Math 112 - Practice for Test 3 **Name** _____
November 21, 2018

Grade: _____/80 = _____

No calculators. Circle or box-in answers.

1. Use differentiation rules to find the derivative of each of the following functions. Simplify and label each derivative appropriately. Circle or box-in your final answer.

(a) $f(x) = x^{14} - 5x^3 \sin\left(\frac{x}{2}\right)$ (6 pts.)

(b) $y = \dfrac{x^2 - x + 3}{x}$ (6 pts.)

(c) $g(t) = \dfrac{\tan \pi t}{1 + t^2}$ (6 pts.)

(d) $z = 4(\sqrt[3]{x})^2 - \frac{2}{3}e^{-8x^2} + 5\,e^4$. (6 pts.)

(e) $y = \sqrt{5 + \ln 4x}$ (6 pts.)

(f) $\phi(t) = \log_2 t - \dfrac{5}{6}\cos 3t$ (6 pts.)

(g) $y = 4^x + \ln|\sec x|$ (6 pts.)

2. Let $B(t)$ be the number of US \$20 bills in circulation at time t. The following table gives values of this function from 1990 to 2010, as of December 31, in billions.

t	1990	1995	2000	2005	2010
$B(t)$	3.45	4.21	4.93	5.77	6.53

Estimate the value of the derivative $B'(2000)$ and interpret. (8 pts.)

3. Find the equation of the tangent line to the curve $y = 1 - \cos(x/2)$ when $x = \pi$. (6 pts.)

4. Show how to find $\lim_{x\to 0} \dfrac{\sin 3x \sin 4x}{x^2}$ using a well-know limit that was derived in class. (6 pts.)

5. A table of values for f, g, f', and g' is given in the following table. (8 pts.)

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	3	2	4	6
2	1	8	5	7
3	7	2	7	9

(a) If $h(x) = f(g(x))$, find $h'(1)$.

(b) If $H(x) = g(f(x))$, find $H'(1)$.

6. A ladder 10 feet long rests against a vertical wall. Let θ be the angle between the top of the ladder and the wall and let x be the the distance from the bottom of the ladder to the wall. If the bottom of the ladder slides away from the wall, how fast does x change with respect to θ when $\theta = \pi/3$? (5pts.)

7. Use logarithmic differentiation to find the derivative of $y = (\tan x)^{1/x}$. (5pts.)

Extra Credit. (4 pts.) Use the definition of the derivative to determine the value of $\lim_{x\to 0} \dfrac{\ln(1+x)}{x}$.