



OUNDLE

School

2015 Academic Scholarship

Preliminary Examination

Mathematics

Time Allowed: 1½ hours

- **Calculators may NOT be used.**
- Write your answers on **lined paper** and **show as much working as possible.** Answers without clear logical working will gain little credit.
- Do not spend too long on any single question. If you are having difficulty with a particular question, move on and return to it at the end if you have time. Do not be concerned if you cannot answer all of the questions.
- **At the end of the examination,** hand in both the question paper and your answers with your name clearly indicated on all sheets.

1. Work out :

(a) $82 - 36$

(b) 18×24

(c) $\sqrt[3]{125}$

(d) $\sqrt{490\,000}$

(e) $5^2 + 2^5$

(f) $5^2 \times 2^5$

(g) $9 \div \frac{1}{2}$

(h) $5 \times \frac{2}{3}$

(i) $20 \div 0.4$

(j) 20×0.4

(k) 40% of 40

(l) $12 - 2 \times 3^2 + 10 \div (4 - (-1))$

(m) $3\frac{3}{5} \div 4\frac{1}{2}$

(n) $\sqrt{\sqrt{3^3 + 3^2} + 3}$

2. If $x = 3$, $y = -2$ and $z = -1$, find the values of :

(a) $4y - 5z$

(b) $x - z^2$

(c) $y^2 - xyz$

(d) $\frac{xy + z}{yz + x}$

3. Remove brackets and simplify fully :
- (a) $3(4x - 1)$
- (b) $x(x^2 + 1)$
- (c) $2(3x - 1) - 3(1 - 2x)$

4. Factorise fully :
- (a) $12y - 6$
- (b) $4x^2 - 12x$
- (c) $15a^2b^3 - 10ab^2$

FOR QUESTIONS 5 AND 6, USE A CLEAR ALGEBRAIC METHOD, **NOT** A TRIAL AND ERROR APPROACH.

5. Solve each equation for x :
- (a) $5x = 7$
- (b) $8x - 5 = 5x - 11$
- (c) $\frac{3}{x-4} + \frac{1}{2} = 1$

6. Solve for x and y :

$$\begin{aligned}3x - 2y &= 13 \\2x + y &= 4\end{aligned}$$

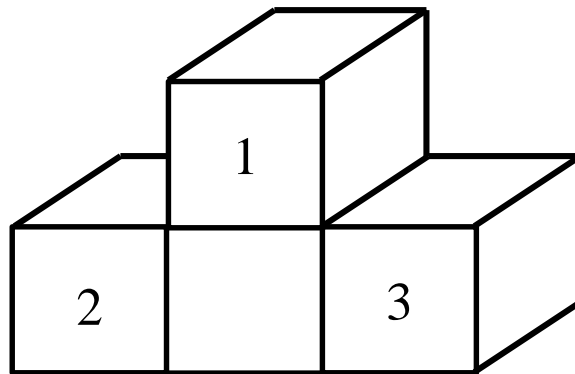
7. Mary is asked to factorise the expression $2x - 8 + 3x^2 - 12x$. She finds it difficult as there seems to be no common factor. Her teacher suggests that she splits the four terms up into two groups of two, so that

$$\begin{aligned}2x - 8 + 3x^2 - 12x \\&= 2(x - 4) + 3x(x - 4) \\&= (2 + 3x)(x - 4) \text{ which is now fully factorised !!}\end{aligned}$$

You must now factorise $4x^2 - 6xy + 6x - 9y$

8. A man drives along the motorway for 2 hours, averaging a speed of 60 miles per hour. He then turns off, and has to drive through heavy traffic for 10 miles. On this stretch, he only does an average of 20 miles per hour.
What is his average speed for the whole journey ?
9. Five years ago, a man was four times as old as his son. Now he is three times as old as his son. By forming and solving equations, answer the question : in how many years' time will he be twice as old as his son ?
(please note : a correct answer obtained by trial and error / guesswork will gain very few marks).
10. If the number 3^{2015} is written out in full, what will the last digit be ?

11.



Four identical small cubes form the model of a medallist's podium for an athletics meeting.

If the model podium has a volume of 108 cm^3 , find the total visible surface area that has to be painted (that is, not including the bottom).

12.



The 'PIN' number of a credit card consists of a 4 digit number, each digit of which can be 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9. Numbers may be used more than once, so there are 10 000 possible 'PIN' numbers

Of these possible 'PIN' numbers, how many

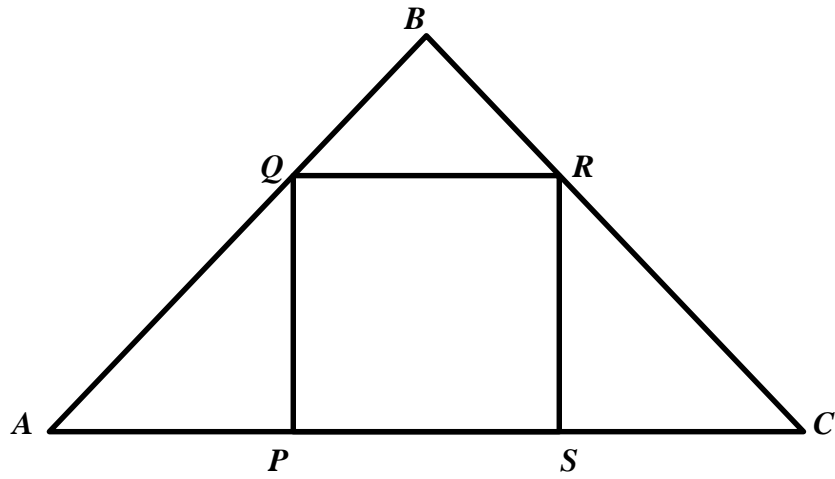
- (a) have 7 as their first digit ?
- (b) have all four digits the same ?
- (c) have only odd numbers ?
- (d) have all four digits different ?
- (e) have at least two digits the same ?

13. The fraction $\frac{37}{13}$ can be written in the form $2 + \frac{1}{x + \frac{1}{y + \frac{1}{z}}}$

where x, y and z are positive whole numbers.

Find the values of x, y and z .

14.



The diagram shows a square $PQRS$ inside a right-angled isosceles triangle ABC .

The length of each side of the square $PQRS$ is x .

Find the area of the triangle ABC (in terms of x).