Section 2.4 Product rules + Quotient rules for Differentiation

→ $\frac{d}{dx}\left[f(x)\cdot g(x)\right] = f'(x)\cdot g(x) + f(x)\cdot g'(x)$

$$\frac{d}{dx} = \underbrace{3x^2}_{1st}\underbrace{(2x+1)}_{2nd} = 6x(2x+1) + 3x^2(2)$$

$$= 12x^2 + 6x + 6x^2$$

$$= 18x^2 + 6x$$

→ $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]$ $g(x) \neq 0$ $= \frac{f'(x)\cdot g(x) - f(x)\cdot g'(x)}{[g(x)]^2}$

$$\frac{d}{dx}\left[\frac{x^2-3x+1}{x-2}\right] = \frac{(2x-3)(x-2) - (x^2-3x+1)\cdot 1}{(x-2)^2}$$

Ex. 1: Find $f'(x)$

a) $f(x) = (x+1)(2x-1)$

$$f'(x) = 1\cdot(2x-1) + (x+1)\cdot 2$$

$$= 2x - 1 + 2x + 2$$

$$= 4x + 1$$

b) $h(x) = (x^3+7x^2-8)(2x^{-3}+x^{-4})$

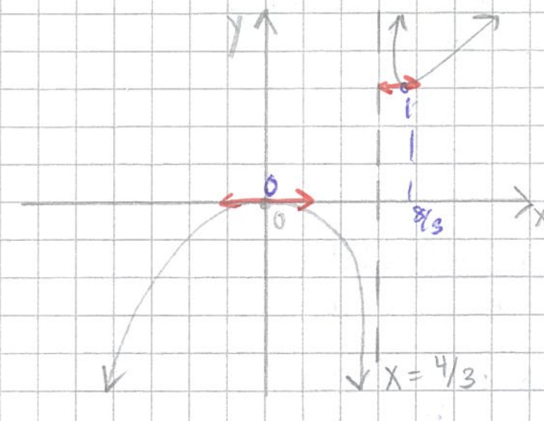
$$= (3x^2+14x)(2x^{-3}+x^{-4}) + (x^3+7x^2-8)(-6x^{-4}-4x^{-5})$$

$=$

Ex.2 Find the x-values for $f(x) = \frac{x^2}{3x-4}$ where the graph of $f(x)$ has horizontal tangent lines

x^2	+	+	+	0	+	|	+	+
$3x-4$	−	−	−	|	−	∞	+	+
	(−)			0	(−)	4/3	(+)	

→



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

$$f'(x) = \frac{2x\,(3x-4) - x^2(3)}{(3x-4)^2}$$

$$= \frac{6x^2 - 8x - 3x^2}{(3x-4)^2}$$

$$= \frac{3x^2 - 8x}{(3x-4)^2}$$

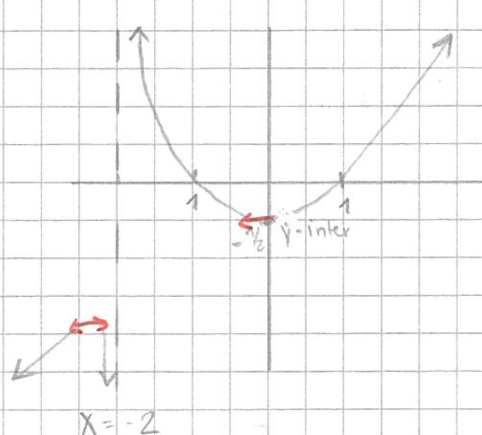
$$= \frac{\cancel{3}x(3x-8)}{(3x-4)^2} = 0$$

$$x = 0 \quad ; x = 8/3$$

Ex. 3 Find the x-values of any horizontal tangents on $f(x) = \frac{x^2-1}{x+2} = \frac{(x+1)(x-1)}{(x+2)}$ → x-intercepts

y-inter

Vert. Asy.



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

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

$$= \frac{x^2 + 4x + 1}{(x+2)^2} = 0$$

Complete square:

$$x^2 + 4x + 4 = -1 + 4$$

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

$$x + 2 = \pm\sqrt{3}$$

$$x = -2 \pm \sqrt{3}$$