MC

ST. JOSEPH'S COLLEGE

MOCK EXAMINATION 2020 – 2021

S.6 MATHEMATICS Compulsory Part
PAPER 2

(1¼ hours)

Date : 10th February, 2021

INSTRUCTIONS

1. Write your Name, Class and Class Number in the spaces provided on the multiple choice answer sheet.

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

3. All questions carry equal marks.

4. **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.

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

6. 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. $\dfrac{\left(2x^{-1}\right)^{-3}}{6^{-1}\left(x^{-3}\right)^{2}} =$

A. $\dfrac{3x^{9}}{4}$.

B. $\dfrac{3}{x^{6}}$.

C. $\dfrac{4x^{3}}{3}$.

D. $\dfrac{x^{9}}{8}$.

2. If $k = \dfrac{h+4}{2h-1} + 5$, then $h =$

A. $\dfrac{k+9}{2k-1}$.

B. $\dfrac{k-5}{4k}$.

C. $\dfrac{k-9}{4k+1}$.

D. $\dfrac{k-1}{2k-11}$.

3. $2x^{6} - 128 =$

A. $2(x+2)^{3}(x-2)^{3}$.

B. $2(x+2)(x-2)(x^{2}-2x+4)^{2}$.

C. $(2x+2)(x-2)(x^{2}+2x+4)^{2}$.

D. $2(x+2)(x-2)(x^{2}-2x+4)(x^{2}+2x+4)$.

4. 20.21625 =

A. 20 (correct to 1 significant figure) .
B. 20.21 (correct to 2 decimal places) .
C. 20.213 (correct to 3 decimal places) .
D. 20.2163 (correct to 5 significant figures) .

5. If α and β are constants such that $(x+\alpha)(\beta x-4) \equiv 4(x+3)^2 - 16(x+3)$. Find the value of $\alpha^2 + 3\beta$.

A. 3
B. 18
C. 21
D. –10

6. Let $f(x) = 4x^2 - 3x + 2$. If k is a constant, then $f(k) - f(1-k) =$

A. $2k - 1$
B. $2k + 1$
C. $-3k + 2$
D. $-3k - 2$

7. The solution of $3x(x-4) > x - 12$ or $\frac{14-5x}{2} < 12$ is

A. $x > 3$
B. $-2 < x < \frac{4}{3}$
C. $-2 < x < \frac{4}{3}$ or $x > 3$
D. All real numbers

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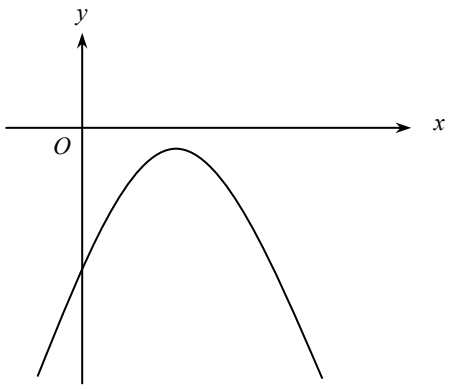
8. The scale of a map is 1 : 5000 . If the area of a construction site on the map is 30 cm^2 , then the actual area of the construction site is

A. 750 m^2
B. 7500 m^2
C. 0.075 km^2
D. 0.0075 km^2

9. The figure below shows the graph of $y = -ax^2 + bx - 4$ where a and b are constants. Which of the following is true?



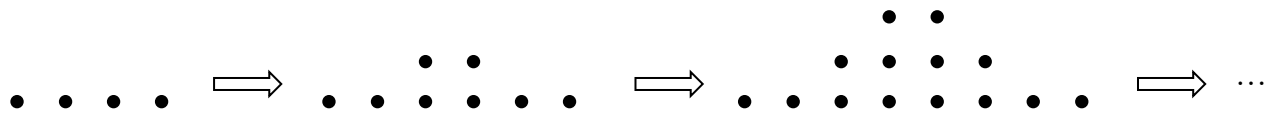
A. $a > 0$ and $b < 0$
B. $a > 0$ and $b > 0$
C. $a < 0$ and $b < 0$
D. $a < 0$ and $b > 0$

10. If $a < b < 0$ and $k \leq -1$, which of the following is/are true ?

I. $ak^2 < bk^2$
II. $a^k < b^k$
III. $\frac{a^2}{k} < \frac{b^2}{k}$

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

11. In the figure, the 1st pattern consists of 4 dots. For any positive integer n , the $(n + 1)$th pattern is formed by adding $(2n + 2)$ dots to the nth pattern. Find the number of dots in the 6th pattern.



A. 32
B. 44
C. 58
D. 74

12. Three identical metal spheres of radius r cm each are melted and recast into a new circular cone. The radius of the circular cone is greater than the radius of the spheres by 25%. If 20% of material is wasted in the recast process, find the height of the circular cone in terms of r.

A. 1.304 r
B. 1.536 r
C. 6.144 r
D. 7.680 r

13. A sum of \$ 35 000 is deposited to a bank at an interest rate of 3% per annum for 4 years, compounded half yearly. Find the amount of interest received, correct to the nearest dollar.

A. \$ 4 427
B. \$ 4 393
C. \$ 9 337
D. \$ 9 496

14. z varies as x^2 and inversely as y. If x is increased by 10% and y is decreased by 20% , then z

A. is increased by 0.833 % .
B. is increased by 45.2 % .
C. is increased by 51.3 % .
D. is decreased by 8.33 % .

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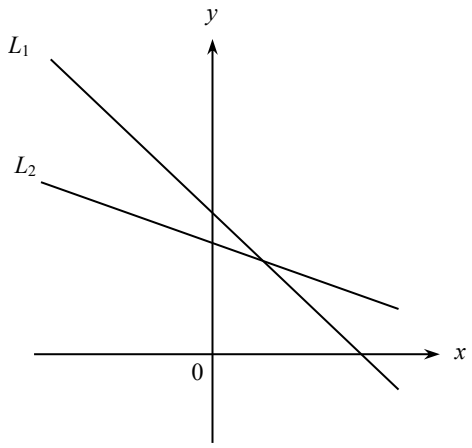
15. A pack of 100 screws weighs 287.9 g (correct to the nearest 0.1 g). Find the minimum weight of 2800 screws.

A. 8 036.0 g
B. 8 059.8 g
C. 8 061.2 g
D. 8 064.0 g

16. In the figure, the equations of the straight lines L_1 and L_2 are $ax + by = 3$ and $2x + y = c$ respectively. Which of the following is/are true?



I. $a < 2b$
II. $bc < 3$
III. $ac > 6$

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

17. Find the range of values of k such that $x^2 - 2(k-1)x + 10 = 1$ has repeated roots.

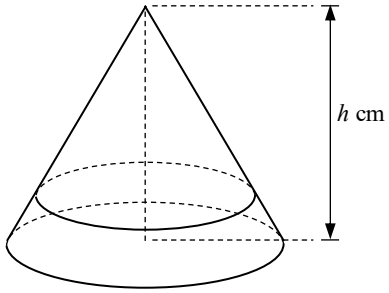
A. $k = 2$
B. $k = 2$ or $k = -4$
C. $k = 3$ or $k = -3$
D. $k = 4$ or $k = -2$

18. Point P' is formed by reflecting a point P (7 , –2) in the x-axis, then rotating 90° in a clockwise direction about the origin. Find the y-intercept of the straight line passing through P and P' .

A. –11
B. –9
C. –7
D. –5

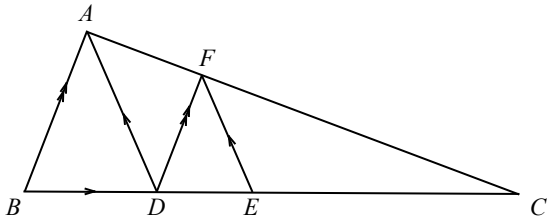
19. The figure below shows a right conical vessel with a capacity of V cm^3 . The height of the vessel is h cm . $\frac{1}{2}V$ cm^3 of water is poured to the conical vessel. Find the depth of water in the vessel.

A. 0.125 h
B. 0.179 h
C. 0.206 h
D. 0.684 h



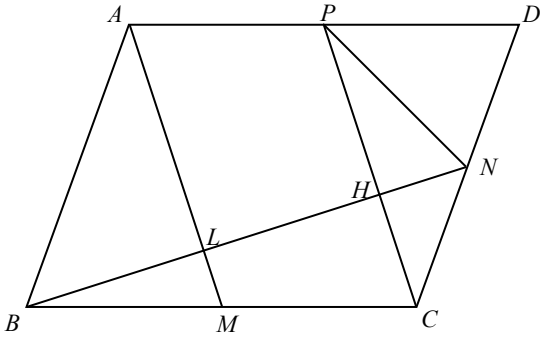
20. In the figure, AFC and $BDEC$ are straight lines. AB // FD , AD // FE and CE = 5 and DE = 2 , find BD.

A. 2
B. 2.6
C. 2.8
D. 3.2



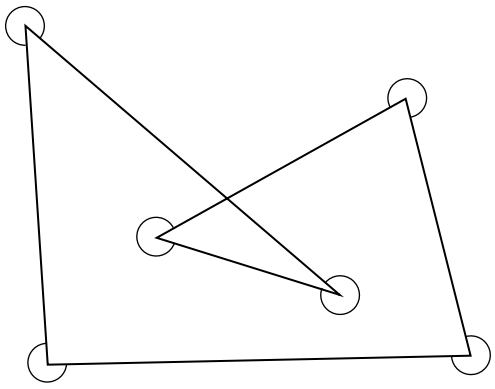
21. In the figure, $ABCD$ is a parallelogram. M, N and P are the mid-points of BC , CD and AD respectively. BN intersects AM and PC at L and H respectively. If AL : LM = 4 : 1 and the area of ΔBLM = 36 cm^2, find the area of ΔPHN.

A. 54 cm^2
B. 48 cm^2
C. 36 cm^2
D. 30 cm^2



22. In the figure, the sum of the marked angles is

A. 720° .
B. 1080° .
C. 1440° .
D. 1800° .



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23. Which of the following statements about the circumcentre of a right-angled isosceles triangle is/are true?

I. The circumcentre lies on the hypotenuse.
II. The circumcentre coincides with the centroid of the triangle.
III. The circumcentre, in-centre, centroid and orthocentre of the triangle are collinear.

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

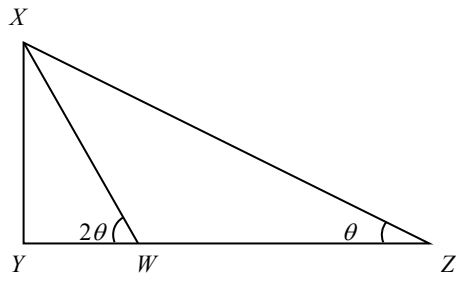
24. Which of the following statements about an equilateral hexagon are **not** necessarily true?

I. Each interior angle is $120°$.
II. It has a minimum of rotational symmetry of 2.
III. It has a minimum of reflectional symmetry of 2.

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

25. In the figure, XYZ is a right-angled triangle. YWZ is a straight line. $\angle XZW = \theta$ and $\angle XWY = 2\theta$. If $WZ = k$, find XY .

A. $k \sin 2\theta$
B. $\dfrac{k \sin 2\theta}{\sin \theta}$
C. $k \cos 2\theta$
D. $\dfrac{k \cos 2\theta}{\sin \theta}$



26. $ABCD$ is a rhombus. Which of the following statements must be true ?

I. $AB \perp CD$.

II. AC is the perpendicular bisector of BD .

III. If AC intersects BD at E, $\Delta ABE \cong \Delta CBE$.

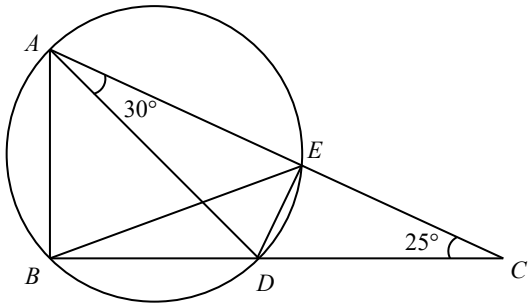
A. I only

B. III only

C. I and II only

D. II and III only

27. In the figure, AD is the diameter of the circle. BDC and AEC are straight lines. $\angle ACB = 25°$ and $\angle DAE = 30°$. Find $\angle BED$.



A. 25°

B. 30°

C. 35°

D. 40°

28. If $\sin\theta - \cos\theta = \frac{1}{2}$ where $0° \le \theta \le 90°$, then $\sin\theta\cos\theta =$

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

B. $\frac{2}{5}$

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

D. $-\frac{1}{8}$

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29. Two cards are randomly drawn from 5 cards numbered –3 , –2 , 0 , 4 and 6 respectively. Find the probability that the product of the numbers drawn is non-negative.

A. $\frac{1}{5}$

B. $\frac{2}{5}$

C. $\frac{3}{5}$

D. $\frac{4}{5}$

30. The stem-and-leaf diagram below shows the distribution of the marks obtained by 25 students in a Maths test.

Stem (tens)	Leaf (units)
1	0 1 3 7 9
2	0 2 2 3 5 7 8
3	1 1 ***x*** 6 6 6 9 9
4	2 4 7 8 8

Which of the following statements is/are true?

I. $32 \leq x \leq 35$.

II. The interquartile range is 18 .

III. The mean of the set of data ranges from 29.8 to 30 .

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Section B

31. $1100110000110100_2 =$

A. $51 \times 2^{10} + 52$.
B. $51 \times 2^{11} + 52$.
C. $50 \times 2^{10} + 52$.
D. $50 \times 2^{11} + 46$.

32. If α and β are the roots of the quadratic equation $x^2 - 8x + 4 = 0$, find the value of $\log_{\alpha+\beta} \alpha^2 + 2\log_{\alpha+\beta} \beta$.

A. 2
B. $\frac{4}{3}$
C. $-\frac{1}{4}$
D. –1

33. If x is a real number, the the imaginary part of $\frac{2 + xi^3}{x - 3i^5}$ is

A. $\frac{6 - x^2}{x^2 + 9}$
B. $\frac{6 + x^2}{x^2 + 9}$
C. $\frac{11 - x^2}{x^2 + 9}$
D. $5x$

34. It is given that $\log_8 y$ is a linear function of x . The graph of the linear function passes through (2 , –1) and its y-intercept is –5. Which of the following must be true ?

A. $64^x y = 8^5$
B. $\frac{64^x}{y} = 8^5$
C. $\frac{8^x}{y} = 8^5$
D. $8^x y = 8^5$

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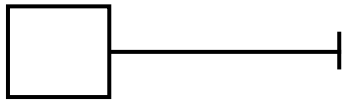
35. The sum of the 3rd term and the 6th term of a geometric sequence is –126 while the sum of the 4th term and the 7th term of the sequence is 504. Find the 9th term of the sequence.

A. 512
B. –2048
C. –4096
D. 8192

36. The figure below shows the box-and-whisker diagram of a set of data. Which of the following must be true?



I. The median is equal to the first quartile.
II. The interquartile range is greater than 0 .
III. The mean is larger than the median.

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

37. A line $L : x - 3y + 4 = 0$ intersects a circle $C : x^2 + y^2 - 10x - 8y + 32 = 0$ at A and B. Find the coordinates of the mid-point of AB.

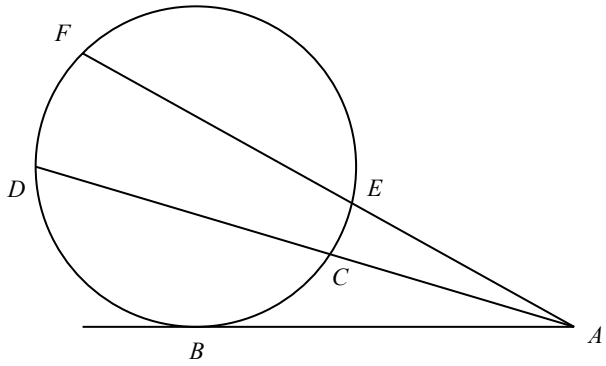
A. (2.6 , 2.2)
B. (4.6 , 3.5)
C. (5.3 , 3.1)
D. (8 , 4)

38. In the figure, AB is a tangent to the circle. ACD and AEF are straight lines. Which of the following is/are true?

I. $AB^2 = AC \cdot AD$.

II. $AC^2 = AB \cdot AE$.

III. $AC \cdot FD = FA \cdot CE$.



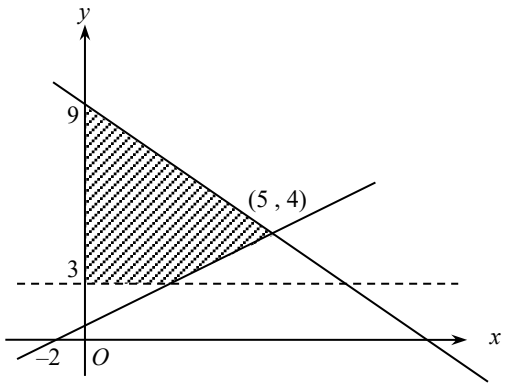
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

39. In the figure, the shaded region represents the solution of



A. $\begin{cases} x + y \le 9 \\ 4x - 7y \le -8 \\ x \ge 0 \\ y > 3 \end{cases}$

B. $\begin{cases} x + y > 9 \\ 4x - 7y \ge -8 \\ x \ge 0 \\ y > 3 \end{cases}$

C. $\begin{cases} x + y \le 9 \\ 4x - 7y \ge -8 \\ x \ge 0 \\ y < 3 \end{cases}$

D. $\begin{cases} x + y \le 9 \\ 4x - 7y \le -8 \\ x \ge 0 \\ y < 3 \end{cases}$

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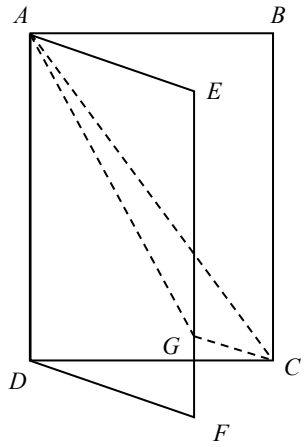
40. The figure below shows a file made of two pieces of identical rectangular papers $ABCD$ and $AEFD$. $AB = 20$ cm and $AD = 30$ cm. If $\angle BAE = 30°$ and $EG = 25$ cm, find the area of ΔACG.



A. 159 cm^2
B. 160 cm^2
C. 181 cm^2
D. 185 cm^2

41. For $0° \le \theta < 360°$, how many roots does the equation $5 - 2\sin^2\theta = 5\cos\theta$ have ?

A. 1
B. 2
C. 3
D. 4

42. There are 10 students in class A, and 15 students in class B. 6 students are selected from the two classes to form a committee. If there must be at least 1 student from each class, how many different teams can be formed ?

A. 85008
B. 171885
C. 177100
D. 127512000

43. In an examination, the variance of the examination scores is 20 marks. The examination score of Peter is 85 and his standard score is 1.5 . If Charles scores 65 in the examination, then his standard score is

A. 0.421
B. 0.5
C. – 0.665
D. – 2.97

44. Anderson, Billy and 6 other members of a committee randomly stand in two rows for a group photo. If there are 4 people in each row, find the probability that there is exactly a person standing between Anderson and Billy.

A. $\frac{3}{11}$

B. $\frac{2}{11}$

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

D. $\frac{1}{7}$

45. If the variance of the five numbers a, b, c, d and e is 16 , then the standard deviation of the five numbers $4a + 3$, $4b + 3$, $4c + 3$, $4d + 3$ and $4e + 3$ is

A. 8

B. 16

C. 64

D. 256

END OF PAPER

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