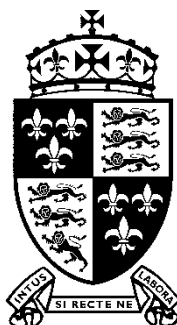


First name:

Surname:

Current School:



SHREWSBURY SCHOOL

SIXTH FORM ENTRANCE

EXAMINATION 2018

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 brackets: ().

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

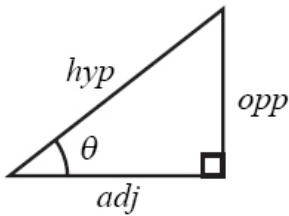
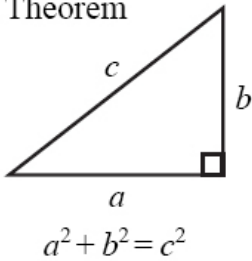
Section B is intended to be more considerably more difficult, and is mainly targeted at candidates who are aiming for an academic scholarship on the strength of their mathematics, or who are hoping to take Further Mathematics at A-Level.

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

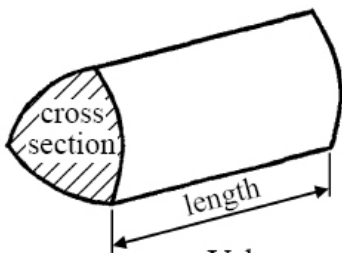


adj = hyp \times cos θ
opp = hyp \times sin θ
opp = adj \times tan θ

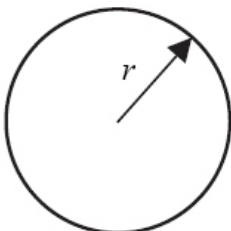
or $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

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

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

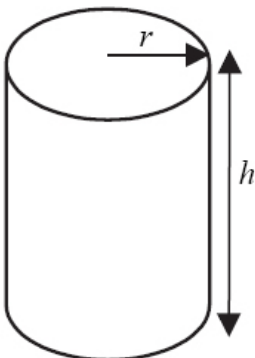


Volume of prism = area of cross section \times length



Circumference of circle = $2\pi r$

Area of circle = πr^2

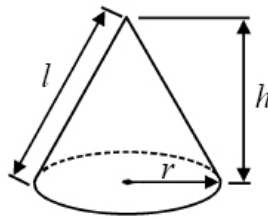


Volume of cylinder = $\pi r^2 h$

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

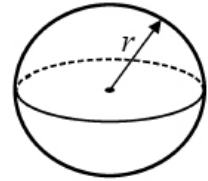
Volume of cone = $\frac{1}{3} \pi r^2 h$

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

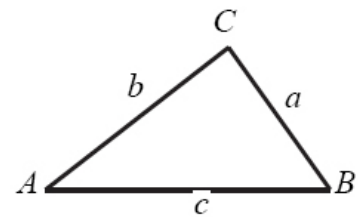


Volume of sphere = $\frac{4}{3} \pi r^3$

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



In any triangle ABC

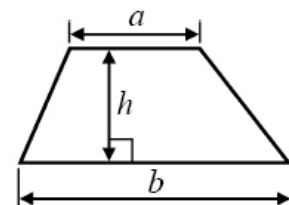


Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

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



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 (60 marks)

Answer all questions in this section.

1. Expand and simplify, where appropriate, the following brackets

a) $5(3y + 7x) - 8(2x - 4y)$

..... (2)

b) $(2p - 7)(5 - 6p)$

..... (2)

c) $(x - 7)(2x - 1)(x + 7)$

..... (3)

2. Factorise the following expressions

a) $15h^3x - 5h^2x^3$

..... (2)

b) $6y^2 + y - 2$

..... (2)

- c) Why can't you factorise $p^2 + 2p + 3$ into the form $(p + a)(p + b)$ where a and b are real numbers? Explain your reasoning clearly, you can use words or algebra.

..... (2)

3. Simplify the following calculations, **you may not use a calculator** and full working must be shown.

a) $4\frac{1}{3} - 1\frac{2}{5}$

..... (2)

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

..... (2)

4. Simplify the following to express as one fraction.

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

..... (3)

5. Bernard and Matthew liked to cook and they were following a recipe for 4 people, they were cooking for 7 people. The recipe said they needed 300g of flour and 110 g of butter.

a) How much of each did they need in their meal for 7 people?

..... (2)

b) In this recipe for 4 people they needed 35ml of oil, Bernard said that a good way to calculate how much oil they needed to use for 7 people was to double the recipe for 4 people and take off 10%. By what % was he incorrect? Give your answer to 1 DP.

..... (3)

6. In a sale a coat is being sold for £247.90, after a reduction of 33%, what was the original price of the coat?

..... (2)

7. I bought my car for £7800, in the first year it loses 15% of its value and in the second year it loses a further 22%. What was the value of my car after 2 years?

..... (2)

8. Transpose formulae

- a) Make q the subject of the following formulae:

i. $T = 5q - 3p$

..... (2)

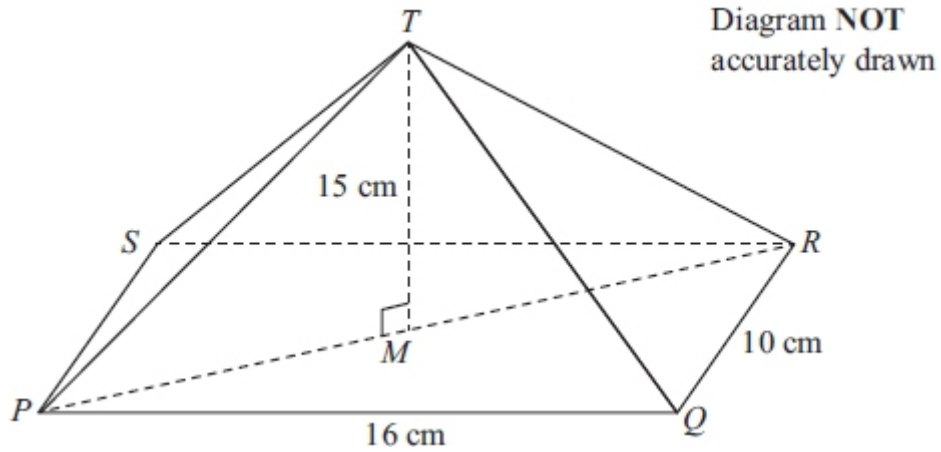
ii. $R = 7s + 3q^2$

..... (3)

iii. $Y = \frac{6q-1}{3+2q}$

..... (3)

9. The diagram shows a pyramid with a horizontal rectangular base $PQRS$.
 $PQ = 16$ cm.
 $QR = 10$ cm.
 M is the midpoint of the line PR .
The vertex, T , is vertically above M .
 $MT = 15$ cm.



- a) Calculate the size of the angle between TP and the base $PQRS$.
Give your answer correct to 1 decimal place.

..... (2)

- b) X is a point on PT such that it is the closest point on PT to the point M . Find the distance XM .

..... (3)

10. Solve the equations:

a) $3y - 1 = 7$

..... (2)

b) $7p - 1 = 4(p - 3)$

..... (3)

c)

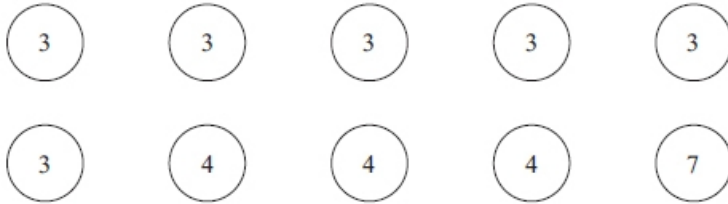
$$\frac{6}{x-2} - \frac{6}{x+1} = 1$$

..... (3)

Show clear algebraic working.

11. Here are ten counters.

Each counter has a number on it.



Fern puts the ten counters in a bag. She takes at random a counter from the bag.

a) Find the probability that the number on the counter is 3 or 4

..... (2)

After Fern replaces her counter Rajan takes at random one of the ten counters from the bag. He **does not** put the counter back into the bag. He then takes at random a second counter from the bag.

b) Calculate the probability that total of the score on the two counters is odd.

..... (3)

12. Simplify the following, writing your answers in the form $a + b\sqrt{c}$ where a, b, c are integers:

To gain **any** marks in this question you must show full clear working

a) $8\sqrt{8} - 5\sqrt{2}$

..... (2)

b) $\frac{3}{\sqrt{3}-1} + \frac{5}{\sqrt{3}+1}$

..... (3)

End of Section A

Section B (20 marks)

This section is intended to be 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.

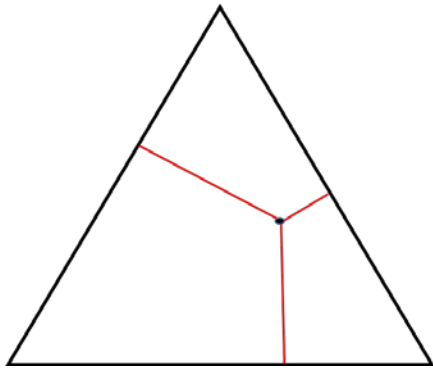
Only attempt these questions if you have done and checked as much of section A as you can.

B1) Prove that if 51 points are selected inside a square of 1m show that it would be possible to find a circle of radius $\frac{1}{7}$ m that contains three points.

Make sure your proof is explained clearly, you may use diagrams to illustrate your points.

..... (5)

B2) Prove that for **any** point inside an equilateral triangle the **sum** of the shortest distances from that point to the sides is equal to the height of the triangle (diagram illustrating this).



..... (5)

B3)

- a) Expand $(a + b)^3$
- b) Using your expansion can you find $(2 + 5x)^3$
- c) Expand $(a + b + c)^3$
- d) Can you find the term in x^2 in the expression $(2x + 3y + 5)^3(x^2 + 4x + 7)$

..... (5)

B4) Prove that a number is divisible by 4 if the number formed by the last 2 digits of this number is divisible by 4. (For example, 7312 is divisible by 4).

Can you find and prove a similar rule for a number being divisible by 8?

..... (5)

END OF QUESTIONS