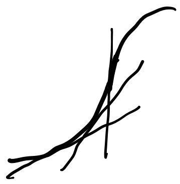


$$\frac{d}{dx}\left(-\frac{5}{x^3}\right) = \frac{d}{dx}\left(-5\cdot x^{-3}\right)$$

(a) $39x^{12} + \frac{7}{2}x^{-\frac{1}{2}} + 15\cdot x^{-4}$ $\qquad \underline{\frac{d}{dx}x^c = c\cdot x^{c-1}}$

(b) $$\frac{(e^x - 2\cos x)(\ln x + x^3) - (e^x - 2\sin x)\cdot\left(\frac{1}{x} + 3x^2\right)}{(\ln x + x^3)^2}$$

(c) $$8x^3\cdot\cos(3e^x) + 2x^4\cdot\underbrace{\left(-\sin(\overset{u}{3e^x})\right)\cdot 3e^x}_{\frac{d}{du}\cos(u)\cdot\frac{d}{dx}(3e^x)}$$

311.

$$h' = \frac{f'(x^2)\cdot 2x\cdot g(x) - f(x^2)\cdot g'(x)}{g(x)^2}$$

$$h'(1) = \frac{f'(1)\cdot 2\cdot 1\cdot g(1) - f(1)\cdot g'(1)}{g(1)^2} = \frac{6\cdot 2\cdot 2 - (-4)\cdot 3}{2^2}$$

$$= \frac{24 + 12}{4} = 6 + 3 = 9$$

312.:

$$f'(4) = \lim_{x\to 4}\frac{f(x) - f(4)}{x-4} = \lim_{x\to 4}\frac{\sqrt{2x+1} - 3}{x-4}$$

$$\lim_{x\to 4}\frac{2x-8}{(x-4)(\sqrt{2x+1}+3)} = \frac{(2x+1)-9}{(x-4)(\sqrt{2x+1}+3)} = \lim_{x\to 4}\frac{(\sqrt{2x+1}-3)(\sqrt{2x+1}+3)}{(x-4)(\sqrt{2x+1}+3)}$$

$$\lim_{x\to 4}\frac{2}{\sqrt{2x+1}+3} = \frac{2}{\sqrt{2\cdot 4+1}+3} = \frac{2}{3+3} = \frac{1}{3}$$

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

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

$$\underset{x_0}{f(4)} = \sqrt{2\cdot 4+1} = \underset{y_0}{3}$$

$$\boxed{y-3 = \frac{1}{3}(x-4)} \qquad y = \frac{1}{3}x - \frac{4}{3} + 3$$

$$y - y_0 = k\cdot(x - x_0) \qquad \boxed{y = \frac{1}{3}x + \frac{5}{3}}$$

313:

$$12x^2 + 6x\cdot y + y^2 = 20 \qquad (f\cdot g)' = f'\cdot g + f\cdot g'$$

$$\boxed{24\cdot x + 6(1\cdot y + x\frac{dy}{dx}) + 2y\cdot\frac{dy}{dx} = 0}$$

$$\frac{d}{dx}y^2 = \frac{d}{dy}y^2 \cdot \frac{dy}{dx}$$

$$(24x+6y) + (6x\cdot\frac{dy}{dx} + 2y\frac{dy}{dx}) = 0$$

$$(24x+6y) + (6x+2y)\cdot\frac{dy}{dx} = 0$$

$$(6x+2y)\frac{dy}{dx} = -(24x+6y) \Rightarrow \boxed{\frac{dy}{dx} = -\frac{(24x+6y)}{(6x+2y)}}$$

Set $\frac{dy}{dx} = 0 \Rightarrow \begin{cases} \boxed{24x+6y=0} \Rightarrow 6y = -24x \Rightarrow \boxed{y=-4x} \\ 12x^2+6xy+y^2=20 \Rightarrow 12x^2+6x\cdot(-4x)+(-4x)^2=20 \end{cases}$

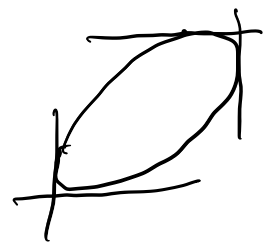
$$\underset{4x^2=20}{(12-24+16)x^2 = 20} \Rightarrow x^2=5$$

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

$$\boxed{(\sqrt{5}, -4\sqrt{5}),\ (-\sqrt{5}, 4\sqrt{5})}$$

($6x+2y = 2(3x+y) \neq 0$ at these two pts).

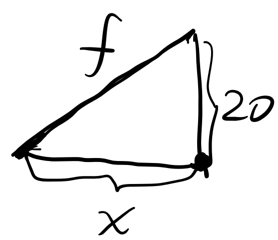
Vertical tangent line: set $\begin{cases} 6x+2y=0, & (24x+6y\neq 0) \\ 12x^2+6xy+y^2=20 \end{cases}$



(a) $\frac{dx}{dt}<0$ because x is a decreasing function of t.

(b) $\frac{d\theta}{dt}>0$ ... θ is an increasing fct. of t

(c) $\theta=\tan^{-1}\left(\frac{20}{45}\right)$ $\boxed{\frac{dx}{dt}=-19}$



$\frac{df}{dt}$ $\boxed{x^2+20^2=f^2}$

$\boxed{2x\cdot\frac{dx}{dt}=2f\cdot\frac{df}{dt}} \Rightarrow \frac{df}{dt}=\frac{x}{f}\frac{dx}{dt}$

$\frac{45}{\sqrt{45^2+20^2}}$ $\quad \frac{dx}{dt} = -19$

$-19\cdot\frac{45}{5\cdot\sqrt{97}}=-\frac{19\times 9}{\sqrt{97}}=-\frac{171}{\sqrt{97}}$

$45 = 5\cdot 9$, $20 = 5\cdot 4$

$5\cdot\sqrt{9^2+4^2}$ $\quad$ 81 + 16

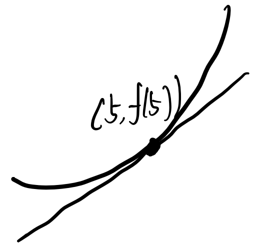
$\boxed{-19\cdot\frac{45}{\sqrt{45^2+19^2}}}$

315: (a) $f(5) = 2\cdot 5 - 3 = 7$

$f'(5) = \underline{2}$

$\|$

slope of tangent line at 5



(b) $g(x) = x \cdot f(x) + 14$ $\qquad (fg)' = f'g + fg'$

$$g' = \underline{1 \cdot f(x) + x \cdot f'} = f(x) + x \cdot f'$$
$$= x' \cdot f + x \cdot f'$$

$$g'(5) = f(5) + 5 \cdot f'(5) = 7 + 5 \cdot 2 = \boxed{17}$$

$$g(5) = 5 \cdot f(5) + 14 = 5 \cdot 7 + 14 = 35 + 14 = 49$$

$$\boxed{y - 49 = 17(x-5)}$$

$(x_0, y_0) = (5, 49)$

$$\boxed{y - y_0 = k(x - x_0)}$$

$$y = 17x - 85 + 49$$

$$\boxed{y = 17x - 36}$$