Stage 1:

1. (a)

$$y' = (x)'(x-10)^4 + [x(x-10)^4]'$$

$$= (x-10)^4 + 4x(x-10)^3$$

$$\text{JE MATHS}$$

 $=(x-10)^3(5x-10)$

JE MATHS

JE MATHS

$$=5(x-2)(x-10)^3$$

let y' = 0

JE MATHS

JE MATHS

$$5(x-2)(x-10)^3=0$$

x = 2.10

JE MATHS

(b)

$$y' = (x^4)'(x-1)^3 + x^4 [(x-1)^3]'$$

JE MATHS

$$=4x^3(x-1)^3+3x^4(x-1)^2$$

$$=x^{3}[4(x-1)^{3}+3x(x-1)^{2}]$$

JE MATHS

$$= x^3 (7x + 4)(x-1)^2$$

JE MATHS

let
$$v' = 0$$

$$x^3(7x-4)(x-1)^2=0$$

JE MATHS

$$x = 0, \frac{4}{7}, 1$$

$$y' = (2x)'(x+5)^3 + 2x[(x+5)^3]'$$

= $2(x+5)^3 + 6x(x+5)^2$

JE MATHS

$$= 2(4x+5)(x+5)^2$$

let $y' = Q_{HS}$

JE MATHS

$$2(4x+5)(x+5)^2 = 0$$

$$x = -\frac{5}{4}, -5$$

(d) $y' = (x^2)'(2x-4)^3 + x^2[(2x-4)^3]'$ $=2x(2x-4)^3+x^2\cdot 3\cdot 2(2x-4)^2$ $=2x\left[(2x^{\frac{1}{2}}4)^{3}+3x(2x-4)^{2}\right]$ $=2x(5x-4)(2x-4)^2$ $=8x(5x-4)(x-2)^2$ let y' = 0 $8x(5x-4)(x-2)^2=0$

JE MATHS

 $x = 0, \frac{4}{5}, 2$

IB MATHS $y' = (x^3)'(1-3x^2)^4 + x^3[(1-3x^2)^4]'$

 $=3x^2(1-3x^2)^4+x^3\cdot 4\cdot -6x\cdot (1-3x^2)^3$ JE MATHS $=3x^{2} \left[(1-3x^{2})^{4} - 8x^{2} (1-3x^{2})^{3} \right]$ $=3x^{2} (1-3x^{2} - 8x^{2})(1-3x^{2})^{3}$

 $=3x^2(1-11x^2)(1-3x^2)^3$ JE MATHS

let y' = 0

 $3x^2(1-11x^2)(1-3x^2)^3=0$

 $x = 0, \pm \sqrt{\frac{1}{11}}, \pm \sqrt{\frac{1}{3}}_{MATHS}$

 $x = 0, \pm \frac{\sqrt{11}}{11}, \pm \frac{\sqrt{3}}{3}$

JE MATHS

(f) $y' = (x^4)'(x^2 + x)^3 + x^4[(x^2 + x)^3]'$ $=4x^{3}(x^{2}+x)^{3}+3x^{4}(2x+1)(x^{2}+x)^{2}$ JE MATHS $= x^{3}(x^{2} + x)^{2} \left[4(x^{2} + x) + 3x(2x + 1) \right]$ IE MATHS $=x^{3}(x^{2}+x)^{2}(4x^{2}+4x+6x^{2}+3x)$ $=x^{6}(x+1)^{2}(10x+7)$ JE MATHS JE MATHS let y' = 0 $x^{6}(x+1)^{2}(10x+7)=0$ JE MATHS $x = 0, -1, -\frac{7}{10}$ JE MATHS JE MATHS (g) $y' = 1(2x+1)^3 + (x-2) \cdot 3 \cdot 2 \cdot (2x+1)^2$ JE MATHS $=(2x+1)^2[2x+1+6(x-2)]$ JE MATHS $=(2x+1)^2(8x-11)$ let v' = 0JE MATHS $(2x+1)^2(8x-11)=0$ $x = -\frac{1}{2}, \frac{11}{8}$ JE MATHS (h) $y' = 2 \cdot 3(3x+1)(4x+5)^3 + (3x+1)^2 \cdot 3 \cdot 4 \cdot (4x-5)^2$

(h) $y' = 2 \cdot 3(3x+1)(4x-5)^3 + (3x+1)^2 \cdot 3 \cdot 4 \cdot (4x-5)^2$ $= 6(3x+1)(4x-5)^2[4x-5+2(3x+1)]$ $= 6(3x+1)(10-3)(4x-5)^2$ let y' = 0 |B| MATHS |B| MATHS

$$6(3x+1)(10-3)(4x-5)^2 = 0$$
$$x = -\frac{1}{3}, \frac{3}{10}, \frac{5}{4}$$

(i)

$$y' = -4\pi x(x^2 - 3x + 1)^3 + 3(2x - 3)(x^2 - 3x + 1)^2 \cdot -2\pi x^2$$
$$= -2\pi x(x^2 - 3x + 1)^2[2(x^2 - 3x + 1) + 3x(2x - 3)]$$

 $= -2\pi x (\bar{x}^{2|S} - 3x + 1)^2 (8x^2 - 15x + 2)$ IB MATHS

IS IE MATHS

let y' = 0

$$-2\pi x(x^2-3x+1)^2(8x^2-15x+2)=0$$

JE MATHS

for
$$x^2 - 3x + 1 = 0$$

for
$$8x^2 - 15x + 2 = 0$$

$$\Delta = (-3)^2 - 4 \cdot 1 \cdot 1 = 5$$

$$\Delta = 15^2 - 4 \cdot 8 \cdot 2 = 161$$

$$x = \frac{3 \pm \sqrt{5}}{2}$$

$$x = \frac{15 \pm \sqrt{161}}{2 \cdot 8} = \frac{15 \pm \sqrt{161}}{16}$$

 $x = 0, \frac{3 \pm \sqrt{5}}{2}, \frac{15 \pm \sqrt{161}}{16}$

JE MATHS

(j)

$$y' = 2\sqrt[3]{x+2} + 2x \cdot \frac{1}{2}(x+2)^{-\frac{1}{2}}$$

JE MATHS

$$=2\sqrt{x+2}+\frac{x}{\sqrt{x+2}}$$

$$=\frac{3x+4}{\sqrt{x+2}}$$

let y' = 0

JE MATHS

JE MATHS

$$\frac{3x+4}{\sqrt{x+2}} = 0$$

$$x = -\frac{4}{3}$$

JE MATHS

JE MATHS

$$y' = -6x\sqrt{3-x} - 3x^2 \cdot \frac{1}{2} \cdot -1(3-x)^{-\frac{1}{2}}$$

$$= -6x\sqrt{3\pi x} + \frac{3x^2}{2} \frac{1}{\sqrt{3-x}}$$

JE MATHS

JE MATHS

$$=\frac{-12x(3-x)+3x^2}{2\sqrt{3-x}}$$

$$=\frac{15x^2-36x}{2\sqrt{3-x}}$$

JE MATHS

JE MATHS

$$=\frac{3x(5x-12)}{2\sqrt{3-x}}$$

JE MATHS

let
$$y' = 0$$

$$x = 0, \frac{12}{5}$$

$$JB MATHS$$

JE MATHS

(I)

JE MATHS

$$y' = 2x\sqrt{1 - x^2} + x^2 \cdot \frac{1}{2} \cdot -2x(1 - x^2)^{-\frac{1}{2}}$$

JE MATHS

$$=2x\sqrt{1-x^2} + \frac{x^3}{\sqrt{1-x^2}}$$
JE MATHS

$$=\frac{2x-2x^3-x^3}{\sqrt{1-x^2}}$$

$$= \frac{x(2-3x^2)}{\sqrt{1-x^2}}$$
JE MATHS

JE MATHS

let
$$y' = 0$$

$$\frac{x(2-3x^2)}{\sqrt{1_{\mathbb{R}}} x^2_{\mathbb{A}} \mathbb{TH}} = 0$$

JE MATHS

$$x = 0, \pm \sqrt{\frac{2}{3}} = 0, \pm \frac{\sqrt{6}}{3}$$

(m)

$$y' = -4x\sqrt{4-x^2} + (3-2x^2) \cdot \frac{1}{2} \cdot -2x(4-x^2)^{-\frac{1}{2}}$$

$$= -4x\sqrt{4-x^2} - \frac{x(3-2x^2)}{\sqrt{4-x^2}}$$

$$= \frac{-4x(4-x^2) - 3x + 3x^3}{\sqrt{4-x^2}}$$

$$= \frac{-19x + 6x^3}{\sqrt{4-x^2}}$$

$$= \frac{x(6x^2 - 19)}{\sqrt{4-x^2}}$$
let $y' = 0$

$$x = 0, \pm \sqrt{\frac{19}{6}} = 0, \pm \frac{\sqrt{114}}{6}$$

$$y' = mx^{m-1}(a-x)^n + x^m \cdot -1 \cdot n(a-x)^{m-1}$$

$$= (a-x)^{m-1}[mx^{m-1}(a-x)^{m-1}]$$

$$= (a-x)^{m-1}(amx^{m-1} - mx^m - nx^m)$$

$$= (a-x)^{m-1} \cdot x^{m-1} \cdot (am - mx - nx)$$
let $y' = 0$

$$(a-x)^{m-1} \cdot x^{m-1} \cdot (am - mx - nx) = 0$$
For $am - mx - nx = 0$

$$mx + nx = am$$

EMATHS

EMATHS

since
$$\frac{am}{m+n} = \frac{a}{1+\frac{m}{n}} \to 0 < \frac{a}{1+\frac{m}{n}} < a$$

ie $x = \frac{am}{m+n}$ is the x-coordinate of the point T which lies between 0 and a.

$$\int \frac{am}{m+n} = \left(\frac{am}{m+n}\right)^m \left(a - \frac{am}{m+n}\right)^n$$

$$= \frac{a^m m^m}{(m+n)^m} \left(\frac{am+an-am}{m+n}\right)^n$$

$$= \frac{a^m a^n m^m n^n}{(m+n)^m (m+n)^n}$$

$$= \frac{a^{m+n} m^m n^n}{(m+n)^{m+n}}$$
ans:
$$T\left(\frac{am}{m+n}, \frac{a^{m+n} m^m n^n}{(m+n)^{m+n}}\right)$$
(ii)
$$x = \frac{am}{m+n} \text{ (when } m=n)$$

$$= \frac{am}{2m} \text{ (when } m=n)$$

$$= \frac{am}{2} \text{ (when } m=n)$$

$$= \frac{a}{2} \text{ (when } m=n)$$

$$= \left(\frac{a}{2}\right)^m \cdot \left(\frac{a}{2}\right)^n \text{ (when } m=n)$$

$$= \left(\frac{a}{2}\right)^{m+n} \text{ (when } m=n)$$

$$= \left(\frac{a}{2}\right)^{m+n} \text{ (when } m=n)$$

$$= \left(\frac{a}{2}\right)^{2m} \text{ (when } m=n)$$

3. (a)

$$y' = (uv)'w + (uv)w'$$

$$= w(u'v + uv') + uvw'$$

$$= u'vw + uv'w + uvw'$$

JE MATHS

JE MATHS

(b)

$$y' = 1(x-1)^{4} \sqrt{2x+1} + x \cdot 4(x-1)^{3} \sqrt{2x+1} + x(x-1)^{4} \cdot \frac{1}{2} \cdot 2(2x+1)^{-\frac{1}{2}}$$

$$= (x-1)^{4} \sqrt{2x+1} + 4x(x-1)^{3} + \frac{x(x-1)^{4}}{\sqrt{2x+1}}$$

$$=\frac{(x-1)^4(2x+1)+4x(x-1)^3(2x+1)+x(x-1)^4}{\sqrt{2x+1}}$$

JE MATHS

$$=\frac{(x-1)^{3}\left[(x-1)(2x+1)+4x(2x+1)+x(x-1)\right]}{\sqrt{2x+1}}$$

JE MATHS

$$=\frac{(x-1)^3\left(10x^2-2x+5x-1+x^2-x\right)}{\sqrt{2x+1}}$$

JE MATHS

$$=\frac{(x_{|\mathbb{S}|}1)^3(11x^2+2x-1)}{\sqrt{2x+1}}$$

JE MATHS

let y' = 0

JE MATHS

$$11x^2 + 2x - 1 = 0$$

$$\Delta = 2^2 - 4 \cdot 11 \cdot -1 = 48$$

JE MATHS

$$x = \frac{-2 \pm 4\sqrt{3}}{2 \cdot 11} = \frac{-1 \pm 2\sqrt{3}}{18 \, \text{M} \, 11^{130}}$$

ans: $x = 1, \frac{-1 \pm 2\sqrt{3}}{11}$

JE MATHS

JE MATHS

Stage 2:

1. (a)

$$y' = \frac{4(2x+1) - 2(4x-1)}{(2x+1)^2}$$

$$=\frac{\sqrt{6}(ATHS)}{(2x+1)^2}$$

JE MATHS

JE MATHS

let y' = 0

$$\frac{6}{(2x+1)^2} = 0$$

JE MATHS

JE MATHS

no solution for x

JE MATHS

(b)

$$y' = \frac{2(x^2 - 2) - 2x(2x)}{(x^2 - 2)^2}$$

JE MATHS

$$=\frac{-2x^2-4}{(x^2-2)^2}$$

JE MATHS

let
$$y_{\mathbb{S}}' \neq 0^{\mathbb{H}^{\mathbb{S}}}$$

JE MATHS

$$\frac{-2x^2-4}{(x^2-2)^2}=0$$

JE MATHS

$$-2x^2 - 4 = 0$$

JD -

$$-2x^2 = 4$$

JE MATHS

 $x^2 = -2$ no real solution for x

JE MATHS

JE MATHS

$$y' = \frac{2x(x^2+1) - 2x(x^2-4)}{(x^2+1)^2}$$

$$= \frac{10x}{(x_{|\mathbb{S}}^2 + 1)^{2/3}}$$

JE MATHS

JE MATHS

let y' = 0

$$\frac{10x}{(x^2+1)^2} = 0$$

JE MATHS

JE MATHS

x = 0

(d)

$$y' = \frac{6x(x^3 - 2) - 3x^2(3x^2)}{(x^3 - 2)^2_{\text{IB MATHS}}}$$

JE MATHS

JE MATHS

$$=\frac{6x^4 - 12x - 9x^4}{(x^3 - 2)^2}$$

 $= \frac{-3x^4 - 12x}{(x^3 - 2)^2}$ let y' = 0

JE MATHS

JE MATHS

$$\frac{-3x^4 - 12x}{\left(x^3 - 2\right)^2} = 0$$

JE MATHS

 $-3x^4 - 12x = 0$

 $-3x(x^3 + 4) = 0$

JE MATHS

 $x = 0, \sqrt[3]{-4}$ JB MATHS

JE MATHS

JE MATHS

(e)

$$y' = \frac{2(x-1)(x^2+2x) - (2x+2)(x-1)^2}{(x^2+2x)^2}$$

$$= \frac{2(x-1) \left[x^2 + 2x - (x+1)(x-1) \right]}{\mathbb{I}^{\mathbb{N}} \mathbb{I}^{\mathbb{N}^{\mathbb{N}}} x^2 (x+2)^2}$$

JE MATHS

JE MATHS

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

let
$$y' = 0$$

JE MATHS

JE MATHS

$$\frac{2(x-1)(2x+1)}{x^2(x+2)^2} = 0$$

$$2(x-1)(2x+1) = 0$$

JE MATHS

$$x = 1, -\frac{1}{2}$$
 JB MATHS

JE MATHS

(f)

(f)

$$y' = \frac{2 \cdot 3(3x-1)(x^2-x) - (2x-1)(3x-1)^2}{(x^2-x)^2}$$
JE MATHS

 $=\frac{(3x-1)\left[6(x^2-x)-(2x-1)(3x-1)\right]}{(x^2-x)^2}$

JE MATHS

$$= \frac{(3x-1)(6x^2-6x-6x^2+5x)^{\mathbb{E}[1]}}{x^2(x-1)^2}$$

$$=\frac{(3x-1)(-x-1)}{x^2(x-1)^2}$$

JE MATHS

$$= \frac{(1-3x)(x+1)}{x^2(x-1)^2} I^{\mathbb{B}} MATH^{S}$$

let y' = 0

$$\frac{(1-3x)(x+1)}{x^2(x-1)^2} = 0$$

JE MATHS

$$(1-3x)(x+1)=0$$

$$x = -1, \frac{1}{3}$$

(g)

$$y' = \frac{3\sqrt{2-x} - \frac{1}{2} \cdot -1(3x-4)(2-x)^{-\frac{1}{2}}}{2-x}$$

$$= \frac{3\sqrt{2-x} + \frac{3x-4}{2\sqrt{2-x}}}{2-x}$$

JE MATHS

JE MATHS

$$=\frac{6(2-x)+3x-4}{2(2-x)\sqrt{2-x}}$$

JE MATHS

JE MATHS

$$= \frac{8 - 3x}{2(2 - x)\sqrt{2 - x}}$$

JE MATHS

let
$$y' = 0$$

JE MATHS

JE MATHS

$$\frac{8-3x}{2(2-x)\sqrt{2-x}} = 0$$

$$8-3x=0$$

JE MATHS

$$x = \frac{8}{3}$$

$$\text{MATHS}$$

JE MATHS

(h)

$$y' = \frac{1\sqrt{x^2 + 1} - \frac{1}{2} \cdot 2x(x+1)(x^2 + 1)^{\frac{1}{|2|} \cdot |3|}}{x^2 + 1}$$

$$= \frac{\sqrt{x^2 + 1} - \frac{x^2 + x}{\sqrt{x^2 + 1}}}{x^2 + 1}$$

$$= \frac{1}{x^2 + 1}$$

$$= \frac{1}{x^2 + 1}$$

$$= \frac{1}{x^2 + 1}$$

JE MATHS

$$=\frac{x^2+1-x^2-x}{(x^2+1)\sqrt{x^2+1}}$$

$$=\frac{1}{(x^2+1)\sqrt{x^2+1}}$$

JE MATHS

let
$$y' = 0$$

$$x = 1$$

(i)

$$y = \left(\frac{3-x}{x-2}\right)^{\frac{1}{2}}$$

$$\left(\frac{3-x}{x-2}\right)_{x=1}^{2} \left(\frac{-1(x-2)-1(3-x)}{(x-2)^{2}}\right)$$

JE MATHS

JE MATHS

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

$$y' = \frac{1}{2} \cdot \frac{-1}{(x-2)^2} \cdot \left(\frac{3-x}{x-2}\right)^{-\frac{1}{2}}$$
 JB MATHS

JE MATHS

$$= \frac{-1}{2(x-2)^2} \cdot \sqrt{\frac{x-2}{3-x}}$$

JE MATHS

$$=\frac{-(x-2)}{2(x-2)^2\sqrt{x-2}\sqrt{3-x}}$$

JE MATHS

$$=\frac{-1}{2(x-2)\sqrt{5x-x^2-6}}$$

JE MATHS

let y' = 0

no values of x

JE MATHS

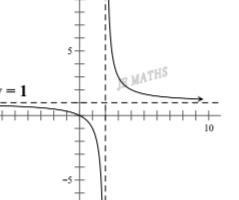
2. (i)

D: $x \neq 2$

R: *y* ≠ 1



JE MATHS



JE MATHS

JE MATHS

(ii)

$$y' = \frac{1(x-2)-1 \cdot x}{(x-2)^2}$$

$$= \frac{-2}{(x_{|S|} - 2)^{\frac{2}{3}}} |S|$$

JE MATHS

JE MATHS

$$y - \frac{p}{p-2} = -\frac{2}{(p-2)^2}(x-p)$$

$$-2x+2p = (p-2)^2 y - p(p-2)^{MATHS}$$

JE MATHS

$$0 = 2x + (p-2)^2 y - p^2$$

(iii)

$$0 = 2x + (p-2)^2 \cdot 0 - p^2$$

JE MATHS

$$2x = p^2$$
 JB MATHS

JE MATHS

$$x = \frac{p^2}{2} \rightarrow A(\frac{p^2}{2}, 0) \rightarrow d_{OA} = \frac{p^2}{2}$$

JE MATHS

$$x = p \rightarrow B(p, 0) \rightarrow d_{BO} = p$$

$$\frac{p^2}{2} = 2|p|$$

JE MATHS

$$p^2 = 4|p|$$
 JE MATHS

 $p^2 = 4p$

 $p^2 = -4p$

p(p-4)=0

p(p+4) = 0 IB MATHS

$$p = 0,4$$
 JB MATHS

p = 0, -4

$$\therefore p = \pm 4 \quad (A = B \text{ at } p = 0, \text{ omit } 0)$$

JE MATHS

JE MATHS

(iv)

$$0 = 2 \cdot 0 + (p-2)^2 c - p^2$$

$$0 = p^2c - 4pc + 4c - p^2$$

$$0 = p^{2}c - 4pc + 4c - p^{2}$$
$$0 = p^{2}c - p^{2} - 4pc + 4c$$

JE MATHS

JE MATHS

$$0 = p^2(c-1) + 4pc - p^2$$

$$p = \frac{4c \pm \sqrt{16c^2 - 4 \cdot 4c(c - 1)}}{2(c - 1)}$$
 JB MATHS

JE MATHS

$$=\frac{4c\pm\sqrt{16c}}{2(c-1)}$$

JE MATHS

$$= \frac{2c \pm \sqrt{4c}}{c - 1}$$
JB MATHS

JE MATHS

$$=\frac{2c\pm2\sqrt{c}}{c-1}$$

JE MATHS

$$p = \frac{2c + 2\sqrt{c}}{\left\|\mathbf{c}\right\|^{2} \left\|\mathbf{c}^{\top}\right\|^{2}}$$

or

$$p = \frac{2c - 2\sqrt{c}}{c - 1}$$

JE MATHS

$$=\frac{2\sqrt{c}}{\sqrt{c}-1}$$

 $_{\text{JE MATHS}} = \frac{2\sqrt{c}}{\sqrt{c} - 1}$

$$\sqrt{c} \ge 0 \rightarrow c \ge 0$$

 $p = \frac{2c \pm \sqrt{4c}}{c-1}$, since 4c must be real number

JE MATHS

tangent at
$$\frac{2}{2} = x = 1$$
 exists for $c = 1$

$$c=0$$
 or $c=1$

$$c = 0 \text{ or } c = 1$$

$$\frac{2\sqrt{c}}{\sqrt{c} - 1} = \frac{2\sqrt{c}}{\sqrt{c} + 1}$$

JE MATHS

$$2c + 2\sqrt{c} = 2c - 2\sqrt{c}$$

$$4\sqrt{c} = 0$$

$$c = 0$$

also, when c=1

only
$$p = \frac{2\sqrt{c}}{\sqrt{c}+1}$$
 exists

(d)
$$0 < 2$$
 (1) $0 < 2$

JE MATHS

JE MATHS

$$2\sqrt{c} \le 2 + 2\sqrt{c}$$

$$\frac{2\sqrt{c}}{\sqrt{c}+1} < \frac{2+2\sqrt{c}}{\sqrt{c}+1}$$

JE MATHS

JE MATHS

since p is on the left side of the asymptote x = 2

 \therefore the tangent is on the left branch of the hyperbola regardless of c

(2) let
$$p > 2$$
 JB MATHS

JE MATHS

$$\frac{2\sqrt{c}}{\sqrt{c}-1} > 2$$

JE MATHS

$$2\sqrt{c} > 2\sqrt{c} - 2$$
$$0 > \frac{1}{2} 2^{\text{MATHS}}$$

JE MATHS

$$\sqrt{c}-1>0$$

$$\sqrt{c} > 1$$

JE MATHS

c > 1

(3)

since $c \ge 0$ for a tangent to exist and c = 0 for only one, MATHS c > 0 for there to be two tangents $(c \ne 1)$

 $p = \frac{2\sqrt{c}}{\sqrt{c}-1}$ must be on the left side as $p = \frac{2\sqrt{c}}{\sqrt{c}+1}$ is always on the left branch

 $\therefore c < 1$ and c > 0

$$0 < c < 1$$
JE MATHS

JE MATHS

3.
$$\frac{dy}{dx} = \frac{\frac{du}{dx} \cdot x - 1 \cdot u}{x^2}$$

$$\times x^2$$
: $\frac{dy}{dx}x^2 = \frac{du}{dx} \cdot x - u$

$$\div x :_{JE} x \frac{dy}{dx} = \frac{du}{dx} - \frac{u}{x}$$
 (since $y = \frac{u}{x}$) $_{JE} MATHS$

JE MATHS

$$x\frac{dy}{dx} = \frac{du}{dx} - y$$

$$\frac{du}{dx} = x\frac{dy}{dx} + y$$

JE MATHS

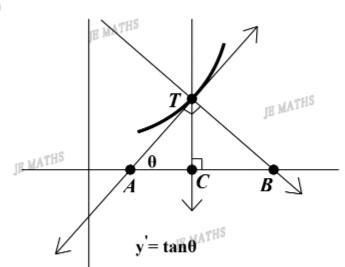
JE MATHS

JE MATHS

$$\frac{du}{dx} = y + x \frac{dy}{dx}$$

JE MATHS

4. (i)



JE MATHS

(ii)

JE MATHS

(a)
$$\tan \theta = \frac{TC}{AC} \text{ JE MATHS}$$

$$y' = \frac{y}{AC}$$

$$AC = \frac{y}{y'_{ATHS}}$$

JE MATHS

(b)
$$\angle TBC = 180^\circ - 90^\circ - \theta = 90^\circ - \theta$$
 $\tan(90^\circ - \theta) = \cot \theta$ $\tan(2TBC) = \frac{TC}{BC}$ $\det(90^\circ - \theta) = \cot \theta$ $\det(90^\circ - \theta) = \cot \theta$

(e)
$$AT^2 = AC^2 + TC^2$$

$$AT = \sqrt{\frac{y^2}{(y')^2} + y^2}$$

$$= \sqrt{\frac{y^2[1 + (y')^2]}{(y')^2}}$$

$$= \frac{y\sqrt{1 + (y')^2}}{y'}$$

$$BT^2 = TC^2 + BC^2$$

$$BT = \sqrt{y^2 + (yy')^2}$$

$$= \sqrt{y^2 + y^2(y')^2} \text{ is MATHS}$$

$$= y\sqrt{1 + (y')^2}$$

$$\text{is MATHS}$$

$$\text{is MATHS}$$

$$\text{is MATHS}$$

$$\text{is MATHS}$$

$$\text{is MATHS}$$

JE MATHS

JE MATHS

(iii)

$$f'(x) = \frac{2(x+1)-1(2x-3)}{(x+1)^2}$$

$$=\frac{2x+2-2x+3}{(x+1)^2}$$

JE MATHS

JE MATHS

$$=\frac{5}{(x+1)^2}$$

$$f'(4) = \frac{5}{x^2} = \frac{1}{5}$$

JE MATHS

JE MATHS

$$f(4) = \frac{2 \cdot 4 - 3}{4 + 1} = 1$$

$$AC = \frac{y}{y'} = 1 \cdot 5 = 5$$

JE MATHS

$$BC = yy' = 1 \cdot \frac{1}{5} \neq \frac{1}{5} ATHS$$

JE MATHS

$$AT = y\sqrt{1 + (y')^2} \cdot \frac{1}{y'}$$

JE MATHS

$$=1\sqrt{1+0.2^2}+5$$

$$= 1\sqrt{1 + 0.2^{2}} + 5$$

$$= 5\sqrt{\frac{26}{25}}$$

JE MATHS

$$=\sqrt{\frac{26}{25}}$$

JE MATHS

$$=\frac{\sqrt{26}}{5}$$

JE MATHS

JE MATHS

JE MATHS

JE MATHS