COPYRIGHT RESERVED UESA - Math (GE - 1)

2024

(Old)

Full Marks: 100

Time: 3 Hours

Candidates are required to give their answer in their own words as far as practicable. Their figures in the margin indicate full marks.

Answer from both the Sections as directed.

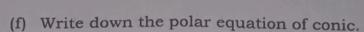
Section - A

(Compulsory)

- Answer the following questions: $1 \times 10 = 10$
 - (a) State Maclaurin's Theorem.
 - (b) If $y = \sin ax$, then $yn = \dots$
 - (c) The length of the sub tangent to the curve y = f(x) is
 - (d) Define curvature.
 - (e) Define Asymptotes.

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- (g) Define Rotation of Axes.
- (h) Write the equation of the normal to the Parabola $y^2 = 4ax$ at the point (at², 2at).

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- (i) Write down the equation of the hyperbola in standard form.
- (j) Write down the director circle of the ellipse.
- 2. Find the co-ordinates of a point in a plane when the origin is shifted to a new point (h, k), the new axes remaining parallel to the original axes.
- 3. Find yn when y = Sin (ax + b).

Section - B

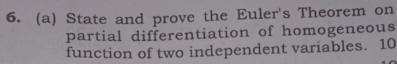
Answer any **four** questions: $20 \times 4 = 80$

- 4. (a) State and Prove the Taylor's theorem on the expansion of (x + h).
 - (b) Apply Maclaurin's series to

$$\sin x = x - \frac{x^3}{2} + \frac{x^5}{5} - to \infty.$$
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- 5. (a) Find the radius of curvature for the Cartesian curve y = f(x).
 - (b) Find the real asymptotes of the curve $x^3 + y^3 = 3axy$.

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(b) Prove That:

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$$(i) \quad \frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4} \left(\frac{dr}{d\theta}\right)^2$$

(ii)
$$\frac{1}{p^2} = u^2 + \left(\frac{du}{d\theta}\right)^2$$

- 7. (a) State and prove Leibnitz's Theorem. 10
 - (b) If $y = a sin^{-1} x$, prove that:
 - (i) $(1-x^2)y_2 xy_1 a^2y = 0$.
 - (ii) $(1-x^2) y_{n+2} (2n+1)xy_{n+1} (n^2 + a^2)y_n = 0$.
- 8. (a) Find the co-ordinates of a point in a plane when the axes are rotated through an angle α , the origin remaining fixed. 10
 - (b) Find the condition that the line y = mx + c may touch the hyperbola.

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

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- 9. (a) Show that the equation of the chord of a parabola $y^2 = 4ax$, whose middle poist is (x_1, y_1) is $(y y_1) y_1 = 2a (x x_1)$ 10
 - (b) Show that the equation $\frac{\ell}{r} = 1 + e\cos\theta$ and

 $\frac{\ell}{r} = -1 + e\cos\theta$, represent the same conic.

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