MAT 201 Test 5, Fall, 2017 Name____________________

100 Points Covers Chapter 5 (and before)

You know the drill. And remember to circle final answers.

1. (20 pts) Sketch and find the area of the region bounded by $f(x)=4\sqrt{2x}$ and $g(x)=2x^2$.

2. Sketch the solid and then write the integral for the volume of the solid of revolution obtained by revolving the region bounded by $f(x)=4\sqrt{2x}$ and $g(x)=2x^2$ about the *y*-axis, using...

   a. (10 pts) ... washers (slices) and
   b. (10 pts) ... cylindrical shells (probably easier).

3. (20 pts) A 4-kg bucket, holding 20 kg of water is hoisted up from a 30-meter-deep well on a chain that has linear density .5 kg/m. How much work is done lifting the bucket of water up to the top of the well? (Use 9.8 m/s^2 for the acceleration due to gravity.)

4. (20 pts) Find the average value, f_{AVG}, of $f(x)=3x^2-2x+5$ on the interval $[1,6]$. Then find all $c\in(1,6)$ such that $f(c)=f_{AVG}$

5. (10 pts) If $g(x)=\int_0^{\sin(x)}\left(\pi t^2+17t-\cos(t)\right)dt$, what is $g'(x)$?

6. Suppose *x* and *y* are related to one another by the equation $x^2-4x\sin(y)-y^3=81$.

   a. (5 pts) Find $\frac{dy}{dx}$.
   b. (5 pts) Based on part a., find an equation of the tangent line to the curve at the point $(3,2)$.

Bonus Section Work up to 3 of the following problems, for up to 30 extra points.

Bonus 1 (10 pts) Use the limit definition of the derivative to find $f'(x)$ for $f(x)=2x^2+5x$.

Bonus 2 (10 pts) Prove that $\lim_{x\to 3}(5x-4)=11$, using the formal definition of the limit.

Bonus 3 (10 pts) Evaluate the definite integral $\int_0^{\pi}|2\cos(x)-1|\,d\theta$

Bonus 4 (10 pts) Find all extreme values of $f(x)=\sin(2x)-x$ on $[0,2\pi)$.

Bonus 5 (10 pts) Use the tangent line to approximate $\sqrt[3]{30}$.