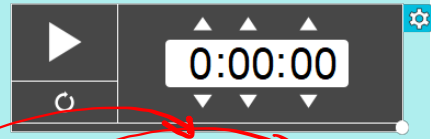


Warm Up

Evaluate the following limits, if they exist:



1. $\lim_{x \rightarrow 2} \frac{x-2}{x^3-8}$

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

2. $\lim_{x \rightarrow 7} \frac{(\sqrt{x+2}-3)(\sqrt{x+2}+3)}{x-7}$

$\lim_{x \rightarrow 7} \frac{x+2-9}{(x-7)(\sqrt{x+2}+3)}$

$\lim_{x \rightarrow 7} \frac{\cancel{x-7}}{\cancel{x-7}(\sqrt{x+2}+3)} = \frac{1}{6}$

3. $\lim_{h \rightarrow 0} \frac{(a+h)^2 - a^2}{h}$

$\lim_{h \rightarrow 0} \frac{[(a+h)+a][(a+h)-a]}{h}$

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

$\lim_{h \rightarrow 0} \frac{(2a+h)\cancel{h}}{\cancel{h}} = 2a$

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

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

$\lim_{h \rightarrow 0} \frac{a^2 + 2ah + h^2 - a^2}{h}$

$\lim_{h \rightarrow 0} \frac{2ah + h^2}{h}$

$\lim_{h \rightarrow 0} \frac{\cancel{h}(2a+\cancel{h})}{\cancel{h}} = 2a$

Questions from Homework

$$5) a) \lim_{h \rightarrow 0} \frac{(4+h)^3 - 64}{h}$$

$$\lim_{h \rightarrow 0} \frac{[(4+h) - 4] [(4+h)^2 + 4(4+h) + 16]}{h}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{h} [(4+h)^2 + 4(4+h) + 16]}{\cancel{h}} = 48$$

$$5) f) \lim_{h \rightarrow 0} \frac{4(a+h)^2 \frac{1}{(a+h)^2} - \frac{1}{4} 4(a+h)^2}{\frac{h}{1} 4(a+h)^2} \quad \text{CD: } 4(a+h)^2$$

$$\lim_{h \rightarrow 0} \frac{4 - (a+h)^2}{4h(a+h)^2} \quad \leftarrow \text{factor}$$

$$\lim_{h \rightarrow 0} \frac{[a+(a+h)][a-(a+h)]}{4h(a+h)^2}$$

$$\lim_{h \rightarrow 0} \frac{[a+a+h][a-a-h]}{4h(a+h)^2}$$

$$\lim_{h \rightarrow 0} \frac{(4+h)\cancel{h}^{-1}}{4h\cancel{h}} = \frac{-4}{16} = \boxed{-\frac{1}{4}}$$

Questions from Homework

$$\textcircled{5} \text{ e) } \lim_{h \rightarrow 0} \frac{(\sqrt{9+h} - 3)(\sqrt{9+h} + 3)}{h(\sqrt{9+h} + 3)}$$

$$\lim_{h \rightarrow 0} \frac{9+h-9}{h(\sqrt{9+h} + 3)}$$

$$\lim_{h \rightarrow 0} \frac{h}{h(\sqrt{9+h} + 3)} = \frac{1}{6}$$

$$\textcircled{4} \text{ f) } \lim_{x \rightarrow -3} \frac{x+3}{x^3+27}$$

$$\lim_{x \rightarrow -3} \frac{(x+3)}{(x+3)(x^2-3x+9)} = \frac{1}{27}$$

The common sense definition of a limit...



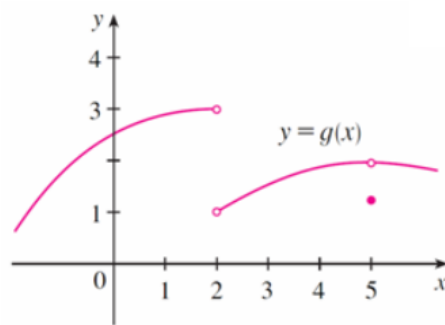
When does a limit exist?



One-sided limits

Use the graph shown below to evaluate the following limits:

when it says $\lim_{x \rightarrow \#}$ use your ruler.



1. $\lim_{x \rightarrow 2^-} g(x) = \boxed{3}$ 2. $\lim_{x \rightarrow 2^+} g(x) = \boxed{1}$ 3. $\lim_{x \rightarrow 2} g(x) = \boxed{\text{DNE}}$

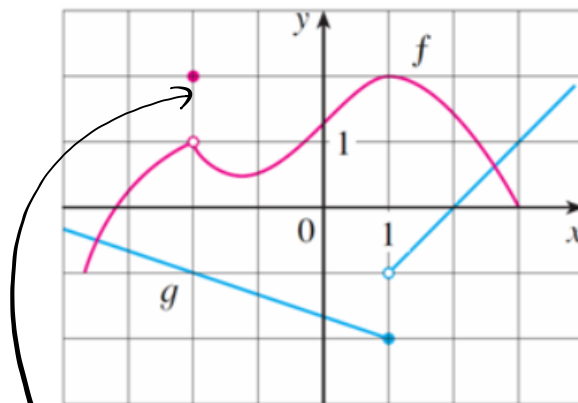
"as x approaches 2 from the left"

"as x approaches 2 from the right"

4. $\lim_{x \rightarrow 5^-} g(x) = \boxed{2}$ 5. $\lim_{x \rightarrow 5^+} g(x) = \boxed{2}$ 6. $\lim_{x \rightarrow 5} g(x) = \boxed{2}$

Notice... $g(5) = 1.2$ (pick closed dot)
 $g(2) = \text{undefined}$

Example:



Evaluate each of the following:

$f(-2) = 2$ $\lim_{x \rightarrow 1^-} g(x) = -2$ $g(1) = -2$

$\lim_{x \rightarrow 1^+} g(x) = -1$ $\lim_{x \rightarrow 1} g(x) = \text{DNE}$ $\lim_{x \rightarrow 1} f(x) = 2$

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

Homework

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