Math 1352 Final Exam ·

1. Consider the region bounded by $y = x^2$ and $y = 2x$. **Set up** integrals to find the
   (a) Area of the region
   (b) Volume of the solid formed by rotating the region about the x-axis.
   (c) Volume of the solid formed by rotating the region about the line $x = -5$.

2. For the vectors $\mathbf{u}=< 1, 0, -2 >$ and $\mathbf{v}=< 0, -3, 1 >$, find
   (a) $\mathbf{u}+3\mathbf{v}$
   (b) $\mathbf{v} \times \mathbf{u}$
   (c) The cosine of the angle between $\mathbf{u}$ and $\mathbf{v}$

3. Sketch the graph of $r = 3(1 - \cos\theta)$.

4. Evaluate the following integrals:
   (a) $\int \dfrac{1}{\sqrt{x^2 + 9}}\, dx$
   (b) $\int x \sec^2 x\, dx$

   (c) $\int \dfrac{5x}{(x - 1)(x + 4)}\, dx$
   (d) $\int \cos^2(3x)\, dx$

5. Does the series $\displaystyle\sum_{k=1}^{\infty} \dfrac{3^k}{4^k}$ converge? If so, find the sum. If not, explain why.

6. Does the sequence $\left\{ \dfrac{3^k}{4^k} \right\}$ converge? If so, find the limit. If not, explain why.

7. Do the following series converge or diverge? Indentify any tests you use and show all the worked needed to apply them.
   (a) $\displaystyle\sum_{k=1}^{\infty} \dfrac{(2k)!}{3^k}$
   (b) $\displaystyle\sum_{k=2}^{\infty} \dfrac{\cos k}{k^2}$
   (c) $\displaystyle\sum_{k=2}^{\infty} \dfrac{3k - \sqrt{k}}{k^4 + 1}$

8. Find the first 3 terms of the Maclaurin series for $\ln(x + 2)$.

9. A (downward pointing) conical tank has a height of 10 ft and radius of $3ft$. It is filled with milk. **Set up** an integral to find the work done in pumping the milk out of the tank through a pipe that extends $5ft$ above the top of the tank. (Note the density of milk is 64.5 lb/ft^3.)