

1. The cost of wheat, in dollars per ton, t days after the harvest, is given by $W=p(t)$. What is the meaning of the derivative $p'(t)$? What are its units?

The rate of change of the cost of wheat with respect to the day is
dollars per ton / day

2. Find the derivative of the given functions using the **definition of derivative**. State the domain of the function and the domain of the derivative.

a) $h(x) = \sqrt{x+2}$

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

$$\lim_{h \rightarrow 0} \frac{\sqrt{x+h+2} - \sqrt{x+2}}{h} \cdot \frac{(\sqrt{x+h+2} + \sqrt{x+2})}{(\sqrt{x+h+2} + \sqrt{x+2})}$$

$$\lim_{h \rightarrow 0} \frac{x+h+2 - (x+2)}{h(\sqrt{x+h+2} + \sqrt{x+2})} =$$

$$\lim_{h \rightarrow 0} \frac{h}{h(\sqrt{x+h+2} + \sqrt{x+2})} = \frac{1}{\sqrt{x+2} + \sqrt{x+2}}$$

$$h'(x) = \frac{1}{2\sqrt{x+2}}$$

b) $f(x) = \frac{3}{x-2}$

$$\lim_{h \rightarrow 0} \left(\frac{\frac{3}{x+h-2} - \frac{3}{x-2}}{h} \right)$$

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

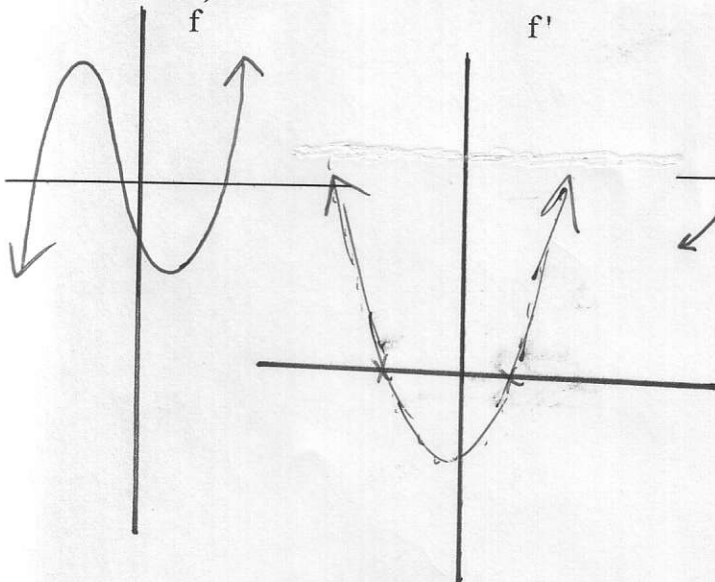
$$\lim_{h \rightarrow 0} \frac{3x-6 - 3x-3h+6}{(x+h-2)(x-2)h}$$

$$\lim_{h \rightarrow 0} \frac{-3h}{(x+h-2)(x-2)h} = \lim_{h \rightarrow 0} \frac{-3}{(x+h-2)(x-2)}$$

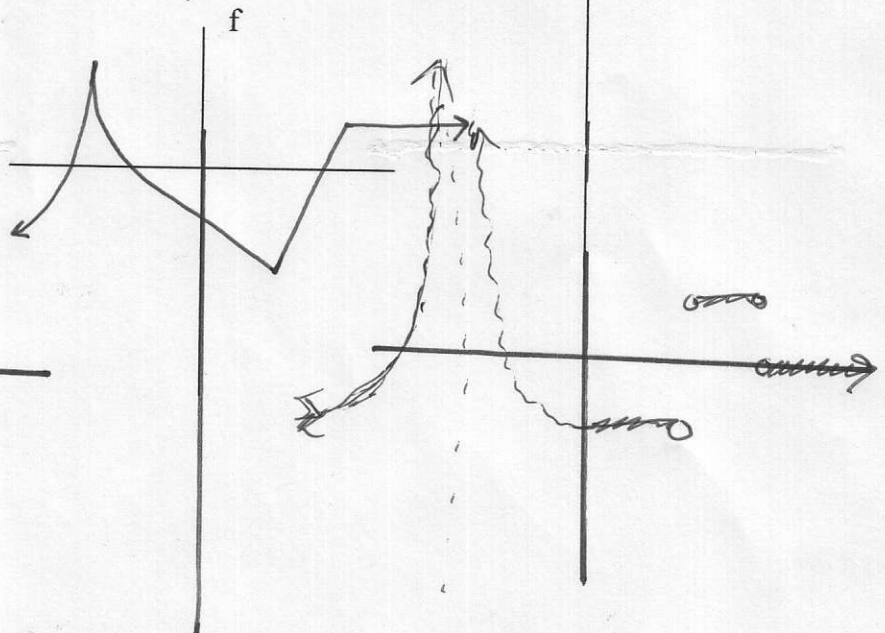
$$f'(x) = \frac{-3}{(x-2)^2}$$

3. Sketch f' beside each function f .

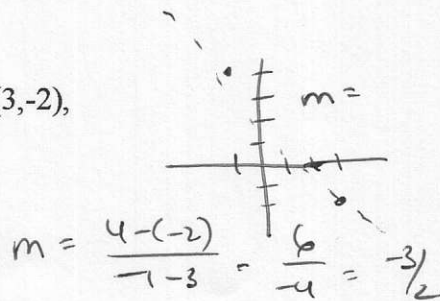
a)



b)



4. If the tangent line to $y = f(x)$ at $(-1, 4)$ passes through the point $(3, -2)$, find $f(-1) = \underline{4}$ and $f'(-1) = \underline{-3/2}$



5. The position function of a particle after time t seconds is given by $s(t) = -t^2 - 4t + 10$.

- a) Find the average velocity of the particle from $t = 0$ to $t = 1$ seconds.

$$s(0) = 10$$

$$s(1) = \underline{5}$$

$$\frac{s(1) - s(0)}{1 - 0} = \frac{5 - 10}{1} = \underline{-5}$$

- b) Find the instantaneous velocity of the ball at 1 sec., using the definition of derivative to find the slope.

$$\lim_{h \rightarrow 0} \frac{s(1+h) - s(1)}{h} = \lim_{h \rightarrow 0} \frac{-(1+h)^2 - 4(1+h) + 10 - 5}{h} = \lim_{h \rightarrow 0} \frac{-1 - 2h - h^2 - 4h - 4 - 5 + 10}{h}$$

$$\lim_{h \rightarrow 0} \frac{h(-2 - h - 4)}{h} = \underline{-6}$$

- c) Explain why the answers vary by so much.

part a is between 0 + 1 sec and part b) is at 1 sec.

6. Use the **definition** of a derivative to find the slope of the tangent line and use it to find an equation of the tangent line to the curve at the given point.

$$f(x) = 3x - 2x^2 + 4 \quad \text{at } (1, 5)$$

$$y - 5 = m(x - 1)$$

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

$$m_{\text{tan}} = f'(x)$$

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

$$\lim_{h \rightarrow 0} \frac{3x + 3h - 2x^2 - 4xh - 2h^2 + 4 - 3x + 2x^2 - 4}{h} =$$

$$\lim_{h \rightarrow 0} \frac{h(3 - 4x - 2h)}{h} = 3 - 4x \text{ at } x = 1 = 3 - 4(1) = -1$$

$$y - 5 = -1(x - 1)$$

$$y = -x + 6$$