COMMON PRE-BOARD EXAMINATION 2024-25

Subject: MATHEMATICS (BASIC) -241

Time: 3 hours   Max. Marks: 80   Date: 04-12-2024

General Instructions:

1. This Question Paper has 5 Sections A - E.

2. Section **A** has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.

3. Section **B** has 5 questions carrying 02 marks each.

4. Section **C** has 6 questions carrying 03 marks each.

5. Section **D** has 4 questions carrying 05 marks each.

6. Section **E** has 3 Case Based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.

7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.

8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$, wherever required if not stated.

SECTION A

**Section A consists of 20 questions of 1 mark each.**

Q.1. If p is a prime number, then LCM of $p, \ p^2, p^3$ is   **1**

    (A) $\quad p^2$ **(B)** $\quad p$ **(C)** $\quad p^3$ **(D)** $\quad p^5$

Q.2. If $x = a, \ y = b$ is the solution of the pair of equations $x - y = 2 \ and \ x + y = 4$, then the respective values of $a \ and \ b$ are   **1**

    (A) $\quad -1, -3$ **(B)** $\quad 3, 5$ **(C)** $\quad 5, 3$ **(D)** $\quad 3, 1$

Q.3. The quadratic equation $2x^2 - \sqrt{5} \ x + 1 = 0$ has   **1**

    (A) two distinct real roots   **(B)** two equal real roots   **(C)** no real roots   **(D)** more than two real roots

Q.4. If the point P(k, 0) divides the line segment joining the points A(2, –2) and B(–7, 4) in the ratio 1 : 2, then the value of k is   **1**

    (A) $\quad 1$ **(B)** $\quad 2$ **(C)** $\quad –2$ **(D)** $\quad –1$

Q.5. In the given figure, PQ is a tangent to the circle with centre O. If ∠OPQ = x, ∠POQ = y, then x + y is   **1**
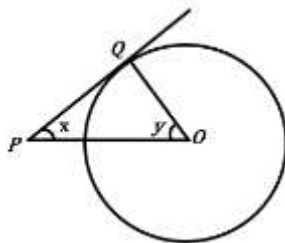
(A)	90°	(B)	120°	(C)	150°	(D)	60°

Q.6. In the given figure, DE ∥ BC, then the value of x is

1
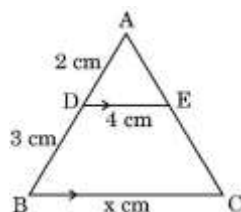
(A)	6	(B)	12.5	(C)	8	(D)	10

Q.7. In Δ ABC, right angled at C, if tan A = $\frac{8}{7}$, then the value of sin B is   **1**

(A)	$\dfrac{7}{8}$	(B)	$\dfrac{8}{7}$	(C)	$\dfrac{7}{\sqrt{113}}$	(D)	$\dfrac{8}{\sqrt{113}}$

Q.8. The sides of two similar triangles are in the ratio 4 : 7. The ratio of their perimeters is   **1**

(A)	4 : 7	(B)	12 : 21	(C)	16 : 49	(D)	7 : 4

Q.9. The largest number that divides 245 and 1029, leaving remainder 5 in each case is   **1**

(A)	15	(B)	9	(C)	5	(D)	16

Q.10. The common difference of the A.P. $\dfrac{1}{p}, \dfrac{1-p}{p}, \dfrac{1-2p}{p}, ….$ is   **1**

(A)	1	(B)	$\dfrac{1}{p}$	(C)	-1	(D)	$-\dfrac{1}{p}$

Q.11. In Δ ABC and Δ DEF, $\dfrac{AB}{DE} = \dfrac{BC}{FD}$. Which of the following makes the two triangles similar?   **1**

(A)	∠A = ∠D	(B)	∠B = ∠D	(C)	∠B = ∠E	(D)	∠A = ∠F

Q.12. Two concentric circles have radii 13 cm and 12 cm, then the length of the chord of the larger circle which touches the smaller circle is   **1**

(A)   10 cm   (B)   25 cm   (C)   26 cm   (D)   24 cm

Q.13. If $\sin\theta = \dfrac{a}{b}$, then $\sec\theta$ is equal to $(0° \le \theta \le 90°)$ **1**

(A) $\dfrac{a}{\sqrt{b^2 - a^2}}$ (B) $\dfrac{b}{\sqrt{b^2 - a^2}}$ (C) $\dfrac{\sqrt{b^2 - a^2}}{b}$ (D) $\dfrac{\sqrt{b^2 - a^2}}{a}$

Q.14. A rectangular sheet of paper 40 cm $\times$ 22 cm, is rolled to form a hollow cylinder of height 40 cm. The radius of the cylinder (in cm) is   **1**

(A)   5   (B)   7   (C) $\dfrac{80}{7}$ (D)   3.5

Q.15. Two coins are tossed together. The probability of getting at least one tail is   **1**

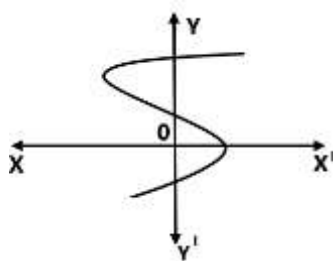(A) $\dfrac{1}{4}$ (B) $\dfrac{1}{2}$ (C) $\dfrac{3}{4}$ (D)   1

Q.16. The discriminant of the quadratic equation $(x + 5)^2 = 2(5x - 3)$ is   **1**

(A)   5   (B) -124 (C) -5 (D)   124

Q.17. The median of first seven prime numbers is   **1**

(A)   7   (B)   5   (C)   11   (D)   13

Q.18. In the graph of $x = p(y)$, for some polynomial $p(y)$, then the number of zeroes is/are   **1**

(A)   3   (B)   1   (C)   0   (D)   2

DIRECTION: In question numbers 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R).**

Choose the correct option.

   (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

   (b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

   (c) Assertion (A) is true but Reason (R) is false.

   (d) Assertion (A) is false but Reason (R) is true.

Q.19. *Statement A (Assertion):* $\sqrt{7}$ is an irrational number.   **1**

Statement R (Reason): A square root of a prime number is always an irrational number.

Q.20. *Statement A (Assertion):* Sum of first hundred even natural numbers divisible by 5 is 500.   **1**

Statement R (Reason): Sum of first 'n' terms of an AP is given by $S_n = \frac{n}{2}(a + l)$, where
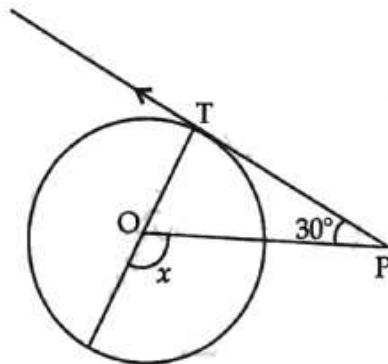
l is the last term.

SECTION B

Section B consists of 5 questions of 2 marks each

Q.21. (a) Show that A(1, 2), B(5, 4), C(3, 8) and D(1, 6) are vertices of a parallelogram ABCD.   **2**

(OR)

(b) Show that the points A(3, 0), B(6, 4) and C(1, 3) are vertices of a right-angled triangle.   **2**

Q.22. In the below given figure, PT is a tangent at T to the circle with centre O. If ∠TPO = 30° , find the value of x.   **2**

Q.23. (a) Find the sum of the first 15 terms of the A.P.: $\frac{1}{15}, \frac{1}{12}, \frac{1}{10}, \dots$.   **2**

<div align="center">(OR)</div>

(b) Find a and b so that the numbers a, 7, b, 23 are in AP.   **2**

Q.24. Evaluate: $5\ cosec\ ^2\ 45° - 3\ sin^2\ 90° + 5\cos 0°$.   **2**

Q.25. Find the mode of the following frequency distribution: **2**

Class	$0 - 20$	$20 - 40$	$40 - 60$	$60 - 80$	$80 - 100$
Frequency	8	7	12	5	3

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SECTION C

Section C consists of 6 questions of 3 marks each

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Q.26. If $\sqrt{2}$ is given as an irrational number, then prove that $(5 - 2\sqrt{2})$ is an irrational number.   **3**

Q.27. (a) The line segment AB joining the points $A(2,1)$ and $B(5, -8)$ is trisected at the points P and Q such that P is nearer to A. Also, if P lies on the line given by $2x - y + k = 0$, find the value of k.   **3**

<div align="center">(OR)</div>

(b) The centre of a circle is $(2a - 1,\ 7)$ and it passes through the point $(-3, -1)$. If the diameter of the circle is 20 units, then find the value of a.   **3**

Q.28. Prove that: $(1 + \tan A - \sec A)(1 + \tan A + \sec A) = 2\tan A$.   **3**

Q.29. (a) Prove that the parallelogram circumscribing a circle is a rhombus.   **3**

<div align="center">(OR)</div>

(b) In the given figure, PQ is a tangent from an external point P to a circle with centre O and OP cuts the circle at T and QOR is a diameter. If $\angle POR = 130°$ and S is a point on the circle, find $\angle 1\ and\ \angle 2$.   **3**
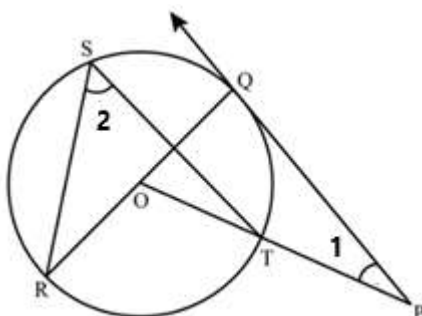
Q.30. Find the mean of the following data: **3**

Classes	$0-10$	$10-20$	$20-30$	$30-40$	$40-50$	$50-60$	$60-70$
Frequency	5	10	18	30	20	12	5

Q.31. Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$. **3**
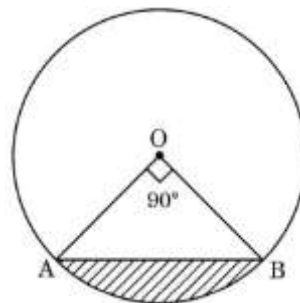
SECTION D
Section D consists of 4 questions of 5 marks each

Q.32. A craft paper is cut in the shape of a circle for an **5**
activity by the student as seen in the given figure.
AB is a chord of a circle of radius 7 cm and centred
at O. Find the area of the shaded region if
$\angle$ AOB $= 90°$. Also, find the length of the
corresponding minor arc.

Q.33. If a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, **5**
then prove that the other two sides are divided in the same ratio.

Q.34. (a) A two-digit number is such that product of its digits is 18. When 63 is subtracted from the **5**
number, the digits interchange their places. Find the number.

(OR)

(b) The sum of the ages of a father and his son is 45 years. Five years ago, the product of their ages **5**
(in years) was 124. Determine their present age.

Q.35. (a) A person standing on the bank of a river observes that the angle of elevation of the top of a tree
on the opposite bank as $60°$. When he moves 30 m away from the bank, he finds the angle of **5**
elevation of the top of the tree to be $30°$. Find the height of the tree and width of the river.
[Take $\sqrt{3} = 1.732$] .

(OR)

(b) From the top of a 7 m high building, the angle of elevation of the top of a cable tower is $60°$ **5**
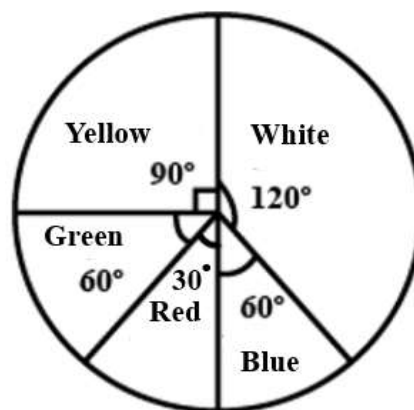and the angle of depression of its foot is $45°$. Determine the height of the tower.

SECTION E
Case study- based questions are compulsory

Q.36. **Case study-based question 1:**

Some students were asked to list their favourite colour. The measure of each colour is shown by the central angle of a pie chart as seen beside:

Study the pie chart and answer the following questions :

(i) If a student is chosen at random, then find the probability of his/her favourite colour being white ?　　**1**

(ii) What is the probability of his/her favourite colour being blue or green ?　　**1**

(iii) (a) If 15 students liked the colour yellow, how many students participated in the survey ?　　**2**

(OR)

(b) What is the probability of the favourite colour being red or blue ?　　**2**

Q.37. **Case study-based question 2:**

ABC construction company got the contract of making speed humps on roads. Speed humps are parabolic in shape and prevents over speeding, minimise accidents and gives a chance for pedestrians to cross the road. The mathematical representation of a speed hump is shown in the given graph.
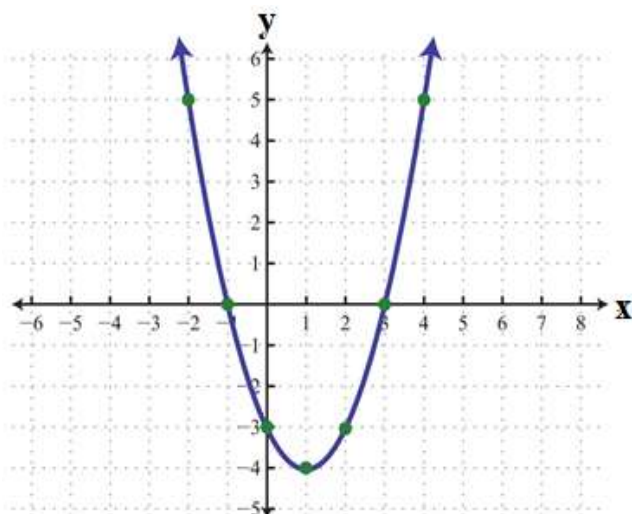
Now, answer the following questions based on the above given information.

(i) Find the zeroes of the polynomial whose graph is given.   **1**

(ii) Find the product of the zeroes of the polynomial which represents the parabola.   **1**

(iii) (a) What will be the expression of the given polynomial p(x)?   **2**

(OR)

(b) Find a quadratic polynomial, if its sum of the roots is -2 and product of the roots is $\dfrac{1}{3}$.   **2**

Q.38. <u>**Case study-based question 3:**</u>

Singing bowls (hemispherical in shape) are commonly used in sound healing practices. Mallet (cylindrical in shape) is used to strike the bowl in a sequence to produce sound and vibration. One such bowl is shown here whose dimensions are : Hemispherical bowl has outer radius 6 cm and inner radius 5 cm. Mallet has height of 10 cm and radius 2 cm.

Now, answer the following questions.

(i) What is the volume of the material used in making the mallet ?   **1**

(ii) The bowl is to be polished from inside. Find the inner surface area of the bowl.   **1**

(iii) (a) Find the volume of metal used to make the bowl. (Use $\pi = 3.14$)   **2**

(OR)

(b) Find total surface area of the mallet. (Use $\pi = 3.14$)   **2**

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