

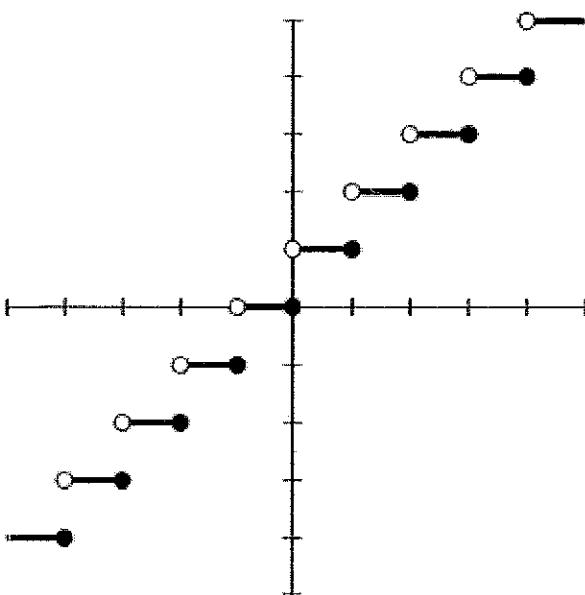
1. Refer to the graph at the right and determine the following values or limits, if they exist. If the limit does not exist explain why.

A)  $\lim_{x \rightarrow 2^+} f(x) = 3$

B)  $\lim_{x \rightarrow 2^-} f(x) = 2$

C)  $\lim_{x \rightarrow 2} f(x)$  DNE, Left  $\neq$  Right  
because  $f(2)$  does not exist.

D)  $f(1) = 1$



2. Graph the function  $f(x)$  at the right to determine the following limits, if they exist. If the limits do not exist explain why.

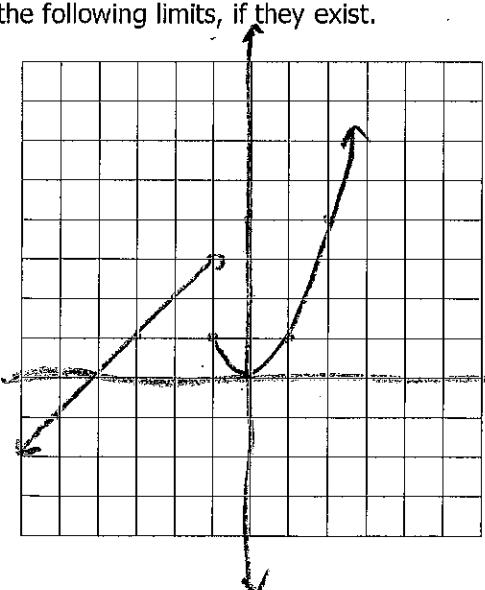
$$f(x) = \begin{cases} x^2 & \text{if } x \geq -1 \\ x + 4 & \text{if } x < -1 \end{cases}$$

A)  $\lim_{x \rightarrow -1^+} f(x)$  1

B)  $\lim_{x \rightarrow -1^-} f(x)$  3

C)  $\lim_{x \rightarrow -1} f(x)$

D)  $\lim_{x \rightarrow 3} f(x)$  9



3-8. Evaluate the limits (if they exist)

3.  $\lim_{x \rightarrow 5} \frac{x+1}{x-3}$

$$\lim_{x \rightarrow 5} \frac{x^2 - 9}{x-3} = \lim_{x \rightarrow 5} \frac{(x-3)(x+3)}{x-3} = \lim_{x \rightarrow 5} (x+3) = 8$$

(3)

4.  $\lim_{x \rightarrow -2} (x^3 - 3x + 6)$

$$(-2)^3 - 3(-2) + 6 = -8 + 6 + 6 = 4$$

(4)

5.  $\lim_{x \rightarrow 3} \frac{x^2 + x - 12}{x-3}$

$$\lim_{x \rightarrow 3} (x+4) = 7$$

(7)

6.  $\lim_{u \rightarrow 0} \frac{(u+1)^2 - 1}{u}$

$$u+1 \rightarrow u+2 \quad \frac{u^2 + 2u}{u}$$

$$u(u+2), \quad u+2 \neq 2$$

7.  $\lim_{x \rightarrow 1} \frac{4x^2 - 3x + 5}{6 + 5x - 3x^2}$

$$\frac{4(1)^2 - 3(1) + 5}{6 + 5(1) - 3(1)^2} = \frac{4 - 3 + 5}{6 + 5 - 3} = \frac{6}{8} = \frac{3}{4}$$

8.  $\lim_{x \rightarrow 9} \frac{\sqrt{x+7} - 3}{5}$

$$\frac{\sqrt{16} - 3}{5} = \frac{1}{5}$$

9. Find the slope of the tangent to the graph of  $f(x) = x^2 - 4x$  at the point  $(3, -3)$

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

$$\lim_{h \rightarrow 0} \frac{h^2 + 6h + 9 - 9 - 4h - 12}{h} = \lim_{h \rightarrow 0} \frac{2h^2 + 2h}{h} = \lim_{h \rightarrow 0} 2(h+1) = 2$$

10. Show a set up and work as you use limits to determine the derivative of  $f(x) = 2x^2 - 1$  at 3

A) Find the derivative

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

B) What is the slope of the tangent line at 3

$$f'(3) = 12$$

$$\lim_{h \rightarrow 0} \frac{2(x^2 + 2xh + h^2) - 1 - 2x^2 + 1}{h} = \lim_{h \rightarrow 0} \frac{4xh + 2h^2}{h} = \lim_{h \rightarrow 0} (4x + 2h) = 12$$

$$\lim_{h \rightarrow 0} \frac{4xh + 2h}{h} = \lim_{h \rightarrow 0} 4x + 2h = 12$$

$$\lim_{h \rightarrow 0} 4x + 2h = 4x$$