MALVERN
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SURNAME:

FIRST NAME:

PREP SCHOOL:

Malvern College Academic Scholarship Examinations 2023

MATHEMATICS - Paper 2

Please read this information before the examination starts:

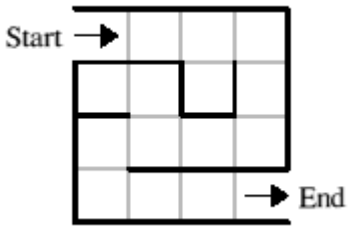
- Paper 2: 60 mins (Option Paper)
- Marks: 75
- Specimen
- No Calculators are allowed for this paper
- Section A (25 marks): Multiple choice but with working and explanations required.
- Section B (50 marks): Investigative questions. These are more challenging and require full solutions.

Section A (25 marks):

Multiple Choice (2 marks will be awarded for a correct answer and upto 3 marks for good explanations)

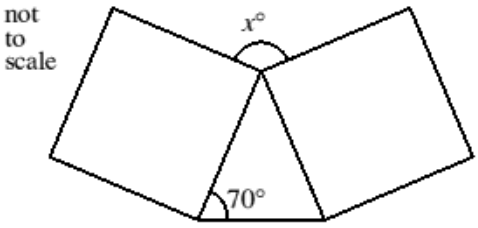
Answer in Booklet provided

1. Jonny's rat is a slow learner! Every time it goes through this maze, it visits every square at least once. What is the smallest number of squares it visits more than once when it goes through the maze?



A 0 B 1 C 2 D 3 E 4

2. The diagram shows two equal squares.
What is the value of x?



A 140 B 145 C 150 D 155 E 160

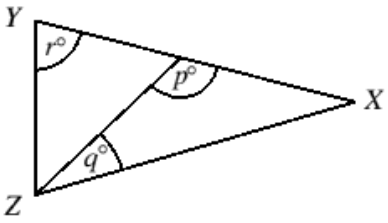
3. In the subtraction sum on the right, a, b and c are digits and a is less than b.
What is the value of c?

$$\begin{array}{r} b\ a \\ -\ a\ b \\ \hline c\ 6 \end{array}$$

A 3 B 4 C 5 D 6 E A number greater than 6

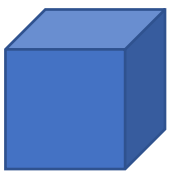
4. In the diagram, triangle XYZ is isosceles, with XY=XZ.

What is the value of r in terms of p and q?



A $\frac{1}{2}(p-q)$ B $\frac{1}{2}(p+q)$ C $p-q$ D $p+q$ E Impossible to tell

5. The diagram shows a unit cube coloured blue. Additional blue unit cubes are glued face to face to each of its six faces to form a three dimensional "cross". If unit cubes coloured yellow are now glued face-to-face to all the spare faces of this cross, how many yellow unit cubes are required.



A 6 B 18 C 24 D 30 E 36

Section B (50 marks):

Each question is worth 10 marks. Greater marks are given for clear detailed working and explanation. You should not expect to finish all of these but attempt as many as you can.

Answer on lined paper

6. This question is about three sequences:

    a. Sequence A starts 84, 81, 78, 75……
        i. What are the next two terms in the sequence
        ii. Find the formula for U_n, the nth term in the formula.
        iii. How many terms of the sequence are positive?
        iv. Find n, where $U_n = 24$

    b. Sequence B starts 8, 15, 24, 35…..
        i. Find the next term in the sequence
        ii. Br writing the terms as pairs of factors, find a formula for U_n, the nth term in the formula.

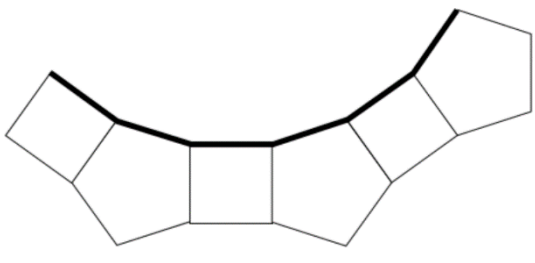
    c. Sequence C starts 92,96,102,110….
        i. Find the next two terms in the sequence
        ii. Find the nth term of the sequence in the form $U_n = an^2 + bn + c$
        iii. Find U_{10}

7. Three dice A, B and C are thrown. Find the probability that:
    a. Each die shows a 6
    b. A shows a 6, but not B or C
    c. Just one die shows a 6
    d. A and B each show a 6 but not C
    e. Just two die show a 6.

    A player throws the three dice 216 times, paying 1 p every time. If one die shows a 6 he is paid 2 p; if 2 die show a 6 he is paid 3 p and if all three die show a 6 he is paid 4 p. Otherwise he is paid nothing.

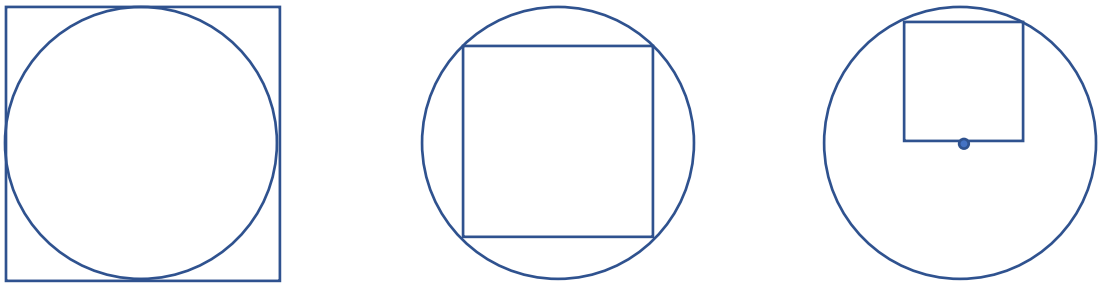
    Does he expect to gain or lose overall?

8. This question is about angles in polygons.
    a. Explain why the interior angle of a regular pentagon is 108^o
    b. To each edge of a regular polygon, I attach a regular pentagon followed by a square, alternating between the two as shown. How many sides does this regular polygon have?



c. LM, MN, NP and PQ are consecutive sides of a regular 10 sided figure. LN and MP intersect at A. Find the size of angles:
   i. MAN
   ii. LMA
   iii. PLA
   iv. LPQ

9. Three squares (A, B & C) are drawn below, each one relating to a circle of radius 1 cm. For C the base of the square goes through the centre of the circle as marked.

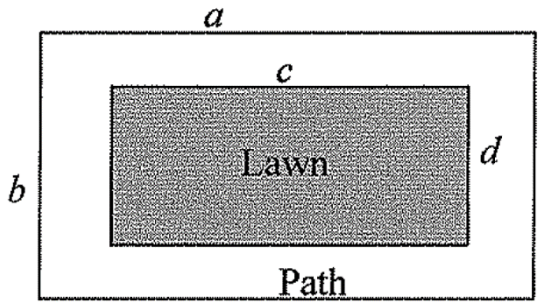


A B C

a. Calculate the areas of the 3 squares
b. Express the ratio, area of A:B:C in simplified form where all the numbers are integers.
c. Two of square A are now taken and filled with *m* of square B and *n* of square C (which may be cut up). Find the values of m and n.

10. The diagram shows a rectangular lawn measuring c by d, surrounded by a constant width path. The whole area measures a by b.

    Give your answers in the simplest form without brackets.

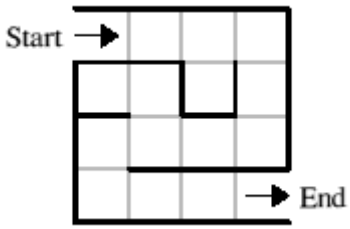


a. Given that c=2d and the path is 2 units wide, Find the perimeter of the outside of the path in terms of d.
b. Given that $a = 5x, b = 2x, c = 3x$ and $d = x + 5$, find the area of the path in terms of x
c. Given that a=2b and that the path is 1 unit wide, find the perimeter of the lawn in terms of b.
d. Given that c=d+4 and that the area of the lawn is 96 m2, find the perimeter of the lawn.
e. Given that the area of the path and the lawn are the same and that b=c, find the length of the path in terms of d.

Answer Booklet
Circle the correct answer and submit working below.

Question 1

A B C D E



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Question 2

A B C D E

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Question 3

A B C D E

Question 4

A B C D E

Question 5

A B C D E

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