Quiz topics:

definition of derivative

alternate form of derivative

derivative rules (sinx, cosx, power)

applications with slope

differentiability

2.2 Basic Differentiation Rules and Rates of Change

- Find the derivative of a function using the Constant Rule.
- Find the derivative of a function using the Power Rule.
- Find the derivative of a function using the Constant Multiple Rule.
- Find the derivative of a function using the Sum and Difference Rules.
- Find the derivatives of the sine function and of the cosine function.
- Use derivatives to find rates of change.

Find the slope

Find the equation of a tangent line

Find where a function has a horizontal slope

Find constants so that a function is differentiable everywhere

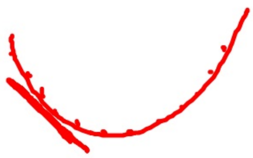
#1 Find the slope at the indicated point.

$f(x) = x^2 + 3x + 4, \quad (-2, 2)$

$f'(x) = 2x + 3$

$f'(-2) = -4 + 3$

$\boxed{f'(-2) = -1}$



$\frac{1}{4^{3/2}}$

$\frac{1}{(2^2)^{3/2}}$

$f(x) = \frac{4}{\sqrt{x}} \quad (4,2)$

$f(x) = 4x^{-1/2}$

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

$f'(4) = -2 \cdot 4^{-3/2}$

$= -2\left(\frac{1}{8}\right)$

$f'(4) = -\frac{1}{4}$

#2 Find the equation of the tangent line at the point indicated.

$f(x) = x^2 + 3x + 4, \quad (-2, 2)$

$y - y_1 = m(x - x_1)$

$\boxed{y - 2 = -1(x + 2)}$

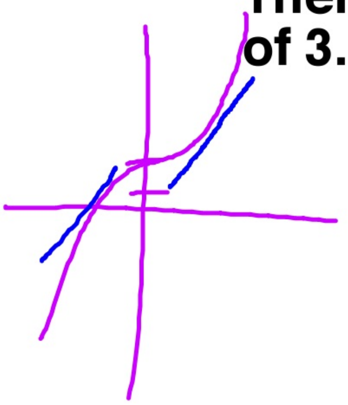
$f(x) = \dfrac{4}{\sqrt{x}} \quad (4,2)$

$\boxed{y - 2 = \frac{-1}{4}(x - 4)}$

#3 Find the equation of the line tangent to the graph of f and parallel to the given line.

$f(x) = x^3 + 2$ $\qquad$ $3x - y - 4 = 0$ $\quad$ $m = 3$

There will be two points that have a slope of 3.



$f'(x) = 3x^2$

$3 = 3x^2$

$\pm 1 = x$

$(1, 3)\ m = 3$

$\boxed{y - 3 = 3(x - 1)}$

$(-1, 1)\ m = 3$

$\boxed{y - 1 = 3(x + 1)}$

#4

Determine the x-coordinates (if any) at which the graph of the function has a horizontal tangent line.

$y = x^3 - x$ **where the function has slope 0.**

$$y' = 3x^2 - 1$$

$$0 = 3x^2 - 1$$

$$\sqrt{\frac{1}{3}} = \sqrt{x^2}$$

$$\pm\sqrt{\frac{1}{3}} = x$$

#5

Find k such that the line is tangent to the graph of the function.

$f(x) = k - x^2$ $\qquad$ $y = -6x + 1$

$\boxed{K - x^2 = -6x + 1}$

$K - 9 = -18 + 1$

$K = -17 + 9$

$K = -8$

$f'(x) = -2x$ $\qquad$ $y' = -6$

$-2x = -6$

$x = 3$

$y = -6(3) + 1$

$y = -17$

$-17 = K - (3)^2$

$-17 = K - 9$

$\boxed{-8 = K}$

#6

Find k such that the line is tangent to the graph of the function.

$f(x) = kx^4$ $\qquad$ $y = 4x - 1$

Two clues:
1. Set the functions equal (because they intersect)

2. Set the derivatives equal (because the slopes are =)

$f'(x) = 4kx^3$ $\qquad$ $y' = 4$

$kx^4 = 4x - 1$ $\qquad$ $4kx^3 = 4$

$\frac{1}{x^3} \cdot x^4 = 4x - 1$ $\qquad$ $k = \frac{1}{x^3}$

$x = 4x - 1$

$\frac{1}{3} = x$ $\qquad$ $k = \frac{1}{\left(\frac{1}{3}\right)^3} = 27$

35.) $y = (4x+1)^2$ $(0, 1)$

$y = 16x^2 + 8x + 1$

$y' = 32x + 8$

$y'(0) = 8$

17.)

$$\lim_{x \to 2^-} f(x) = \lim_{x \to 2^+} f(x) = f(2)$$

$$8a = 4 + b$$

$$f'(x) = \begin{cases} 3ax^2, & x \le 2 \\ 2x, & x > 2 \end{cases}$$

$$\lim_{x \to 2^-} f'(x) = \lim_{x \to 2^+} f'(x) = f'(2)$$

$$12a = 4$$

$$a = 1/3$$

$$f(x) = \begin{cases} ax^3, & x \le 2 \\ x^2 + b, & x > 2 \end{cases}$$

51.) $h(s) = s^{4/5} - s^{2/3}$

$h'(s) = \frac{4}{5} s^{-1/5} - \frac{2}{3} s^{-1/3}$