Last name:(blockletters)____________________ **First/Given Name:**________________

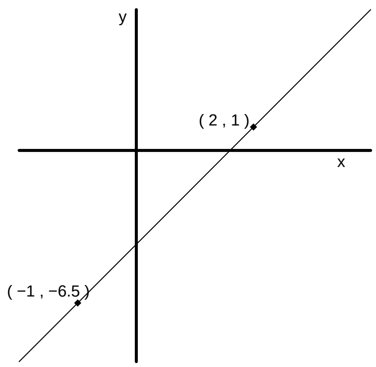
Student Number:____________________

MATH 121 - TEST 1 (Based on Assignments 1, 2, and 3)
Version 2A Fall 2010

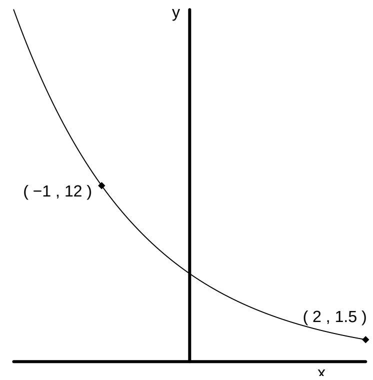
This test consists of 3 questions to be answered in the space provided. Show all work and give explanations when needed.

1. (a) Give the formula for the **linear** function shown in Graph A.

   (b) Give the formula for the **exponential** function shown in Graph B.



A



B

a) linear through $(-1, 6.5)$ & $(2,1)$

Genera form: $y = mx + b$

$-6.5 = m(-1) + b$ ①

$1 = m(2) + b$ ②

①−②

$-7.5 = -3m$

$\boxed{m = 2.5}$

From ② $1 = \overbrace{2.5(2)}^{=5} + b$

$\boxed{b = -4}$

$\boxed{y = 2.5x - 4}$ is the linear function

b) exp'l through $(-1, 12)$ & $(2, 1.5)$

General form: $y = a \cdot b^x$

$\Rightarrow$ ① $12 = a \cdot b^{-1}$

& ② $1.5 = a \cdot b^2$

Divide ①/②, $\dfrac{12}{1.5} = \dfrac{\cancel{a} \cdot b^{-1}}{\cancel{a} \cdot b^2}$

$8 = b^{-3}$

$b^3 = 1/8$

$\boxed{b = 1/2}$

Into ①, $12 = a \cdot (1/2)^{-1} = a \cdot 2$

$\boxed{6 = a}$

so $\boxed{y = 6 \cdot (1/2)^x}$ is the exponential function

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2. (a) Find all values of k that make the following function continuous on any interval.

$$f(x) = \begin{cases} kx^2 & x \le 2 \\ 3x & x > 2 \end{cases}$$

Need limits to equal value at $x=2$ (only possible discontinuity)

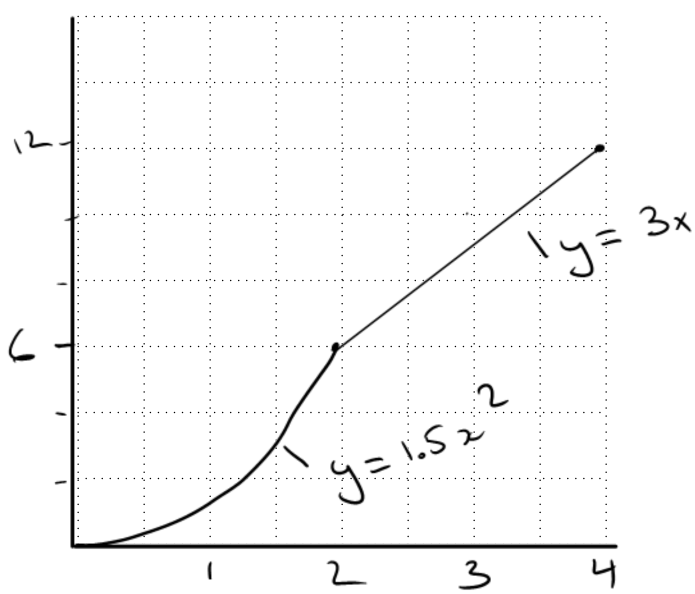
$$\lim_{\underbrace{x \to 2^-}_{x<2}} f(x) = \lim_{x \to 2^-} Kx^2 = K(2)^2 = 4K$$

$$\lim_{\underbrace{x \to 2^+}_{x>2}} f(x) = \lim_{x \to 2^+} 3x = 3(2) = 6$$

value at $x=2 \Rightarrow f(2) = K(2)^2 = 4K$

To be continuous, we need $4K = 6$, or $\boxed{K = 1.5 = 3/2}$

(b) Sketch the graph of $f(x)$ on the axes below, using one of the k value(s) found in part (a), on the interval $0 \le x \le 4$.



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3. Evaluate the following derivatives. You do not need to simplify the result.

   (a) $\frac{d}{dx}\left(x^4 + 8 \cdot 10^x\right)$

   (b) $\frac{d}{dx}\sin(4x^2)$

   (c) $\frac{d}{dx}\frac{e^{9x}}{\sqrt[3]{x}}$

a) $4x^3 + 8 \cdot 10^x \cdot \ln(10)$

b) $\cos(4x^2) \cdot 8x$

c) $\frac{d}{dx}\left(\frac{e^{9x}}{x^{1/3}}\right) = \frac{e^{9x} \cdot 9 \cdot x^{1/3} - e^{9x} \cdot \left(\frac{1}{3}x^{-2/3}\right)}{x^{2/3}}$

or $= \frac{d}{dx}\left(e^{9x} \cdot x^{-1/3}\right) = 9e^{9x} \cdot x^{-1/3} + e^{9x}\left(-\frac{1}{3}x^{-4/3}\right)$