$$\text{Slope} = \frac{1}{4(1)^{3/4}} = \boxed{\frac{1}{4}}.$$

Plug $x=1$ to derivative

Point-Slope Equation: $y - 1 = \frac{1}{4}(x-1)$

$$\boxed{y = \frac{1}{4}x + \frac{3}{4}} \longrightarrow \text{Slope-intercept Equation.}$$

E.g. $f(x) = x^3 - 4x^2 + 3x + 6$.

Q: Find all the x-values at which the graph has a horizontal tangent line.

Process: Take derivative and set it $=0$ and solve for x.

Sol: $f'(x) = 3x^2 - 8x + 3 = 0$

Quadratic Formula: $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

$$x = \frac{8 \pm \sqrt{64 - 36}}{6} = \frac{8 \pm \sqrt{28}}{6} = \frac{8 \pm 2\sqrt{7}}{6} = \frac{4 \pm \sqrt{7}}{3}$$

Answer: $x = \frac{4+\sqrt{7}}{3}$; $x = \frac{4-\sqrt{7}}{3}$. (horizontal tangent line at these locations)

Product Rule:

$$\cancel{[f(x)\cdot g(x)]' = f'(x)\cdot g'(x)}$$ WRONG.

Correct formula for the product rule:

In "prime" notation:

$$\boxed{[f(x)\cdot g(x)]' = f'(x)\cdot g(x) + f(x)\cdot g'(x)}$$

In Leibnitz notation: set $u = f(x)$; $v = g(x)$

$$\boxed{\frac{d}{dx}[u\cdot v] = v\cdot\frac{du}{dx} + u\cdot\frac{dv}{dx}}$$

Quotient Rule:

$$\cancel{\left(\frac{f(x)}{g(x)}\right)' = \frac{f'(x)}{g'(x)}}$$ Wrong

Monday, February 4, 2019 9:22 AM

Correct formula for quotient rule:

In "prime" notation:

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

In Leibnitz notation: set $f(x) = u$; $g(x) = v$

$$\boxed{\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{v \cdot \frac{du}{dx} - u \cdot \frac{dv}{dx}}{v^2}}$$

$$\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{\underset{\text{low}}{\boxed{v}} \cdot \underset{\text{d high}}{\frac{du}{dx}} - \underset{\text{high}}{u} \cdot \underset{\text{d low}}{\frac{dv}{dx}}}{\underset{(\text{low})^2}{v^2}}$$

E.g. $h(x) = \dfrac{3x+1}{4x-3}$. Find $f'(x)$.

$$h'(x) = \frac{3\cdot(4x-3) - 4\cdot(3x+1)}{(4x-3)^2} = \frac{12x - 9 - 12x - 4}{(4x-3)^2}$$

$$\boxed{h'(x) = -\frac{13}{(4x-3)^2}}$$

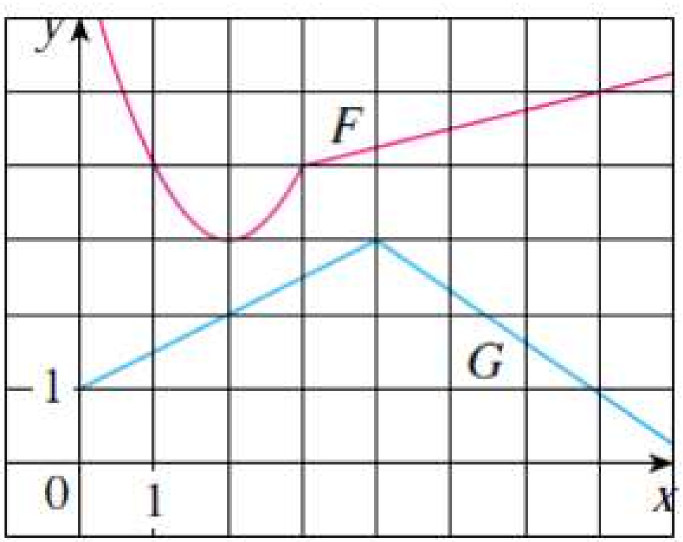
Eg: $W(x) = \dfrac{1 - x^8}{1 + x^8}$. Find $w'(x)$.

$$w'(x) = \frac{-8x^7 \cdot (1+x^8) - 8x^7 \cdot (1-x^8)}{(1+x^8)^2}$$

quotient rule

$$= \frac{-8x^7 \cancel{-8x^{15}} - 8x^7 \cancel{+8x^{15}}}{(1+x^8)^2}$$

$$\boxed{w'(x) = \frac{-16x^7}{(1+x^8)^2}}$$



$H(x) = \dfrac{F(x)}{G(x)}$

Find $H'(7)$?

$W(x) = F(x)G(x)$

$W'(2) = ?$

Higher order derivative.

$$f(x) = x^{10}$$

$f'(x) = 10x^9 \rightarrow$ first derivative.

$f''(x) = 90x^8 \rightarrow$ second derivative.

$f'''(x) = 720x^7 \rightarrow$ third derivative

$f^{(4)}(x) = 5040x^6 \rightarrow$ fourth derivative.

$\vdots$

$f^{(11)}(x) = 0$; $\underbrace{f^{(n)}(x)}_{n^{th} \text{ order derivative of } f.} = 0$ for all $n \geq 11$

$$\boxed{f^{(n)}(x) = \text{derivative of } f^{(n-1)}(x)}$$

In Leibnitz notation: 1^{st} derivative: $\frac{dy}{dx}$

2^{nd} derivative: $\frac{d^2y}{dx^2}$; 3^{rd} derivative $\frac{d^3y}{dx^3}$

n^{th} derivative: $\frac{d^ny}{dx^n}$.