

Eton College King's Scholarship Examination 2018

MATHEMATICS A

(One and a half hours)

Candidate Number:.....

Please write your candidate number on EVERY sheet.

Please answer on the paper in the spaces provided.

This paper is divided into two sections:

Section I (Short-answer questions) – 50 marks available

Section II (Extended questions) – 50 marks available

Answer all of Section I and as many questions as you can from Section II.

The marks for each part of each question are given in square brackets.

Show all your working.

No diagram is drawn to scale.

The use of calculators is NOT permitted.

Do not turn over until told to do so.

Section I : Short-answer questions (50 marks)

1. Find the value of the following, giving your answers as reduced, mixed fractions:

a) $1\frac{13}{14} \times 5\frac{4}{9}$ [3]

b) $3\frac{21}{35} \div 1\frac{13}{35}$ [3]

c) $207\frac{3}{10} - 199\frac{7}{15}$ [3]

d) $\left(3 + \frac{1}{2}\right)^2$ [3]

2. Find the value of the following, giving your answer as a decimal or whole number where appropriate:

a) 3.5×0.04 [3]

b) $0.064 \div 0.000016$ [3]

c) $(0.04)^3$ [3]

3. Solve the following equation, giving your answer as a mixed fraction:

$$13x - 7 = 1 + 5(3 - x) \quad [3]$$

4. Solve the following inequality. In your final answer, x must appear on the left-hand side.

$$19x - 3 < 23x + 21 \quad [3]$$

5. Solve the pair of equations simultaneously:

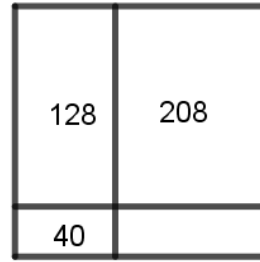
$$\begin{aligned} 3x - 4y &= 27 \\ 4x - 3y &= 43 \end{aligned} \quad [4]$$

6. A square has an area of 0.0036 cm^2 . Find its perimeter, in centimetres. [3]

7. I have a block of gold weighing five-twelfths of an ounce. I remove four-fifteenths of an ounce. What percentage of the original gold remains? [4]

8. Most of the children in a certain school were born in one of five English counties. A third were born in Berkshire, a fifth were born in Buckinghamshire, a sixth were born in Hampshire, an eighth were born in Surrey and a tenth were born in Middlesex. The remaining 45 children were born in other counties. How many children are in the school? [4]

9. A square is divided into four rectangles as shown; the areas of three of the rectangles are given. Find:



- i) the area of the remaining rectangle;

- ii) the side length of the square.

[4]

10. In a survey, people were asked if they owned a goat or a camel. One person in fifteen said they had a goat; one person in eighteen said they had a camel and a tenth of the people had one animal or the other but not both. What proportion of the people owned neither kind of animal?

[4]

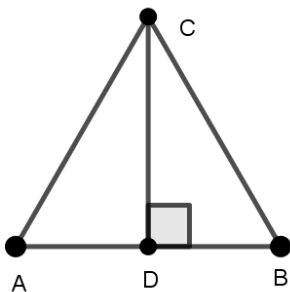
Section II: Extended questions (50 marks)

11. Note: The notation $5\sqrt{7}$ is merely shorthand for $5 \times \sqrt{7}$

a) Show that $5\sqrt{7}$ equals $\sqrt{175}$. [1]

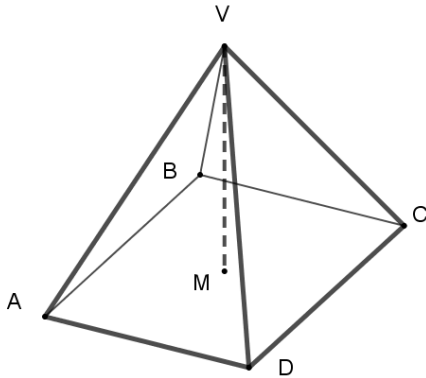
b) Without trying to work out the square roots as decimals, try to determine which of the two is the larger: $3\sqrt{3}$ or $2\sqrt{7}$. [2]

c) An equilateral triangle ABC has sides of length 12 units. Use Pythagoras' Theorem to show that the perpendicular height CD is $a\sqrt{3}$ units, where a is a whole number to be found. [2]



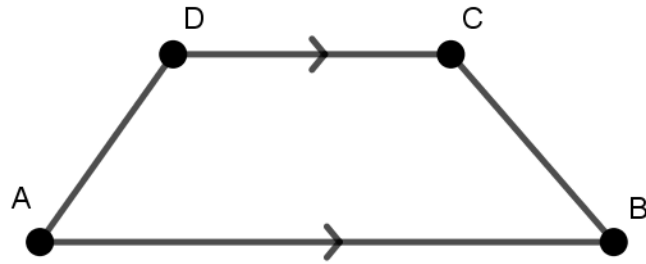
- d) A square-based pyramid $ABCDV$ is made from a square of side 12 cm and four equilateral triangles as shown. Find the perpendicular height VM , where M is the centre of $ABCD$, and show it can be written as $b\sqrt{2}$ where b is a whole number to be found.

[5]

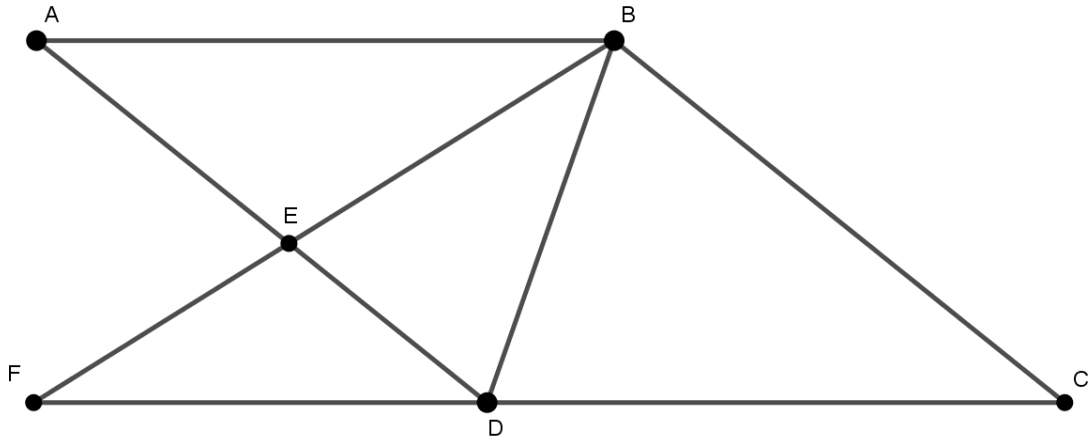


12. a) $ABCD$ is a trapezium. The internal angle at A is 9° greater than the internal angle at B but half the internal angle at C . Find the internal angle at D .

[4]



- b) In the diagram shown, the line segments AB , BC , CD and DA are all equal in length; in addition, $BE = BD$. Lines AED , BEF and CDF are straight. Given that $\angle BFD = 33^\circ$, find the value of $\angle FED$. [6]



13. a) The letters a, b, c, d and e represent five different positive, whole numbers such that $abcde = 210$. Show (clearly) that there is exactly one possible value for $a+b+c+d+e$ and find that value.

[2]

- b) Let p, q, r and s represent four different positive, whole numbers such that $pqrs = 210$. Find all possible values for $p + q + r + s$.

[3]

- c) Let w, x, y and z represent four whole numbers (not necessarily positive).
If $(w-1)(x-2)(y-3)(z-4) = 10$, find all possible values for
 $w+x+y+z$.

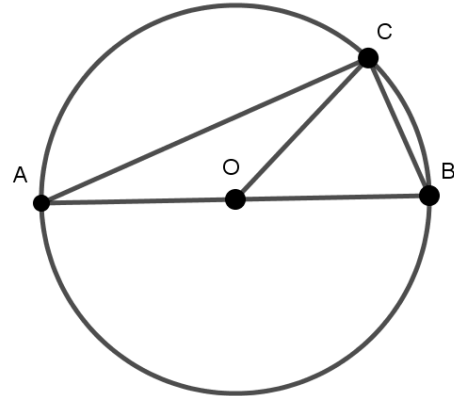
[5]

14. a) If x and y are positive, whole numbers, then two possible solutions to the equation $50x + 9y = 2018$ are $(x, y) = (4, 202)$ and $(x, y) = (13, 152)$.
- i) Verify these are indeed solutions to the equation. [1]
- ii) Find the other three solutions to the equation. [3]

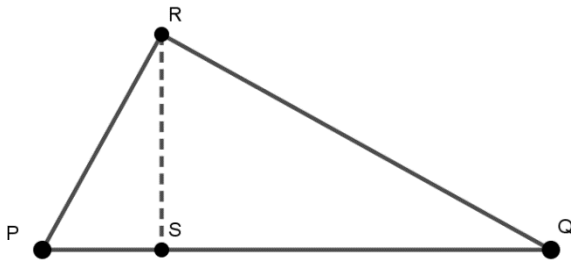
- b) I buy chocolate bars and fizzy drinks. Of the chocolate bars, Venus bars cost 68p each and Tiger bars cost 48p each; cans of fizzy drink cost 60p each. I buy five times as many chocolate bars (Venus and Tiger combined) as I buy cans of fizzy drink. If I spent £10.40, how many cans of fizzy drink did I buy?

[6]

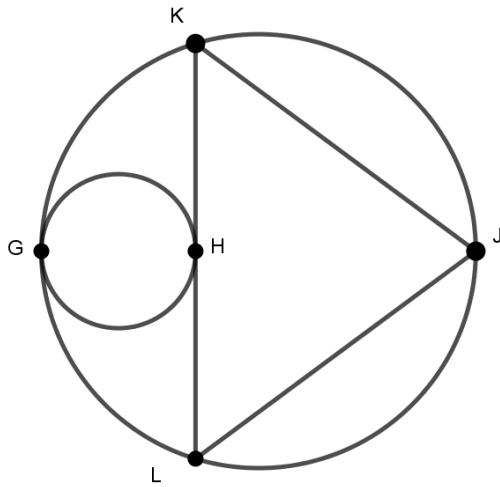
15. a) AB is a diameter as shown. O is the centre of the circle.
 Prove that $\angle ACB$ is a right angle. [2]



- b) In triangle PQR represented below, $RQ = 40\text{cm}$, $RP = 30\text{cm}$ and both $\angle PRQ$ and $\angle PSR$ are right angles. Find the perpendicular height RS . [3]



- c) In the diagram shown, triangle JKL is isosceles with $KJ = LJ = 10$ cm and $KL = 12$ cm. The small circle touches KL at its midpoint H and touches the larger circle at G in such a way that the line GHJ is a line of symmetry. Find the radius of the smaller circle.



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