Surname:	Forename(s):

GCSE Mathematics – Higher Tier

Paper 1 – Non Calculator

Practice Set B

ANSWERS

/40

Materials

- **Formulae Sheet** (on the next page)
- **Black** ink or ball-point pen
- Pencil
- Eraser
- Protractor
- Compass
- Tracing Paper
- **No calculator allowed**

Instructions

- Time allowed: **45 minutes.**
- The total mark for this paper is **40**.
- Show **all** of your working.
- Draw diagrams in pencil.
- Plot graphs in pencil.
- Diagrams are **not** accurately drawn, unless otherwise indicated.
- Cross through any work you don't want to be marked

Higher Tier Formulae Sheet

Perimeter, Area and Volume

Where a and b are the lengths of the parallel sides and h Is their perpendicular separation:

Area of a trapezium = ½ (a + b) h

Volume of a prism = area of cross section x length

Where r is the radius and d is the diameter:

Circumference of a circle = 2πr = πd

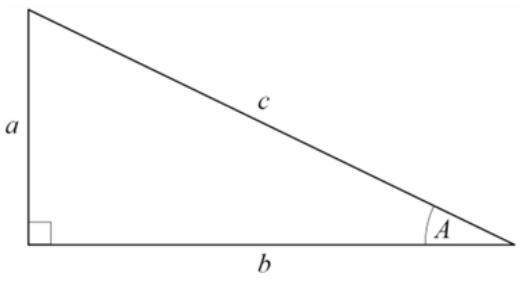
Area of a circle = πr^2

Quadratic Formula

The solution of $ax^2 + bx + c = 0$ where $a \neq 0$

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

Pythagoras' Theorem and Trigonometry

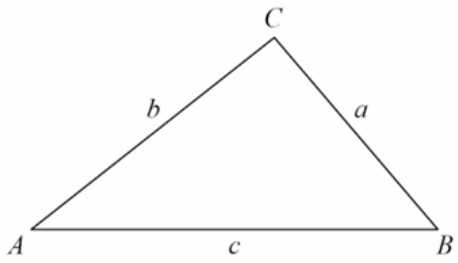


In any right-angled triangle where a, b and c are the length of the sides and c is the hypotenuse:

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

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \qquad \cos A = \frac{b}{c} \qquad \tan A = \frac{a}{b}$$



In any triangle ABC where a, b and c are the length of the sides:

$$\text{sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$

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

Compound Interest

Where P is the principal amount, r is the interest rate over a given period and n is number of times that the interest is compounded:

$$\text{Total accrued} = P\left(1 + \frac{r}{100}\right)^n$$

Probability

Where P (A) is the probability of outcome A

and P (B) is the probability of outcome B:

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A given B) P(B)

1 Ella is 7 years older than Karim.
Seth is twice as old as Ella.
The sum of their three ages is 77.

Find the ratio of Karim's age to Ella's age to Seth's age.

Karim = x

Ella = $x+7$

Seth = $2(x+7) = 2x+14$

$x + x+7 + 2x + 14 = 77$

$4x + 21 = 77$

$-21 \quad -21$

$4x = 56$

$\div 4 \quad \div 4$

$x = 14$

Karim : Ella : Seth

$x : x+7 : 2x+14$

$14 : 14+7 : 2(14)+14$

$14 : 21 : 42$

$\div 7$

$2 : 3 : 6$

2 : 3 : 6
OR 14 : 21 : 42

(Total for question 1 is 4 marks)

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2 Work out 34.6 x 7.2

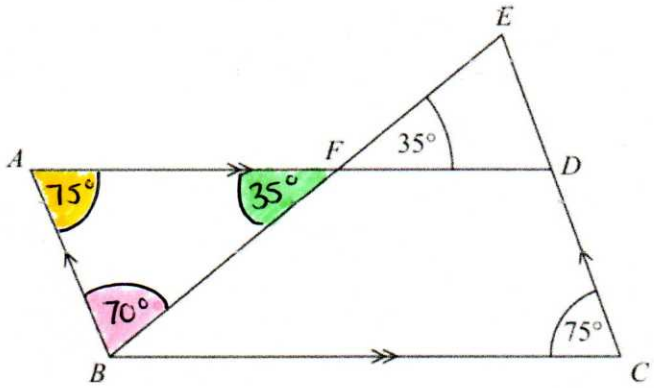
$$\begin{array}{r} 346 \\ \times\ 72 \\ \hline 692 \\ +\ 24220 \\ \hline 24912 \end{array}$$

= 249.12

249.12

(Total for question 2 is 3 marks)

3



ABCD is a parallelogram.
EDC is a straight line.
F is the point on AD so that BFE is a straight line.

Show that angle ABE = 70°

Give a reason for each stage of your working.

$\angle BAD = 75°$ because opposite angles in a Parallelogram are equal.

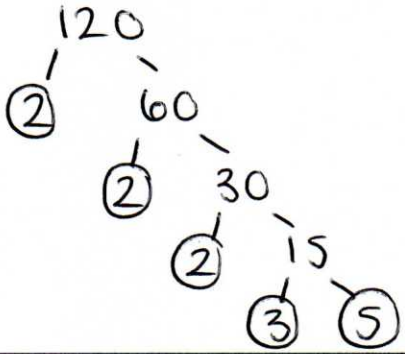
$\angle AFB = 35°$ because vertically opposite angles are equal.

$\angle ABE = 70°$ because angles in a triangle sum to 180°. $75 + 35 + 70 = 180$.

(Total for question 3 is 4 marks)

(there are lots of possible ways to get to this final answer)

4 Express 120 as a product of its prime factors



$120 = 2 \times 2 \times 2 \times 3 \times 5$

OR $\frac{2^3 \times 3 \times 5}{2 \times 2 \times 2 \times 3 \times 5}$

(Total for question 4 is 2 marks)

5 (a) Find the value of $36^{-\frac{1}{2}}$

$$36^{-\frac{1}{2}} = \frac{1}{\sqrt{36}} = \frac{1}{6}$$

$\frac{1}{6}$

(2)

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}}$

$$\frac{\sqrt[3]{64}^2}{\sqrt[3]{125}^2} = \frac{4^2}{5^2} = \frac{16}{25}$$

$\frac{16}{25}$

(2)

(Total for question 5 is 4 marks)

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6 The table shows a set of values for x and y.

x	1	2	3	4
y	9	$2\frac{1}{4}$	1	$\frac{9}{16}$

y is inversely proportional to the square of x.

(a) Find an equation for y in terms of x.

$$y \propto \frac{1}{x^2} \Rightarrow y = \frac{k}{x^2}$$

(Substitute any pair of values to find k).

$$9 = \frac{k}{1^2}$$

$$\boxed{9 = k}$$

$y = \frac{9}{x^2}$

(2)

(b) Find the positive value for x when y = 16

$$y = \frac{9}{x^2}$$

$$\hookrightarrow x^2 = \frac{9}{y}$$

$$\hookrightarrow x = \sqrt{\frac{9}{y}} \rightarrow x = \sqrt{\frac{9}{16}}$$

$$x = \frac{\sqrt{9}}{\sqrt{16}}$$

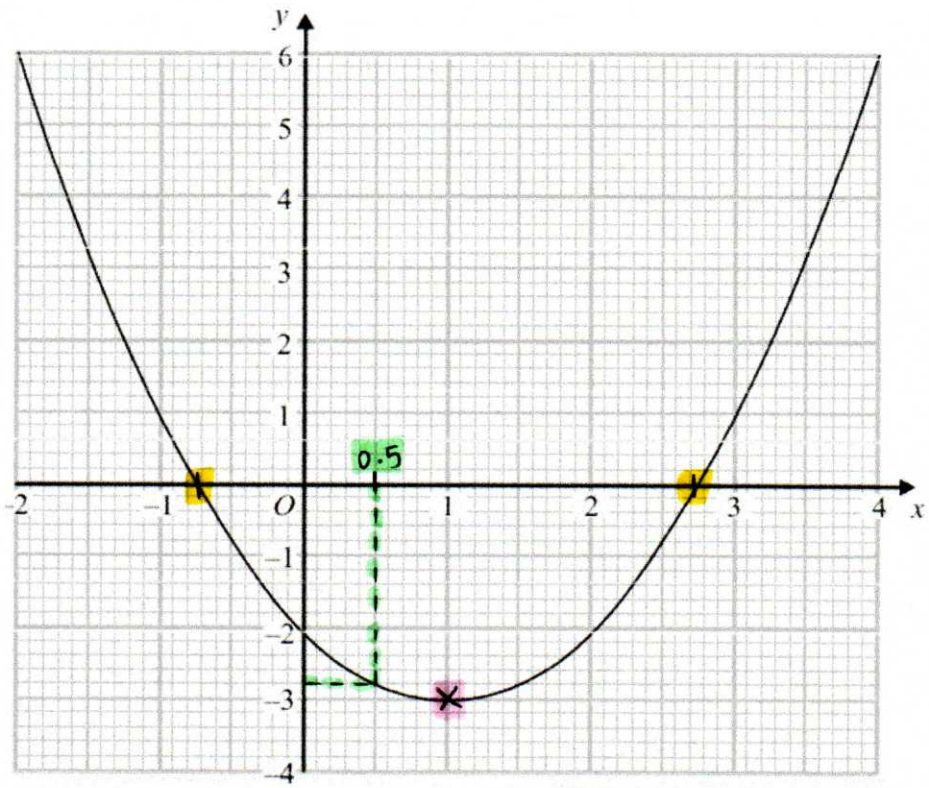
$$x = \frac{3}{4}$$

$x = \frac{3}{4}$

(2)

(Total for question 6 is 4 marks)

7 The graph of y = f(x) is drawn on the grid.



(a) Write down the coordinates of the turning point of the graph.

(1 , -3)

(1)

(b) Write down estimates for the roots of f(x) = 0

x = -0.7 or x = 2.7

(1)

(c) Use the graph to find an estimate for f(0.5)

-2.8

(1)

(Total for question 7 is 3 marks)

8 $x = 0.4\dot{3}\dot{6}$

Prove algebraically that x can be written as $\frac{24}{55}$

$x = 0.4\dot{3}\dot{6}$

$10x = 4.\dot{3}\dot{6}$

$100x = 43.\dot{6}\dot{3}$

$1000x = 436.\dot{3}\dot{6}$

$1000x = 436.\dot{3}\dot{6}$

$-\ 10x \quad -\ 4.\dot{3}\dot{6}$

$990x = 432$

$x = \frac{432}{990} \xrightarrow{\div 9} \frac{48}{110} \xrightarrow{\div 2} \frac{24}{55}$

$9\overline{)432}$ → 048

(Total for question 8 is 3 marks)

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9 A cone has a volume of 97 cm^3. → $100\,cm^3$

The radius of the cone is 5.09 cm. → 5 cm

$\pi \rightarrow 3$

(a) Work out an estimate for the height of the cone

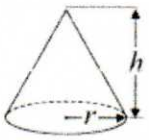
$V = \frac{1}{3}\pi r^2 h$

$100 = \frac{1}{3}(3)(5)^2 h$

$100 = 25h$

$4 = h$

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



4 cm

(3)

Jacob uses a calculator to work out the height of the cone to 2 decimal places.

(b) Will your estimate in part (a) be more or less than Jacobs' answer?

Give reason for your answer.

$V = \frac{1}{3}\pi r^2 h$

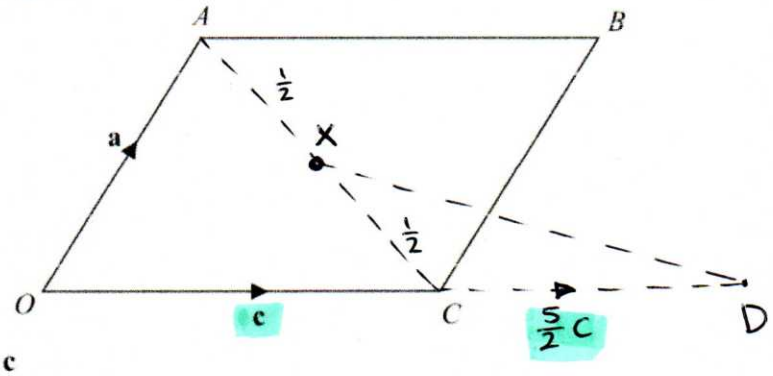
$\frac{3V}{\pi r^2} = h$

Overestimate as both denominators rounded down and numerator rounded up.

(1)

(Total for question 9 is 4 marks)

10 OABC is a parallelogram.



$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$

X is the midpoint of the line AC.
OCD is a straight line so that $OC : CD = k : 1$

Given that $\overrightarrow{XD} = 3\mathbf{c} - \frac{1}{2}\mathbf{a}$

find the value of k.

$\overrightarrow{AC} = -a + c$

$\overrightarrow{XD} = 3c - \frac{1}{2}a$

$\overrightarrow{XD} = \overrightarrow{XC} + \overrightarrow{CD}$

$\overrightarrow{XD} = \frac{1}{2}\overrightarrow{AC} + \overrightarrow{CD}$

$\overrightarrow{XD} = \frac{1}{2}(-a + c) + \overrightarrow{CD}$

$\overrightarrow{XD} = -\frac{1}{2}a + \frac{1}{2}c + \overrightarrow{CD}$

$\overrightarrow{XD} = -\frac{1}{2}a + 3c$

$\overrightarrow{XD} = -\frac{1}{2}a + \frac{1}{2}c + \overrightarrow{CD}$

$3c = \frac{1}{2}c + \overrightarrow{CD}$

$\therefore \overrightarrow{CD} = \frac{5}{2}c$

$OC : CD$

$1 : \frac{5}{2}$

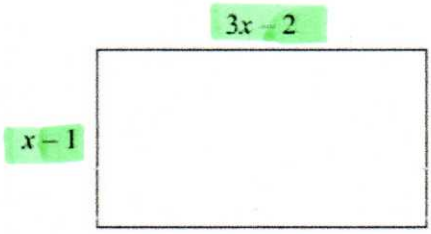
$\div\frac{5}{2}$ $\quad$ $\div\frac{5}{2}$

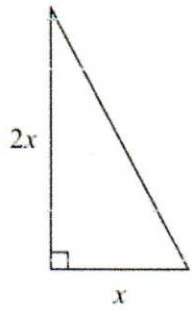
$\frac{2}{5} : 1$

k = $\frac{2}{5}$

(Total for question 10 is 4 marks)

11 Here is a rectangle and a right-angled triangle.

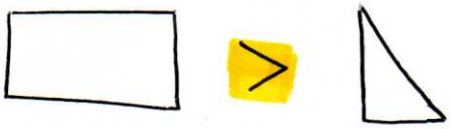




All measurements are in centimetres.

The area of the rectangle is greater than the area of the triangle.

Find the set of possible values of x.



$b \times h > \frac{b \times h}{2}$

$(3x-2)(x-1) > \frac{(2x)(x)}{2}$

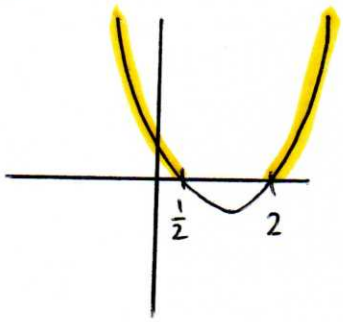
$3x^2 - 3x - 2x + 2 > x^2$

$3x^2 - 5x + 2 > x^2$

$2x^2 - 5x + 2 > 0$

$(2x - 1)(x - 2) > 0$

$x = \frac{1}{2}$ $x = 2$



$x < \frac{1}{2}$ or $x > 2$

Smallest possible value for $x > 1$ because height of rectangle can not be negative.

$\therefore x > 2$

$x > 2$

(Total for question 11 is 5 marks)

END OF TEST

TOTAL FOR THIS PAPER IS 40 MARKS

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