Mock Examination (2018-2019)
Form Six
Mathematics Compulsory Part
Paper 2

Name: _____   Class:_____ (   )

Total Mark: 45   **Time Allowed: $1\frac{1}{4}$ hours**

INSTRUCTIONS

1.   All questions carry equal marks.

2.   **ANSWER ALL QUESTIONS**. You should mark all the answers on the MC answer sheet.

3.   You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

4.   No marks will be deducted for wrong answers.

There are 30 questions in Section A and 15 questions in Section B.

The diagrams in this paper are not necessarily drawn to scale.

Choose the best answer for each question.

Section A

1. $\dfrac{1}{(-9)^{333}} \times 3^{111} =$

   A. $-\dfrac{1}{3^{555}}$.

   B. $-\dfrac{1}{3^{888}}$.

   C. $\dfrac{1}{3^{555}}$.

   D. $\dfrac{1}{3^{888}}$.

2. If $\dfrac{a}{5} - b = ax - \dfrac{b}{2}$, then $a =$

   A. $\dfrac{8b}{5-10x}$.

   B. $\dfrac{8b}{10x-5}$.

   C. $\dfrac{5b}{2-10x}$.

   D. $\dfrac{5b}{10x-2}$.

3. $1 - 4x^2 + 12xy - 9y^2 =$

   A. $(1 + 2x - 3y)(1 - 2x + 3y)$.

   B. $(1 + 2x - 3y)(1 - 2x - 3y)$.

   C. $(1 + 2x + 3y)(1 - 2x - 3y)$.

   D. $(1 + 2x + 3y)(1 - 2x + 3y)$.

4. If $0.073496 < x < 0.073512$, which of the following must be true?

    I. $x = 0.07$ (round off to the nearest 0.01)

    II. $x = 0.0735$ (correct to 3 decimal places)

    III. $x = 0.07350$ (correct to 4 significant figures)

    A.   I only

    B.   II only

    C.   I and III only

    D.   II and III only

5. If $a < b < 0$, solve $ax + 4 > 0$ or $-bx - 1 < 3$.

    A. $x > -\dfrac{4}{a}$

    B. $x > -\dfrac{4}{b}$

    C. $x < -\dfrac{4}{a}$

    D. $x < -\dfrac{4}{b}$

6. The figure shows the graph of $y = mx^2 + nx - 4$, where m and n are constants. Which of the following is true?

    A. $m > 0$ and $n > 0$

    B. $m > 0$ and $n < 0$

    C. $m < 0$ and $n > 0$

    D. $m < 0$ and $n < 0$

$y = mx^2 + nx - 4$
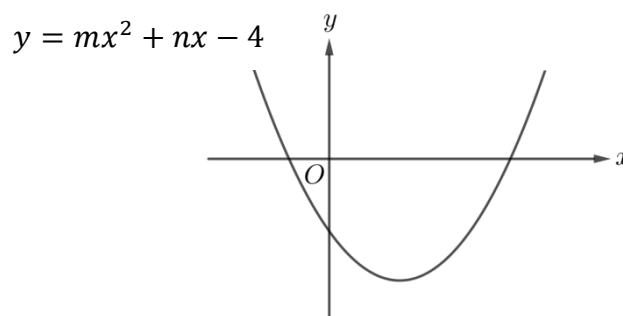
7. If the price of a pen is 60% higher than the price of a book, then the price of the book is

    A. 37.5% lower than the price of a pen.

    B. 40% lower than the price of a pen.

    C. 60% lower than the price of a pen.

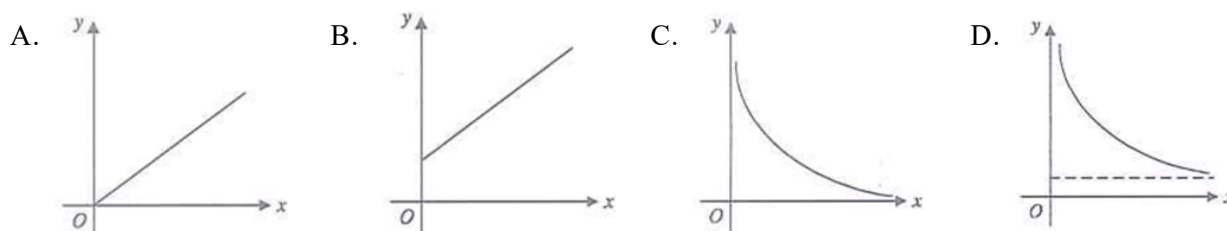   D. 62.5% lower than the price of a pen.

8. It is given that $\frac{3}{2x} = \frac{4}{3y} = \frac{5}{4z}$, where x, y and z are negative numbers. Which of the following is true?

    A. $x < y < z$

    B. $x < z < y$

    C. $z < y < x$

    D. $z < x < y$

9. x and y are two variables. The table below shows some values of x and their corresponding values of y .

x	3	6	9	18
y	11	17	23	41

    Which of the following graphs may represent the relation between x and y ?

    A.   B.   C.   D.

10. Let $f(x) = x^3 + kx^2 + x + 3$, where k is a constant. If $f(x)$ is divisible by $x + k$, find the remainder when $f(x)$ is divided by $x - 1$.

    A. 0

    B. 4

    C. 6

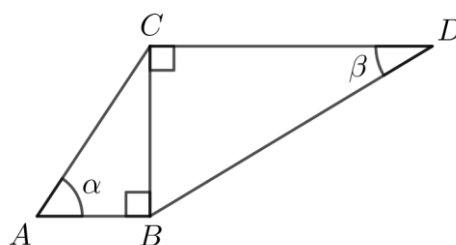   D. 8

11. If $f(x - 1) = x^2 + 2x - 4$, then $f(m) =$

    A. $m^2 - 5$.

    B. $m^2 + 2m - 4$.

    C. $m^2 + 2m - 3$.

    D. $m^2 + 4m - 1$.

12. Find the range of values of k such that the quadratic equation $kx^2 + 2kx - 1 = -k$ has two distinct real roots.

    A. $k > 0$

    B. $k < 0$
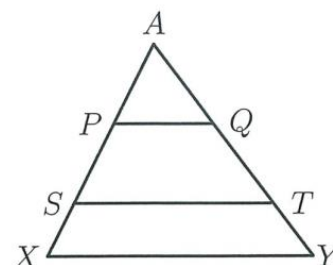
    C. $k < -1$ or $k > 0$

    D. $-1 < k < 0$

13. In the figure, $CD =$

    A. $AC \sin \alpha \tan \beta$.

    B. $AB \tan \alpha \tan \beta$.

    C. $\dfrac{AB}{\tan \beta \tan \alpha}$.

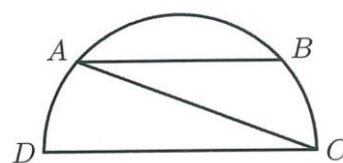   D. $\dfrac{AC \sin \alpha}{\tan \beta}$.

14. In the figure, $APSX$ and $AQTY$ are straight lines, and $PQ \, // \, ST \, // \, XY$. If $PQ : XY = 4 : 9$ and $QT : TY = 3 : 1$, then $AP : SX =$

    A. $4 : 5$.

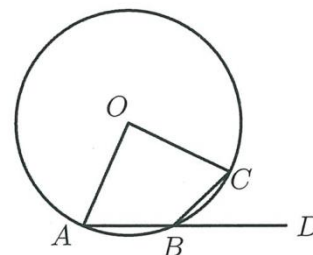   B. $4 : 9$.

    C. $16 : 5$.

    D. $16 : 15$.

15. In the figure, $ABCD$ is a semi-circle. If $\overparen{AB} : \overparen{BC} = 6 : 2$ and $AB \, // \, DC$, then $\angle BAC =$

    A. $18°$.

    B. $27°$.

    C. $36°$.

    D. $54°$.
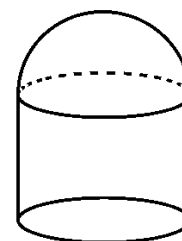
16. In the figure, ABC is a circle, where O is the centre. AD cuts the circle at B . If $\angle CBD = 50°$, find $\angle AOC$.

   A. $80°$

    B. $100°$

    C. $130°$

    D. $140°$

17. In the figure, the solid consists of a cylinder and a hemisphere with a common base. The base radius and the height of the cylinder are 6 cm and 8 cm respectively. Find the volume of the solid.

    A. $312\pi \text{ cm}^3$

    B. $432\pi \text{ cm}^3$

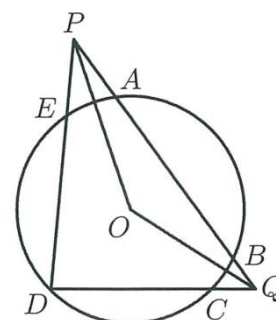   C. $576\pi \text{ cm}^3$

    D. $1152\pi \text{ cm}^3$

18. In the figure, the diameter of the circle ABC is 5 cm . If $AB = 4$ cm , find the area of the shaded region correct to the nearest 0.01 cm^2 .

    A. 2.80 cm^2

    B. 5.80 cm^2

    C. 15.25 cm^2

    D. 16.84 cm^2
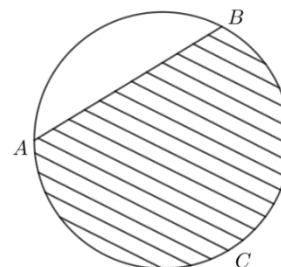
19. In the figure, O is the centre of the circle . $\triangle PQD$ intersects with the circle at A , B , C , D and E such that $AB = CD = DE$. If $\angle POQ = 118°$, find $\angle PDQ$.

    A. $53°$

    B. $56°$

    C. $59°$

    D. $62°$

20. In the figure, $ABCD$ is a parallelogram. E is a point lying on AD. CE and BD intersects at H. BC and BD are produced to F and G respectively such that $CD \mathbin{/\mkern-5mu/} FG$. It is given that $AE : ED : CF = 1 : 4 : 2$ and the area of $\triangle CDH$ is 20 cm^2. Find the area of the quadrilateral $CFGD$.

    A. 12.5 cm^2

    B. 18 cm^2

    C. 43.2 cm^2

    D. 49.2 cm^2
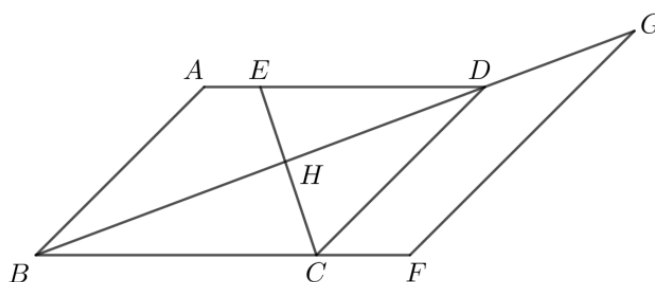
21. For $180° \le \theta \le 360°$, the greatest value of $1 + 3\sin(180° + \theta) - 4\cos(270° - \theta)$ is

    A. 1 .

    B. 2 .

    C. 5 .

    D. 7 .

22. Let a_n be the nth term of a sequence. If $a_1 = 11$ and $a_{n+1} = 7 + a_n + 3n$ for any positive integer n , then $a_6 =$

    A. 69 .

    B. 91 .

    C. 116 .

    D. 144 .

23. In a rectangular coordinate system, L is a straight line with slope $-\dfrac{4}{3}$ and x-intercept 75 , where O is the origin. If A is the foot of perpendicular from O to L , find the coordinates of A .

    A. $(24, 18)$

    B. $(36, 27)$

    C. $(48, 36)$

    D. $(30, 40)$

24. The figure shows the graphs of two straight lines $y = mx + c$ and $x - ay + 2 = 0$. Which of the following must be true?
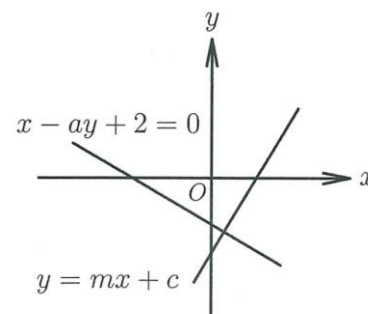
    I. $a < 0$

    II. $ac > 2$

    III. $2m > c$

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II and III

25. The circle $x^2 + y^2 + 6x + 8y + 21 = 0$ is rotated anticlockwise about the origin through $270°$. What is the equation of the image of the circle after rotation?

    A. $(x - 4)^2 + (y + 3)^2 = 4$

    B. $(x + 4)^2 + (y - 3)^2 = 4$

    C. $(x - 3)^2 + (y + 4)^2 = 4$

    D. $(x + 3)^2 + (y - 4)^2 = 4$

26. The equation of a circle is $(2x - 3)^2 + (2y + 3)^2 = 4$. Which of the following are true?

    I. The centre of the circle is $\left(\frac{3}{2}, -\frac{3}{2}\right)$.

    II. The radius of the circle is 1.

    III. The point $(1, -1)$ lies outside the circle.

    A. I and II only

    B. I and III only
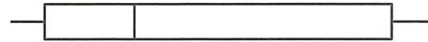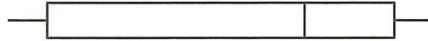
    C. II and III only

    D. I, II and III

27. Two fair dice are thrown in a game. If the sum of the two numbers thrown is not less than 10, $\$6$ will be gained; otherwise, $\$18$ will be gained. Find the expected gain of the game.

    A. $7

    B. $8

    C. $16

    D. $17

28. Suppose that the scores in a Mathematics test are normally distributed. If two students are selected randomly, find the probability that at least one of the selected students have standard scores less than 1. It is given that for normal distribution, 68% , 95% and 99.7% of the data lie within one, two and three standard deviations from the mean respectively.

    A. $\dfrac{1089}{2500}$

    B. $\dfrac{289}{625}$

    C. $\dfrac{441}{625}$

    D. $\dfrac{609}{625}$

29. The cumulative frequency curve shows the distribution of weights of students in a class. Which of the following box-and-whisker diagrams may represent the distribution of the weights of the students?

    A.

    B.

    C.

    D.
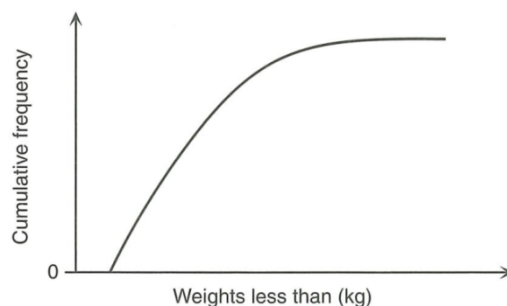
30. The stem-and-leaf diagram below shows the distribution of the marks of the students in a test.

Stem(tens)	Leaf (units)				
2	a	5	6	7	
3	2	3	5	c	
4	d	4			
5	1	2	2	6	7
6	b				

    If the range of the above distribution is at most 45 and the median is 39, which of the following are true?

    I. $0 \le b - a \le 5$

    II. $0 \le a \le 5$

    III. $0 \le c + d \le 9$

    A. I only

    B. II only

    C. I and III only

    D. II and III only

Section B

31. $\dfrac{2}{x^2-1} - \dfrac{1}{x^2-2x-3} =$

    A. $\dfrac{x+5}{(x+1)(x-1)(x+3)}$.

    B. $\dfrac{x+7}{(x+1)(x-1)(x+3)}$.

    C. $\dfrac{x-5}{(x+1)(x-1)(x-3)}$.

    D. $\dfrac{x-7}{(x+1)(x-1)(x-3)}$.

32. The H.C.F. of $a^2 - 6ab + 9b^2$, $a^2 - 9b^2$ and $a^3 - 27b^3$ is

    A. $a - 3b$.

    B. $(a - 3b)(a + 3b)$.

    C. $(a - 3b)^2(a + 3b)(a^2 + 3ab + 9b^2)$.

    D. $(a - 3b)^2(a + 3b)(a^2 - 3ab + 9b^2)$.

33. $18 \times 16^8 + 11 \times 16^5 + 270 \times 16^2 - 2 \times 16^2 =$
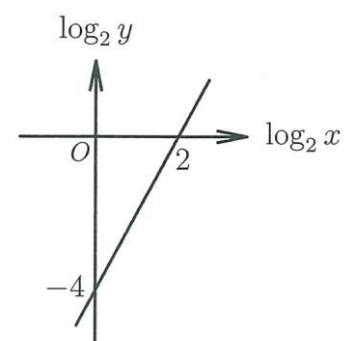
    A. $1100A10B0_{16}$.

    B. $1200B10C0_{16}$.

    C. $1100A10B00_{16}$.

    D. $1200B10C00_{16}$.

34. The graph in the figure shows the linear relation between $\log_2 y$ and $\log_2 x$. Which of the following must be true?

    A. $y = \dfrac{x^2}{16}$

    B. $y = x^2 - 4$

    C. $y = 4x^2$

    D. $y = 4x^2 - 4$

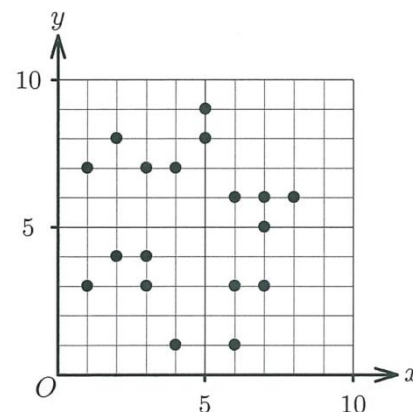35. If α and β are the roots of the equation $x^2 - 3x + 6 = 0$, then $\alpha^3 + 3\beta =$
    A. -3 .
    B. -9 .
    C. -18 .
    D. -27 .

36. If α is a real number, then the real part of $\dfrac{\alpha+i}{\alpha i^4 + i^7} =$

    A. 1 .

    B. α .

    C. $\dfrac{\alpha^2-1}{\alpha^2+1}$.

    D. $\dfrac{\alpha^2+1}{\alpha^2-1}$.

37. Find the difference between the maximum value and the minimum value of the function
$P = 3x - 2y$, where (x, y) are the coordinates of the dots shown in the figure.

   A.   25

    B.   26

    C.   27

    D.   28

38. The sum of the first n terms of an arithmetic sequence is $n^2 - 18n$. Which of the following
must be true?

    I.   25 is a term of the sequence.

    II.   The 5th term of the sequence is -153 .

    III. The sequence has 9 negative terms.

    A.   I only

    B.   II only

    C.   I and III only
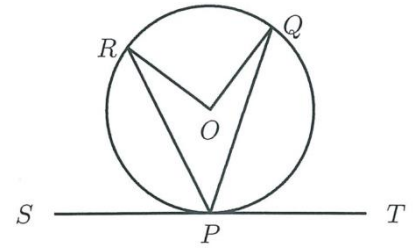
    D.   II and III only

39. Let a be a constant and $-90° < \theta < 90°$. If the figure shows the graph of
$y = \tan(ax - \theta)$, then

    A. $a = \frac{1}{2}$ and $\theta = -30°$.

    B. $a = \frac{1}{2}$ and $\theta = 30°$.

    C. $a = 2$ and $\theta = -30°$.

    D. $a = 2$ and $\theta = 30°$.
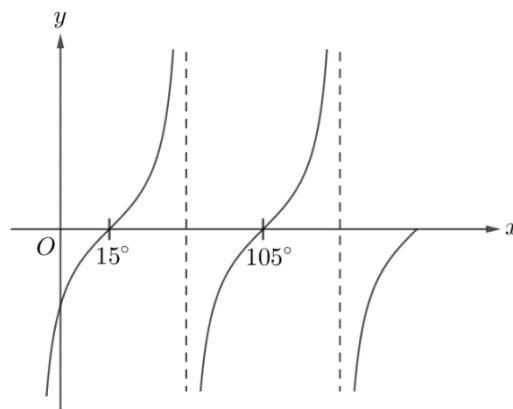
40. In the figure, O is the centre of the circle PQR and ST is the tangent to the circle at P . If PQ is the angle bisector of $\angle RPT$ and $\angle QOR = 124°$, then $\angle PQO =$

    A. $26°$.

    B. $28°$.

    C. $31°$.

    D. $34°$.

41. If $(h, 2)$ is a point on the circle $x^2 + y^2 - 2x + 4y - 20 = 0$, where $h > 0$. Find the equation of the tangent to the circle at $(h, 2)$.
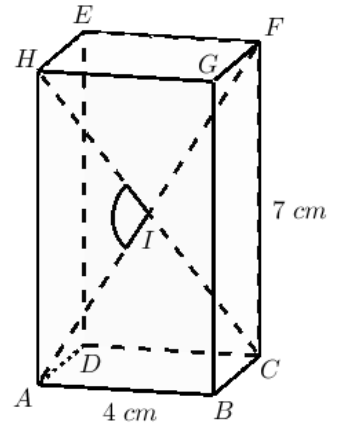
    A. $4x + 3y - 14 = 0$

    B. $4x - 3y - 10 = 0$

    C. $3x + 4y - 20 = 0$

    D. $3x - 4y + 2 = 0$

42. The coordinates of two vertices of a triangle are $(-2, -9)$ and $(k, 0)$. If the coordinates of the circumcenter of the triangle are $(2, -4)$, then $k =$

    A. -2 or 5 .

    B. -3 or 7 .

    C. 1 or 4 .

    D. 3 or 6 .

43. In the figure, $ABCDEFGH$ is a square prism. Let I be the intersection point of AF and CH . If $AB = 4$ cm and $CF = 7$ cm , then

    A. $\sin\dfrac{\angle AIH}{2} = \dfrac{7}{9}$.

    B. $\sin\dfrac{\angle AIH}{2} = \dfrac{9}{7}$.

    C. $\sin \angle AIH = \dfrac{2}{7}$.

    D. $\sin \angle AIH = \dfrac{4}{9}$.

44. In how many ways can Carol put 6 different letters into 4 different post boxes?

    A. 15

    B. 360

    C. 1296

    D. 4096

45. The standard deviation of the 3 numbers $\{a_1, a_2, a_3\}$ is 12 and the standard deviation of the 5 numbers $\{b_1, b_2, b_3, b_4, b_5\}$ is 4. If the mean of the two sets of numbers are the same, find the variance of the 8 numbers $\{a_1, a_2, a_3, b_1, b_2, b_3, b_4, b_5\}$.

    A. 49

    B. 64

    C. 160

    D. 256

END OF PAPER