NAME: ____ **Group Work 1**

1. **Know your graphs**: Give a function that satisfies the given criteria:

   (a) A function $f(x)$ that is not a polynomial, but has domain $(-\infty, \infty)$.

   There are multiple answers here, but some functions that work include $\sin(x)$, $\cos(x)$, e^x, $\arctan(x)$, $\sqrt[3]{x}$, etc.

   (b) A function $g(x)$ that is a polynomial, with $g(1) = 4$. Again, there are multiple answers here. The simplest function would have been the horizontal linear function $g(x) = 4$.

   (c) A function $h(x)$ that has domain $[-9, 5) \cup (5, 11)$. You could get creative here and do a piecewise function, but the easiest way to do this is to involve division by zero, even radicals, and logarithm terms. A function that works would be:

   $$h(x) = \frac{\sqrt{x+9}}{x-5} + \ln(11-x)$$

   My goal here was twofold: Can you follow our class notes and can you adjust accordingly.

2. **Miscellaneous Pre-Calc**: Answer the following:

   (a) Determine the slope of the line containing the points $(-2, 3)$ and $(5, 9)$.

   We'll revisit slopes in Section 2.1. I wanted to make sure that this concept is still fresh in your memory. The slope here should be 6/7.

   (b) A right circular cylinder has total volume of 300π cubic feet and a height of 15 ft. Determine its total surface area.

   You need to use the cylinder formula to find the radius, which is $r = \sqrt{20}$. You then plug this in to get SA = $2\pi\left(\sqrt{20}\right)^2 + 2\pi\left(\sqrt{20}\right)10$.

   (c) Let $f(x) = 2\sin(x)$ and $g(x) = \sin(2x)$. Determine the numeric values for the following:

Domain of $f(x) = (-\infty, \infty)$	Range of $f(x) = [-2, 2]$	$f\left(\frac{\pi}{4}\right) = \sqrt{2}$	$f\left(\frac{\pi}{2}\right) = 2$
Domain of $g(x) = (-\infty, \infty)$	Range of $g(x) = [-1, 1]$	$g\left(\frac{\pi}{4}\right) = 1$	$g\left(\frac{\pi}{2}\right) = 0$

Moral of 2C: These two functions are NOT the same.

3. **Solving Algebraic Equations**: You may just write in your answer.

   (a) $\dfrac{4}{x} = \dfrac{x^2+48}{x^3}$

   Cross multiply to get $4x^3 = x^3 + 48x$. Move the terms to one side to get $3x^3 - 48x = 0$. You can then factor this as $3x(x-4)(x+4) = 0$.

   This then gives you three potential answers. However, $x = 0$ is not allowed since it is not included in the domain of the original equation.

   (b) $e^{2x+5} = 7$

   This is an exponential equation. Take the natural log of both sides to get $\ln(e^{2x+5}) = \ln(7)$. The left side cancels giving you $2x + 5 = \ln(7)$. Isolate your variable and solve to get $x = \dfrac{\ln(7) - 5}{2}$.

(c) $\ln(8-2x)=9$

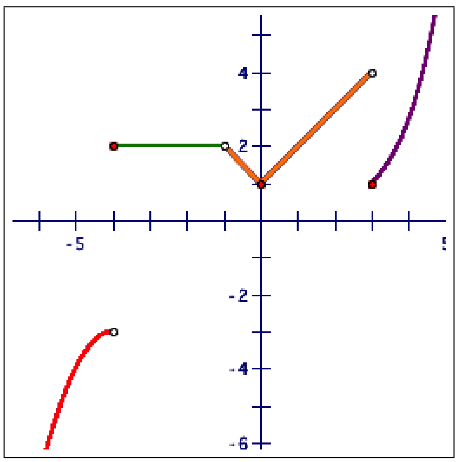
This is a logarithmic equation. Exponentiate both sides to get $e^{\ln(8-2x)}=e^9$. The left side cancels giving you $8-2x=e^9$. Isolate your variable and solve to get $x=\dfrac{e^9-8}{-2}$.

Let $f(x)$ be the piecewise function defined below. Use it to answer #4 and #5.

$$f(x)=\begin{cases} -(x+4)^2-3 & \text{for } x<-4 \\ 2 & \text{for } -4\le x<-1 \\ |x|+1 & \text{for } -1<x<3 \\ e^{x-3} & \text{for } x\ge 3 \end{cases}$$

Answer the following:

4. Sketch the graph of $f(x)$ below.



5. Compute the following limits.

a. $\lim_{x\to-4^-} f(x) = -3$

b. $\lim_{x\to-4^+} f(x) = 2$

c. $\lim_{x\to-4} f(x) =$ DNE

d. $\lim_{x\to-1^-} f(x) = 2$

e. $\lim_{x\to-1^+} f(x) = 2$

f. $\lim_{x\to-1} f(x) = 2$

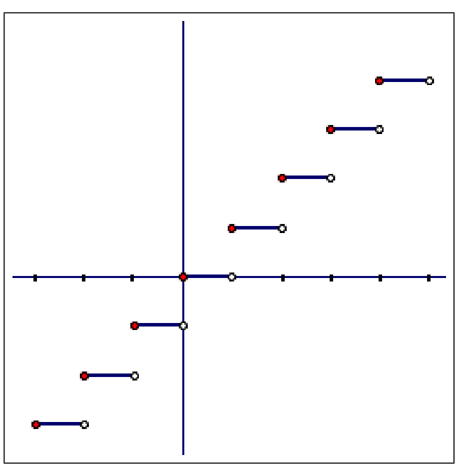
g. $\lim_{x\to3^-} f(x) = 4$

h. $\lim_{x\to3^+} f(x) = 1$

i. $\lim_{x\to3} f(x) =$ DNE

Take note of the colors. When you're approaching from one side, it is important that you consider which piece of the graph you are analyzing.

6. The floor function, denoted as $f(x)=\lfloor x\rfloor$, is graphed below. Use it to compute the following limits.



a. $\lim_{x\to1^-} \lfloor x\rfloor = 0$

b. $\lim_{x\to1^+} \lfloor x\rfloor = 1$

c. $\lim_{x\to2^-} x\cdot\lfloor x\rfloor = 2$

d. $\lim_{x\to2^+} x\cdot\lfloor x\rfloor = 4$

e. $\lim_{x\to3^-} \dfrac{\lfloor x\rfloor}{3x+1} = \dfrac{2}{10}$

f. $\lim_{x\to3^+} \dfrac{\lfloor x\rfloor}{3x+1} = \dfrac{3}{10}$