Lesson 99 Objective: SWBAT understand and determine limits algebraically by substituting.

Kickoff- Simplify each of the following:

1) $\frac{x^2+5x+4}{x+4}$

$\frac{(x+1)\cancel{(x+4)}}{\cancel{x+4}}$

$x+1$

2) $\frac{x^2+8x+12}{x^2+3x-18}$

$\frac{(x+2)\cancel{(x+6)}}{\cancel{(x+6)}(x-3)}$

$\frac{x+2}{x-3}$

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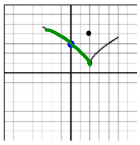
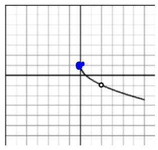
5)



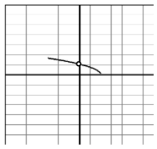
a) $\lim_{x\to 2^-} f(x)$ 1
b) $\lim_{x\to 2^+} f(x)$ 1
c) $\lim_{x\to 2} f(x)$ 1
d) f(2) 4
e) $\lim_{x\to 0^-} f(x)$ 3
f) $\lim_{x\to 0^+} f(x)$ 3
g) $\lim_{x\to 0} f(x)$ 3
h) f(0) 3

5)



a) $\lim_{x\to 2^-} f(x)$ -1
b) $\lim_{x\to 2^+} f(x)$ -1
c) $\lim_{x\to 2} f(x)$ -1
d) f(2) DNE
e) $\lim_{x\to 0^-} f(x)$ * No Domain
f) $\lim_{x\to 0^+} f(x)$ 1
g) $\lim_{x\to 0} f(x)$ * 1
h) f(0) 1

6)



a) $\lim_{x\to 2^-} f(x)$ 0
b) $\lim_{x\to 2^+} f(x)$ * ND
c) $\lim_{x\to 2} f(x)$ * ND
d) f(2) 0
e) $\lim_{x\to 0^-} f(x)$ 1
f) $\lim_{x\to 0^+} f(x)$ 1
g) $\lim_{x\to 0} f(x)$ 1
h) f(0) DNE

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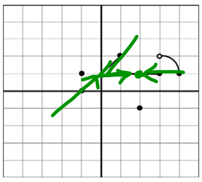
10) ***True or False:*** *Write (T) for True and (F) for False.*



F a) $\lim_{x\to 2} f(x) = -1$
F b) $\lim_{x\to 1^-} f(x) = 1$
T c) $\lim_{x\to 1^+} f(x) = 1$
T d) $\lim_{x\to 2} f(x)$ exists
F e) $\lim_{x\to 3} f(x) = 1$
T f) $\lim_{x\to 1} f(x)$ DNE
T g) $\lim_{x\to 3^-} f(x) = 1$
T h) $\lim_{x\to 0^+} f(x) = \lim_{x\to 0^-} f(x)$
T i) $\lim_{x\to 0} f(x)$ exists
T j) $\lim_{x\to 2} f(x) = 1$

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14) $g(x) = \frac{x^2+1}{x+1}$, **find the following limits**

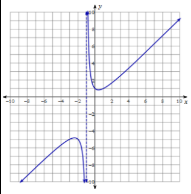
a) $\lim_{x\to 0} g(x)$

-1 0

Limit from the left → ← Limit from the right

x	-.01	-.001	-.0001	0	.0001	.001	.01
f(x)			1.0001	1	.9999		

Verify graphically



$\lim_{x\to 0^+} \frac{x^2+1}{x+1} = 1$

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

Therefore the $\lim_{x\to 0} \frac{x^2+1}{x+1} = 1$

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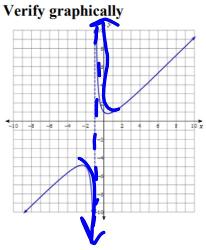
b) $\lim_{x\to -1} g(x)$

-2 -1 0

Limit from the left → ← Limit from the right

x	-1.1	-1.01	-1.001	-1	-.999	-.99	-.9
f(x)			-2002	DNE	1998		

Verify graphically



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

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

Therefore the $\lim_{x\to -1} \frac{x^2+1}{x} =$ DNE

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Direct Substitution and you get a whole number, fraction or decimal.

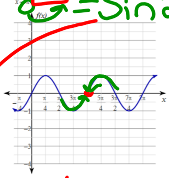
- Means the function is continuous and has no holes or asymptotes at that value.

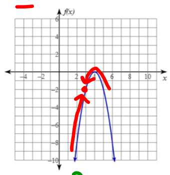
How to Solve: *Plug in the value directly into the function and the result is your answer.*

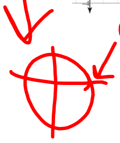
* exact values every time! *

1) $\lim_{x\to \pi} \sin(2x)$ $=\sin 2\pi = 0$

2) $\lim_{x\to 3} (-2x^2+16x-32)$ $= -2(3)^2+16(3)-32 = -2$







(1, 0)

Sin

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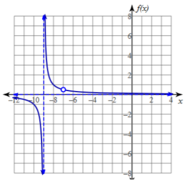
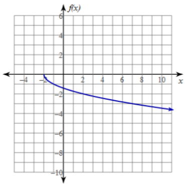
3) $\lim\limits_{x\to -4} \dfrac{x+7}{x^2+16x+63}$



$= \dfrac{-4+7}{(-4)^2+16(-4)+63} = \dfrac{\cancel{3}\,1}{\cancel{15}\,5} = \dfrac{1}{5}$

4) $\lim\limits_{x\to 3} -\sqrt{x+2} = -\sqrt{3+2} = -\sqrt{5}$



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Direct Substitution and you get 0/0

- Means the function has a hole at that value.

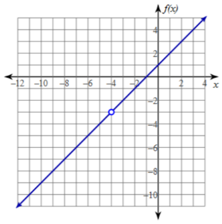
How to Solve: *Factor and cancel, and then plug the number into the simplified version*

Example #1:

$\lim\limits_{x\to -4} \dfrac{x^2+5x+4}{x+4} = \dfrac{0}{0}$

$\dfrac{\cancel{(x+4)}(x+1)}{\cancel{x+4}}$

$\lim\limits_{x\to -4} x+1 = \boxed{-3}$



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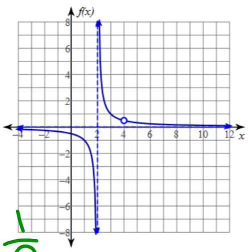
$\lim\limits_{x\to 4} \dfrac{x-4}{x^2-6x+8} = \dfrac{0}{0}$

$\dfrac{\cancel{x-4}}{(\cancel{x-4})(x-2)}$

$\lim\limits_{x\to 4} \dfrac{1}{x-2} = \dfrac{1}{4-2} = \dfrac{1}{2}$



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