



UNIVERSITY OF THE PUNJAB

MathCity.org
Merging Man and maths

A/2015

Examination:- B.A./B.Sc.

Roll No.

Subject: Mathematics General
PAPER: B

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

NOTE: Attempt SIX questions in all selecting TWO questions from Section – I, TWO questions from Section – II, ONE question from Section – III and ONE question from Section-IV.

SECTION-I

Q.No.1 (a) For what value of λ will the equation represent a pair of straight lines?

$$\lambda xy + 5x + 3y + 2 = 0 \quad 9, 8$$

(b) Show that the tangents at the ends of a focal chord of a parabola intersect at right angles on the directrix.

Q.No.2 (a) Find the points at which the curve $r = 1 + \sin\theta$ has vertical tangents.

9, 8

(b) Find an equation of tangent to $r = 1 + \cos\theta$ at $(1, \frac{\pi}{2})$

Q.No:3(a) Using vectors prove that,

9, 8

$$\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$

(b) Find the value of λ which makes $i + j - k$, $i - 2j + k$ and $\lambda i + j - \lambda k$ coplaner.

Q.No: 4(a) Integrate

$$\frac{d^2r}{dt^2} = -n^2r \quad 9, 8$$

(b) Find the divergence of F , where

$$F = \frac{xi+yj+zk}{(x^2+y^2+z^2)^{3/2}}$$

SECTION-II

Q.No:5(a) Find equation of straight line through the point $A(11, 4, -6)$ and intersecting at right angles the straight line $x = 4 - t$, $y = 7 + 2t$, $z = -1 + t$

9, 8

(b) Find an equation of the plane through the points $(1, 0, 1)$ and $(2, 2, 1)$ and perpendicular to the plane. $x - y - z + 4 = 0$

Q.No:6(a) Express the given equation in cylindrical and spherical coordinates.

$$x^2 - y^2 - z^2 = 1 \quad 9, 8$$

P.T.O.

(b) Find an equation of the sphere through the circle $x^2 + y^2 + z^2 = 1$,

$2x + 4y + 5z - 6 = 0$ And touching the plane $z = 0$

Q.No:7(a) Find the direction of Quibble at a place with latitude $23^{\circ}42'N$ and longitude $90^{\circ}22'E$.

9, 8

(b) Find the squares of all the 5th roots of

$$\frac{1}{2} + \frac{\sqrt{3}}{2}i$$

Q.No:8(a) If $\tan(\alpha + i\beta) = x + iy$, show that,

$$x^2 + y^2 - 2y \coth 2\beta = -1$$

9, 8

(b) Show that if $z = x + iy$ then $\text{Log} \frac{z}{\bar{z}} = 2i \tan^{-1} \left(\frac{y}{x} \right)$

SECTION-III

Q.No:9(a) Find inverse of the matrix

8, 8

$$\begin{bmatrix} 5 & 9 & 3 \\ -3 & 5 & 6 \\ -1 & -5 & -3 \end{bmatrix}$$

(b) Solve the system of equations.

$$2x_1 - x_2 - 3x_3 = 3$$

$$3x_1 + x_2 - 5x_3 = 0$$

$$4x_1 - x_2 + x_3 = 3$$

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Q.No:10(a) Show that

8, 8

$$\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$$

(b) Show that the vectors $(1 - i, i), (2, -i + 1)$ in C^2 are linearly dependent over C but linearly independent over R .

SECTION-IV

Q.No:11(a) Solve: $\frac{dy}{dx} + y = xy^3$

8, 8

(b) Find equation of orthogonal trajectories of the curve $y = (x - c)^2$

Q.No:12(a) Solve the initial value problem.

8, 8

$$y'' - 4y = 2 - 8x, \quad y(0) = 0, \quad y'(0) = 5$$

(b) Solve: $[(2x + 1)^2 D^2 - 6(2x + 1)D + 16]y = 8(2x + 1)^2$