Read these instructions carefully. 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. The pictures that go with the problems will be at least $20 \%$ of the points.

1. (5 pts) Find all solutions $x \in[0,2 \pi)$ of the equation $2 \cos (x)-1=0$. This will support \#2 and Bonus 1 .
2. (5 pts) Find all solutions $x \in[0,2 \pi)$ of the equation $2 \cos (2 x)-1=0$. This supports \#3 and Bonus 2 .
3. (5 pts) Find all solutions of the equation in \#2.
4. (10 pts) Sketch the graph of $f(x)=2 \cos (2 x)-1$ in rectangular coordinates. This graph will support

Bonus 2, but it will have more of a "Bonus 3 shape."
5. Consider the triangle in the figure.
a. (10 pts) Use the Law of Cosines to find the length of side $c$. Round your final answer to 4 decimal places, but keep the un-rounded number in your calculator for
 the next question.
b. (5 pts) Give an exact answr to part a, in simplified radical form.
c. (10 pts) Use the Law of Sines to find the measure of angle $A$, in degrees, to 4 decimal places.
6. Let $f(x)=2 x^{3}-9 x^{2}+8 x+39$.
a. (10 pts) Use synthetic division to show that $x=3+2 i$ is a solution of the equation $f(x)=0$.
b. (5 pts) Find the linear factorization of $f$ that is promised by the Fundamental Theorem of Algebra
7. (5 pts) Express $z=5-5 i$ in trigonometric form.
8. Let $z=81\left(\cos \left(\frac{11 \pi}{6}\right)+i \sin \left(\frac{11 \pi}{6}\right)\right)$.
a. (10 pts) Express z in standard form.
b. ( 10 pts ) Find the principal $4^{\text {th }}$ root of $z$, i.e., find $\sqrt[4]{z}$. Leave $z$ in trigonometric form for this.
c. (10 pts) Now, find the other three $4^{\text {th }}$ roots of $z$, in trigonometric form.

Bonus Section Answer up to two (2) Bonus questions for up to 20 points.

Bonus 1. (10 pts) Sketch the graph of $r=2 \sin (x)-1$ in polar coordinates.

Bonus 2. ( 10 pts ) Sketch the graph of $r=2 \sin (2 x)-1$ in polar coordinates.
Bonus 3. (10 pts) Sketch the graph of $f(\theta)=20 \cos \left(\frac{\pi}{30} \theta+\frac{\pi}{3}\right)+40$. Show the midline as a dashed line, and clearly label the standard 5 (evenly-spaced) points that I always want to see. After this class, you won't be asked for this, special. It'll just be expected that you will find those key points.

Bonus 4. (10 pts) A 200-pound weight is fixed to 2 cables as shown in the figure. Find the amount of tension in each cable, in pounds. I want an exact answer (in simplified radical form, if necessary).


Bonus 5. (10 pts) Find $\sin \left(\frac{u}{2}\right), \cos \left(\frac{u}{2}\right)$ and $\tan \left(\frac{u}{2}\right)$, given that $\cos (u)=\frac{5}{16}$ and $\tan (u)<0$.

Bonus 6. ( 10 pts ) Build a sine function that achieves its maximum height of $y=215$ meters at time $x=8$ seconds and its minimum height of $y=15$ meters at $x=40$ seconds.

