OUNDLE

School

2021 Academic Scholarship
Preliminary Round Examination

Mathematics

Time Allowed: 90 minutes
Total Marks: 90

Instructions

- **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.
- **Please note that the diagrams in Question 10, 12 and 13 have not been drawn accurately or to scale**.
- **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) $66 + 17$

        (b) $5 - (-8)$

        (c) $6 \div \dfrac{1}{2}$

        (d) $\dfrac{1}{2} \div 6$

        (e) $7 \times \dfrac{3}{5}$

        (f) $\sqrt{\sqrt{16}}$

        (g) $60\,000 \times 0.0003$

        (h) $0.072 \div 0.0008$

        (i) $\sqrt{81}$

        (j) $\sqrt{0.0081}$

        (k) $2\dfrac{1}{3} - 1\dfrac{3}{4}$

        (l) $1^1 + 2^2 + 3^3$

        (m) 40% of 60% of 250

        (n) $(3 + 4)^2 - (3^2 + 4^2)$ (21 marks)

2.   If $p = \dfrac{-1}{2}$, $q = -8$ and $r = 4$, find the value of :

        (a) $p - q - r$

        (b) $\dfrac{q}{p \times r}$

        (c) $p^2 \times r$

        (d) $(r - 2q) \div (p + 1)$

                                                                    (8 marks)

3. Find the next two terms in each of the following sequences :

(a) $2, 4, 8, 16, \ldots\ldots, \ldots\ldots$

(b) $9, 1, -7, -15, \ldots\ldots, \ldots\ldots$

(c) $2, 3, 5, 7, 11, \ldots\ldots, \ldots\ldots$

(d) $1, 3, 6, 10, \ldots\ldots, \ldots\ldots$

(e) $-2, 7, 9, 2, -7, -9, \ldots\ldots, \ldots\ldots$

(5 marks)

4. Remove brackets and simplify

(a) $2 (5 - 3x)$

(b) $3 - 2 (x + 5) - x (1 - x)$

(c) $(4x - 1)^2$

(6 marks)

5. Factorise fully :

(a) $5x - 40x^2$

(b) $8p^2q - 12pq^2$

(4 marks)

FOR QUESTIONS 6, USE A CLEAR ALGEBRAIC METHOD, <u>NOT</u> A TRIAL AND ERROR APPROACH. PLEASE NOTE THAT EQUATIONS TO BE SOLVED DO NOT NECESSARILY HAVE INTEGER (WHOLE NUMBER) SOLUTIONS. SHOW YOUR STEP-BY-STEP WORKING IN FULL.

6. Solve each equation for x :

(a) $7 + 4x = 10$

(b) $4 (3 - 2x) = 2 (4 - 3x)$

(c) $\dfrac{x}{2} - 2x = 6$

(d) $\dfrac{9}{x} = \dfrac{x}{4}$

(11 marks)

FOR THE REMAINING QUESTIONS, YOU CAN ANSWER THEM IN ANY ORDER THAT YOU CHOOSE. YOU MUST SHOW FULL WORKING TO MAKE IT CLEAR HOW YOU OBTAINED YOUR ANSWER. (ANSWERS WITHOUT WORKING WILL BE AWARDED VERY FEW MARKS).

7.   Here are three lamps

lamp **A**   lamp **B**   lamp **C**

Lamp **A** flashes every 20 seconds.
Lamp **B** flashes every 45 seconds.
Lamp **C** flashes every 120 seconds.

The three lamps start flashing at the same time.

How many times in one hour will the three lamps flash at the same time ?

(SHOW FULL WORKING TO EXPLAIN YOUR ANSWER)

(3 marks)

8.   (a)   A taxi travels from town A to town B at an average speed of 60 miles per hour. On the return journey from B to A (in very heavy traffic), the taxi's average speed was only 30 miles per hour.

Calculate the taxi's average speed for the 'whole' journey (from A to B and back).

(b)   A car travels from town C to town D (a distance of x miles) at a speed of y miles per hour. On the return journey from D to C, the car's average speed is z miles per hour. Find an expression (in terms of x, y and z) for the car's average speed for the 'whole' journey (from C to D and back).

(6 marks)

9.

(a)   Ravi has held shares in a pharmaceutical company for the past 3 years.
In Year 1, the value of his shares increased by 20%.
In Year 2, the value of his shares then increased by another 20%.
In Year 3, the value of his shares then decreased by 50%.
Calculate the overall percentage increase or decrease in the value of Ravi's shares over the 3-year period.

(3 marks)

(b)   Ravi is also a property developer.
Recently he sold two of his houses, for £990 000 each .
He made a 10% profit on the first house but a 10% loss on the second.
Calculate the overall percentage profit or loss he made on the two houses together.
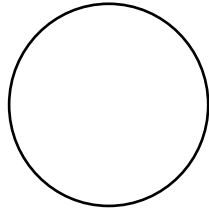
(5 marks)

10.

Diagram NOT
drawn to scale

A circle and square are shown above. The circumference of the circle and the perimeter of the square are equal.   Work out the ratio of

area of circle : area of square

giving your answer in terms of π

(5 marks)

11.   There are three dials on a combination lock.
Each dial can be set to one of the numbers 1, 2, 3, 4, 5.
For example, the three digit number 553 is one way the dials can be set, as shown below.

(a)   Work out the number of different three digit numbers that can be set for the combination lock.

(b)   How many of the possible three digit numbers have three different digits ?
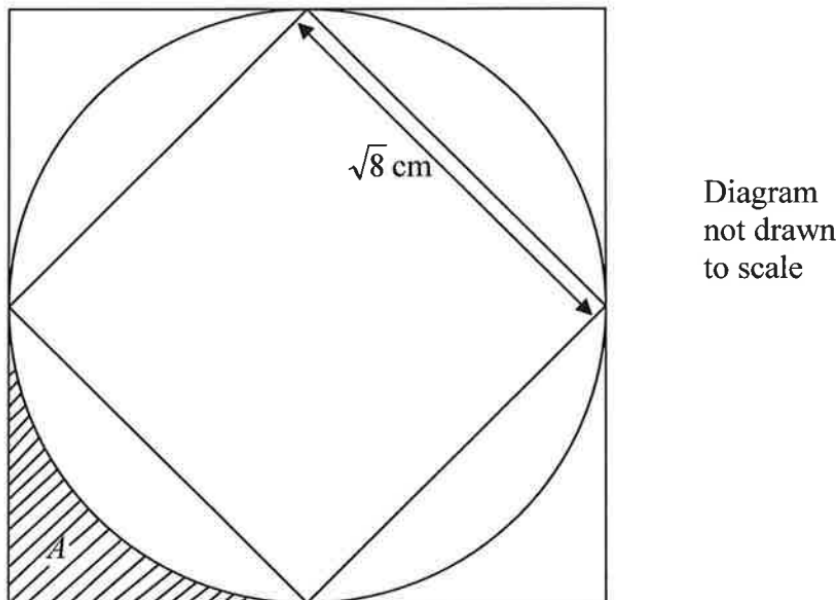
(4 marks)

12. The diagram below shows 2 overlapping squares with regions *A, B* and *C* as shown.

4 cm

6 cm

B

C

A

Diagram
not drawn
to scale

2 cm

9 cm
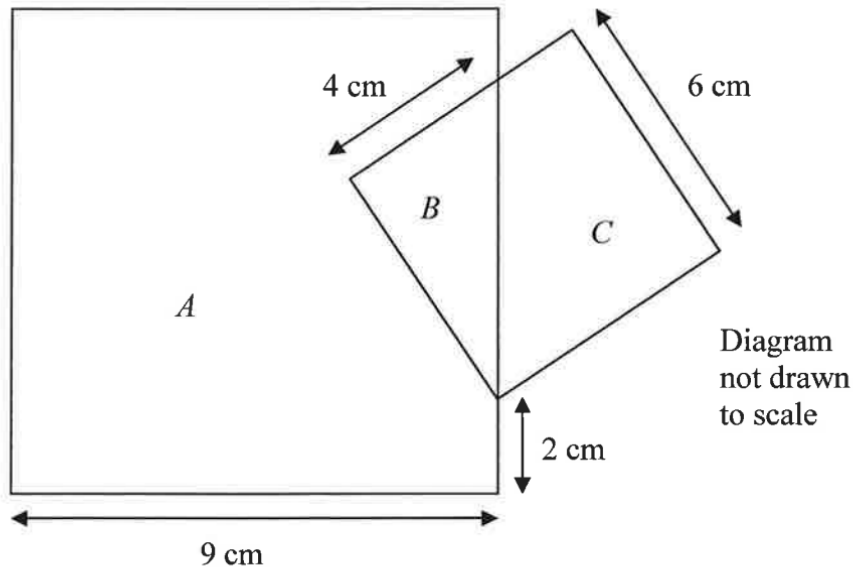
Calculate the difference between the areas of the regions *A* and *C*. (4 marks)

13. The diagram below shows a square contained within a circle which is contained inside another square.
The length of each side of the smaller square is $\sqrt{8}$ cm.

$\sqrt{8}$ cm

Diagram
not drawn
to scale

A

Calculate the perimeter of the shaded area *A*.
For this question please use the approximation $\pi \approx 3$ (5 marks)