Surname:	**First Name:**

Current School:

SHREWSBURY SCHOOL

SIXTH FORM ENTRANCE EXAMINATION

2025 ENTRY

MATHEMATICS

(1 Hour 15 Minutes)

Instructions to candidates

Answer all questions, writing your answers in the spaces provided.

The number of marks for each question is shown in square brackets: [ ].

Section A contains questions of a GCSE nature. Attempt this section first, but do not spend too long on any particular question.

Section B is intended to be considerably more difficult, and is targeted at candidates who are either aiming for an academic scholarship on the strength of their mathematics or hoping to take Further Mathematics at A-Level.

You are expected to use a calculator in this examination.

Relevant working must be shown in order to gain high marks.

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

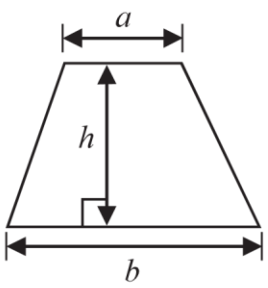
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

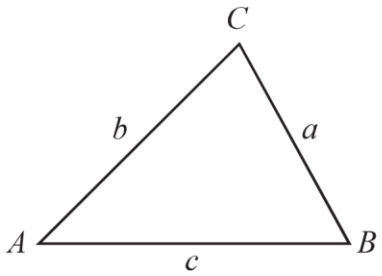
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle ABC

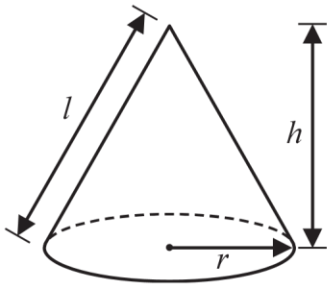
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

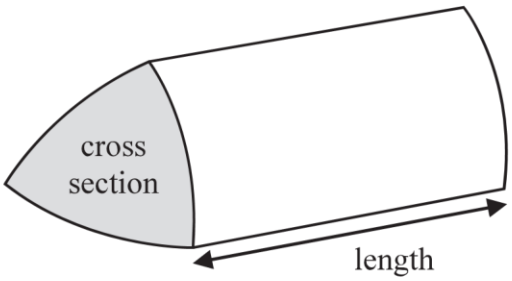
Area of triangle $= \frac{1}{2}ab\sin C$

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

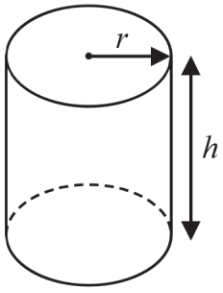
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

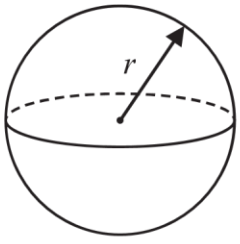


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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

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



Section A (60 marks)

Answer all questions in this section.

1) Expand and simplify the following expressions:

a) $6(3a + b) - 4(2a - 5b)$

_____ [2]

b) $(4x - 3)(x - 7)$

_____ [2]

2) Factorise the following expressions fully:

a) $12uv^3 + 16u^3v$

_____ [2]

b) $m^2 - 15m + 36$

_____ [2]

3) You must **not** use a calculator in this question. Full working **must** be shown.

a) Evaluate these, giving your answers as **mixed numbers** in their simplest form:

i) $4\frac{2}{5} + 1\frac{3}{8}$

_____ [3]

ii) $4\frac{2}{5} \div 1\frac{3}{8}$

_____ [3]

b) Simplify the following:

$$(5r^4)^3$$

_____ [2]

4) a) Angelface was given 2000 lines as punishment for releasing a stink bomb. This was increased by 35% when a water pistol was found in his sports bag. How many lines does Angelface have now?

_____ [2]

b) Amazon is having a Christmas sale in which the prices of all music downloads are reduced by 25%. An album by Grupo Niche is on sale for only £7.20.

What is the normal selling price of this album?

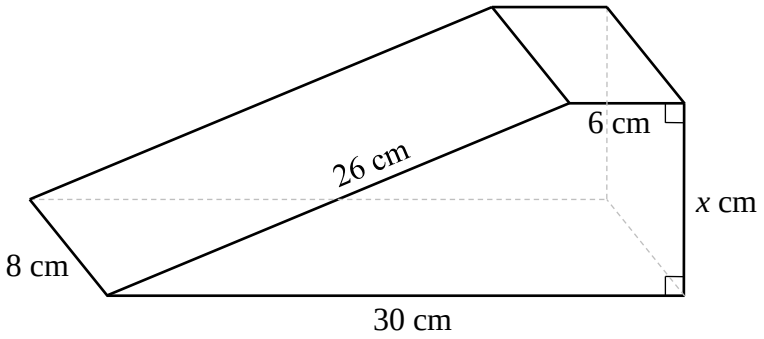
_____ [2]

c) At its peak in May 2021, Dogecoin was worth $0.682. Since then, it has collapsed in value to $0.126.

Calculate the percentage decrease in the value of Dogecoin since May 2021, giving your answer to 3 significant figures.

_____ [2]

5) The diagram below shows a prism with a depth of 8 cm. The cross-section of the prism is a right-angled trapezium whose parallel sides are 30 cm and 6 cm. The sloping edge of the trapezium is 26 cm; the height of the trapezium is x cm.



a) Using Pythagoras, calculate the value of x.

_____ [3]

b) Calculate the total surface area of the prism.

_____ [4]

c) Calculate the angle between the horizontal base and the sloping face of the prism. Give your answer to 3 significant figures.

_____ [2]

6) The velocity v of a medium banana (measured in m/s) is directly proportional to the **square root** of its kinetic energy E (measured in Joules).

When $E = 25$, $v = 20$.

a) Find a formula for v in terms of E.

_____ [3]

b) Calculate the kinetic energy of a medium banana with velocity 60 m/s.

_____ [3]

7) Rearrange the following formulae to make *x* the subject:

a) $y = 5x - 2$

_____ [2]

b) $y = \frac{\sqrt[3]{x}+4}{2}$

_____ [3]

c) $A = \frac{3c}{5x^2}$

_____ [3]

d) $T = \frac{5x+1}{3-2x}$

_____ [3]

8) Solve the following equations:

a) $9x + 1 = 4x - 29$

_____ [2]

b) $\left(\sqrt{x} - 4\right)^3 = 27$

_____ [3]

c) $5x^2 - 28x - 12 = 0$

_____ [3]

d) $\dfrac{x}{3+\dfrac{x}{3+x}} = \dfrac{3}{4}$

_____ [4]

Spare page for Section A working.

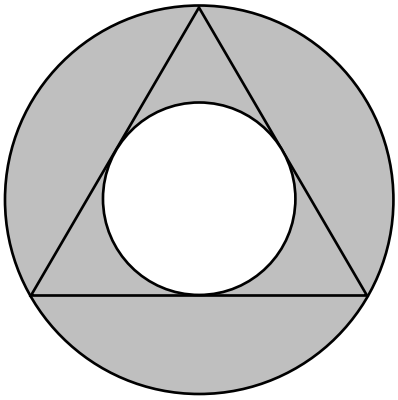
Please turn over for Section B.

Section B (20 marks)

This section is intended to be considerably more difficult, and is targeted at candidates who are either aiming for an academic scholarship on the strength of their mathematics or hoping to take Further Mathematics at A-Level.

Only attempt these questions if you have done as much of Section A as you can.

B1) The diagram below shows an equilateral triangle and two circles. The smaller circle is tangential to all three sides of the triangle. The larger circle passes through all three vertices of the triangle.



Determine what proportion of the larger circle is shaded.

_____ [6]

B2) Two red counters and one blue counter are to be placed on different squares in a 3x4 grid, so that the red counters do **not** lie on adjacent squares (i.e. squares with a common edge). The blue counter can be placed anywhere.

Figures 1 and 2 below give examples of what is, and isn't, allowed.

Figure 1 (allowed)

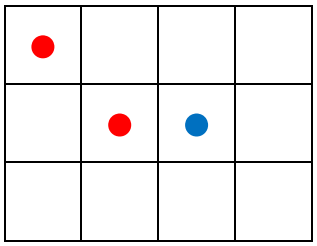
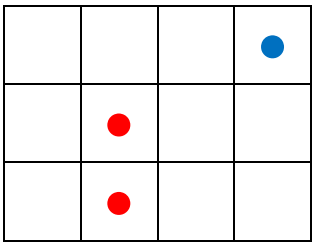


*Figure 2 (**not** allowed)*



Calculate the number of different ways the counters can be placed.

_____ [7]

Please turn over for the final question.

B3) For each positive whole number *n*, let $S(n)$ be the sum of the first *n* terms of the series

$$1 - 2 + 3 - 4 + 5 - 6 + \cdots$$

For example, $S(5) = 1 - 2 + 3 - 4 + 5 = 3$.

For which positive whole numbers *x* and *y* does $S(x) + S(y) + S(x + y) = 1$?

_____ [7]

+++++ END +++++

Spare page for Section B working.