

Wednesday, September 11

What is the slope of a horizontal line?
How can you use the derivative to find
horizontal tangent lines?

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Students will verbally explain how to
find the derivative

(using the words:
slope, limit, exponent, coefficient...)

$$f(x) = \frac{x^4}{4} + 2x^3 - 4x^2 - 5$$

find all
horizontal
tangent lines

→ horizontal tangent lines
have a slope of zero

⇒ take the derivative,

set the derivative
equal to zero, and

solve for x

$$f(x) = \frac{x^4}{4} + 2x^3 - 4x^2 - 5$$

$$f(x) = \frac{1}{4}(x^4) + 2x^3 - 4x^2 - 5$$

$$f'(x) = \frac{1}{4}(4x^3) + 2(3x^2) + 4(2x) - 0$$

$$f'(x) = x^3 + 6x^2 + 8x$$

$$x^3 + 6x^2 + 8x = 0$$

$$x(x^2 + 6x + 8) = 0$$

$$x(x+4)(x+2) = 0$$

$$\boxed{x = 0}$$

$$x+4=0 \quad \begin{matrix} -4 & -4 \end{matrix} \rightarrow \boxed{x = -4}$$

$$x+2=0 \quad \begin{matrix} -2 & -2 \end{matrix} \rightarrow \boxed{x = -2}$$

What is the definition of the derivative?

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = f'(x)$$

$$\lim_{h \rightarrow 0} \frac{\frac{1}{4(x+h)^3} - 2(x+h) + 20 - \frac{1}{4x^3} + 2x - 20}{h}$$

$$f(x) = \frac{1}{4x^3} + 2x + 20$$

$$\lim_{h \rightarrow 0} \frac{5\sqrt{x+h} - 2x - 2h + 12 - 5\sqrt{x} + 2x - 12}{h}$$

$$f(x) = 5\sqrt{x} - 2x + 12$$

$$\lim_{h \rightarrow 0} \frac{5\sqrt{x+h} + 2x + 2h - 12 - 5\sqrt{x} - 2x + 12}{h}$$

$$f(x) = 5\sqrt{x} + 2x - 12$$

$$\lim_{h \rightarrow 0} \frac{4(x+h)^7 + 3(x+h) - 10 - (4x^7 + 3x - 10)}{h}$$

$$f(x) = 4x^7 + 3x - 10$$

$$\lim_{h \rightarrow 0} \frac{10(x+h)^{-4} + 5x + 5h - (10x^{-4} + 5x)}{h}$$

$$f(x) = 10x^{-4} + 5x$$