(4) When tangent is making equal Non Zero Intercepts

I^2

$$\Rightarrow m = -1$$

$$\angle\theta = 135° \quad \boxed{\frac{dy}{dx} = -1}$$
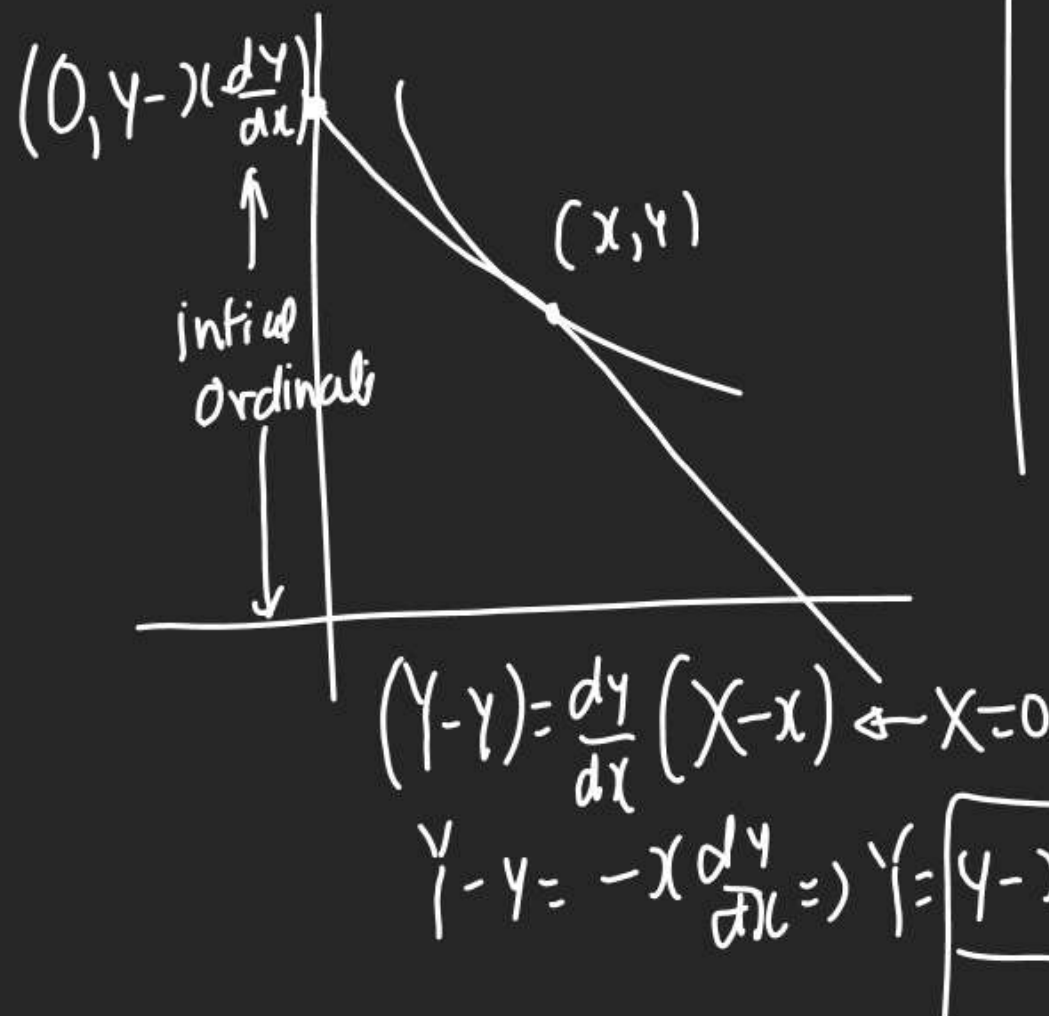
(5) When normal is making equal non Zero Intercept

$$\frac{-1}{\left(\frac{dy}{dx}\right)} = -1 \Rightarrow \boxed{\frac{dy}{dx} = 1}$$

(6) Initial Ordinate = y intercept

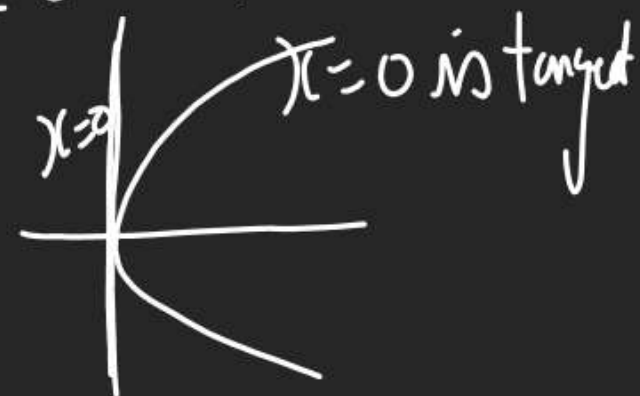When tangent is cutting Y Axis then ordinate at y axis is also known as Initial Ordinate.

$\left(0, y - x\left(\frac{dy}{dx}\right)\right)$

↑ initial ordinate

(x, y)

$$(Y - y) = \frac{dy}{dx}(X - x) \leftarrow X = 0$$

$$Y - y = -x\frac{dy}{dx} \Rightarrow Y = \boxed{y - x \cdot \frac{dy}{dx}}$$

(7) If curve is Passing through origin then Eq^n of tangent can be find directly

$$\boxed{\text{Putting least degree term} = 0}$$

① $Y^2 = 4ax$ find EOT. at $(0,0)$

$\rightarrow y^2 = 4ax$ is P.T. $(0,0)$

deg = 2 deg = 1 (छोटी)

EOT $\rightarrow 4ay = 0$

$x = 0$ is tangent

$x = 0$

Q $x^3+y^3-3xy=0$

find EOT ?

1) $x^3+y^3-3xy=0$ has no

(onstant term =) it is

Passing thru $(0,0)$

$0^3+0^3-3\times0\times0=0$

$0=0$ ✓

(2) EOT

$x^3+y^3-3xy=0$

③ ③ ② (chhoti)

$3xy=0 =) x=0$ OS $y=0$

X Axis & y Axis

both are tangent to curve

Q Find Pt. on Curve.

$$\frac{1}{2\sqrt{x}}+\frac{1}{2\sqrt{y}}\frac{dy}{dx}=0$$

$\sqrt{x}+\sqrt{y}=\sqrt{a}$. Where $\frac{dy}{dx}=-\frac{\sqrt{y}}{\sqrt{x}}$

1) tangent is $\parallel$ to X Axis

$$\frac{dy}{dx}=0 =) -\frac{\sqrt{y}}{\sqrt{x}}=0=) y=0$$

in Curve $\rightarrow \sqrt{x}+\sqrt{0}=\sqrt{a}$

$=) x=a$

$\therefore$ Pt $=(a,0)$

(2) tanget is $\parallel^{r1}$ to y Axis

$$\frac{dy}{dx}=\frac{1}{0}=) -\frac{\sqrt{y}}{\sqrt{x}}=\frac{1}{0} =) \sqrt{x}=0$$

$x=0$

in Curve

$\sqrt{0}+\sqrt{y}=\sqrt{a} =) y=a$

$\therefore$ Pt. $(0,a)$

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(3) tangent is equally inclined.

$$\frac{dy}{dx}=\pm1 =) -\frac{\sqrt{y}}{\sqrt{x}}=\pm1$$

$$\frac{\sqrt{y}}{\sqrt{x}}=\mp1 =) \sqrt{y}=\mp\sqrt{x}$$

$=) \underline{y=x}$ in

Curve

$\sqrt{x}+\sqrt{x}=\sqrt{a} =) 2\sqrt{x}=\sqrt{a}$

$\sqrt{x}=\frac{\sqrt{a}}{2} =) x=\frac{a}{4}=y$

$\therefore$ Pt. $\left(\frac{a}{4},\frac{a}{4}\right)$

Q. E OT. to Curre

$$Y = 2\sin x + \sin 2x \text{ at } x = \frac{\pi}{3}$$

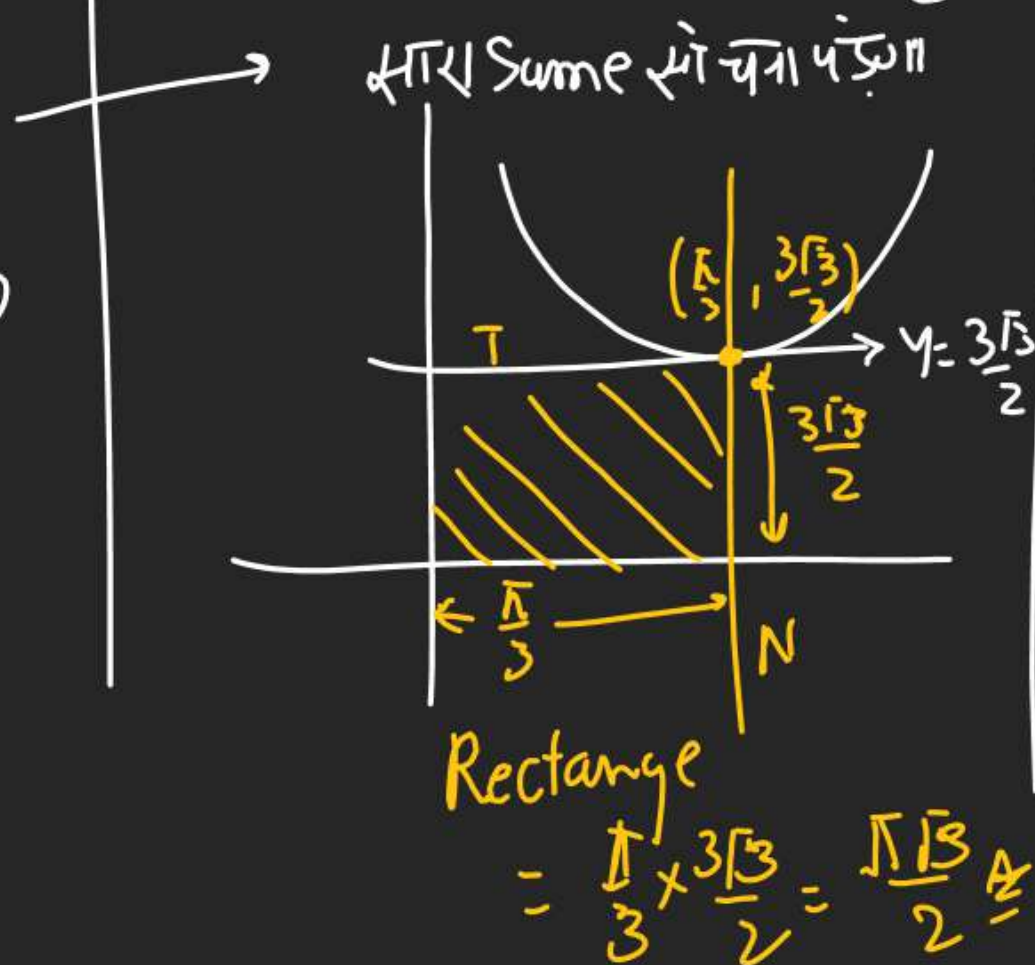① $Y = 2\sin\frac{\pi}{3} + \sin\frac{2\pi}{3} = \frac{2\sqrt{3}}{2} + \frac{\sqrt{3}}{2}$

$$= \frac{3\sqrt{3}}{2}$$

$$Pt\left(\frac{\pi}{3}, \frac{3\sqrt{3}}{2}\right)$$

② $\left.\frac{dy}{dx}\right| = 2\cos x + 2\cos 2x$

$x = \frac{\pi}{3} = 2\times\frac{1}{2} + 2\times\left(-\frac{1}{2}\right) = 0$

③ $EOT \rightarrow \left(Y - \frac{3\sqrt{3}}{2}\right) = 0\left(x - \frac{\pi}{3}\right)$

$$\boxed{Y = \frac{3\sqrt{3}}{2}} \text{ is EOT.}$$

Same Qs would be given ↓

Q Find area of Quadrilateral made by tangent, Normal & Cord. axes by the Curve.
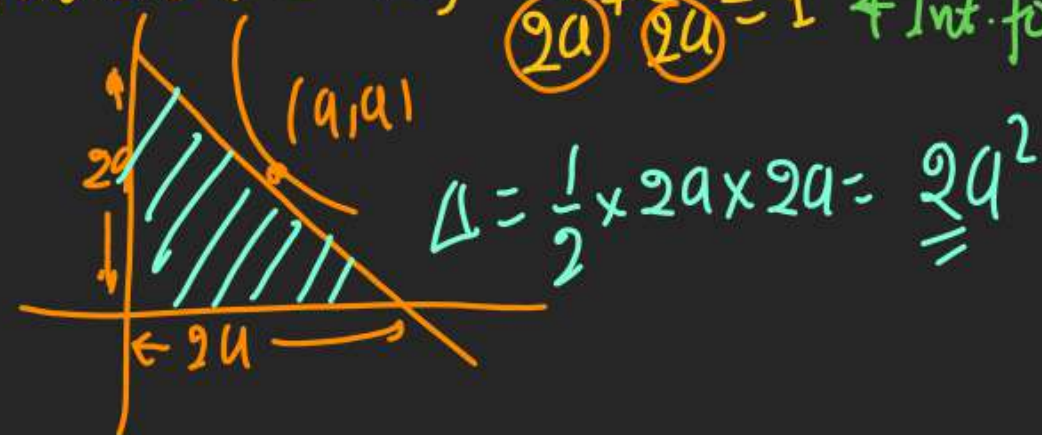
$Y = 2\sin x + \sin 2x$ at $x = \frac{\pi}{3}$.

भाई Same सोचना पड़ेगा

Rectange $= \frac{\pi}{3} \times \frac{3\sqrt{3}}{2} = \frac{\pi\sqrt{3}}{2}$

Q Find EOT at (a, a) to Curve $\frac{1}{\sqrt{x}} + \frac{1}{\sqrt{y}} = \frac{2}{\sqrt{a}}$

1) Curve $\rightarrow x^{-1/2} + y^{-1/2} = \frac{2}{\sqrt{a}}$

$-\frac{1}{2}x^{-3/2} - \frac{1}{2}y^{-3/2}\cdot\frac{dy}{dx} = 0$

$\left.\frac{dy}{dx}\right| = -\left(\frac{x}{y}\right)^{-3/2} = -\frac{y\sqrt{y}}{x\sqrt{x}} = -\frac{a\sqrt{a}}{a\sqrt{a}} = -1$
(a, a)

2) $EOT \rightarrow (Y - a) = -1(x - a) \Rightarrow \boxed{x + y = 2a}$

Q Find area of △ made by Intercepts co axes to the tangent at Curve $\frac{1}{\sqrt{x}} + \frac{1}{\sqrt{y}} = \frac{2}{\sqrt{a}}$

विभिन्न Qs & EOT $\rightarrow \frac{x}{2a} + \frac{y}{2a} = 1$ ← Int. for.

$\Delta = \frac{1}{2} \times 2a \times 2a = \underline{2a^2}$

Q) find EOT at (x_1, y_1) to curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$

① If (x_1, y_1) is on curve.

$$\sqrt{x_1} + \sqrt{y_1} = \sqrt{a}.$$

② $\dfrac{1}{2\sqrt{x}} + \dfrac{1}{2\sqrt{y}} \cdot \dfrac{dy}{dx} = 0 \Rightarrow \dfrac{dy}{dx}\Big| = -\dfrac{\sqrt{y}}{\sqrt{x}} = -\dfrac{\sqrt{y_1}}{\sqrt{x_1}}$

(x_1, y_1)

3) EOT

$\rightarrow (y - y_1) = -\dfrac{\sqrt{y_1}}{\sqrt{x_1}} (x - x_1)$

$\Rightarrow \dfrac{y}{\sqrt{y_1}} - \sqrt{y_1} = -\dfrac{x}{\sqrt{x_1}} + \sqrt{x_1}$

$\Rightarrow \dfrac{x}{\sqrt{x_1}} + \dfrac{y}{\sqrt{y_1}} = \sqrt{x_1} + \sqrt{y_1}$

$\dfrac{x}{\sqrt{x_1}} + \dfrac{y}{\sqrt{y_1}} = \sqrt{a}$

$x^m + y^m = a^m.$

has EOT at (x_1, y_1)

is $\dfrac{x}{(x_1)^{1-m}} + \dfrac{y}{(y_1)^{1-m}} = a^m.$

$\sqrt{x} + \sqrt{y} = \sqrt{a}$ then EOT at (x_1, y_1)

$\dfrac{x}{(x_1)^{1-1/2}} + \dfrac{y}{(y_1)^{1-1/2}} = a^{1/2}$

$\dfrac{x}{\sqrt{x_1}} + \dfrac{y}{\sqrt{y_1}} = \sqrt{a}$

Q) Find Sum of **Intercept** made by

Main tangent at (x_1, y_1) to the curve

$\sqrt{x} + \sqrt{y} = \sqrt{a}$

$EOT \rightarrow \dfrac{x}{\sqrt{x_1}} + \dfrac{y}{\sqrt{y_1}} = \sqrt{a}$

Int. for $\Rightarrow \dfrac{x}{\sqrt{a}\sqrt{x_1}} + \dfrac{y}{\sqrt{a}\sqrt{y_1}} = 1$

Sum of Int $= \sqrt{a}\sqrt{x_1} + \sqrt{a}\sqrt{y_1}$

$= \sqrt{a}(\sqrt{x_1} + \sqrt{y_1}) = \sqrt{a}\,\sqrt{a} = a$

Q) WOTF pts lie on tangent to curve

Main $x^4 e^y + 2\sqrt{y+1} = 3$ at pt. $(1, 0)$

$(2, 2)$ // $(-2, 6)$ $(-2, 4)$ $(2, 6)$

1) $x^4 e^y \cdot \dfrac{dy}{dx} + 4x^3 e^y + \dfrac{2}{2\sqrt{y+1}} \cdot \dfrac{dy}{dx} = 0 \leftarrow x=1$ $\leftarrow y=0$

$1 \cdot 1 \cdot \dfrac{dy}{dx} + 4 \times 1 \times 1 + \dfrac{2}{2} \cdot \dfrac{dy}{dx} = 0 \Rightarrow \dfrac{dy}{dx} = -2$

2) $(y - 0) = -2(x - 1) \Rightarrow 2x + y = 2$

$2x - 2 + 6 = 2$ ✓✓

Q If tangent to $y = x + \sin x$ at (a, b) is $\parallel^{rel}$ to line joining pts $\left(0, \frac{3}{2}\right)$ & $\left(\frac{1}{2}, 2\right)$ then.

Mains

$b = a$ $\qquad b = \frac{\pi}{2} + a$ $\qquad |b - a| = 1$ $\qquad |a + b| = 1$

① tangent is $\parallel^{rel}$ to line

$\downarrow$

$\dfrac{dy}{dx} = m$

$\left.\dfrac{dy}{dx}\right| = 1 + \cos x$

(a, b)
$= 1 + \cos a$

$1 + \cos a = \dfrac{2 - \frac{3}{2}}{\frac{1}{2} - 0} = 1$

$\cos a = 0 \Rightarrow a = \dfrac{\pi}{2}$

② (a, b) also lies on curve $y = x + \sin x$

$|b - a| = 1 \leftarrow$ $\boxed{a = \dfrac{\pi}{2}}$ $\quad b = a + \sin a$ $\boxed{b = \dfrac{\pi}{2} + 1}$

Q For Curve.

$x^4 + y^4 = a^4$ if Intercept made by tangent are $\underline{P}$ & $\underline{Q}$

find $(P)^{-\frac{4}{3}} + (Q)^{-\frac{4}{3}} = ?$

1) Pt in not given let's assume it (x_1, y_1)

2) $x_1^4 + y_1^4 = a^4$ ✓

3) EOT $\to$ $\dfrac{x}{(x_1)^{1-4}} + \dfrac{y}{(y_1)^{1-4}} = a^4$

Int $\boxed{\dfrac{x}{x_1^{-3} \cdot a^4}} + \boxed{\dfrac{y}{y_1^{-3} \cdot a^4}} = 1$

$P \qquad\qquad Q$

$(P)^{-\frac{4}{3}} + (Q)^{-\frac{4}{3}} = \left(x_1^{-3} \cdot a^4\right)^{-\frac{4}{3}} + \left(y_1^{-3} \cdot a^4\right)^{-\frac{4}{3}}$

$x_1^4 \cdot a^{-16/3} + y_1^4 \cdot a^{-16/3}$

$a^{-16/3} (x_1^4 + y_1^4) = a^{-16/3} \cdot a^4$

$= a^{4 - \frac{16}{3}} = a^{-\frac{4}{3}}$

$\underline{ax + by + c = 0}$

Q Value of Parameter a Such that line $\left(\log_2(1 + 5a - a^2)\right) x - 5y - (a^2 - 5) = 0$ is $\boxed{normal}$ to Curve $\boxed{xy = 1}$ may lie in Interval.?

① $xy = 1 \Rightarrow y = \dfrac{1}{x} \Rightarrow \dfrac{dy}{dx} = \dfrac{-1}{x^2}$

$(\text{Sl})_N = \dfrac{+\frac{1}{1}}{+\frac{1}{x^2}} = x^2 > 0$

② $(\text{Sl})_{line} = \dfrac{+\log_2(1 + 5a - a^2)}{+5} > 0$

$\log_2(1 + 5a - a^2) > 0$

$1 + 5a - a^2 > 1 \Rightarrow a^2 - 5a < 0$

$\Rightarrow 0 < a < 5$

Q At What Pt. tangent to the Curve $y = G_3(x+y)$ is $\parallel^{vt}$ to.

$\boxed{x + 6y = 0}$ if $-2\pi \leq x \leq 2\pi$

1) tangent $\parallel$ line.

$(Sl)_T = (Sl)_{line} = \frac{-1}{2} = \frac{dy}{dx}$

(2) $(Sl)_T \to \frac{dy}{dx} = -\sin(x+y)\left(1 + \frac{dy}{dx}\right)$

$+\frac{1}{2} = +\sin(x+y)\left(1 - \frac{1}{2}\right)$

$\frac{1}{2} = \sin(x+y) \cdot \frac{1}{2}$

$\sin(x+y) = 1 \quad \overset{30°}{\text{,}} \quad L^{st}/2^{nd}$

$G_3(x+y) = 0 \quad \Big\} \; 2 \; \text{Solution}$

$x - y + 1 = 0$

Q A diff. fxn $y = f(x)$ Satisfies.

$f'(x) = f^2(x) + 5$ & $f(0) = L$ then EOT

at Pt. in there Curve Crosses (Y Axis) is.)

$x - 2y + 1 = 0 \quad \overset{=}{\text{}} 6 \; x - y + 1 = 0 \quad x - 2y - 1 = 0.$

① Y Axis → $(0, 1)$ De Rakha.

② Slope → $f'(x) = f^2(x) + 5$

$\overset{x=0}{\underset{y=1}{}} f'(0) = f^2(0) + 5 = 1^2 + 5 = 6 \Rightarrow \frac{dy}{dx}\Big|_{x=0} = 6$

(3) EOT. → $(y-1) = 6(x-0)$

$\Rightarrow 6x - y + 1 = 0$

Q. EOT / EON.

HW.

to Curve $x = \dfrac{2at^2}{1+t^2}$, $y = \dfrac{2at^3}{1+t^2}$; $t = \dfrac{1}{2}$

Q. If line $x+y=a$ is tangent to

$2x^2 + 3y^2 = 6$ then a ?

$\dfrac{x^2}{3} + \dfrac{y^2}{2} = 1 \to$ Ellipse.

$a^2 = 3, \; b^2 = 2$

line $\to y = -x + a \longrightarrow m = -1$

$a = \pm\sqrt{3 \times (-1)^2 + 2}$

$\boxed{a = \pm\sqrt{5}}$

$\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$

& $y = mx + c$ is tangent then

$c = \pm\sqrt{a^2 m^2 + b^2}$

M2

$x+y=a$ is tangent to

$2x^2 + 3y^2 = 6$

$2x^2 + 3(a-x)^2 = 6$ ← Combined Eqn.

$2x^2 + 3a^2 + 3x^2 - 6ax - 6 = 0$

$5x^2 - 6ax + 3a^2 - 6 = 0$

$D = 0 \leftarrow$ cond^n of tanget

$(-6a)^2 - 4 \times 5 \times (3a^2 - 6) = 0$

$36a^2 - 60a^2 + 120 = 0$

$24 a^2 = 120$

$a = \pm\sqrt{5}$

T&N &

Q1-44.