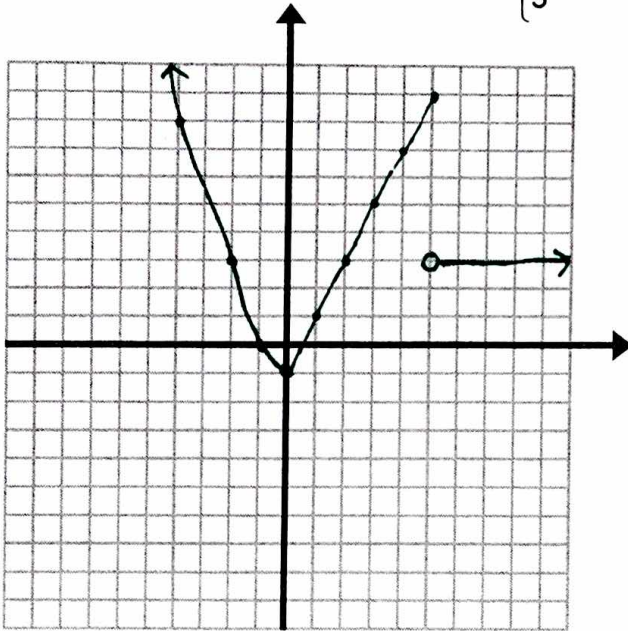


1. Graph the piecewise function $f(x) = \begin{cases} x^2 - 1 & x \leq 0 \\ 2x - 1 & 0 < x \leq 5 \\ 3 & x > 5 \end{cases}$



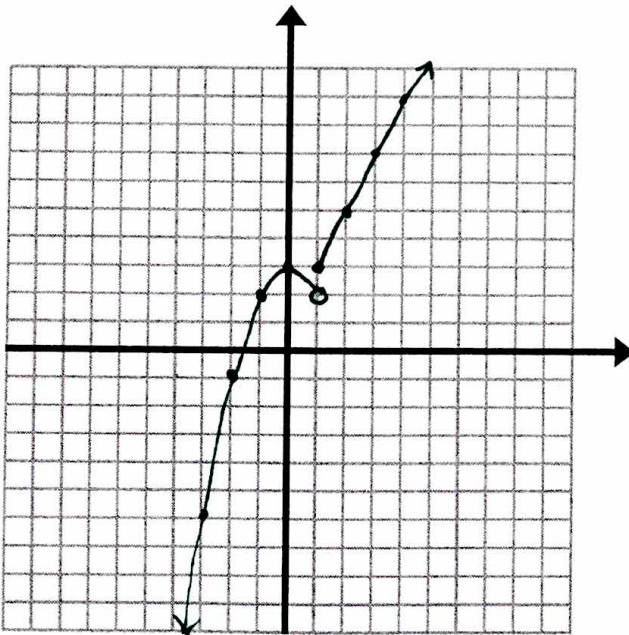
Evaluate each for $f(x)$ above.

$$f(-2) = 3$$

$$f(0) = -1$$

$$f(5) = 9$$

2. Graph the piecewise function $f(x) = \begin{cases} -x^2 + 3 & x < 1 \\ 2x + 1 & x \geq 1 \end{cases}$



Evaluate each for $f(x)$ above.

$$f(-2) = -1$$

$$f(6) = 13$$

$$f(1) = 3$$

Use the definition of derivative to find the derivative of each.

3. $f(x) = 3x^2 + 5x - 2$

$$= \lim_{h \rightarrow 0} \frac{3(x+h)^2 + 5(x+h) - 2 - (3x^2 + 5x - 2)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 + 5x + 5h - 2 - 3x^2 - 5x + 2}{h}$$

$$\lim_{h \rightarrow 0} 6x + 3h + 5 = 6x + 5 \quad \boxed{f'(x) = 6x + 5}$$

4. $f(x) = \frac{4}{x+1}$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\frac{4}{x+h+1} - \frac{4}{x+1}}{h} = \lim_{h \rightarrow 0} \frac{4(x+1) - 4(x+h+1)}{(x+h+1)(x+1)} \cdot \frac{1}{h}$$

$$= \lim_{h \rightarrow 0} \frac{4x + 4 - 4x - 4h - 4}{h(x+h+1)(x+1)}$$

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

Find each limit algebraically! Show work!

5. $\lim_{x \rightarrow -3} \left(\frac{x^2 - 9}{2x^2 + 7x + 3} \right)$

$$\lim_{x \rightarrow -3} \frac{(x-3)(x+3)}{(2x+1)(x+3)}$$

$$\frac{-3-3}{2(-3)+1} = \frac{-6}{-5} = \boxed{\frac{6}{5}}$$

6. $\lim_{x \rightarrow 1} \left(\frac{2x+1}{3x-2} \right)$

$$\frac{2(1)+1}{3(1)-2}$$

$$\boxed{3}$$

7. $\lim_{x \rightarrow 2} \frac{\frac{x+2}{x} - 2}{x-2}$

$$= \lim_{x \rightarrow 2} \frac{\frac{x+2}{x} - \frac{2x}{x}}{x-2}$$

$$= \lim_{x \rightarrow 2} \frac{-x+2}{x} \cdot \frac{1}{x-2}$$

$$= \lim_{x \rightarrow 2} \frac{-(x-2)}{x(x-2)}$$

$$= \lim_{x \rightarrow 2} \frac{-1}{x}$$

$$= \boxed{-\frac{1}{2}}$$