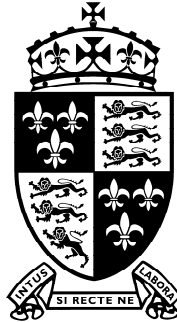


Surname:

First Name:

Current School:



SHREWSBURY SCHOOL

SIXTH FORM ENTRANCE EXAMINATION 2014/15

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.

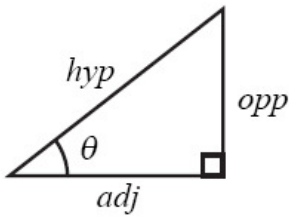
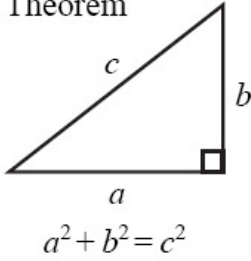
Section B is intended to be more considerably more difficult, and is mainly targeted at candidates who are aiming for an academic scholarship on the strength of their mathematics, or who are hoping to take Further Mathematics at A-Level.

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

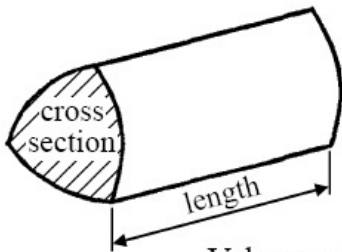


adj = hyp \times cos θ
opp = hyp \times sin θ
opp = adj \times tan θ

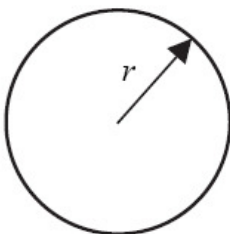
or $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

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

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

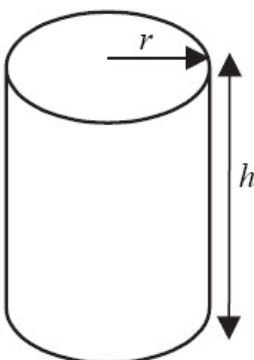


Volume of prism = area of cross section \times length



Circumference of circle = $2\pi r$

Area of circle = πr^2

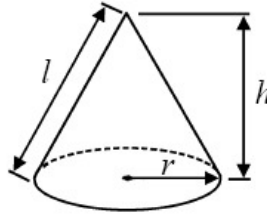


Volume of cylinder = $\pi r^2 h$

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

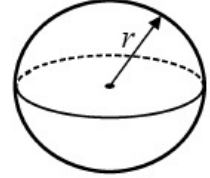
Volume of cone = $\frac{1}{3} \pi r^2 h$

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

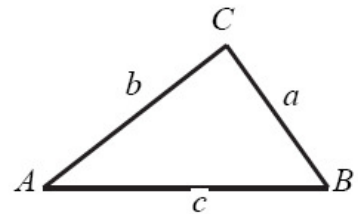


Volume of sphere = $\frac{4}{3} \pi r^3$

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



In any triangle ABC

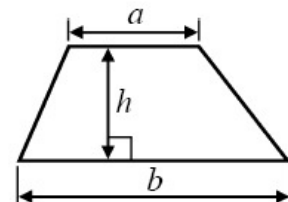


Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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 the following, simplifying where appropriate:

a) $6(x + 3y) - 3(2x - 4y)$

_____ [2]

b) $(2w - 5)(w + 3)$

_____ [3]

Factorise the following:

c) $8a^3b + 20ab$

_____ [2]

d) $x^2 + 11x + 24$

_____ [2]

- 2) a) A large tree has 6380 leaves. During a storm, it loses 15% of its leaves. How many does it have afterwards?

_____ [2]

- b) The tree also lost 35% of its flowers during the storm. If it now has 208 flowers remaining, how many did it have before the storm?

_____ [2]

- c) Ten years ago, the height of the tree was 6.3 metres. It has now reached a height of 10.2 metres.
What was the percentage increase in the height of the tree during this period of time, to 3 significant figures?

_____ [3]

3) A biscuit tin contains 10 Jammie Dodgers and 5 Custard Creams. Eric takes a biscuit at random from the tin. Jane then takes one at random for herself.

a) What is the probability that Eric's biscuit is a Custard Cream?

_____ [1]

b) What is the probability that Eric and Jane select the same type of biscuit?

_____ [3]

4) The density D of a sphere is **inversely** proportional to the **cube** of the radius r . When $r = 2$ cm, $D = 135$ g/cm³.

a) Find a formula for D in terms of r .

_____ [3]

b) Calculate the radius when the density is 40 g/cm³.

_____ [3]

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

a) Calculate these, giving your answers as fractions in their simplest form:

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

_____ [2]

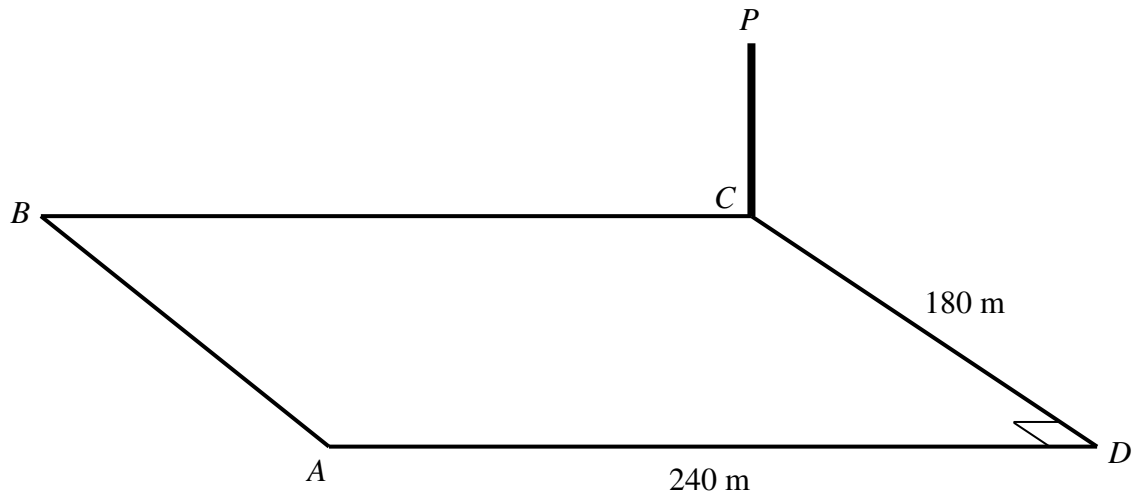
ii) $3\frac{3}{8} \div 2\frac{1}{4}$

_____ [3]

b) Without using a calculator, calculate the number which is $\frac{2}{3}$ of the way from $5 - 2\sqrt{2}$ to $11 + 7\sqrt{2}$. Give an exact answer in surd form.

_____ [3]

6)



The diagram shows a rectangular field $ABCD$ with a vertical post CP at one corner. Given that the angle of elevation from A to the top of the post P is 1.5° , calculate the height of the post to 3 significant figures.

_____ [5]

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

a) $2a - 3x = 7$

_____ [2]

b) $P = \sqrt{x + 3Q}$

_____ [2]

c) $y^2 = \frac{4}{x + 3}$

_____ [3]

d) $r^2 = (2x + a)(2x - a)$

_____ [3]

8) Solve the following equations:

a) $2w + 11 = 2 - 4w$

_____ [2]

b) $\frac{6}{u-5} = \frac{4}{u}$

_____ [3]

c) $2x^2 - 21x + 40 = 0$

_____ [3]

d) $(y+3)^8 = 4(y+3)^7$

_____ [3]

Section B (20 marks)

This section 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.

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

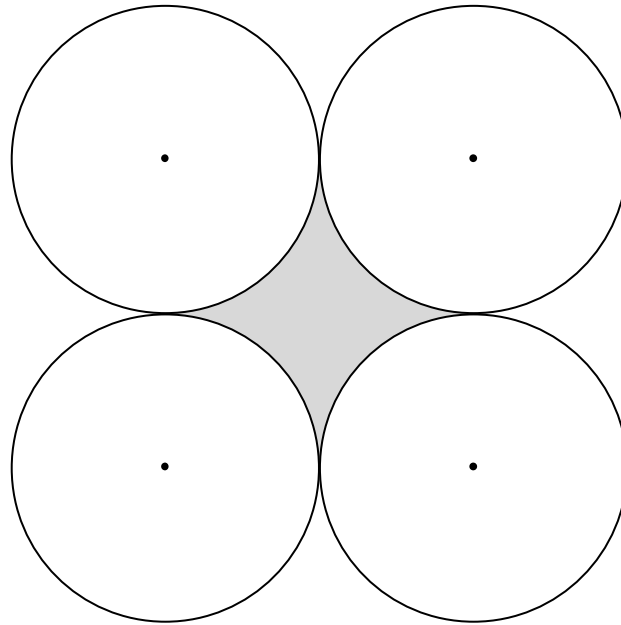
- B1) Postman Pat has four parcels to deliver, one to each of four houses. Unfortunately the addresses on the parcels have washed away in the rain, so he guesses which parcel to deliver to each house.

Find the probability that no parcel is delivered to the correct house.

_____ [6]

B2) Four circles of unit radius are drawn touching each other, with their centres forming a square of side 2 units, as shown below.

Calculate the exact area of the largest square which can be drawn in the shaded region enclosed between the four circles.



_____ [6]

Please turn over for the final question.

B3) a) What can you say about the real numbers a and b if $a^2 + b^2 = 0$?

_____ [2]

b) The real numbers x, y, z satisfy the equation:

$$(3x + 5y + 7z - 9)^2 + (5x + 4y + 3z - 2)^2 = 0.$$

i) Calculate the value of $x + y + z$.

_____ [4]

ii) Hence calculate the value of $x + 2y + 3z$.

_____ [2]

+++++ END +++++