MOCK EXAM 9

MATHEMATICS Compulsory Part

PAPER 1

Question-Answer Book

Name: _____

($2\frac{1}{4}$ hours)

This paper must be answered in English

INSTRUCTIONS

1. Write your name in the space provided on Page 1.
2. This paper consists of **THREE** sections, A(1), A(2), and B.
3. Attempt **ALL** questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.
4. Graph paper and supplementary answer sheets will be supplied on request. Write your name on the graph paper and supplementary answer sheets.
5. Unless otherwise specified, all working must be clearly shown.
6. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
7. The diagrams in this paper are not necessarily drawn to scale.

SECTION A(1) (35 marks)

1. Simplify $\dfrac{m^{12}n^{-7}}{(m^3n^{-2})^3}$ and express your answer with positive indices. (3 marks)

2. Factorize

   (a) $8m^2 - 2n^2$,

   (b) $8m^2 - 2n^2 - 6m - 3n$. (3 marks)

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3. (a) Round up 2.016 to 2 significant figures.

(b) Round down 2.016 to 2 decimal places.

(c) Round off 2.016 to the nearest 0.1. (3 marks)

4. Let a, b and c be non-zero numbers such that $\frac{a}{c}=\frac{5}{6}$ and $4b = 5c$. Find $\frac{2a+b}{2b+c}$. (3 marks)

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5. In a school, S6 has 5 classes. Each class has the same number of students. In each class, there are 3 more girls than boys. There are 175 students in S6. Find the number of girls in S6. (4 marks)

6. (a) Find the range of values of x which satisfy both $\frac{5x+14}{3} - 2 < 3x$ and $4x + 8 \geq 0$.

(b) Write down the least integer satisfying both inequalities in (a).

(4 marks)

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7. Let $f(x) = 9x^2 - 24x + c$, where c is a constant. The equation $f(x) = 0$ has equal roots. Find

   (a) c.

   (b) the x-intercept(s) of the graph of $y = f(x) - 4$ (5 marks)

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8. In Figure 1, B and D are points lying on AC and AE respectively. BE and CD intersect at the point F. It is given that $BD = CD$, $BD \parallel CE$, $\angle BEC = 18^\circ$ and $\angle DCB = 64^\circ$.

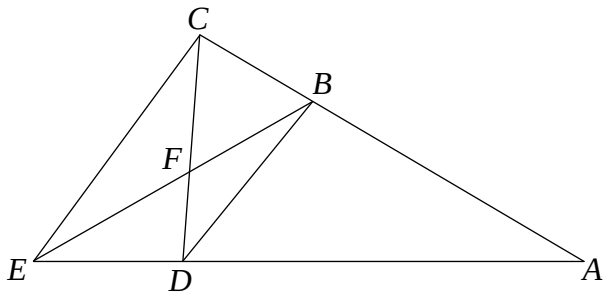

Figure 1

(a) Find $\angle BFD$.

(b) Let $\angle ADB = \alpha$. Express $\angle BAD$ in terms of α. (5 marks)

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9. The table below shows the distribution of the number of comics owned by a class of students

Number of comics	10	11	12	13	14
Number of students	9	18	8	12	7

(a) Write down the mean, the median and the standard deviation of the above distribution.

(b) A new student now joins the class. The student has 13 comics. Find the change in the median of the distribution due to the joining of this student. (5 marks)

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SECTION A(2) (35 marks)

10. Let $\$C$ be the cost of making a copper statue of volume V m^3. It is given that C is partly a constant and partly varies as the square of V. When $V = 1$, $C = 380$; when $V = 2$, $C = 920$.

    (a) Find the cost of a statue of volume 5 m^3. (4 marks)

    (b) The statue in (a) is melted and recast into two statues of volume 2 m^3 and 3 m^3 respectively. Does the total cost increase or decrease? Explain. (2 marks)

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11. The heights (in cm) of the students in Group *A* are shown as follows:

118	121	121	121	124	124	126	129	132	133
134	138	142	145	146	146	147	150	152	153

(a) Write down the median and the mode of the heights of the students in Group *A*. (2 marks)

(b) The stem-and-leaf diagram below shows the distribution of heights of the students in Group *B*. It is given that the range of this distribution is 37.

Stem (tens)	Leaf (units)			
10	*a*	3	4	9
11	3	4	8	
12	5	8	9	9
13	1	5	5	*b*

(i) Find *a* and *b*.

(ii) A student is randomly selected as the representative from each group. If the sum of their heights is between 250 cm and 260 cm inclusive, they can join a competition. Find the probability that the two selected representatives can join the competition. (4 marks)

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12. The height of a right pyramid is 24 cm. It has a square base with a side of 36 cm. The pyramid is divided into three parts by two planes which are parallel to its base. The height of the three parts are equal. Find

(a) the volume of the middle part of the pyramid; (3 marks)

(b) the total area of the lateral faces of the middle part of the pyramid. (3 marks)

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13. The cubic polynomial f(x) is divisible by $x + 2$. When f(x) is divided by $x^2 - 4$, the remainder is $kx - 22$, where k is a constant.

(a) Find k. (3 marks)

(b) It is given that $x - 3$ is a factor of f(x). When f(x) is divided by $x - 1$, the remainder is -42. Someone claims that all the roots of the equation f(x) = 0 are integers. Is the claim correct? Explain your answer. (5 marks)

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14. The x-intercept and y-intercept of straight line L_1 are –3 and 6 respectively. The equation of the straight line L_2 is $x + 2y – 17 = 0$. L_1 intersects with L_2 at A.

(a) Find the equation of L_1. (2 marks)

(b) Find the coordinates of A. (1 mark)

(c) L_1 and L_2 cuts the x-axis at B and C respectively.

(i) Find the equation of the circle passing through A, B and C.

(ii) P is a moving point in the rectangular coordinate plane such that $AP = BP$. Denote the locus of P by Γ.

(1) Describe the geometric relationship between Γ and AB.

(2) If Γ cuts AB and the x-axis at D and E respectively, find the area of ΔBDE.

(6 marks)

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SECTION B (35 marks)

15. In a bag, there are 4 blue balls, 8 green balls and 11 red balls. If 5 balls are randomly selected from the bag at the same time, find

    (a) the probability that all the balls selected are of the same colour. (3 marks)

    (b) the probability that at least 2 balls of different colours are selected. (2 marks)

16. The 4th term and the 6th term of a geometric sequences are 500 and 3125 respectively.

(a) Find the 1st term of the sequence. (2 marks)

(b) Find the least value of n such that the sum of the first n terms of the sequence is greater than 9×10^{20}. (3 marks)

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17. (a) Let $f(x) = 40x - x^2$. Using the method of completing the square, find the coordinates of the vertex of the graph of $y = f(x)$. (2 marks)

(b) The length of a piece of string is 200 m. It is cut into four pieces. One piece is used to enclose a rectangular exhibition zone of area A m^2 in a hall. Other pieces, each of length x m, are used to divide the zone into four rectangular regions of equal areas as shown in Figure 2.

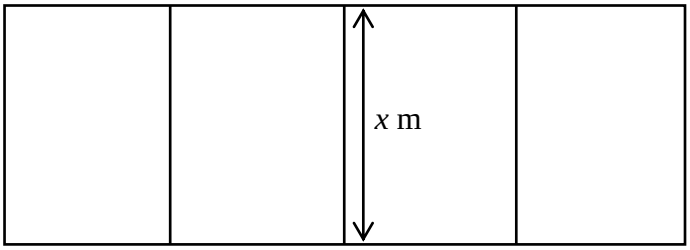

Figure 2

(i) Express A in terms of x.

(ii) It is claimed that the area of the exhibition zone can be greater than 1000 m^2. Do you agree? Explain your answer. (4 marks)

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18. In Figure 3, *E*, *F* and *G* are points lying on a circle. Denote the circle by *C*. *DE* is the tangent to *C* at *E* such that *DFG* is a straight line.

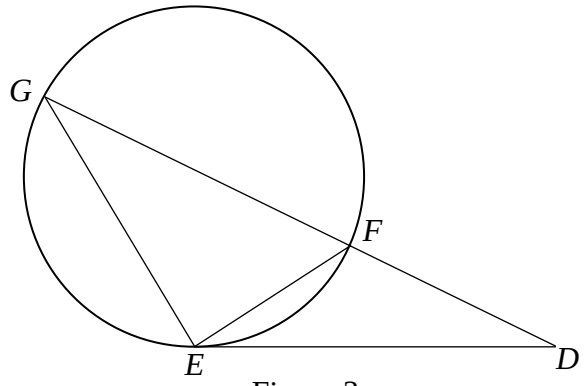

Figure 3

(a) Prove that $\Delta DEF \sim \Delta DGE$. (2 marks)

(b) It is given that *FG* is a diameter of *C*. Suppose that *DE* = 4080 cm and *DF* = 2176 cm.

(i) Express the area of *C* in terms of π.

(ii) Someone claims that the area of ΔEFG is greater than 600 m^2. Do you agree? Explain your answer. (5 marks)

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19. $PQRS$ is a quadrilateral paper card, where $PQ = 50$ cm, $PS = 30$ cm, $\angle PQR = 40^o$, $\angle QPR = 80^o$ and $\angle QPS = 100^o$. The paper card is held with QR lying on the horizontal ground as shown in Figure 4.

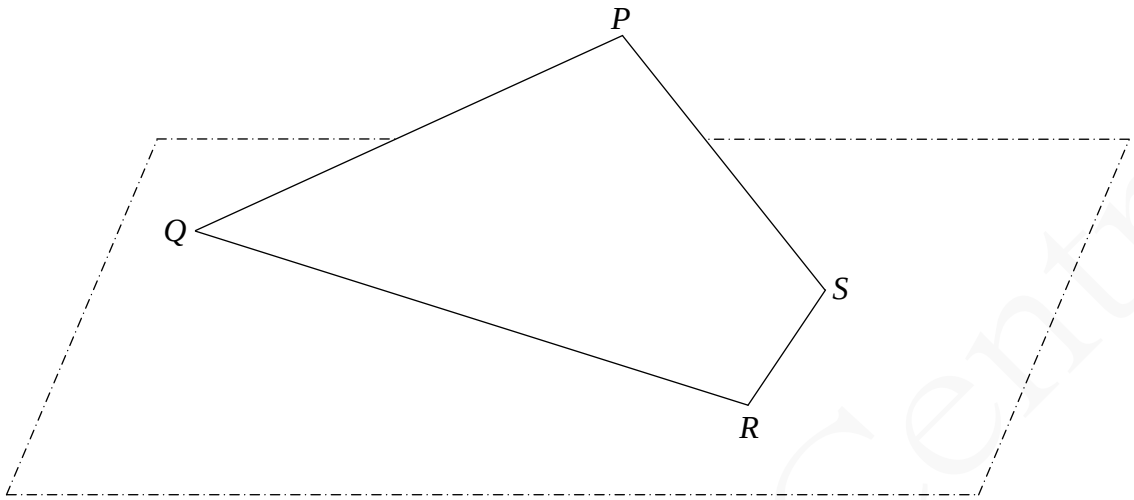

Figure 4

(a) Find the length of RS. (3 marks)

(b) Find the area of the paper card. (2 marks)

(c) It is given that the angle between PQ and the horizontal ground is 30^o.

(i) Find the angle between the paper card and the horizontal ground.

(ii) A student claims that the angle between RS and the horizontal ground is at most 50^o. Is the claim correct? Explain your answer. (7 marks)

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END OF PAPER

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