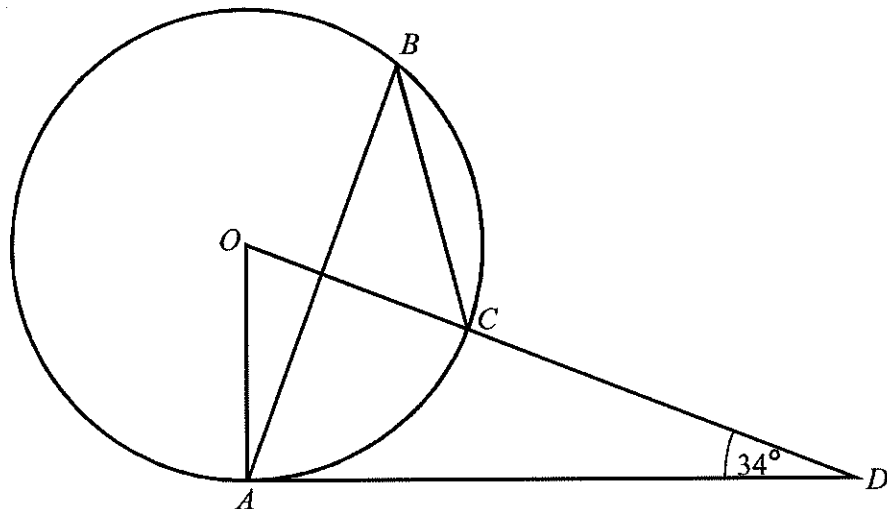
Angle  $BAD = 55^\circ$ .

Angle  $BOD = x^\circ$ .

Angle  $BCD = y^\circ$ .

- a) (i) Work out the value of  $x$ .  
 (ii) Give a reason for your answer.
- b) (i) Work out the value of  $y$ .  
 (ii) Give a reason for your answer.

2)



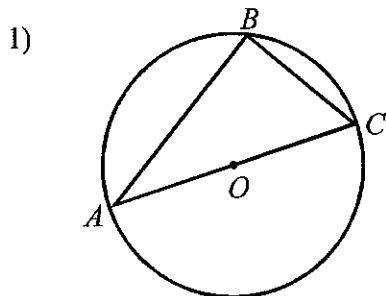
The diagram shows a circle centre  $O$ .

$A$ ,  $B$  and  $C$  are points on the circumference.

$DCO$  is a straight line and  $DA$  is a tangent to the circle.

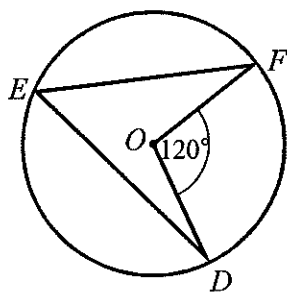
Angle  $ADO = 34^\circ$

- a) Work out the size of angle  $AOD$ .
- b) (i) Work out the size of angle  $ABC$ .  
 (ii) Give a reason for your answer.



$A$ ,  $B$  and  $C$  are points on the circumference of a circle centre  $O$ .  
 $AC$  is a diameter of the circle.

- a) (i) Write down the size of angle  $ABC$ .  
(ii) Give a reason for your answer.

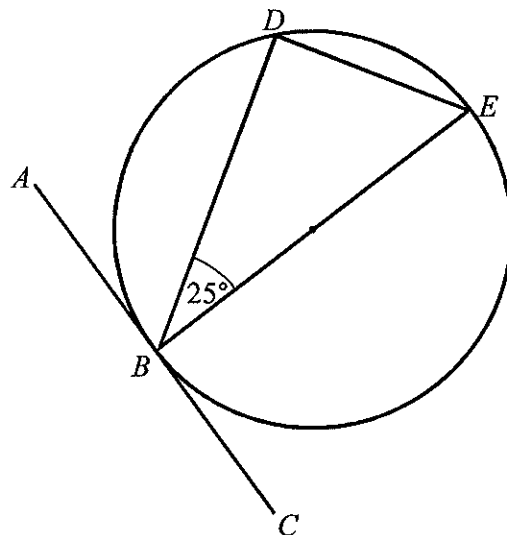


$D$ ,  $E$  and  $F$  are points on the circumference of a circle, centre  $O$ .  
Angle  $DOF = 120^\circ$ .

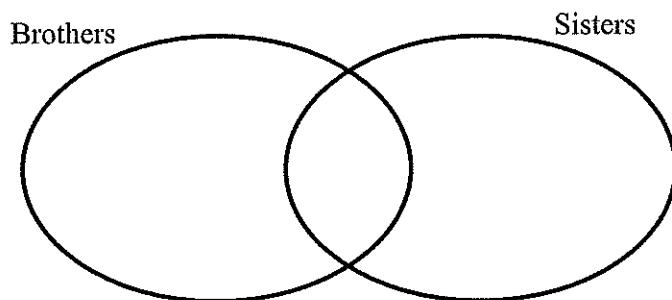
- b) (i) Work out the size of angle  $DEF$ .  
(ii) Give a reason for your answer.

- 2)  $B$ ,  $D$  and  $E$  are points on a circle centre  $O$ .  
 $ABC$  is a tangent to the circle.  
 $BE$  is a diameter of the circle.  
Angle  $DBE = 25^\circ$ .

- a) Find the size of angle  $ABD$ .  
Give a reason for your answer.
- b) Find the size of angle  $DEB$ .  
Give a reason for your answer.



- 1) In a class of 30 students, all of them have brothers or sisters or both.
- 19 have a brother.
- 16 have a sister.
- a) Complete the Venn diagram.



- b) Find the probability that a student in the class has a brother and a sister.
- c) If it is known that a student has a sister, what is the probability that they also have a brother?
- 2) A cafeteria serves only main courses and desserts. Some people just have a main, some have just a dessert and some have both.
- One day, 65% of the customers had a main course and 90% had a dessert.
- a) Show this information on a Venn diagram.
- b) What is the probability that a customer had a main course and a dessert?
- c) If it is known that a customer had a dessert, what is the probability that they also had a main course?

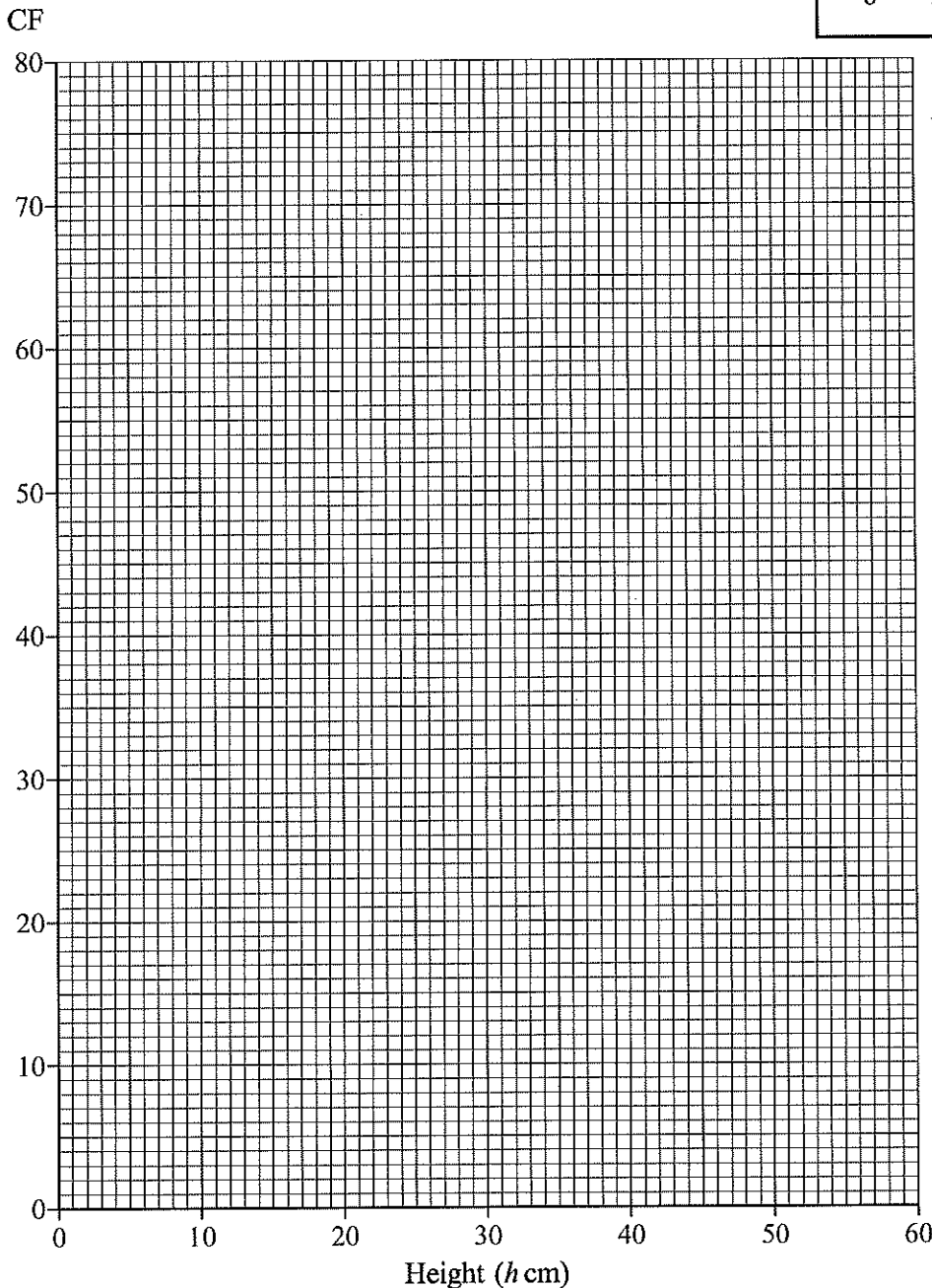
## Cumulative Frequency

The heights of 80 plants were measured and can be seen in the table, below.

Height ( $h$ cm)	Frequency
$0 < h \leq 10$	2
$10 < h \leq 20$	5
$20 < h \leq 30$	19
$30 < h \leq 40$	38
$40 < h \leq 50$	13
$50 < h \leq 60$	3

- a) Complete the cumulative frequency table for the plants.

Height ( $h$ cm)	Cumulative Frequency
$0 < h \leq 10$	2
$0 < h \leq 20$	
$0 < h \leq 30$	
$0 < h \leq 40$	
$0 < h \leq 50$	
$0 < h \leq 60$	



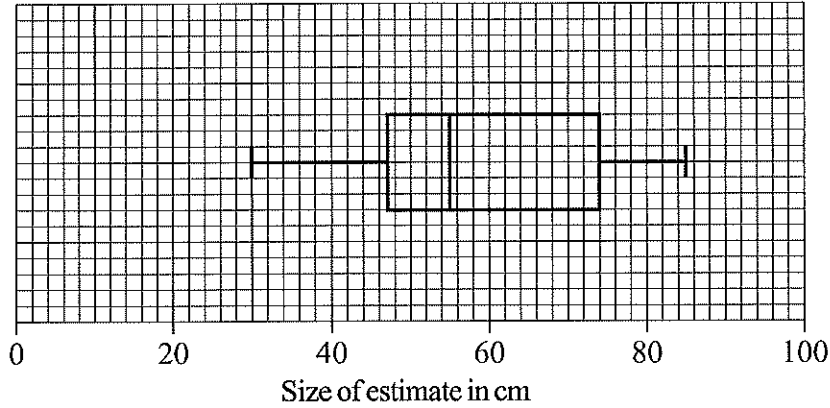
- b) Draw a cumulative frequency graph for your table.
- c) Use your graph to find an estimate for
- the median height of a plant.
  - the interquartile range of the heights of the plants.
- d) Use your graph to estimate how many plants had a height that was greater than 45cm.



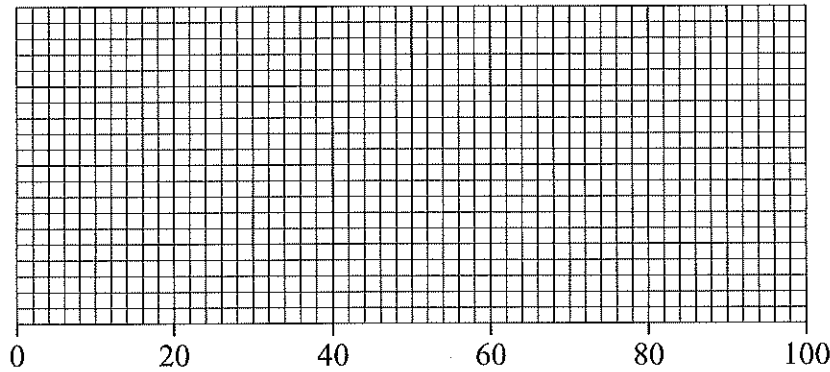
## Boxplots

Terry drew a line of length 60 cm.  
He asked some children to estimate the length of the line he had drawn.  
He recorded their estimates.  
The box plot gives some information about these estimates.

Children's estimates



Adults' estimates



- Write down the median of the children's estimates.
- Write down the interquartile range of the children's estimates.

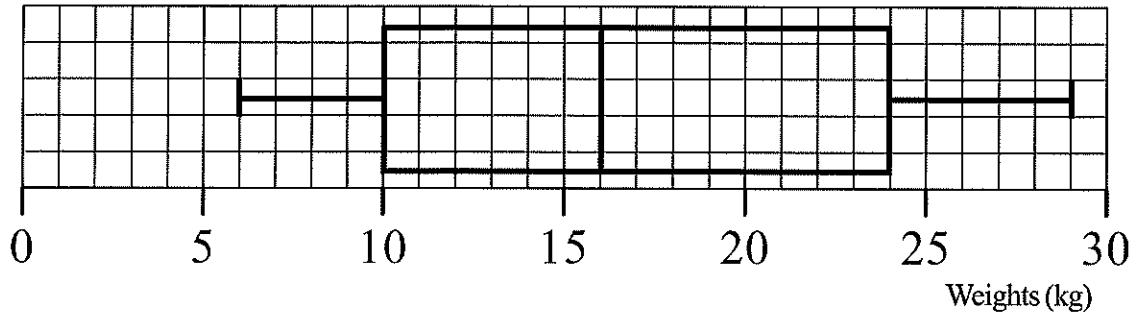
Terry then asked some adults to estimate the length of the line he had drawn.  
The table gives some information about the adults' estimates.

	Length
Lowest estimate	20 cm
Lower quartile	45 cm
Median	62 cm
Upper quartile	75 cm
Highest estimate	95 cm

- On the grid above, draw a box plot to show this information.
- Use the two box plots to compare the distribution of the children's estimates with the distribution of the adults' estimates.

# Boxplots

1) The box plot gives information about the distribution of the weights of bags on a plane.

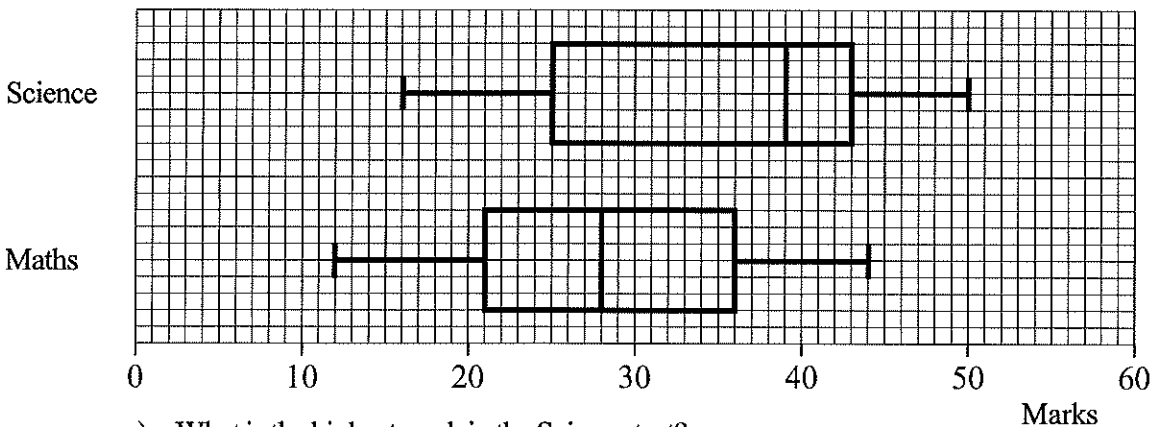


- a) Claude says that the heaviest bag weighs 24 kg.  
He is **wrong**.  
Explain why.
- b) Write down the median weight.
- c) Work out the interquartile range of the weights.

There are 240 bags on the plane.

- d) Work out the number of bags with a weight of 10 kg or less.

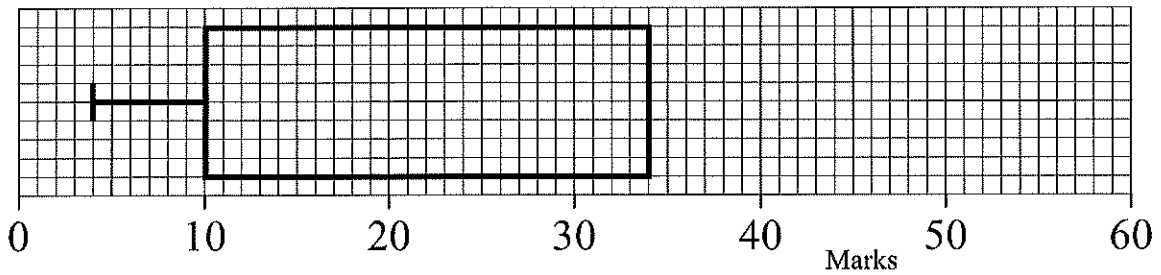
2) The box plots show the distribution of marks in a Science and Maths test for a group of students.



- a) What is the highest mark in the Science test?
- b) Compare the distribution of the marks in the Science test and marks in the Maths test.
  - 1 .....
  - .....
  - 2 .....
  - .....

## Boxplots

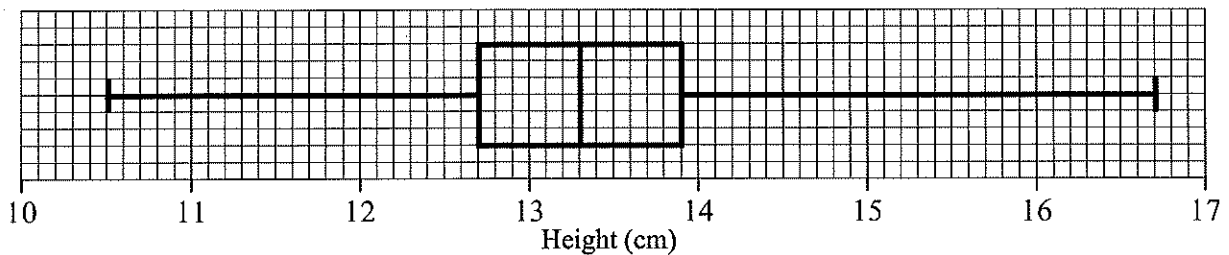
1) The incomplete box plot and table show some information about some marks.



	Marks
Lowest mark	4
Lower quartile	
Median	30
Upper quartile	34
Highest mark	55

- Use the information in the table to complete the box plot.
- Use the information in the box plot to complete the table.

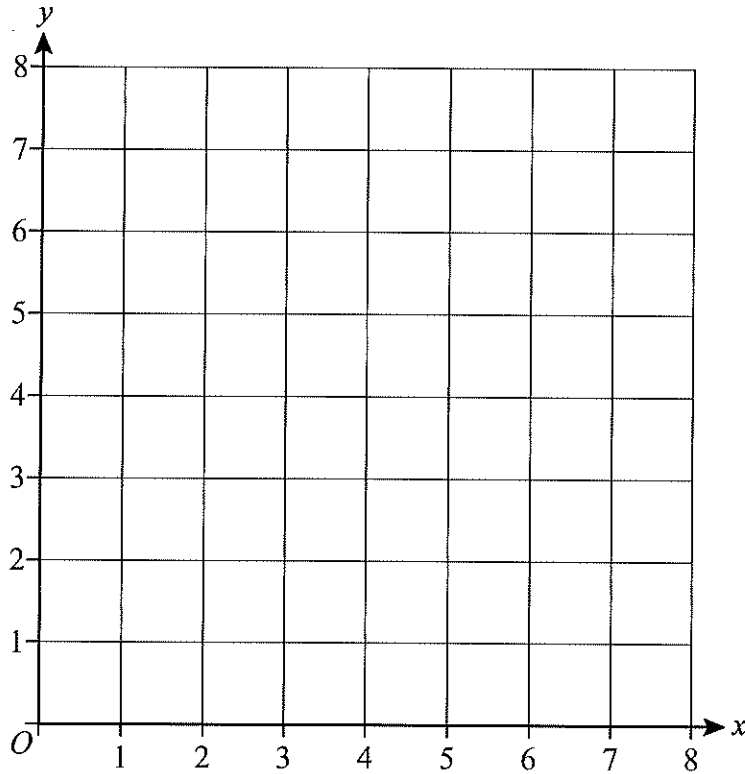
2) Kim measured the height, in cm, of each tomato plant in her greenhouse. She used the results to draw the box plot shown below.



- Write down the median height.
- Work out the interquartile range.
- Explain why the interquartile range may be a better measure of spread than the range.

## Regions

- 1) On the grid below, draw straight lines and use shading to show the region  $R$  that satisfies the inequalities  $x \geq 1$   $y \geq x$   $x + y \leq 7$



- 2) On the grid below, draw straight lines and use shading to show the region  $R$  that satisfies the inequalities  $y \geq x + 1$   $y \leq 5$   $x \geq 1$

