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DEPARTMENT OF MATHEMATICS

23MAT101 - MATRICES AND CALCULUS UNIT-III DIFFERENTIAL CALCULUS

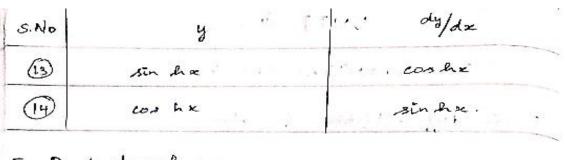
	UNIT	
	DIFFERENTIAL	CALCULUS
I.I	Basic differentiation	formulas:
S.No	y y	dy/dx.
0	k (Constant)	0
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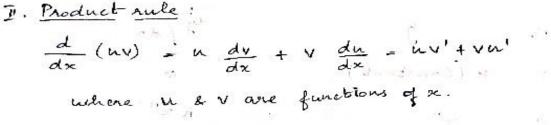




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I. Quotient surle :

$\frac{d}{dx}\left(\frac{u}{v}\right)$	= v du	- u dv dr	= vui-uvi	
an et		V ²	Y 2-	

$$\begin{split} \vec{W} \cdot \vec{T}_{1} & x = x(t), \quad y = y(t) \quad \text{where 't' is a parameter} \\ & \frac{dy}{dx} = \frac{dy/dt}{dx/dt} \\ & \frac{d^{2}y}{dx^{2}} = \frac{d}{dx} \left(\frac{dy}{dx}\right) \\ & = \frac{d}{dx} \left(\frac{dy}{dx}\right) \frac{dt}{dt} \\ & = \frac{d}{dx} \left(\frac{dy}{dx}\right) \frac{dt}{dt} \\ & = \frac{d}{dx} \left(\frac{dy}{dx}\right) \frac{dt}{dx} \\ & = \frac{d}{dt} \left(\frac{dy}{dx}\right) \frac{dt}{dx} \end{split}$$

Matrices and Calculus





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Eurvature of a curve:

The nate of bending of a europe in any. interval is called the curvature of the curve in that interval. It is denoted by k.

Note: The convature of a straight line is yoro.

Radius of curvature :

It is defined as the reciprocal of the curvabure of the curve and is denoted by P.

Note:

The nadius of inavabure at every point of the circle is equal to the nadius of the ranche i.e p=n

Hence the univature is, $k = \frac{1}{p} = \frac{1}{n}$

Formula for radius of curvature:

$$P = \frac{(1+y_1^2)^{3/2}}{(5y_2)^{3/2}} = \frac{\left[1+\left(\frac{dy_1}{dx}\right)^2\right]^{3/2}}{d^2y/dx^{2}}$$

where
$$y_1 = \frac{dy}{dx}$$
, $y_2 = \frac{d^2y}{dx^2}$
Note: When $\frac{dy}{dx}$ becomes ∞ , $P = \left[2 + \left(\frac{dx}{dy}\right)^2\right]^{\frac{3}{2}}$
is the alternative formula for radius of unvalue.

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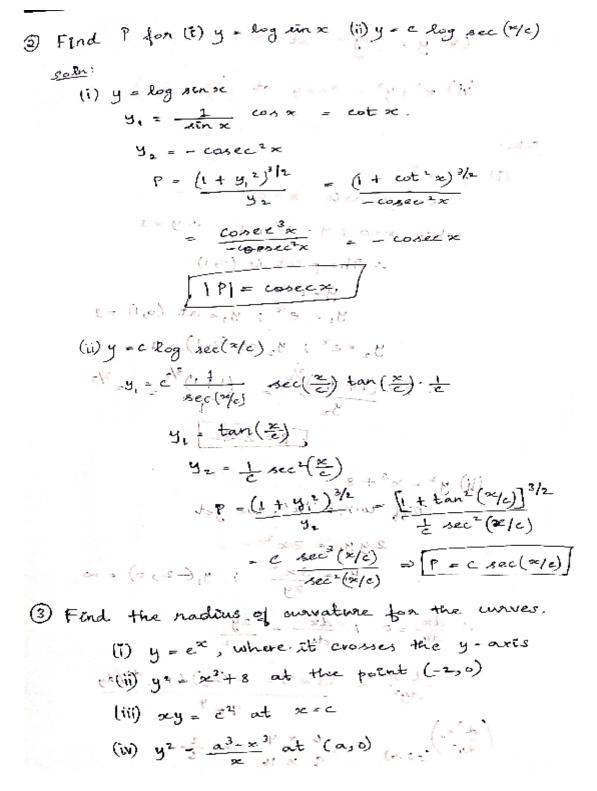
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Problems: and the second s D Find the nadius of curvature at any point of the catenany y = c cash (*/c) Soln: $y = c \cosh\left(\frac{y}{e}/c\right) \longrightarrow 0$ $y_1 = c \sinh\left(\frac{y}{e}/c\right) \frac{1}{e} - \sinh\left(\frac{y}{e}/c\right)$ $y_{2} = \cos \left(\frac{s_{1}}{c}\right) - \frac{1}{c}$ $P = \frac{\left(1 + \frac{y_{1}}{2}\right)^{\frac{3}{2}}}{\frac{y_{2}}{2}}$ $= \frac{\left(1 + \sin \lambda^{+} \left(\frac{x_{1}}{c}\right)\right)^{\frac{3}{2}}}{\cos \lambda \left(\frac{y_{1}}{c}\right)}$ $= \frac{\left(\cos \lambda^{2} \left(\frac{x_{1}}{c}\right)\right)^{\frac{3}{2}}}{\left(\cos \lambda^{2} - \sinh \lambda^{2}\right)}$ $= \frac{\left(\cos \lambda^{2} \left(\frac{x_{1}}{c}\right)\right)^{\frac{3}{2}}}{\cos \lambda \left(\frac{y_{1}}{c}\right)}$ $From D, \cos h (2/c) = 3/c$ subs this in @, we get $P = c \cdot \frac{y^2}{c^2}$ P = 9%/c) Olderender all





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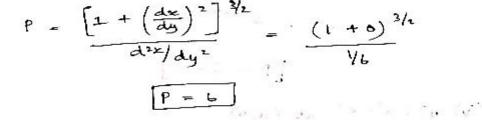
 $(v) y = \frac{\log x}{x}$ at x = 1(vi) $x^3 + y^3 = 3axy$ at $\left(\frac{3a}{2}, \frac{3a}{2}\right)$ Soln: (i) y = ex in the prime on y-axis x=0 when acco, y = e = 1 ... y = 1 .. The point is (0,1) $y = e^{x_1} = ||||$ $y_1 = e^{x_1}; y_1 = 1$ (91) =1 y = ex; y at (0,1) = 1 ... $P = \frac{(1+y_1)^{3/2}}{y_2} = \frac{(1+1)^{3/2}}{1} = 2^{2/2}$ [P=2.52 1 $\frac{1}{\left(\frac{1}{2}\right)^{n}} = \frac{1}{2} + \frac{1}{8} +$ $2 - y = 3z^{2}$ $(y_{1} = 3z^{2} + y_{1} = 3z^{2}$ $(y_{1} = 3z^{2} + y_{1} = 3z^{2}$ $(y_{1} = 3z^{2} + y_{1} = 3z^{2}$ $\frac{dx}{dy} = 0 \quad i \quad \frac{dx}{dy} = \frac{d^2 - y^2}{dy} = \frac{d^2 - y^2}{dy} = \frac{d^2 - y^2}{dy} \quad i \quad x \neq 1$ $\frac{d^{2}x}{dy^{2}} = \frac{(3^{2}x^{2})^{2} - (2y) 6xy}{dx^{2}dy}$ $(-2,0) = \frac{-6 \times 4}{4 \times 4} = \frac{1}{6} = 0$ $\left(\frac{d^2x}{d^2x}\right)$

Matrices and Calculus





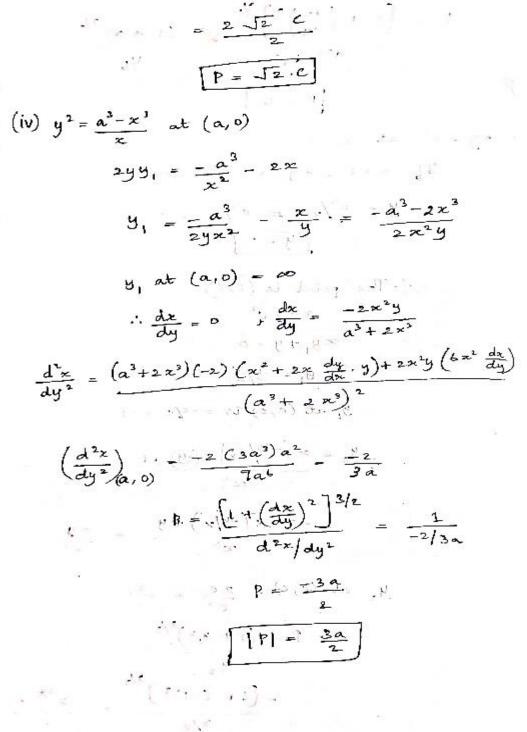
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$$(v) \ y = \frac{2eg_{x}}{x} \quad \text{at } x = i$$

$$y = \frac{1 - 2eg_{x}}{2t} \quad \text{when } x = i, \ y = e$$

$$(i, e) \ is \ the point.$$

$$y_{2} = \frac{x^{2}(1/n) - (1 - 2eg_{x})^{2} x}{x^{1}} = \frac{-1 - (1 - 2eg_{x})^{2}}{x^{2}}$$

$$y_{2} = \frac{-1 - (1 - 2eg_{x})^{2} x}{x^{2}} = \frac{-1 - (1 - 2eg_{x})^{2}}{x^{2}}$$

$$y_{2} = (1 + g_{1}t)^{2})^{2}h = (2)^{3}h = \frac{-1 - (1 - 2eg_{x})^{2}}{x^{2}}$$

$$y_{2} = (1 + g_{1}t)^{2})^{2}h = (2)^{3}h = \frac{-2\sqrt{2}}{2}$$

$$y_{1} = \frac{(1 + g_{1}t)^{2}}{y_{2}} = \frac{(2)^{3}h}{-3} = \frac{-2\sqrt{2}}{2}$$

$$(vi) \ x^{3} + y^{3} = 2axg \quad at \quad (\frac{3a}{2}, \frac{2a}{2})$$

$$3x^{2} + 3y^{2}y_{1} = 3a(xy_{1} + y)$$

$$3y_{1} (y^{2} - ax) = 3(ay - x^{2})$$

$$y_{1} = \frac{ay - x^{2}}{y^{2} - ax}$$

$$y_{1} = \frac{(3a + \frac{3a}{2})}{y_{1} - ax} = \frac{a \times \frac{3a}{2} - \frac{9a^{2}}{4}}{-\frac{9a^{2}}{4}}$$





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