C12 - 1.8 - Limit Slope Notes

Find average slope over domain, equation of the secant line, and sketch only [1,2].

$f(x) = x^2$; [1,2], [1,1.1], [1,1.01].

$f(2) = (2)^2 = 4$ (2,4)

$f(1) = (1)^2 = 1$ (1,1)

$f(1.1) = (1.1)^2 = 1.21$ (1.1,1.21)

$f(1.01) = (1.-1)^2 = 1.0201$ (1.01,1.0201)

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{(4) - (1)}{(2) - (1)}$

$m = 3$

$m = \frac{1.21 - 1}{1.1 - 1}$

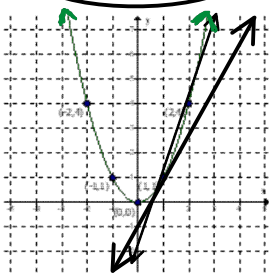
$m = 2.1$

$m = \frac{1.0201 - 1}{1.01 - 1}$

$m = 2.01$

$y - 4 = 3(x - 2)$

$y = 3x - 2$



$y - 1 = 2(x - 1)$

$y = 2x - 1$

Find the instantaneous slope, equation of the tangent line, and sketch.

$f(x) = x^2$; $x = 1$

$f(1) = 1$ (1,1)

$y - 1 = 2(x - 1)$

$y = 2x - 1$

Method 1*

$$m = f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

$$m = f'(1) = \lim_{x \to 1} \frac{x^2 - f(1)}{x - 1}$$

$$\lim_{x \to 1} \frac{x^2 - 1}{x - 1}$$

$$\lim_{x \to 1} \frac{(x + 1)(x - 1)}{(x - 1)}$$

$$\lim_{x \to 1} x + 1$$

$$1 + 1$$

$m = f'(1) = 2$

Method 2*

$$m = f'(a) = \lim_{h \to 0} \frac{f(a + h) - f(a)}{h}$$

$$m = f'(1) = \lim_{h \to 0} \frac{f(1 + h) - f(1)}{h}$$

$$\lim_{h \to 0} \frac{(1 + h)^2 - (1)^2}{h}$$

$$\lim_{h \to 0} \frac{1 + 2h + h^2 - 1}{h}$$

$$\lim_{h \to 0} \frac{2h + h^2}{h}$$

$$\lim_{h \to 0} \frac{h(2 + h)}{h}$$

$$\lim_{h \to 0} 2 + h$$

$$2 + 0$$

$m = f'(1) = 2$

Find average slope over domain, equation of the secant line, and sketch only [1,2].

$f(x) = x^3$; [1,2], [1,1.1], [1,1.01].

Find the instantaneous slope, equation of the tangent line, and sketch.

$f(x) = x^2 - 2x$; $x = 3$

$f(x) = x^3$; $x = -1$

$f(x) = x^4$; $x = 1$

$f(x) = \frac{1}{x + 2}$; $x = 2$

$f(x) = \sqrt{x + 1}$; $x = 0$

$f(x) = \frac{1}{\sqrt{x + 3}}$; $x = 1$