Math 121 Precalculus **NAME:** _____

Final Exam **TA:** _____

December 9, 1999

Give complete explanations, not just answers, for full credit. Sketch any calculator graph you use including the axes with a scale. Give exact answers whenever possible; otherwise give answers accurate to 2 decimal places

1. Graph the function $f(x) = \dfrac{2x+3}{5x-4}$, but first find the following
   (a) The zero(s) of f. (b) The y-intercept of f.
   (c) The vertical asymptotes of f. (d) The end behavior asymptote of f.
   Show all the properties (a) through (d) on your graph.

2.
   a) A boat runs in a straight line for 4 km and then makes a 90° turn and goes for another 6 km. How far from its starting point is the boat?
   b) A boat runs in a straight line for 5 km and then makes a 45° turn and goes for another 6 km. How far from its starting point is the boat?

3. Find all solutions, real or complex, to the equation $5x^3 + 3x^2 - x + 1 = 0$. Give exact answers.

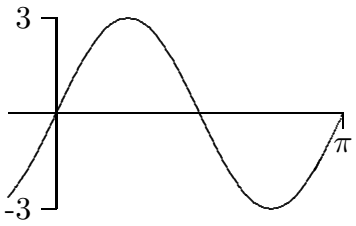
4. Find all real solutions to the equation $\ln(x) + \ln(x+2) = 3\ln 2$.

5. How long will it take for an investment to triple in value when interest is earned at an annual rate of 6.25% compunded monthly?

6. Find all solutions to the equation $\sin(x) = \sin(2x)$ in $[0,2\pi)$.

7. The formula $S(t) = P(1 + \dfrac{r}{12})^{12t}$ is used to compute the value of an investment with interest compounded monthly. If the annual interest rate is $r = 6.25\%$, answer the following questions:
   (a) If $\$15,000$ is invested originally, what is the value of the investment after five years?
   (b) How long will it take for an investment to triple in value?

8. Find a possible trig formula for the function whose graph is:



9. Given two vectors, $\mathbf{v} =< 2, 3 >$ and $\mathbf{u} =< 5, 4 >$,
   (a) Find $\mathbf{v} - 2\mathbf{u}$.
   (b) Find $\|\mathbf{u}\|$.
   (c) Find the direction angle of $\mathbf{u}$.
   (d) Find the component form of the unit vector in the direction $\mathbf{u}$.

10. A woman on the top of a 510 ft high building spots a small plane at an angle of elevation of 61°. A man on the ground level entrance to the building sees the plane and notes its angle of elevation is 67°.
    a) How far is the woman from the plane?
    b) How far is the man from the plane?
    c) How high is the plane?