

**3.3 Rules for Differentiation** Day 2

## Power Rule

Ex 1)  $y = x^4 + 3x^3 - 2x^{-2} + 4\sqrt{x}$

## Product Rule

$$\frac{d}{dx} (uv) = uv' + vu'$$

Ex 2)  $\frac{d}{dx} (x - 1)(x^2 - 2)$

## Quotient Rule

$$\frac{d}{dx} \left( \frac{u}{v} \right) = \frac{vu' - uv'}{v^2}$$

$$\text{Ex 3) } \frac{d}{dx} \left( \frac{x^2 + 2x - 1}{x - 4} \right)$$

$$\text{Ex 4) } f(x) = x^4 - x^3 + x^2 - 2x + 6$$

Find equations for the tangent and normal lines at  $x = 1$ .

$$\text{Ex 5) } f(x) = x^3 + 3x^2 - 3x + 6$$

Where is the tangent line horizontal?

$$\text{Ex 6) Suppose } u(1) = 2, u'(1) = 3, v(1) = -2, v'(1) = 4$$

$$\frac{d}{dx} (uv)$$

$$\frac{d}{dx} 2u - 4v + 3uv$$

$$\frac{d}{dx} \frac{u}{v}$$

$$\text{Ex 7) } y = x^4 - x^3 + x^2 - 2x + 6$$

$$y' =$$

$$y'' =$$

$$y''' =$$

$$y'''' =$$

$$y''''' =$$

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$$y = 2x^3 - 3x^2 - 12x + 20$$

$$y' = 0 = 6x^2 - 6x - 12$$

$$0 = 6(x^2 - x - 2)$$

$$0 = 6(x - 2)(x + 1)$$

$$x - 2 = 0$$

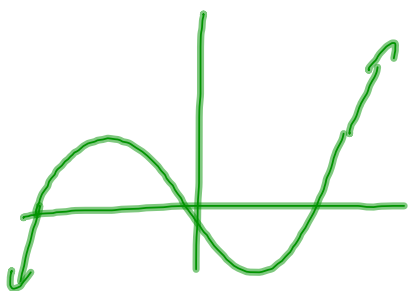
$$x = 2$$

min

$$x + 1 = 0$$

$$x = -1$$

max



$$35 \quad y = x^{-1} + x^2$$

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

$$y'' = 2x^{-3} + 2 = \frac{2}{x^3} + 2$$

$$y''' = -6x^{-4} = \frac{-6}{x^4}$$

$$y'''' = 24x^{-5} = \frac{24}{x^5}$$