

Percentages (Senior UKMT)

These questions must be attempted without a calculator

Topics covered in the questions below may not necessarily be from the topic of the title.

1. This crossnumber must be completed so that there is a different non-zero digit in each square.

Which digit goes in the square marked **X**?

Clues	Across	Down
	1. Cube	1. Square
	3. Sum of two squares	2. Prime

1.	2.
3.	X

- A 1 B 3 C 5 D 7 E 9

2. Observe that $18 = 4^2 + 1^2 + 1^2 + 0^2$.

How many of the first fifteen positive integers can be written as the sum of the squares of four integers?

- A 11 B 12 C 13 D 14 E 15

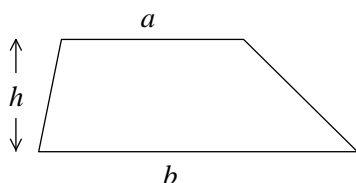
3. Our ancient Ancient History teacher's copy of Homer's *Odyssey* cost 40p in 1974. A similar edition today costs £5.

What percentage increase is this?

- A 12.5% B 1150% C 1250% D 12400% E 12500%

4. A trapezium has parallel sides of length a and b , and height h . Sides a and b are both decreased by 10% and the height h is increased by 10%.

What is the percentage change in the area of the trapezium?



- A 10% decrease B 1% decrease C no change
 D 10% increase E 30% increase

5. Rosie the road-runner recently ran in two road races. The second race was 20% further in distance than the first race and Rosie's average speed was 20% slower in the second race.

By what percentage was her time for the second race greater than that for the first?

- A $33\frac{1}{3}\%$ B 40% C 44% D 50% E $66\frac{2}{3}\%$

6. In a sale, a shopkeeper reduced the advertised selling price of a dress by 20%. This resulted in a profit of 4% over the cost price of the dress.

What percentage profit would the shopkeeper have made if the dress had been sold at the original selling price?

- A 16% B 20% C 24% D 25% E 30%

7. Which is the lowest positive integer by which 396 must be multiplied to make a perfect cube?

- A 11 B 66 C 99 D 121 E 726

8. How many two-digit numbers N have the property that the sum of N and the number formed by reversing the digits of N is a square?

- A 2 B 5 C 6 D 7 E 8

9. Which of the curves or lines given by the following equations comes closest to the origin?

- A $y = x - 4$ B $x^2 + y^2 = 4$ C $y = \frac{4}{x}$ D $y = x^2 + 4$ E $y = x^4 - 4$

10. The line with equation $y = x$ is an axis of symmetry of the curve with equation

$$y = \frac{px + q}{rx + s}, \text{ where } p, q, r, s \text{ are all non-zero.}$$

Which of the following is necessarily true?

- A $p + q = 0$ B $r + s = 0$ C $p + r = 0$ D $p + s = 0$ E $q + r = 0$