P.V.G.'s

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Preliminary Examination (2025-26)

Standard - XII

Subject : Mathematics Marks - 80

Date : 03.01.2026 Time : 1.30 pm to 4.30 pm

General Instructions -

The question paper is divided into four sections.

1. Section A : Q1 contains **Eight** multiple choice type questions carrying **Two** marks each.

   Q2 contains **Four** very short answer type questions carrying **One** mark each.
2. Section B : Contains **Twelve** short answer type questions carrying **Two** marks each. (Attempt any **Eight**)
3. Section C : Contains **Twelve** short answer type questions carrying **Three** marks each. (Attempt any **Eight**)
4. Section D : contains **Eight** long answer type questions carrying **Four** marks each. (Attempt any **Five**)
5. Use of log table is allowed. Use of calculator is **not** allowed.
6. Figures to the right indicate full marks.
7. For each MCQ, only the first attempt will be considered for evaluation.
8. Start answer to each section on a new page.

Section A

Q1. Select and write the correct answer of the following multiole choice type of questions. (16)

i) Dual of $(P \wedge t) \to \sim(q \vee c)$

a) $(P \vee t) \to \sim(q \wedge c)$ b) $(P \wedge c) \to (\sim q \wedge t)$

c) $(P \wedge c) \to \sim(q \wedge t)$ d) $(P \vee c) \to \sim(q \wedge t)$

ii) In ΔABC if $c^2 + a^2 - b^2 = ac$, then $\angle B =$ __________

a) $\frac{\pi}{4}$ b) $\frac{\pi}{3}$

c) $\frac{\pi}{2}$ d) $\frac{\pi}{6}$

iii) The value of $\hat{i} \cdot (\hat{j} \times \hat{k}) + \hat{j} \cdot (\hat{i} \times \hat{k}) + \hat{k} \cdot (\hat{i} \times \hat{j})$

a) 0 b) -1

c) 1 d) 3

iv) If α, β, γ are direction angles of a line $\alpha = 60^0, \beta = 45^0$ then $\gamma =$ ____________

a) 30^0 or 90^0 b) 45^0 or 60^0

c) 30^0 or 60^0 d) 60^0 0r 120^0

v) If y is a function of x and $\log(x + y) = 2xy$ then the value of $y'(0) =$ ____________

a) 2 b) 0

c) -1 d) 1

vi) If $f(x) = \dfrac{\sin^{-1} x}{\sqrt{1 - x^2}}$, $g(x) = e^{\sin^{-1} x}$, then $\int f(x).g(x)\, dx =$ ____________

a) $e^{\sin^{-1} x} \cdot (\sin^{-1} x - 1) + c$ b) $e^{\sin^{-1} x} (1 - \sin^{-1} x) + c$

c) $e^{\sin^{-1} x} \cdot (\sin^{-1} x + 1) + c$ d) $\sin^{-1} x\, (e^{\sin^{-1} x} - 1) + c$

vii) The area of the region bounded by the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ is ____________

a) ab sq. unit b) πab sq. unit

c) $\dfrac{\pi}{ab}$ sq. unit d) πa^2 sq. unit

viii) For a binomial distribution, n = 5. If P(X = 4) = P(X = 3) then p = ____________

a) $\dfrac{1}{3}$ b) $\dfrac{3}{4}$

c) 1 d) $\dfrac{2}{3}$

Q2. Answer the following questions. (4)

i) If the statements p, q are true and r, s are false then determine the truth value of

$(p \longrightarrow q) \vee (r \longrightarrow s)$

ii) Find the vector perpendicular to both $\bar{u}$ and $\bar{v}$,

where $\bar{u} = 2\hat{i} + \hat{j} - 2\hat{k}$, $\bar{v} = \hat{i} + 2\hat{j} - 2\hat{k}$

iii) Determine the order and degree of

$$\sqrt[3]{1 + \left(\frac{dy}{dx}\right)^2} = \frac{d^2y}{dx^2}$$

iv) Check whether $f(x) = \dfrac{1}{x}$ is increasing or decreasing function.

Section B

Attempt any Eight of the following questions : **(16)**

Q3. Construct switching circuit for the statement.

$(p \vee q) \wedge (\sim p) \wedge (\sim q)$

Q4. Solve the equations $2x + 5y = 1$ and $3x + 2y = 7$ by the method of inversion.

Q5. Prove that $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) = \frac{\pi}{4}$

Q6. Show that equation $x^2 + 7xy - 2y^2 = 0$ represents a pair of lines.

Q7. Find k if the sum of the slopes of the lines given by $3x^2 + kxy - y^2 = 0$ is zero.

Q8. If the vectors $\hat{i} + 2\hat{j} + 3\hat{k}$, $-\hat{i} + \hat{j} + 2\hat{k}$, $2\hat{i} + \hat{j} + 4\hat{k}$ are co-terminus edges of the parallelopiped, then find the volume of the parallelopiped.

Q9. Differentiate $\sin^4[\sin^{-1}(\sqrt{x})]$ w.r.t. x.

Q10. Evaluate $\int \frac{x}{x+2}\,dx$

Q11. Prove that $\int \frac{f'(x)}{\sqrt{f(x)}}\,dx = 2\sqrt{f(x)} + c$

Q12. Find the area of the region bounded by the curve $y = \sin x$ and lines $y = 0, x = 0$ and $x = \frac{\pi}{3}$

Q13. Show that $\int_a^b f(x)\,dx = -\int_b^a f(x)\,dx$

Q14. Verify whether $f(x) = \begin{cases} \frac{x^2}{3} & \text{for } -1 < x < 2 \\ 0 & \text{otherwise} \end{cases}$

is p.d.f. of r.v.x. and also find $P(0 < x \leq 1)$

Section C

Attempt any Eight of the following questions. **(24)**

Q15. Construct the truth table of the statement pattern $[(p \vee q) \vee r] \leftrightarrow [p \vee (q \vee r)]$

Q16. With usual notations prove that $2\left[a \sin^2\left(\frac{C}{2}\right) + c \sin^2\left(\frac{A}{2}\right)\right] = a - b + c$

Q17. Find the general solution of the equation $4\sin^2\theta = 1$

Q18. Prove that the medians of a triangle are concurrent.

Q19. Find the distance of point P(0, 2, 3) from the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$

Q20. Show that lines $\bar{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda (2\hat{i} - 2\hat{j} + \hat{k})$ and $\bar{r} = (4\hat{i} - 3\hat{j} + 2\hat{k}) + \mu(\hat{i} - 2\hat{j} + 2\hat{k})$ are coplanar. Find the equation of the plane determined by them.

Q21. If y = f(u) is a differntiable function of u and u = g(x) is a differentiable function of x such that the composite function y = f[g(x)] is a differentiable function of x then prove that $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

Q22. An open box is to be cut out of piece of square card coard of side 18cm by cutting of equal squares from the corners and turning up the sides. Find the maximum volume of the box.

Q23. The surface area of a spherical balloon is increasing at the rate of $2cm^2$/sec. At what rate the volume of the balloon is increasing, when radius of the balloon is 6cm?

Q24. A random variable X has the following probability distribution :

X	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

Determine : i) k ii) P(x < 3) iii) P(x > 4)

Q25. Five cards are drawn successively with replacement from a well - shuffled deck of 52 cards. Find the probability that

i) all the five cards are spades

ii) only 3 cards are spades

iii) none is a spade

Q26. Solve $\frac{dy}{dx} + \frac{y}{x} = x^3 - 3$

Section D

Attempt any Five of the following questions : (20)

Q27. If $A = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 1 \\ 3 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 24 & 7 \\ 31 & 9 \end{bmatrix}$

then find matrix X such that A X B = C

Q28. Prove that - The acute angle θ between the lines represented by $ax^2 + 2hxy + by^2 = 0$ is given by $\tan\theta = \left| \frac{2\sqrt{h^2 - ab}}{a + b} \right|$, and hence obtain the condition for lines to be coincident.

Q29. If $A(\bar{a})$ and $B(\bar{b})$ be any two points in the space and $R(\bar{r})$ be a point on the line segment AB dividing it internally in the ratio m : n then prove that $\bar{r} = \frac{m\bar{b} + n\bar{a}}{m + n}$ and hence find midpoint formula for line segment AB.

Q30. Maximize : $z = 4x + 3y$

Subjected to $3x + y \leq 15$, $3x + 4y \leq 24$

$x \geq 0$, $y \geq 0$.

Q31. If $y = \log\left(x + \sqrt{x^2 + a^2}\right)^m$, show that $(x^2 + a^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0$

Q32. Find the area of the region bounded by the curve $y^2 = 9x$ and $x^2 = 9y$

Q33. Evaluate $\int_0^{\pi/4} \log(1 + \tan x)\, dx$

Q34. Integrate $\sin(\log x)$ w.r.t. x

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