MAT 122 Test 5 – Spring, 2018 (5 pts) Name_____
100 Points NO GRAPHING CALCULATORS!!!

10-point deduction for each of the following: Faint writing, Lack of margin, Problems out of order, Illegibile work. Work on the back of any page will receive zero points. Other than that, we're golden. :o)

1. We convert $(x, y) = (-3, 2)$ to polar coordinates, (r, θ).

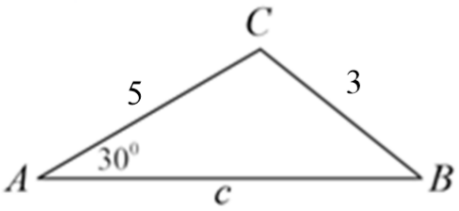
   a. (15 pts) Assume $r > 0$ and $\theta \in [0, 360^0)$. Find the *exact* polar coordinates of the point. This may require leaving your answer with an 'arctan' in it. Use degrees for angle measures.

2. (15 pts) Convert $(r, \theta) = \left(5, \frac{7\pi}{6}\right)$ to rectangular coordinates. Give an exact answer and a decimal answer, accurate to 4 decimal places.

3. (15 pts) Sketch the graph of $r = 5\cos(3\theta)$.

Check the function in #3 for symmetry.

4. Consider the triangle in the figure on the right. Lengths are in miles.



   a. (10 pts) Show that this triangle has 2 solutions.
   b. (10 pts) Find the *acute* angle *B*. Round final answer to 4 decimal places.
   c. (10 pts) Find side *c*. Round final answer to 4 decimal places. Any numbers that you use in previous calculations should not be rounded. Always round at the end. Use the un-rounded *B* from part b, when you dive into the Law of Cosines, here.

Bonus 2 (5 pts) Find the *obtuse* version of angle *B*. Round final answer to 4 decimal places.

5. Let $f(x) = 2x^3 - 15x^2 + 44x - 39$.

   a. (5 pts) Use synthetic division to show that $x = 3 + 2i$ is a solution of the equation $f(x) = 0$.
   b. (5 pts) Find the linear factorization of f that is promised to us in the Fundamental Theorem of Algebra.

6. (15 points) Find the projection of $\bar{u}$ onto $\bar{v}$, that is, find $\text{proj}_{\bar{v}}\bar{u}$.

Bonus 1. (10 pts) Build a *cosine* function that achieves its maximum height of $y = 70$ meters at time $x = 3$ seconds and its minimum height of $y = -30$ meters at $x = 31$ seconds.

Bonus 2. (10 pts) Find $\sin\left(\frac{u}{2}\right), \cos\left(\frac{u}{2}\right)$ and $\tan\left(\frac{u}{2}\right)$, given that $\sin(u) = \frac{3}{7}$ and $\cos(u) < 0$.

Bonus 3. (5 pts) Check the function in #3 for symmetry.