



Rewarding Learning

General Certificate of Secondary Education
2022

Centre Number

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Candidate Number

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Mathematics

Unit M7 Paper 1
(Non-Calculator)

Higher Tier



[GMC71]

GMC71

MONDAY 13 JUNE, 9.15am–10.30am

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page. **You are provided with Higher Tier Additional Support Materials for use with this paper.**

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page, on blank pages or tracing paper.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all fourteen** questions.

All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.

You **must not** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You should have a ruler, compasses and a protractor.

The Formula Sheet is on page 2.

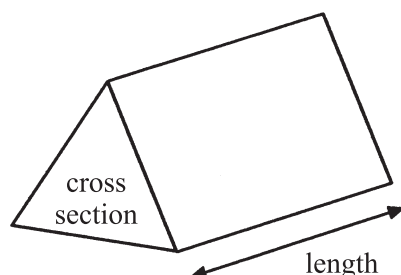
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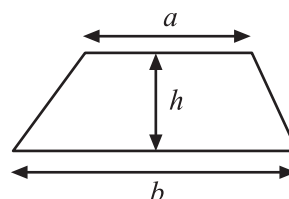
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Formula Sheet

Volume of prism = area of cross section \times length

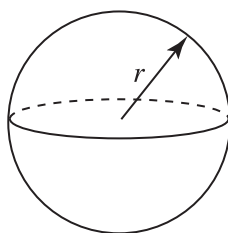


Area of trapezium = $\frac{1}{2}(a + b)h$



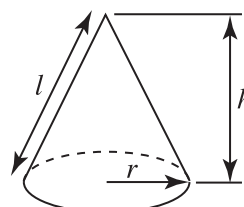
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$

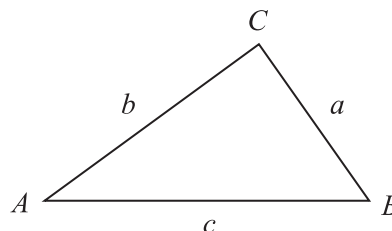


Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$



In any triangle ABC



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc \cos A$

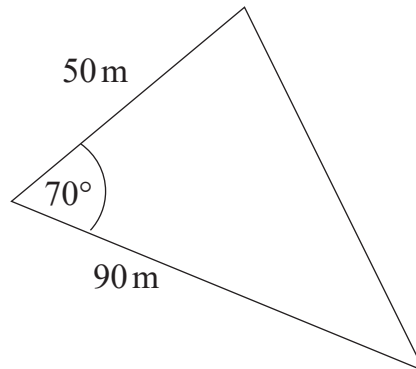
Area of triangle = $\frac{1}{2} ab \sin C$



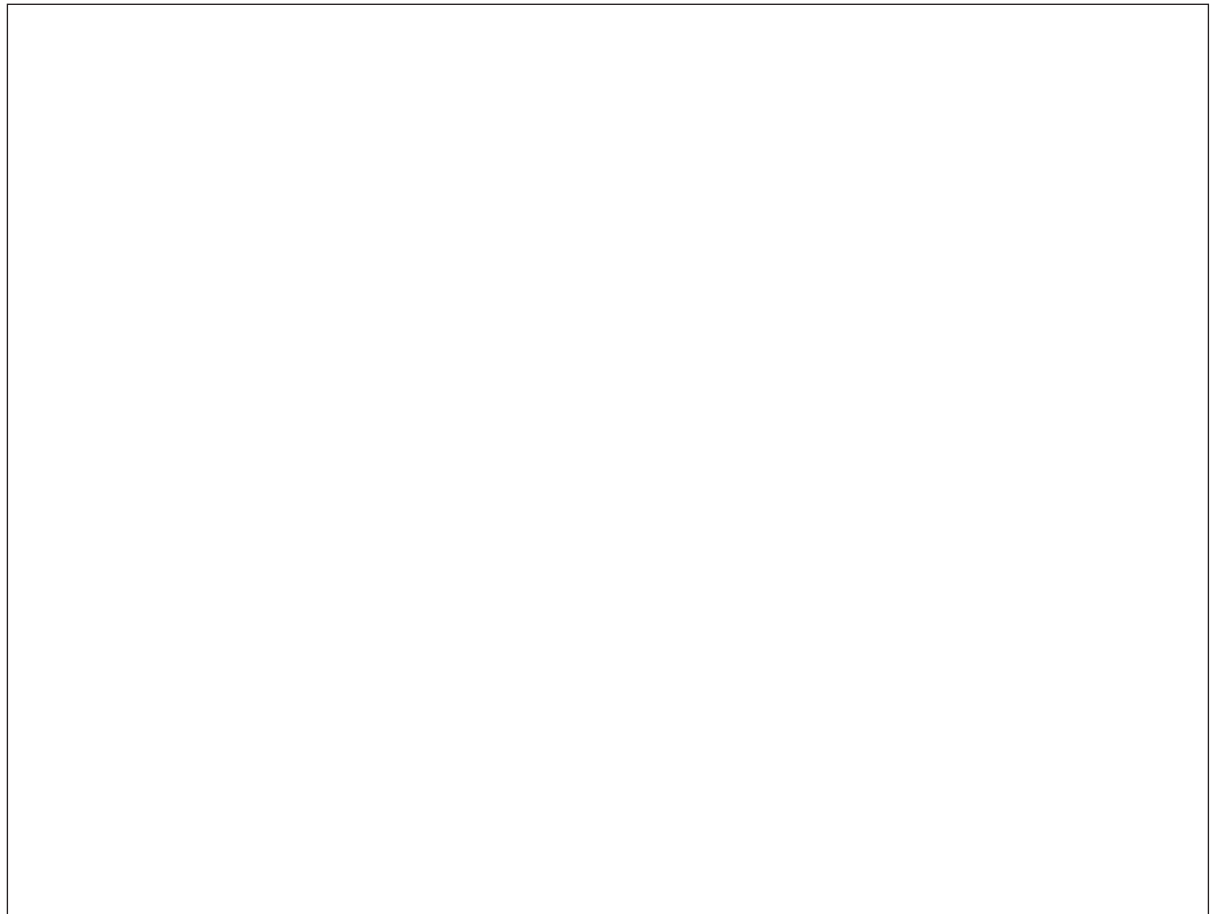
1 The sketch below shows a triangular field.

Two sides have lengths of 50 m and 90 m.

The angle between these two sides is 70°



Using a scale of $1 \text{ cm} = 10 \text{ m}$, draw this triangular field in the space below. [3]



[Turn over]



2 Below is a menu from Dillies Diner.

A two-course lunch is made up of one Starter and one Main course.

DILLIES DINER LUNCH MENU

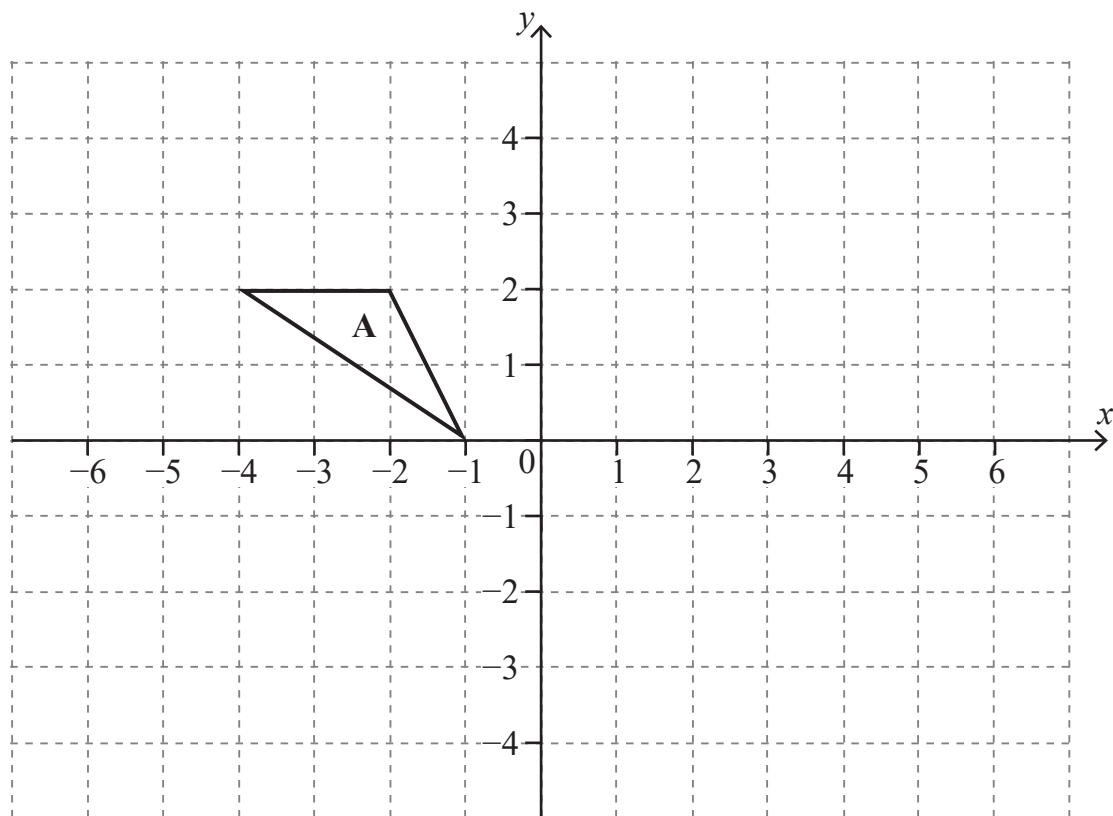
Starter	Main Course
Soup	Plaice
Mushrooms	Beef
Ribs	Chicken
	Quiche

Work out the number of different two-course lunches that can be ordered from this menu.

Answer _____ lunches [2]



3



(a) (i) Translate triangle A 7 right and 4 down. Label your answer **B**. [2]

(ii) Describe the translation which maps **B** to **A**.

Answer _____ [1]

(b) Reflect triangle A in the line $x = 1$ [2]

[Turn over]



4 Estimate

$$\frac{395 \times 9.88}{53}$$

Show your method.

Answer _____ [2]

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5 Andrew cycles at a steady speed from his home to school for a meeting.

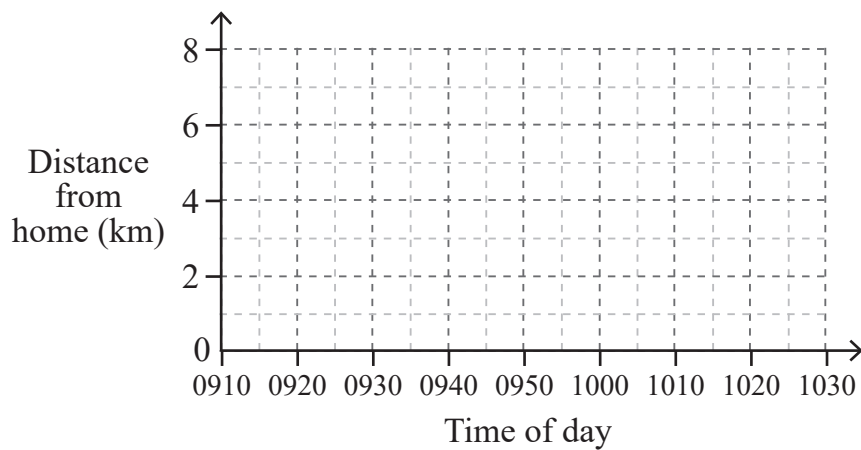
He leaves home at 0915 and arrives at school at 0945

The distance from his home to school is 5 km.

He spends 20 minutes at school before returning home again.

He arrives home at 1025

(a) On the grid below draw a distance–time graph for Andrew’s complete journey.



[3]

(b) (i) Work out Andrew’s average speed for his journey home.

Answer _____ km/hr [2]

(ii) Is this Andrew’s fastest average speed during his journey?

Explain why.

Answer _____ because _____
_____ [1]

[Turn over]



6 Beechgrove High School has 1200 pupils in total.

45% of the pupils are girls.

(a) Work out the number of girls in the school.

Answer _____ [2]

There are 240 pupils in Year 12

(b) What percentage of the pupils in the school are in Year 12?

Answer _____ % [2]



- 7 Students in a class were asked how many text messages they each sent in a particular week.

Number of text messages	0–19	20–39	40–59	60–79	80 or over
Number of students	1	3	13	8	3

A student was taken at random from the class.

- (a) What is the probability that this student sent more than 59 messages?

Answer _____ [2]

A student was taken at random from those who sent less than 60 messages.

- (b) What is the probability that this student sent 40–59 messages?

Answer _____ [2]

[Turn over]



- 8 (a) What is the main difference between the Binary number system and the Decimal number system?

Answer _____ [1]

- (b) Write the binary number 111111 as a decimal number.

Answer _____ [1]

- (c) Write the decimal number 87 as a binary number.

Answer _____ [1]



9 (a) Simplify

(i) $w^3 \times w^2$

Answer _____ [1]

(ii) $\frac{y^6}{y^2}$

Answer _____ [1]

(b) Work out the n^{th} term of the sequence

7, 14, 21, 28, 35 ...

Answer _____ [1]

(c) Work out the value of

(i) 5^{-2}

Answer _____ [1]

(ii) $1^5 + 6^0$

Answer _____ [1]

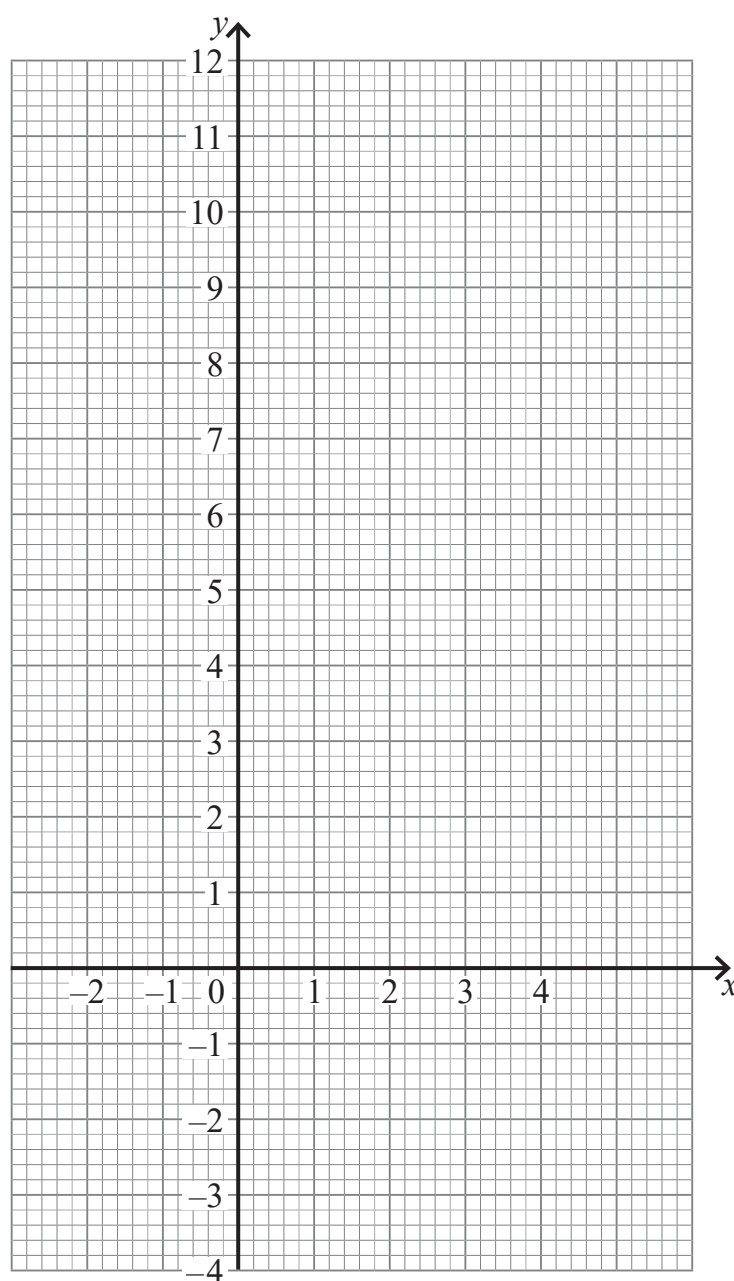
[Turn over]



10 The following table gives some values for the quadratic equation $y = x^2 - 3x + 1$

x	-2	-1	0	1	2	3	4
y	11	5	1	-1	-1	1	5

- (a) On the grid below, draw the graph of $y = x^2 - 3x + 1$ for values of x between -2 and 4



[2]



(b) Use your graph to estimate the values of x for which $y = 3$

Answer $x =$ _____ [2]

- 11 A tent in the shape of a cone has a perpendicular height of 7 m and a volume of 220 m^3

Using $\pi = \frac{22}{7}$, work out the base radius of this tent.

Write your answer in surd form.

Answer _____ [3]

[Turn over]



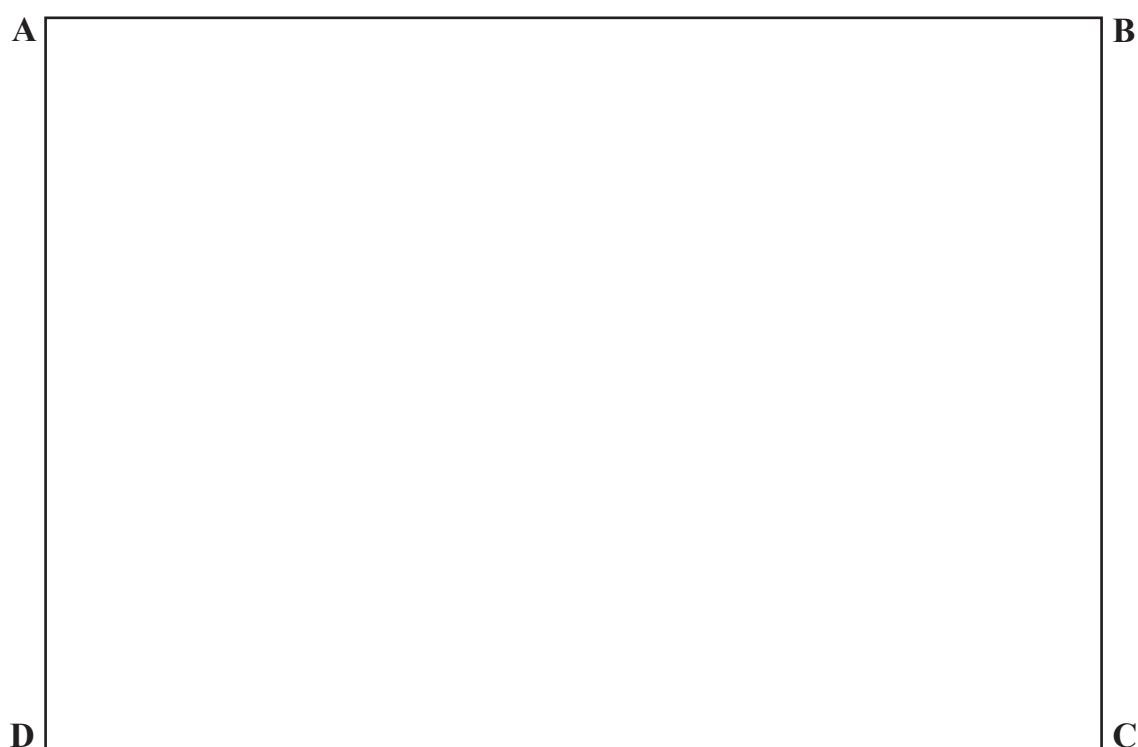
12 Toby walks his dog in the field **ABCD** so that he is always:

more than 40 m from **A**;

nearer to **A** than **B**;

nearer to **DA** than **DC**.

Shade the area where Toby walks his dog.



Scale of diagram: 1 cm = 10 m

[4]



13 $m = 4.5 \times 10^7$ $n = 5 \times 10^{-3}$

Work out the value of $\frac{m}{n}$, giving your answer in standard form.

Answer _____ [2]

14 Make q the subject of the formula

$$p = \frac{q}{r - q}$$

Answer _____ [3]

THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
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Total Marks	
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Examiner Number

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Rewarding Learning

**General Certificate of Secondary Education
Summer 2022**

GCSE Mathematics

HIGHER TIER ADDITIONAL SUPPORT MATERIALS (For use in Summer 2022)

HIGHER TIER ADDITIONAL SUPPORT MATERIALS (Summer 2022)

Numbers

Lowest common multiple (LCM): The lowest common multiple is the lowest multiple shared by 2 or more numbers.

Trial and Improvement

This is a method of trying different values in an equation until you get a suitable solution (e.g to 1 decimal place).

Metric units

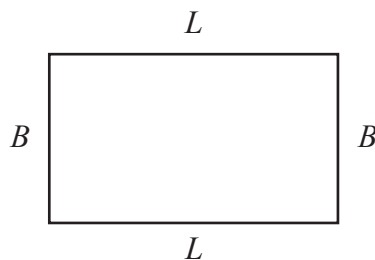
$$1 \text{ ml} = 1 \text{ cm}^3$$

Compound Measures

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

Perimeter, Area and Volume



The perimeter of a rectangle is the distance around the outside of the rectangle. It is found by adding the lengths of the 4 sides of the rectangle.

$P = 2L + 2B$ where P is perimeter, L is length and B is breadth.

The area of a rectangle is found by multiplying the length of the rectangle by the breadth.

$A = L \times B$ where L is length and B is breadth.

The volume of a cuboid is found by multiplying the length by the breadth by the height of the cuboid.

$V = L \times B \times H$ where V is volume, L is length, B is breadth and H is height.

The area of a circle is $A = \pi r^2$ where r is the radius of the circle.

The circumference (perimeter) of a circle is $C = 2\pi r$ where r is the radius of the circle. An alternative formula is $C = \pi d$ where d is the diameter of the circle.

Mid point of a line

If (x_1, y_1) and (x_2, y_2) are the end points of a line, then the coordinates of the midpoint M of the line are

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Gradient of a line

If (x_1, y_1) and (x_2, y_2) are two points on a line, then the gradient m of the line is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Lines

Parallel lines have the same gradient.

If a straight line has gradient m , then a line which is perpendicular to this line has a gradient $-\frac{1}{m}$

Geometry and Angles

There are 180° on a straight line.

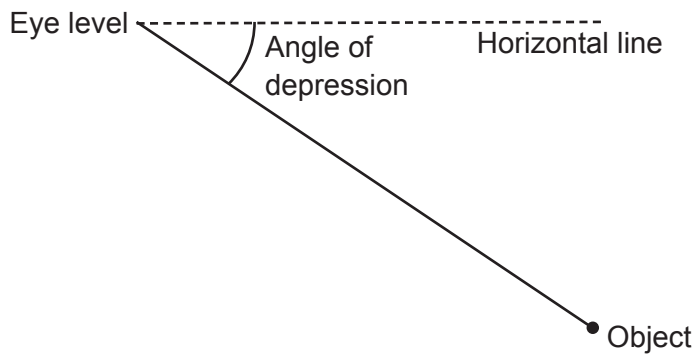
There are 180° inside a triangle.

An isosceles triangle is a triangle with 2 equal sides and 2 equal angles.

The sum of all the angles inside a polygon is given by $180(n - 2)$ where n is the number of sides in the polygon.

Angle of depression

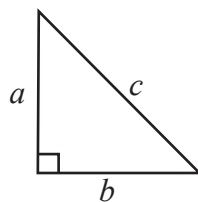
If a person stands and looks down at an object, the **angle of depression** is the angle between the horizontal line of sight and the object.



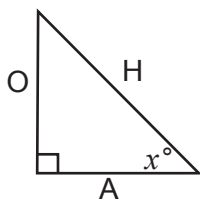
Pythagoras' Theorem

If a , b and c are the sides of a right angled triangle shown below, then

$$a^2 + b^2 = c^2$$



Trigonometric ratios in right angled triangles



$$\sin x^\circ = \frac{O}{H} \quad \cos x^\circ = \frac{A}{H} \quad \tan x^\circ = \frac{O}{A}$$

Tangent/Radius property

The tangent to a circle is perpendicular to the radius at the point of contact with the circle.

Alternate Segment Theorem

In a circle, the angle between a chord and a tangent through one of the end points of the chord is equal to the angle in the alternate segment.

Range

The range of a set of data is the difference between the largest value and the smallest value in the data set.

Mean

The mean of a set of data is the sum of all the data values divided by the number of data values.

Estimate for the mean of a grouped frequency distribution

Estimated mean = sum of (mid interval values multiplied by their frequency) divided by the sum of all the frequencies.

Pie Chart

In a pie chart, the total angle that corresponds to the entire data set is 360°

Probability

The sum of the probabilities of all outcomes equals 1

Frequency density in histograms

$$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$$