Name: _____

AP Calculus BC **Diagnostic Test - Precalculus** September 18, 2011

Instructions: Put your name above. Put your final answers to each question in the designated space, circled if possible. Remember that no work translates to no credit. If you have a question about the clarity of a problem, please ask. This will be due on Sunday, September 25, 2011 at the beginning of class. Do not worry at this point about how this assignment will be graded—just focus on getting a good review out of this.

Graphing Calculator Not Necessary: This entire assessment can be completed successfully without the use of a calculator. As a matter of fact, several of the problems are "writing" problems, and several of them actually give you the "answer" and ask you how to find it. If you wish to check your answers with a calculator, that is understandable and perfectly legitimate. However, final answers without sufficient work shown are not helpful to me and will simply not be graded on this assessment.

1. Explain why c and d are the x- and y-intercepts, respectively, of the line with equation $\frac{x}{c}+\frac{y}{d}=1$.

2. Find an equation for the line passing through the origin which is perpendicular to the line with equation $4y-2x=1$.

3. Sketch a graph of the function $f(x)=2-|2x+1|$. Then, rewrite $f(x)$ as a piecewise-defined function.

4. Draw a sketch of the piecewise-defined function f, and find its domain and range, if f is defined by:

$$f(x) = \begin{cases} 4 - x^2 & x < 1 \\ \left(\frac{3}{2}\right)x + \frac{3}{2} & 1 \le x \le 3 \\ \frac{4x^2 + 1}{3x^2 + 4} & x > 3 \end{cases}$$

5. Describe the graph of $y = 2(x - 1)^2 - 4$ in relation to the graph of $y = x^2$. Key words for this problem may include words like shift, stretch, shrink, translation.

6. Find the points of intersection of the graphs of the equations $x^2 + y = 6$ and $x + y = 4$.

7. If $u(x) = 4x - 5$, $v(x) = x^2$, and $f(x) = 1/x$, find formulas for $u\big(v(x)\big)$ and $v\Big(u\big(f(x)\big)\Big)$.

8. Sketch a graph of $y = -2^x - 1$.

9. Rewrite 9^{6x} to have base 3. In other words, $9^{6x} = 3^{???}$.

10. Force an exponential function (of the form $f(x) = ka^x$) through the two points $P(1, 4.5)$ and $Q(-1, 0.5)$. I.e., solve for k and a so that f goes through P and Q. Is your answer unique, or are there many values of k and a that work? Try to explain why this might be the case.

11. Suppose that a colony of bacteria starts with 1 bacterium and doubles in population every half hour. How many bacteria will the colony contain in exactly one day?

12. Express $f(x) = 1 - (\ln 3)\log_3 x$ as a single natural logarithm; state the domain and range of f, and sketch a graph.

13. Derive the following identities using the **angle-sum** formulas:

a) $\cos\left(\frac{\pi}{2} - x\right) = \sin x$

b) $\sin(A - B) = \sin A \cos B - \cos A \sin B$

14. Sketch a graph of $y = \cos\left(x + \frac{\pi}{4}\right) - 1$.

15. Rewrite the parametric equations solely in terms of x and y: $x = 3t$, $y = 9t^2$, and sketch the curve with these parametric equations.

16. Find a parameterization for the line segment with endpoints $(-1, -3)$ and $(4, 2)$.

17. Plot the point with Cartesian coordinates $P(-1, 1)$ and find two sets of polar coordinates for P. Then, plot the point with polar coordinates $Q\left(2, -\frac{\pi}{3}\right)$ and find the Cartesian coordinates for Q.

18. Show that the graph of the equation $r = -8\cos\theta$ is a circle (Hint: you can easily convert to rectangular coordinates after multiplying both sides of the equation by r; you should get $x^2 + y^2 = -8x$ when you convert. Then, complete the square and you should get something that looks like an equation for a circle.)

19. Find a formula for the nth term of the sequence $2, 6, 10, 14$.

20. Find a formula for the nth term of a geometric sequence whose infinite series converges to $1/2$.

	Section	#	Score	Out Of
AB and BC Content (70%)	Linear Functions (10%)	1		5
		2		5
		TOTAL		10
	Functions and Systems (25%)	3		5
		4		5
		5		5
		6		5
		7		5
		TOTAL		25
	Exponentials and Logarithms (25%)	8		5
		9		5
		10		5
		11		5
		12		5
		TOTAL		25
	Trigonometry (10%)	13a		2.5
		13b		2.5
		14		5
		TOTAL		10
BC Content (30%)	Parametric Equations (10%)	15		5
		16		5
		TOTAL		10
	Polar Coordinates (10%)	17		5
		18		5
		TOTAL		10
	Sequences and Series (10%)	19		5
		20		5
		TOTAL		10
	Total Score (%):			

Notes: This will be counted as an extra credit toward your final semester average. It is undetermined to what extent, but no more than an addition of this score divided by 100 (I.e., a score of 100 would translate to the addition of 1 percentage point to your final semester average.)