

# 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)  $3.5 \times 0.04$  [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:

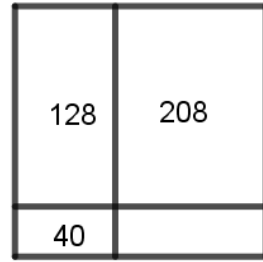
$$\begin{aligned} 3x - 4y &= 27 \\ 4x - 3y &= 43 \end{aligned} \quad [4]$$

6. A square has an area of  $0.0036 \text{ cm}^2$ . 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]

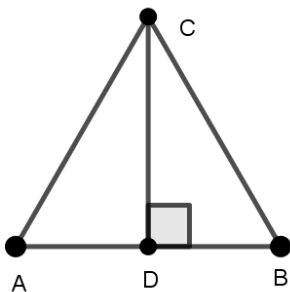
**Section II: Extended questions (50 marks)**

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]

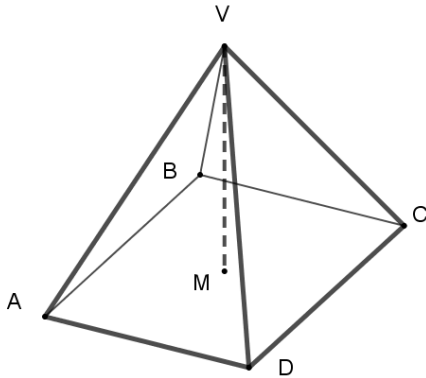
b) Without trying to work out the square roots as decimals, try to determine which of the two is the larger:  $3\sqrt{3}$  or  $2\sqrt{7}$ . [2]

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.

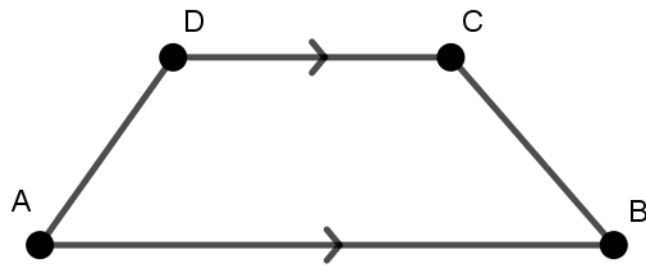
[5]



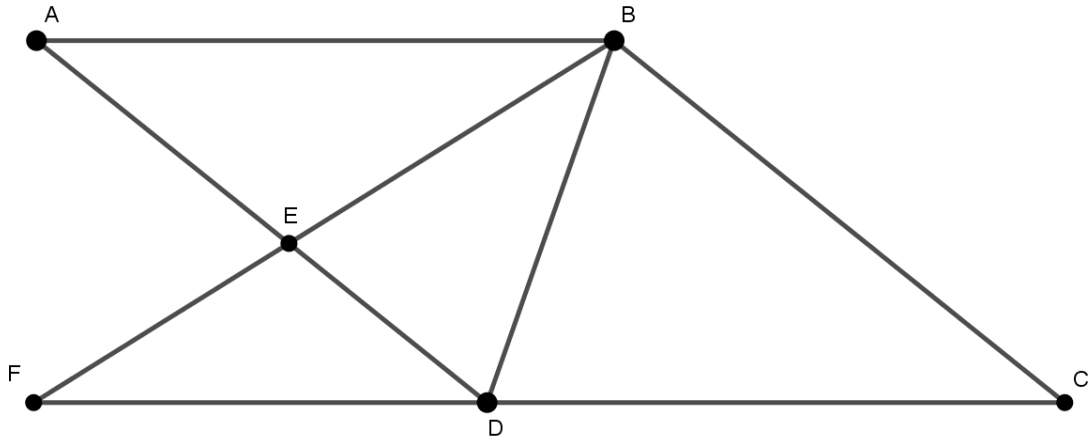


12. a)  $ABCD$  is a trapezium. The internal angle at  $A$  is  $9^\circ$  greater than the internal angle at  $B$  but half the internal angle at  $C$ . Find the internal angle at  $D$ .

[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  
 $w+x+y+z$ .

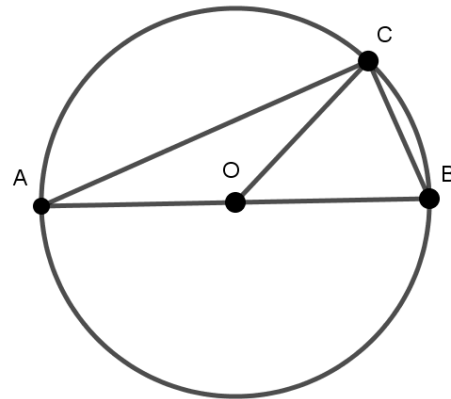
[5]

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]

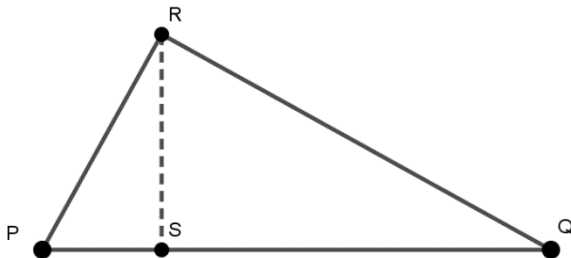
- b) I buy chocolate bars and fizzy drinks. Of the chocolate bars, Venus bars cost 68p each and Tiger bars cost 48p each; cans of fizzy drink cost 60p each. I buy five times as many chocolate bars (Venus and Tiger combined) as I buy cans of fizzy drink. If I spent £10.40, how many cans of fizzy drink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

[6]

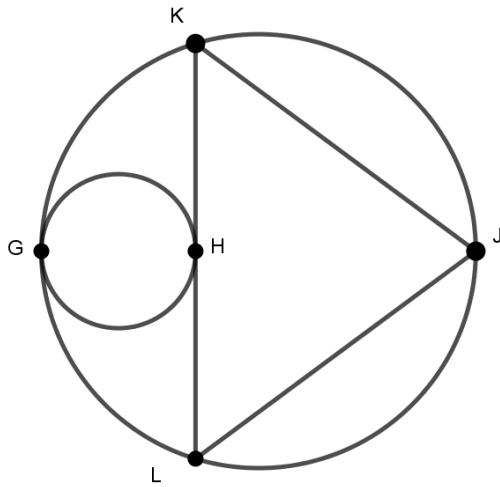
15. a)  $AB$  is a diameter as shown.  $O$  is the centre of the circle.  
 Prove that  $\angle ACB$  is a right angle. [2]



- 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.



**END OF PAPER**