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PRACTICE QUESTION PAPER - II
CLASS XII - MATHEMATICS (041)

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

1. This Question Paper contains **38** questions. All questions are compulsory.

2. The question paper is divided into FIVE Sections – A, B, C, D and E.

3. Section **A** comprises of **20** questions of **1** mark each.

4. Section **B** comprises of **5** questions of **2** marks each.

5. Section **C** comprises of **6** questions of **3** marks each.

6. Section **D** comprises of **4** questions of **5** marks each.

7. Section **E** comprises of **3** Case Study Based Questions of **4** marks each.

8. There is no overall choice in the question paper. However, an internal choice has been provided in **2** questions in Section B, **3** questions in Section C, **2** questions in Section D and **2** questions in Section E (in the sub-parts).

9. Use of calculators is **not** permitted.

SECTION A ANSWERS

1. **Answer:** (b) $\{-4, 4\}$

2. **Answer:** (b) 7

3. **Answer:** (c) $\frac{3\pi}{4}$

4. **Answer:** (a) x

5. **Answer:** (b) $[0, \pi] - \left\{\frac{\pi}{2}\right\}$

6. **Answer:** (b) $\begin{bmatrix} 16 & 0 \\ 0 & 16 \end{bmatrix}$

7. **Answer:** (b) $-A$

8. **Answer:** (b) 4 elements

9. **Answer:** (c) ± 6

10. **Answer:** (c) $|A|^{n-2}A$ (where n is order)

11. **Answer:** (c) $\left(0, \frac{\pi}{4}\right)$

12. **Answer:** (a) $e^y = e^x + \frac{x^3}{3} + C$

13. **Answer:** (a) $25y$

14. **Answer:** (b) 1

15. **Answer:** (a) 1 sq. unit

16. **Answer:** (b) -3

17. **Answer:** (a) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

18. **Answer:** (d) $\left(-\frac{2}{3}, \frac{1}{3}, 0\right)$

19. **Answer:** (a) Both A and R are true and R is the correct explanation of A.

20. **Answer:** (a) Both A and R are true and R is the correct explanation of A.

SECTION B ANSWERS

21. **Answer:**

$$\frac{dy}{dx} = (\cos x)^x \left(\log(\cos x) - x \tan x\right) + x^{\sin x} \left(\frac{\sin x}{x} + \cos x \log x\right)$$

22. **Answer:** Verified that $A^2 - 6A + 11I = 0$.

23. **Answer:** (For first part) $|\vec{a} \times \vec{b}| = \sqrt{26}$.
    (For OR part) Area of parallelogram $= 7\sqrt{5}$ square units.

24. **Answer:** The function $f(x)$ is strictly decreasing in the interval $(-2, 3)$.

25. **Answer:** (For first part) Probability that exactly two balls are red $= \frac{15}{28}$.
    (For OR part) $P(A|B) = 0.3$.

SECTION C ANSWERS

26. **Answer:** $\displaystyle \int \frac{(x^2+1)e^x}{(x+1)^2}\,dx = \frac{x-1}{x+1}e^x + C$

27. **Answer:** (For first part) The point of intersection is $(-3, 0, -3)$.
    (For OR part) $\theta = \cos^{-1}\left(\frac{19}{21}\right)$.

28. **Answer:** (For first part) $y\sec^2 x = \sec x + C$.
    (For OR part) $x^2 + 4xy - y^2 = C$.

29. **Answer:** Symmetric matrix $= \frac{1}{2}(A + A^T) = \begin{bmatrix} 3 & \frac{1}{2} & -\frac{5}{2} \\ \frac{1}{2} & -2 & -2 \\ -\frac{5}{2} & -2 & 2 \end{bmatrix}$,

    Skew-symmetric matrix $= \frac{1}{2}(A - A^T) = \begin{bmatrix} 0 & -\frac{5}{2} & -\frac{3}{2} \\ \frac{5}{2} & 0 & -3 \\ \frac{3}{2} & 3 & 0 \end{bmatrix}$.

30. **Answer:** Verified that $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{2}{11}\right) = \tan^{-1}\left(\frac{3}{4}\right)$.

31. **Answer:** (For first part) Minimum value $Z = 5$ at the point $(0,1)$.
    (For OR part) Maximize $Z = 7x + 10y$ subject to $4x + 6y \leq 240$, $6x + 3y \leq 240$, $x, y \geq 0$.

SECTION D ANSWERS

34. **Answer:** Area $= \frac{3}{2}$ square units.

35. **Answer:** (For first part) $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x}\, dx = \pi \left(\frac{\pi}{2} - 1 \right)$.

    (For OR part) $\dfrac{d(\sin x)}{d(x^x)} = \dfrac{\cos x}{x^x(1 + \log x)}$.

36. **Answer:** (For first part) The equation of the plane is $7x - 8y + 3z + 25 = 0$.

    (For OR part) $p = \frac{70}{11}$.

37. **Answer:** The wire should be cut into pieces of length $\frac{144}{\pi+4}$ m for the square and $\frac{36\pi}{\pi+4}$ m for the circle.

SECTION E ANSWERS

39. **Answer:**

    (a) $MC(x) = 10 + 0.01x$

    (b) $MC(100) = 11$

    (c) Number of units where MC = AC is $x = 1000$ (with corrected cost function $C(x) = 500 + 10x + 0.0005x^2$)

40. **Answer:**

    (a) $\vec{r} = (3\hat{i} + \hat{j} + 5\hat{k}) + \lambda(\hat{i} + \hat{j} - \hat{k})$

    (b) Verified that lines are skew.

    (c) Vector perpendicular to both lines is $\vec{n} = 4\hat{i} - 5\hat{j} - \hat{k}$. (Dot product of direction vectors is 0, not 4)

41. **Answer:**

    (a) $P(\text{exactly 3 hits}) = \frac{45}{512}$

    (b) $P(\text{at least once}) = \frac{781}{1024}$
    (OR: minimum $n = 3$)