Marymount Secondary School

Mock Examination 2021 - 2022

Mathematics (Compulsory Part) Paper 2

Secondary 6

Date : 24 January 2022

Time Allowed: 1 hour 15 minutes

Total Marks : 45

INSTRUCTIONS

1. When told to open this question paper, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the question.

2. All questions carry equal marks.

3. **ANSWER ALL QUESTIONS**. You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

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

5. 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. $9^{444} \cdot 16^{222} =$

   A. 6^{666}.
   B. 6^{888}.
   C. 144^{666}.
   D. 144^{888}.

2. If $h = 2 - \dfrac{4}{k+3}$, then $k =$

   A. $\dfrac{3h-2}{2-h}$.
   B. $\dfrac{2-3h}{2-h}$.
   C. $\dfrac{3h-10}{h-2}$.
   D. $\dfrac{10-3h}{h-2}$.

3. $3x + 3y - x^2 + y^2 =$

   A. $(x - y)(3 - x - y)$.
   B. $(x + y)(3 - x - y)$.
   C. $(x + y)(3 - x + y)$.
   D. $(x + y)(3 + x - y)$.

4. Simplify $\dfrac{1}{x-1} + \dfrac{1}{(x-1)(x-2)}$.

   A. $x-1$
   B. $\dfrac{1}{x-1}$
   C. $\dfrac{1}{x-2}$
   D. $\dfrac{1}{(x-1)(x-2)}$

5. 0.010 305 07 =

A. 0.01 (correct to 2 significant figures).
B. 0.0103 (correct to 3 decimal places).
C. 0.0103 (correct to 4 significant figures).
D. 0.010 31 (correct to 5 decimal places).

6. If *a* and *b* are constants such that $n(x-3)^2 - 2x \equiv 9x^2 + mx(x+2) + 18$, then *m* =

A. 7.
B. 1.
C. –1.
D. –7.

7. If $f(x) = 2x^2 + kx - 1$ and $f(2) = f\left(\frac{1}{2}\right)$, then *k* =

A. $-\frac{17}{3}$.
B. –5.
C. 3.
D. $\frac{31}{5}$.

8. Let $f(x) = x^3 + ax^2 + 12x ? 7$. When $f(x)$ is divided by $x - 1$, the remainder is 3. When $f(x)$ is divided by $x + 1$, the remainder is

A. 23.
B. 3.
C. –3.
D. –23.

9. If the base and the height of a right-angled triangle are both increased by *x*% so that the area of the triangle is increased by 125%, then *x* =

A. 25.
B. 50.
C. 125.
D. 150.

10. The solution of $3(2x - 1) < 8x - 13$ or $2x + 1 \geq \frac{4x - 7}{3}$ is

A. $x > 5$.
B. $x < 5$.
C. $x \geq -5$.
D. $x \leq -5$.

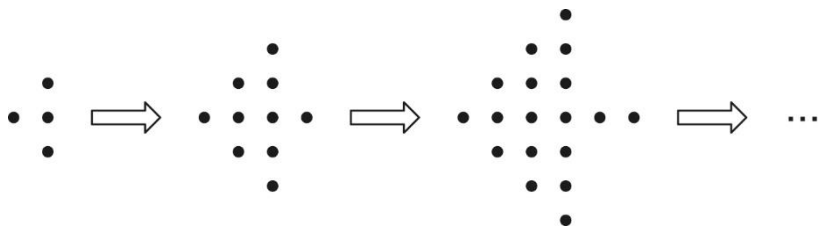
11. Let a, b and c be non-zero numbers. If $2a = 3b = 4c$, then $a : b : c =$

A. 2 : 3 : 4.
B. 3 : 4 : 6.
C. 4 : 3 : 2.
D. 6 : 4 : 3.

12. It is given that z varies directly as x and inversely as y^2 where $y \neq 0$. If x triples and y doubles, find the percentage change in z.

A. Decreases by 25%
B. Decreases by 75%
C. Increases by 25%
D. Increases by 75%

13. In the figure, the 1st pattern consists of 4 dots. For any positive integer n, the $(n + 1)$th pattern is formed by adding $(2n + 4)$ dots to the nth pattern. Find the number of dots in the 7th pattern.

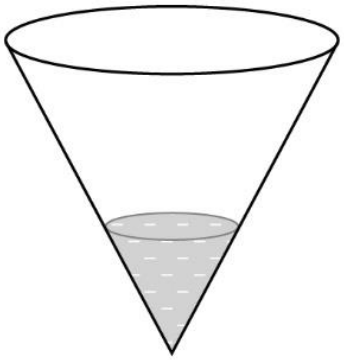


A. 40
B. 54
C. 64
D. 70

14. Which of the following statements about the graph of $y = -4 - (3 - x)^2$ is true?

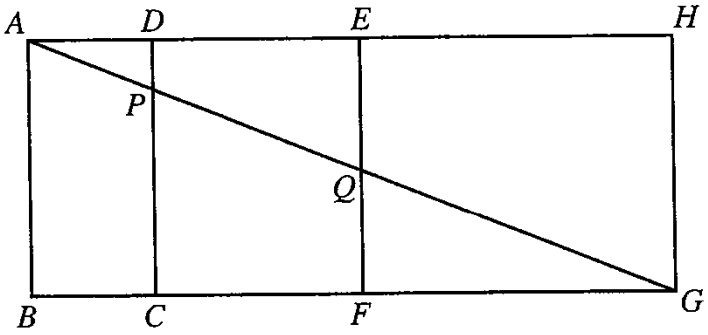
A. The graph passes through the origin.
B. The graph opens upwards.
C. The graph does not cut the x-axis.
D. The y-intercept of the graph is -4.

15. In the figure, there is water of 180 cm^3 in a right circular conical paper cup which is held vertically. It is given that the height of the paper cup and the depth of water are h cm and $\frac{2}{5}h$ cm respectively. How much more water is required to fully fill the paper cup?



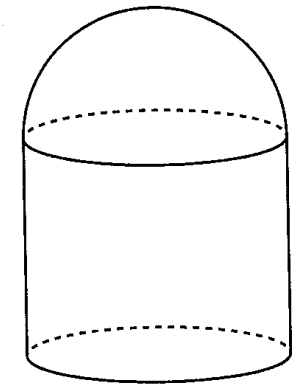
A. 945 cm^3
B. 1 125 cm^3
C. 2 632.5 cm^3
D. 2 812.5 cm^3

16. In the figure, a rectangle *ABGH* is divided into 3 rectangles *ABCD*, *CDEF* and *EFGH* such that $AD : DE : EH = 1 : 2 : 3$. *AG* cuts *CD* and *EF* at *P* and *Q* respectively. Find the ratio of the area of the quadrilateral *EQGH* to the area of the quadrilateral *ABCP*.



A. 1 : 1
B. 9 : 11
C. 27 : 8
D. 27 : 11

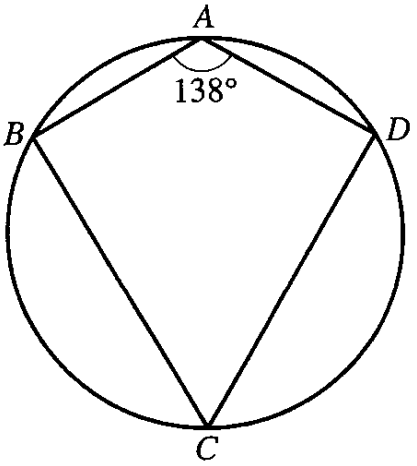
17. In the figure, a solid consists of a right cylinder and a hemisphere with a common base. The radius of the hemisphere is 6 cm and the volume of the solid is 432π cm^3. Find the total surface area of the solid.



A. 96π cm^2
B. 168π cm^2
C. 204π cm^2
D. 240π cm^2

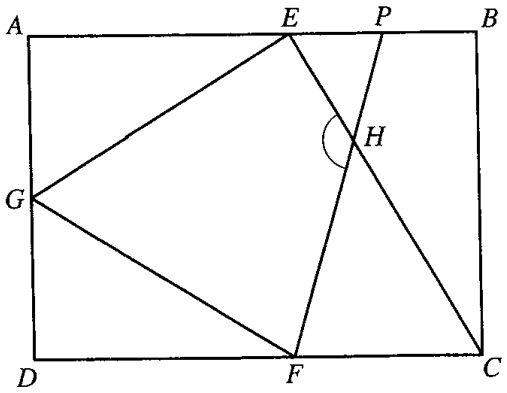
18. In the figure, A, B, C, and D are four points lying on the circle. It is given that $AB = AD = 5$ cm and $\angle BAD = 138°$. If $ABCD$ is a kite, find the area of the circle, correct to 2 decimal places.

A. $78.54\ \text{cm}^2$
B. $133.25\ \text{cm}^2$
C. $152.89\ \text{cm}^2$
D. $611.55\ \text{cm}^2$



19. In the figure, $ABCD$ is a rectangle. E, F and G are the points lying on AB, CD and AD respectively, such that $AG = DG = BE$ and $AE = BC = DF$. P is a point lying on AB such that FP bisects $\angle CFG$. CE and FP intersect at H. Find $\angle EHF$ correct to the nearest degree.

A. 103°
B. 117°
C. 122°
D. 140°



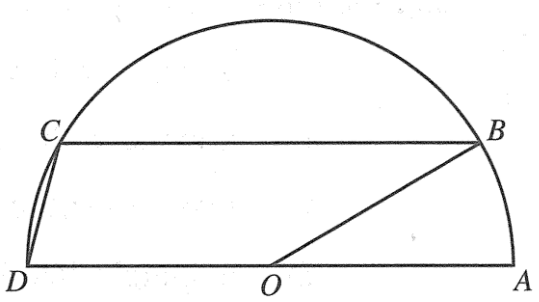
20. ABC is a circle. Let D be the mid-point of AB. If $AD = AC$ and $\angle ACB = 90°$, which of the following are true?

I. ΔBCD is an isosceles triangle
II. $BC = \sqrt{3}AC$
III. $\Delta ADC \sim \Delta CDB$

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

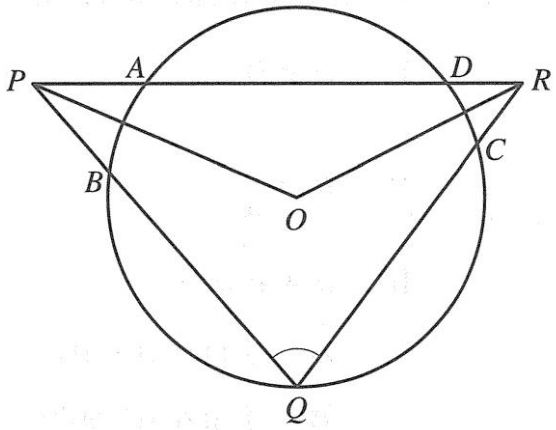
21. In the figure, O is the centre of the semicircle $ABCD$. If $\overset{\frown}{AB} = \overset{\frown}{CD}$ and $\angle BCD = 110°$, then $\angle OBC =$

A. 20°.
B. 40°.
C. 55°.
D. 70°.



22. In the figure, O is the centre of the circle $ABQCD$. ΔPQR intersects the circle at A, B, Q, C and D. If $\angle POR = 130°$ and $AD = BQ = CQ$, then $\angle PQR =$

A. 65°.
B. 70°.
C. 75°.
D. 80°.

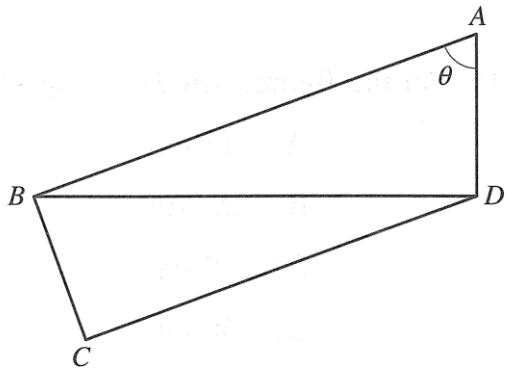


23. $M(3, -2)$ is reflected about the x-axis to N. Which of the following transformations of M also can give N?

I. Rotated 90° anticlockwise about the origin.
II. Translated 6 units to the left.
III. Translated 4 units upwards.
IV. Translated 2 units downwards and then reflected about the line $y = -1$.

A. I and II only
B. I and III only
C. II and IV only
D. III and IV only

24. In the figure, if $\angle ABC = \angle ADB = \angle BCD = 90°$, then $\dfrac{AD}{BC} =$



A. $\dfrac{1}{\sin\theta}$.

B. $\sin\theta$.

C. $\sin\theta\tan\theta$.

D. $\dfrac{\cos^2\theta}{\sin\theta}$.

25. The straight line $2x + 3y - 6 = 0$

I. is parallel to the line $2x + 3y - 12 = 0$.
II. is perpendicular to the line $2x - 3y - 6 = 0$.
III. is perpendicular to the line $2x + 3y - 6 = 0$.

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

26. C_1 and C_2 are two concentric circles. $P(3, -5)$ and $Q(7, 1)$ are points on C_1 such that PQ is a diameter of C_1. If RS is a diameter of C_2, which of the following may be the coordinates of R and S?

A. $R(4, -2)$ and $S(6, 6)$
B. $R(0, -1)$ and $S(10, -3)$
C. $R(-1, 1)$ and $S(5, 5)$
D. $R(-4, -7)$ and $S(0, 1)$

27. The coordinates of the points X and Y are (0, 5) and (1, 0) respectively. Let P be a moving point in the rectangular coordinate plane such that $PX = 2PY$. Find the equation of the locus of P.

A. $3x - 15y + 23 = 0$
B. $3x + 15y - 27 = 0$
C. $3x^2 + 3y^2 - 8x + 10y - 21 = 0$
D. $x^2 + y^2 - 4x + 10y - 23 = 0$

28. Mrs. Lee has four children. Find the probability that the eldest one is a girl and the rest are boys.

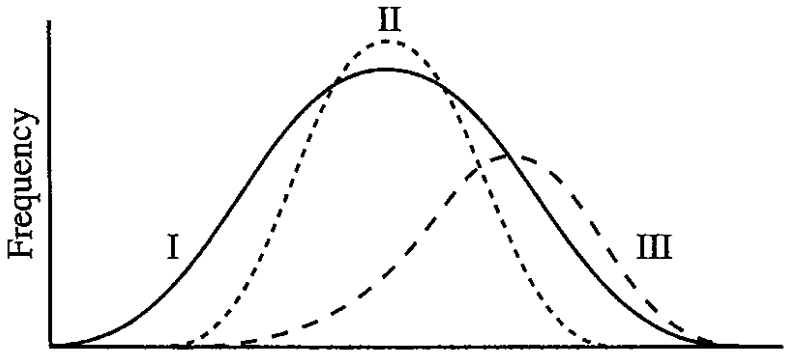
A. $\frac{1}{8}$

B. $\frac{3}{8}$

C. $\frac{1}{16}$

D. $\frac{7}{16}$

29. The frequency curves below show the distributions of three sets of data. Arrange them according to their standard deviation in ascending order.



A. I < II < III
B. I < III < II
C. II < III < I
D. III < I < II

30. The table shows the distribution of the numbers printed on 20 cards in a box.

Number printed on the card	$x - 3$	$x - 1$	x	$x + 5$
Frequency	6	5	7	2

If the median of the numbers is a, then the mean of the numbers is

A. $a - 0.65$.
B. a .
C. $a + 0.35$.
D. $a + 1$.

Section B

31. The H.C.F. and the L.C.M. of three expressions are a^3b^2c and $a^5b^6c^7$ respectively. If the first expression and the second expression are $a^3b^2c^4$ and $a^3b^4c^7$ respectively, then the third expression is

A. a^5b^4c.
B. $a^2b^4c^2$.
C. a^5b^6c.
D. $a^3b^3c^7$.

32. $8^5+8^{13}=$

A. 100000100_{16}.
B. 800000800_{16}.
C. 1000001000_{16}.
D. 8000008000_{16}.

33. It is given that $a>b>0$. If $\log\left(a^2-b^2\right)=8$ and $\log\left(a-b\right)=3$, then $\log\dfrac{1}{\sqrt[3]{\left(a+b\right)^2}}=$

A. $5^{-\frac{2}{3}}$.
B. $\left(\dfrac{8}{3}\right)^{-\frac{2}{3}}$.
C. $\left(\dfrac{3}{8}\right)^{\frac{3}{2}}$.
D. $-\dfrac{10}{3}$.

34. It is given that $\log_4 y$ is a linear function of $\log_2 x$. The graph of the linear fucntion cuts the vertical axis at *A* and the horizontal axis at *B*. Denote the origin by *O*. If $y=\dfrac{64}{x^3}$, find the area of ΔOAB.

A. 3
B. 6
C. 32
D. 64

35. If k and $\frac{5k}{1+2i}-4i$ are real numbers, then $k=$

A. -5.
B. -2.
C. 2.
D. 5.

36. Let x_n be the nth term of an arithmetic sequence and S_n be the sum of the first n terms of the sequecne. If $x_2=-86$ and $x_3=-78$, find the minimum value of S_n.

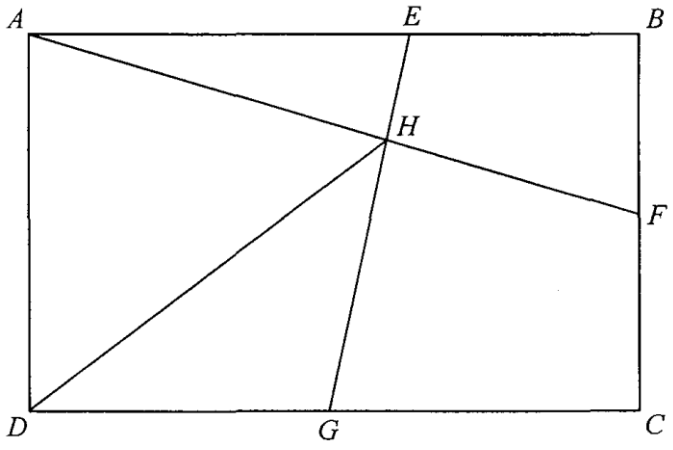
A. 13
B. 12
C. -600
D. $-\frac{2401}{4}$

37. Let p be a constant. Find the range of values of p such that $2x^2+px+p+6\geq 0$ for any real number x.

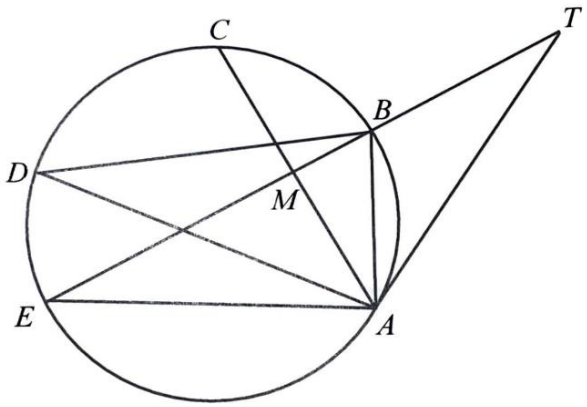
A. $-12\leq p\leq 4$
B. $-4\leq p\leq 12$
C. $p\leq -12$ or $p\geq 4$
D. $p\leq -4$ or $p\geq 12$

38. The figure shows the rectangle $ABCD$, where $AB=600$ cm and $BC=382$ cm. Let E, F and G be points lying on AB, BC and CD respectively such that $AE=350$ cm, $BF=100$ cm and $CG=450$ cm. Denote the point of intersection of AF and EG by H. Find HF correct to the nearest cm.

A. 281 cm
B. 282 cm
C. 283 cm
D. 284 cm



39. In the figure, BE is a diameter of the circle $ABCDE$. BE bisects AC at M. EB is produced to T such that AT is the tangent to the circle at A. If $\angle ABD = 80°$ and $\angle CAD = 38°$, find $\angle BAT$.



A. 26°
B. 28°
C. 29°
D. 31°

40. Let k be a real constant. It is given that the circle $x^2 + y^2 - 2x + 8y + k = 0$ and the straight line $x + y + 1 = 0$ intersect at two points P and Q. Find the coordinates of the mid-point of PQ.

A. $(2,\ 3)$
B. $(2, -3)$
C. $(3,\ 2)$
D. $(3, -2)$

41. Let O be the origin. A and B be the points $(-8, k)$ and $(2, -6)$ respectively, where $k < 0$. Which of the following must be true?

I. The y-coordinate of the orthocenter of ΔOAB is $\dfrac{80 + 30k}{24 - k}$.

II. The y-coordinate of the circumcentre of ΔOAB is $\dfrac{k^2 + 224}{2k - 48}$.

III. The y-coordinate of the centroid of ΔOAB is $\dfrac{k - 6}{3}$.

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

42. A committee is formed by 25 students and 10 teachers. If 8 members are selected from the committee to form a choir consisting of at least 5 students, how many different choirs can be formed?

A. 6 375 600
B. 20 233 675
C. 45 904 320
D. 79 695 000

43. James has 6 different photos and 8 different video clips on his computer. He selects 7 of the computer files, including at least 3 photos, and opens them one by one. Find the probability of all selected photos are opened consecutively.

A. $\frac{94}{1001}$
B. $\frac{85}{2066}$
C. $\frac{133}{5040}$
D. $\frac{32}{163}$

44. In an examination, the mean of the examination scores is 45 marks. A girl gets 66 marks in the examination and her standard score is 3. If the standard score of a boy in the examination is -5, then his examination score is

A. 0 mark.
B. 10 marks.
C. 40 marks.
D. 90 marks.

45. Let m_1, r_1 and v_1 be the mean, the range and the variance of a group of numbers $\{a, b, c, d, e, f\}$ respectively. It is given that $m_1 = c$. If m_2, r_2 and v_2 are the mean, the range and the variance of the group of numbers $\{a, b, d, e, f\}$ respectively, which of the following must be true?

I. $m_2 = c$

II. $r_2 = r_1$

III. $v_2 < v_1$

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

– END OF PAPER –