



UNIT III DIFFERENTIAL CALCULUS

| DIFFERENTIAL CALCOLOS |
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| \mathcal{O} |
| Problems : |
| () Find the radius of curvature at any point of the |
| Catenary $y = c \cosh(x/c)$ |
| Sein : |
| $y = c \cosh(\pi/c) \longrightarrow 0$ |
| $y_i = c \cdot \sinh(\frac{x}{c}) - \frac{1}{c} - \sinh(\frac{x}{c})$ |
| $y_{\star} = \cosh\left(\frac{x}{c}\right) \cdot \frac{t}{c}$ |
| $P = (1+y_r^2)^{3/2}$ |
| $y_a = 3/a$ $\cosh^2 x - \sinh^2 x = 1$ |
| $= \left(1 + \sinh^2\left(\frac{x}{c}\right)\right)$ |
| cosh (x/c) 3/2 |
| $= (\cosh^{+}(x/c)) \cdot c$ |
| cosh (*/c) |
| $\rho = c \cosh^2(x/c) \rightarrow \bigcirc$ |
| From (), $\cosh(x/c) = y/c$ |
| subs this in 3, we get. |
| $P = C \cdot y^2 / c^2$ |
| $\left[P = y^2 / c \right]$ |



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(2) Find
$$l^{2}$$
 for $(y' y = \log \sin x)$ (i) $y = c \log \sec(x/c)$
Soln:
(i) $y = \log 9 \ln x$
 $y_{1} = \frac{1}{\sin x} \cos x = \cot x$
 $y_{2} = -\csc^{2} x$
 $l = \frac{(1+y_{1}^{2})^{3/2}}{y_{3}} = \frac{(1+\cot^{2} x)^{3/2}}{-\csc^{2} x}$
 $= \frac{\cos^{2} c^{3} x}{-\csc^{2} x} = -\csc^{2} x$
 $\int |p| = \csc^{2} x$
 $y_{1} = c \log \sec^{2} (x/c)$
 $y_{1} = \frac{1}{\sec^{2} (x/c)}$
 $g_{2} = \frac{1}{c} - \frac{\sec^{2} (x/c)}{y_{2}} = \frac{(1+\tan^{2} (x/c))}{\frac{1}{c} \sec^{2} (x/c)}$
 $l = \frac{(1+y_{1}^{2})^{3/2}}{y_{2}} = \frac{(1+\tan^{2} (x/c))}{\frac{1}{c} \sec^{2} (x/c)}$





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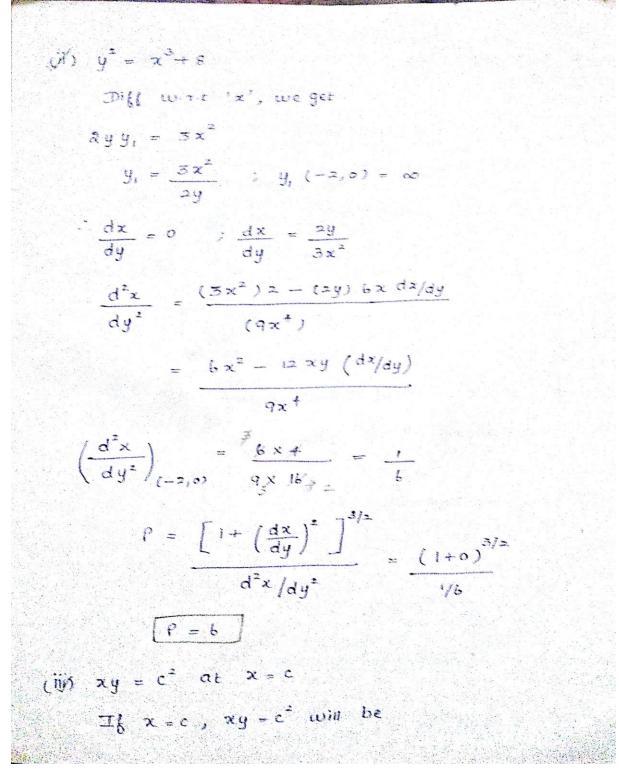
(c)
(3) Find the radius of curvature for the curves
(i)
$$y = e^{x}$$
, where it crosses the y-axis
(ii) $y^{2} = x^{3} + 8$ at the Point $(-2, 0)$
(iii) $xy = c^{2}$ at $x = c$
(iv) $y^{2} = \frac{a^{3} - x^{3}}{x}$ at $(a, 0)$
(v) $y = \frac{\log x}{x}$ at $x = 1$
(v) $x^{3} + y^{3} = 3axy$ at $\left(\frac{3a}{2}, \frac{3a}{2}\right)$
Solon:
(if) $y = e^{x}$
On y-axis $x = 0$
when $x = 0$, $y = e^{x} = 1$ if $y = 1$
if The Point is $(0, 1)$
 $y = e^{x}$
 $y_{1} = e^{x}$; y_{1} at $(0, 1) = 1$
 $y_{2} = e^{x}$; y_{2} at $(0, 1) = 1$
 $\therefore P = \left(1 + y_{1}^{2}\right)^{3/2} = \left(1 + 1\right)^{3/2} = \frac{3/2}{2}$



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