Pg 190

② $f(x) = \dfrac{x+1}{x-1}$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\frac{x+\Delta x+1}{x+\Delta x-1} - \frac{x+1}{x-1}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \left[\frac{\frac{x+\Delta x+1}{x+\Delta x-1} - \frac{x+1}{x-1}}{\Delta x} \cdot \frac{(x+\Delta x-1)(x-1)}{(x+\Delta x-1)(x-1)} \right]$$

$$= \lim_{\Delta x \to 0} \frac{(x+\Delta x+1)(x-1) - (x+1)(x+\Delta x-1)}{\Delta x(x+\Delta x-1)(x-1)}$$

$$= \lim_{\Delta x \to 0} \frac{\cancel{x^2} + \cancel{x\Delta x} + \cancel{x} - \cancel{x} - \Delta x - \cancel{1} - \cancel{x^2} - \cancel{x\Delta x} + \cancel{x} - \cancel{x} - \Delta x + \cancel{1}}{\Delta x\,(x+\Delta x-1)(x-1)}$$

$$= \lim_{\Delta x \to 0} \frac{-2\Delta x}{\Delta x(x+\Delta x-1)(x-1)} = \lim_{\Delta x \to 0} \frac{-2}{(x+\Delta x-1)(x-1)}$$

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

④ $f(x) = \dfrac{2}{x}$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\frac{2}{x+\Delta x} - \frac{2}{x}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \left[\frac{\frac{2}{x+\Delta x} - \frac{2}{x}}{\Delta x} \cdot \frac{x(x+\Delta x)}{x(x+\Delta x)} \right]$$

$$= \lim_{\Delta x \to 0} \frac{2x - 2(x+\Delta x)}{x(\Delta x)(x+\Delta x)}$$

$$= \lim_{\Delta x \to 0} \frac{-2\Delta x}{x(\Delta x)(x+\Delta x)} = \lim_{\Delta x \to 0} \frac{-2}{x(x+\Delta x)}$$

$$= \frac{-2}{x^2}$$

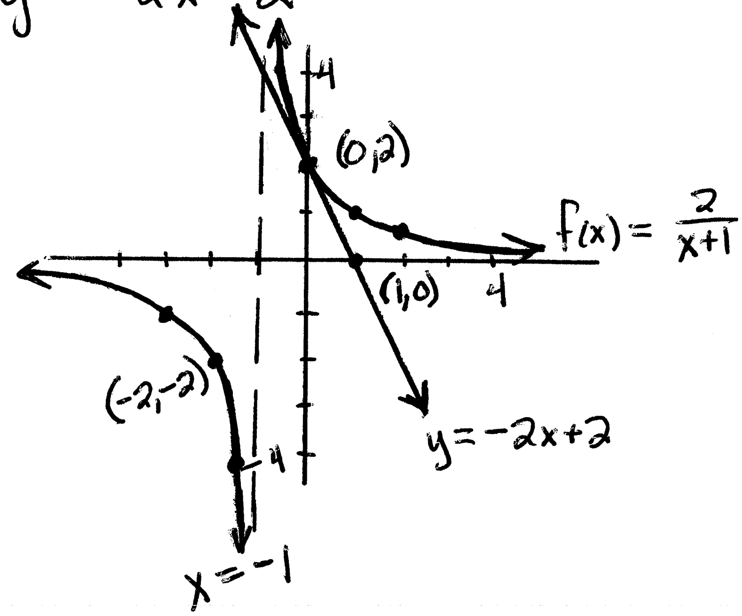
(12) $f(x)=\frac{2}{x+1}$, $(0,2)$

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

$m_{tan}=f'(0)=\frac{-2}{(0+1)^2}=-2$

tangent line: $y-2=-2(x-0)$

$y=-2x+2$



(44) $f(t)=t^3\cos t$

$f'(t)=t^3(-\sin t)+(\cos t)(3t^2)$

$=3t^2\cos t-t^3\sin t$

OR $=t^2(3\cos t-t\sin t)$

(46) $f(x) = \dfrac{x+1}{x-1}$

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

☆ see #2

(48) $f(x) = \dfrac{6x-5}{x^2+1}$

$$f'(x) = \frac{(x^2+1)(6) - (6x-5)(2x)}{(x^2+1)^2}$$

$$= \frac{6x^2+6-12x^2+10x}{(x^2+1)^2}$$

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

OR

(50) $f(x) = \dfrac{9}{3x^2-2x}$

$$f'(x) = \frac{-9(6x-2)}{(3x^2-2x)^2} = \frac{-18(3x-1)}{(3x^2-2x)^2}$$

(52) $y = \dfrac{\sin x}{x^2}$

$$\frac{dy}{dx} = \frac{x^2 \cos x - (\sin x)(2x)}{x^4}$$

$$= \frac{x^2 \cos x - 2x \sin x}{x^4} = \frac{x \cos x - 2\sin x}{x^3}$$

(54) $y = 2x - x^2 \tan x$

$$\frac{dy}{dx} = 2 - [x^2 \sec^2 x + (\tan x)(2x)]$$

$$= 2 - x^2 \sec^2 x - 2x \tan x$$

(56) $y = \dfrac{1+\sin x}{1-\sin x}$

$$\frac{dy}{dx} = \frac{(1-\sin x)(\cos x) - (1+\sin x)(-\cos x)}{(1-\sin x)^2}$$

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

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

(68) $f(x) = \sqrt[3]{x^2-1} = (x^2-1)^{1/3}$

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

(70) $f(x) = \left(x^2 + \frac{1}{x}\right)^5$

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

(72) $h(\theta) = \dfrac{\theta}{(1-\theta)^3}$

$$h'(\theta) = \frac{(1-\theta)^3(1) - \theta[3(1-\theta)^2(-1)]}{(1-\theta)^6}$$

$$= \frac{(1-\theta)^3 + 3\theta(1-\theta)^2}{(1-\theta)^6} = \frac{1-\theta+3\theta}{(1-\theta)^4}$$

$$= \frac{2\theta+1}{(1-\theta)^4}$$

(74) $y = 1 - \cos 2x + 2\cos^2 x$

$$\frac{dy}{dx} = (\sin 2x)(2) + 2[2\cos x(-\sin x)]$$

$$= 2\sin 2x - 4\sin x\cos x$$

$$= 2\sin 2x - 2\sin 2x = 0$$

NOTE: $y = 1 - \cos 2x + 2\cos^2 x$

$$= 1 - (2\cos^2 x - 1) + 2\cos^2 x$$

$$= 1 - 2\cos^2 x + 1 + 2\cos^2 x = 2$$

thus $\dfrac{dy}{dx} = 0$

(76) $y = \csc 3x + \cot 3x$

$$\frac{dy}{dx} = -3\csc 3x\cot 3x - 3\csc^2 3x$$

$$= -3\csc 3x(\cot 3x + \csc 3x)$$

(78) $y = \dfrac{\sec^7 x}{7} - \dfrac{\sec^5 x}{5}$

$y' = (\sec^6 x)(\sec x \tan x) - \sec^4 x\,(\sec x \tan x)$

$= \sec^7 x \tan x - \sec^5 x \tan x$

OR $= \sec^5 x \tan x\,(\sec^2 x - 1)$

$= \sec^5 x \tan x\,(\tan^2 x) = \sec^5 x \tan^3 x$

(80) $f(x) = \dfrac{3x}{\sqrt{x^2+1}}$

$f'(x) = \dfrac{\sqrt{x^2+1}\,(3) - 3x\left(\dfrac{\cancel{2}x}{\cancel{2}\sqrt{x^2+1}}\right)}{x^2+1}$

$= \dfrac{3\sqrt{x^2+1} - \dfrac{3x^2}{\sqrt{x^2+1}}}{x^2+1} \cdot \dfrac{\sqrt{x^2+1}}{\sqrt{x^2+1}}$

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

(82) $y = \dfrac{\cos(x-1)}{x-1}$

$\dfrac{dy}{dx} = \dfrac{(x-1)(-\sin(x-1)\cdot 1) - \cos(x-1)(1)}{(x-1)^2}$

$= \dfrac{-\left[(x-1)\sin(x-1) + \cos(x-1)\right]}{(x-1)^2}$

OR $= \dfrac{\sin(x-1) - x\sin(x-1) - \cos(x-1)}{(x-1)^2}$

(84) $h(z) = e^{-z^2/2}$

$$h'(z) = -ze^{-z^2/2}$$

(86) $y = 3e^{-3/t}$ <u>OR</u>

$$y' = 3e^{-3/t} \cdot \frac{3}{t^2} = \frac{9e^{-3/t}}{t^2} = \frac{9}{t^2 e^{3/t}}$$

(88) $f(\theta) = \frac{1}{2} e^{\sin 2\theta}$

$$f'(\theta) = \frac{1}{2}(2\cos 2\theta) e^{\sin 2\theta}$$

$$= (\cos 2\theta) e^{\sin 2\theta}$$

<u>OR</u> $= e^{\sin 2\theta} \cos 2\theta$