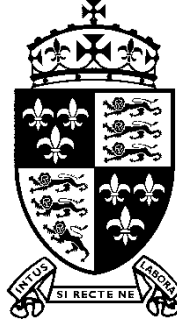


First name:

Surname:

Current School:



SHREWSBURY SCHOOL

SIXTH FORM ENTRANCE EXAMINATION

2021 ENTRY

MATHEMATICS

(1 Hour)

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.

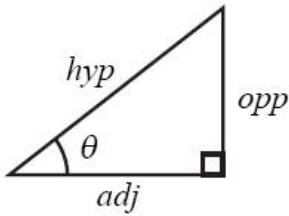
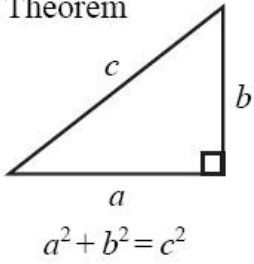
Section B is intended to be more considerably more difficult, and is mainly targeted at candidates who are aiming for an academic scholarship on the strength of their mathematics, or who are hoping to take Further Mathematics at A-Level.

You are expected to use a calculator in this examination.

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

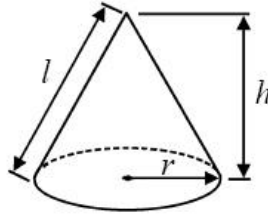
IGCSE MATHEMATICS 4400
FORMULA SHEET – HIGHER TIER

Pythagoras' Theorem



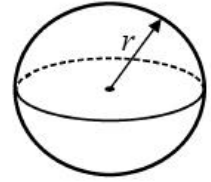
Volume of cone = $\frac{1}{3} \pi r^2 h$

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



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

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



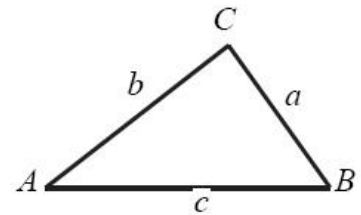
adj = hyp \times cos θ
opp = hyp \times sin θ
opp = adj \times tan θ

or $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

$\cos \theta = \frac{\text{adj}}{\text{hyp}}$

$\tan \theta = \frac{\text{opp}}{\text{adj}}$

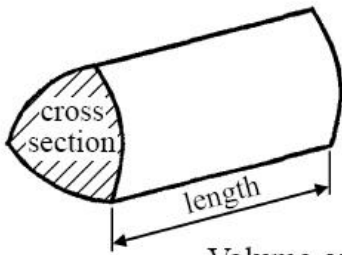
In any triangle ABC



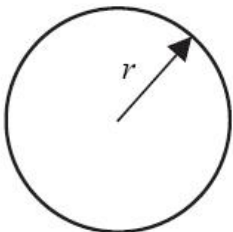
Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



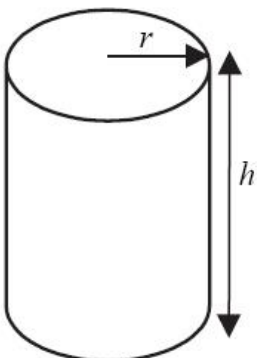
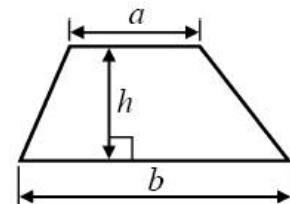
Volume of prism = area of cross section \times length



Circumference of circle = $2\pi r$

Area of circle = πr^2

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



Volume of cylinder = $\pi r^2 h$

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

The Quadratic Equation

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

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

Section A (50 marks)

Answer all questions in this section.

1) Expand the following, simplifying where appropriate:

a) $2(6p + 7q) + 3(5p - 4q)$

_____ [3]

b) $(8x - 3y)(6x + 5y)$

_____ [3]

2) Factorise the following expressions fully:

a) $24h^4x^3 - 16h^3x^4$

_____ [2]

b) $3p^2 - 7p + 2$

_____ [2]

- 3) a) Kevin obtains 48 marks out of 75 in a music exam. What is this as a percentage?

_____ [1]

- b) Lucy bought a painting a few years ago for £240. Since then, the value of the painting has increased by 32%. What is the painting worth now?

_____ [2]

- c) A coat is reduced in price by 15% and is now on sale for only £134.30. What was the original price of the coat before the sale?

_____ [2]

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

- a) Evaluate the following, giving your answer as a mixed number:

$$2\frac{4}{5} \div 1\frac{3}{4} + 3\frac{1}{2}$$

_____ [3]

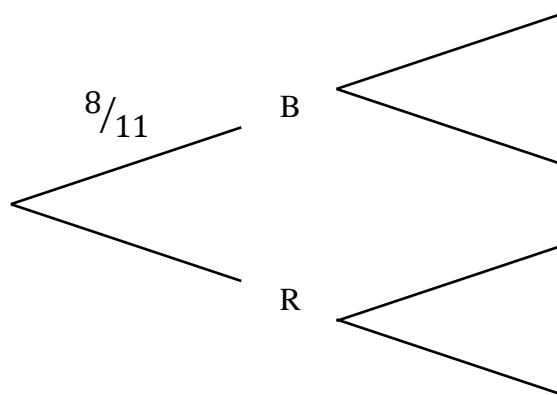
- b) Express the following in the form $a\sqrt{b}$, where a and b are integers:

$$\sqrt{24} + 3\sqrt{6}$$

_____ [2]

- 5) A bag contains 8 blue counters and 3 red counters. Two counters are removed from the bag, one at a time, **without** replacement.

- a) Complete the missing labels and probabilities in the tree diagram below.



[3]

- b) Calculate the probability that at least one of the counters is red.

_____ [2]

- 6) a) Jane, Sarah and Clive share 165 sweets in the ratio 8:5:2.
How many more sweets does Jane get than Clive?

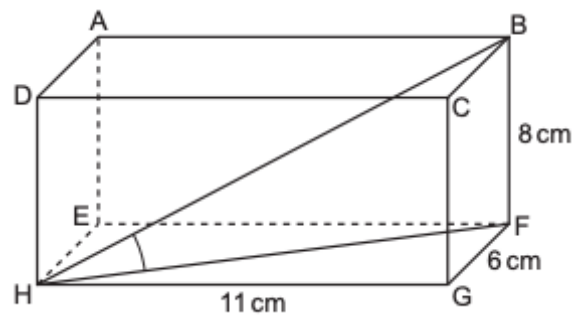
_____ [2]

- b) The children share some biscuits in a different ratio. Sarah gets 5 more biscuits than Jane, Clive gets 3 times as many as Jane, and Clive gets 11 more than Sarah.
How many biscuits do the children have altogether?

Hint: let x be the number of biscuits Jane has.

_____ [3]

- 7) The diagram below shows a cuboid with dimensions 11 cm by 6 cm by 8 cm.



- a) Using Pythagoras, calculate the length FH to 3 significant figures.

_____ [2]

- b) Calculate the angle BHF to 3 significant figures.

_____ [2]

8) Solve the following equations:

a) $3u - 8 = -2$

_____ [2]

b) $7(x - 2) = 4 - 3(x - 5)$

_____ [3]

c) $\frac{5y+3}{4} = \frac{3y-1}{2}$

_____ [3]

9) Rearrange the following formulae to make C the subject:

a) $R = 5 + 3C$

_____ [2]

b) $U = \frac{6}{2C-3}$

_____ [3]

10) Simplify the following expression fully:

$$\frac{x^2 - 3x + 2}{x + 5} \times \frac{2x + 10}{x^2 - 1}$$

_____ [3]

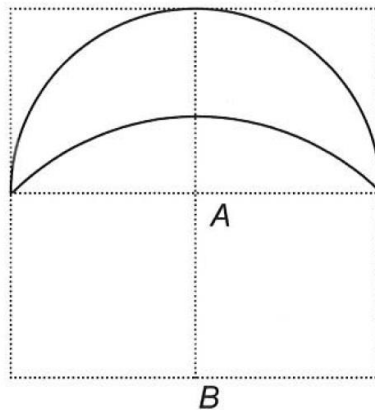
Spare page for Section A working.

Section B (15 marks)

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

Only attempt these harder questions if you have done and checked as much of Section A as you can. Each question is worth 5 marks.

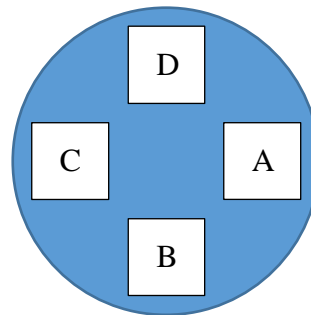
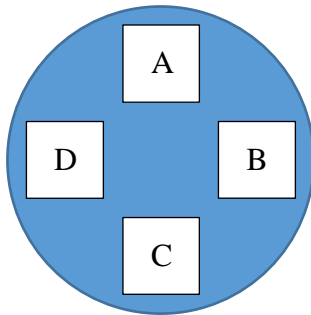
- B1)** The diagram below shows an outer square divided into four identical unit squares, so that length AB is 1 unit. Two circular arcs are drawn inside the outer square. The centre of the upper arc is A , and the centre of the lower arc is B . Calculate the area enclosed between the two arcs.



- B2) a) Horace has four favourite books: A, B, C and D. In how many ways can he arrange these books on a shelf? (For example, two possible ways are ABCD and BDCA.)
-

- b) This time, Horace places the four books on a circular shelf. In how many ways can the books be arranged up to rotation?

Note: “up to rotation” means that two arrangements are the same if one can be rotated into the other. For example, the two diagrams below show the same arrangement:



- c) Horace now has six books to place on the circular shelf. Two of them are by the same author. In how many ways can they be arranged up to rotation, so that the two books by the same author are **not** beside each other?

Please turn over for the final question.

B3) a) Expand and simplify $\left(x - \frac{1}{x}\right)^2$.

b) If $u = x - \frac{1}{x}$, write $x^2 + \frac{1}{x^2}$ in terms of u .

c) Hence find the exact solutions of the equation

$$x^4 - x^3 - 4x^2 + x + 1 = 0$$

Hint: divide both sides by x^2 .

d) Find the exact, real solutions of the equation

$$y^8 - y^6 - 4y^4 + y^2 + 1 = 0$$

+++++ END +++++