MATH 131 – Calculus for Physical and Life Sciences
Practice Questions for Exam 1
September 17, 2007

Disclaimers: The actual exam questions may be formatted differently and may ask things in different ways, explore different aspects of the topics we have discussed, etc. The following questions *only* indicate the range of topics that will be covered and the approximate mix of topics and degree of difficulty of the questions on the real exam. There are probably a few more parts here than will appear on the real exam.

I. Let $f(x) = \sqrt{1-x}$ and $g(x) = e^{-x}$.

A) What is are the functions $(f \circ g)(x) = f(g(x))$ and $(g \circ f)(x) = g(f(x))$?

B) What is the domain of $f \circ g$?

C) Is $f \circ g$ a one-to-one function? If so, find its inverse function $(f \circ g)^{-1}$. If not, say why not.

II. Consider the function $K(t)$, which gives the height (in feet) of a kite above the ground at time t (in seconds):

t	2.0	2.5	3.0	3.5	4.0
$K(t)$	47	54	61	68	75

A) Explain why it is reasonable to suspect that $K(t)$ is a linear function, and give a possible formula for $K(t)$.

B) If $K(t)$ is given by your formula from part A, K a one-to-one function. Give a formula for K^{-1}.

C) Using your formula from part A, what is the value $K(5)$ and what does this number represent?

D) What does the number $K^{-1}(70)$ represent.

III. Charcoal is created by burning wood. The amount of radioactive C^{14} left in in the charcoal decays over time. One half of the original amount is left after 5730 years.

A) If 300 grams are present originally, give a formula for the amount left after t years.

B) How much is left after 17190 years?

C) How much is left after 30000 years? Express your answer in *exact form*, not as a decimal approximation.

IV. Short answer:

A) Find all solutions of the equation $|\sin(2x)| = 1$ for $0 \le x \le 2\pi$ (Note: $|x|$ is the absolute value of x: $|x| = x$ if $x \ge 0$ and $|x| = -x$ if $x < 0$.)

B) Express as a single logarithm value: $-\frac{1}{2}\ln(x) + 3\ln(x-1)$.

C) True or False: For all real x, $\tan^{-1}(\tan(x)) = x$. Explain.

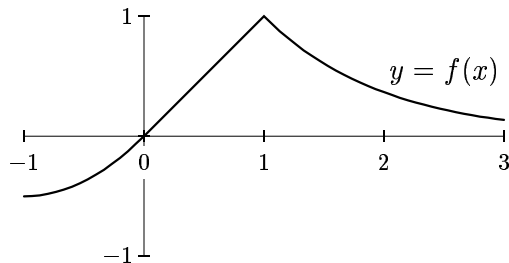D) Simplify: $\tan(\sin^{-1}(3x))$. (Hint: Set up a right triangle containing an angle $\theta = \sin^{-1}(3x)$.)

V. Use graph transformations to sketch the following graphs. Indicate clearly where your graphs cross the x- and y-axes:

A) $y = 5\sin(x - \pi/2) + 3$ for $0 \le x \le 2\pi$

B) $y = 5 - 2^x$

C) $y = 5 - 2^{-x}$

VI. The graph $y = f(x)$ and four graphs obtained by transforming it are shown. Match the given formulas with the corresponding graph. Note that there is an extra graph.

(a) $y = f(\frac{1}{2}x)$:   (b) $y = \frac{1}{2}f(x)$:   (c) $y = \frac{1}{2} - f(x)$:

(i)   (ii)   (iii)   (iv)