MAT 122 Test 4 – Fall, 2018 Name_____
100 Points NO GRAPHING CALCULATORS!!!

I think you know the drill on margins and legibility. I can't give points for what I can't read. Take a minute, at the end, to make sure your work is organized and submitted in proper order.

1. Let $f(x) = 2x^3 - 3x^2 + 6x + 65$

a. (10 pts) Use synthetic division to find $f(3)$.

b. (10 pts) Use synthetic division to show that $x = 2 + 3i$ is a solution of the equation $f(x) = 0$.

2. Let $z = -\sqrt{3} - i$

a. (10 pts) Find $z + \bar{z}$ and $z\bar{z}$, where $\bar{z}$ is the complex conjugate of z.

b. (10 pts) Express z in trigonometric form.

3. Let $z = 8\left(\cos\left(\frac{5\pi}{3}\right) + i\sin\left(\frac{5\pi}{3}\right)\right)$

a. (10 pts) Express z in standard form.

b. (10 pts) Find the principal 3rd root of z, i.e., find $\sqrt[3]{z}$. Leave z in trigonometric form for this.

c. (10 pts) Now, find the *other* 3rd roots of z, in trigonometric form.

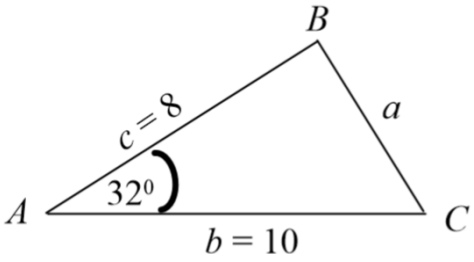
d. (10 pts) Find the trigonometric form of z^2.

4. (10 pts) Solve $3\csc^3(2\theta) - 6\csc^2(2\theta) - \csc(2\theta) + 2 = 0$.

(Hint: If $f(x) = 3x^3 - 6x^2 - x + 2$, then $f(2) = 0$.)

5. (10 pts) Sketch the polar graph of $r = 2 + 3\sin\theta$. (See Bonus 5 to possibly maximize your points for the amount of work you do.)

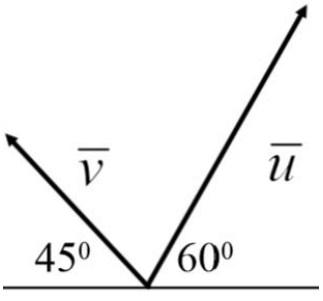
Work up to 4 bonus for up to 20 bonus points.



Bonus 1. (5 pts) Find the length of side *a*, for the triangle in the figure on the right, to 4 decimal places.

Bonus 2. (5 pts) Find the measure of angle *B*, for the triangle in the figure on the right, to 4 decimal places.

Bonus 3. Dad's out walking his dog and his toddler. The dog pulls with 50 pounds of force in the direction of the vector $\bar{u}$. The toddler pulls with 30 pounds of force in the direction of the vector $\bar{v}$.

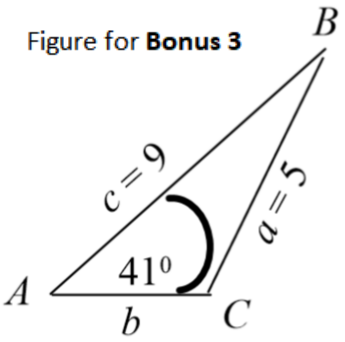


a. (5 pts) Express $\bar{u}$ and $\bar{v}$ in component form, in two ways: Give an exact answer, and an answer rounded to 3 decimal places.

b. (5 pts) What's the net force, as a vector, on poor Dad? Give an exact answer, and an answer rounded to 3 decimal places.

Bonus 4. (5 pts) Find the measure of the obtuse angle, *C*, to 4 decimal places, in the figure to the right

Figure for **Bonus 3**



Bonus 5. (5 pts) Sketch the graph of $-30\sin\left(\frac{3\pi}{22}x-\frac{15\pi}{22}\right)+17$

Bonus 6. (5 pts) Find $\sin\left(\frac{u}{2}\right)$, $\cos\left(\frac{u}{2}\right)$ and $\tan\left(\frac{u}{2}\right)$, given that $\cos(u)=-\frac{5}{8}$ and $\sin(u)<0$. Give exact answers in simplified radical form.

Bonus 7. (5 pts) Test the function in #5 for all 3 types of symmetry.