Full credit will be given for correct answers with complete explanations. Give exact answers whenever possible, otherwise give answers accurate to two decimal places.

1. (10 pts) Determine whether the given statement is TRUE or FALSE. Briefly explain your reason for each answer.
(a) $(a+b i)^{2}=a^{2}-b^{2}$
(b) $\ln \left(\frac{a}{b}\right)=\frac{\ln a}{\ln b}$
(c) $\sqrt{a}+\sqrt{b}=\sqrt{a b}$
(d) $\log 10^{c}-c=0$
(e) $2^{a} \cdot 2^{b}=2^{a b}$
2. (15 pts) For the rational function $f(x)=\frac{2 x+1}{x-3}$,
(a) Find the the $x$-intercept(s).
(b) Find the $y$-intercept (where the graph of $f(x)$ crosses the $y$-axis).
(c) Find the vertical asymptote.
(d) Find the horizontal asymptote.
(e) Sketch the graph of $f(x)$, clearly indicating the above information on the graph.
3. (15 pts) Find a polynomial $f(x)$ of degree 4 whose roots are $1,-2,2 i$, and $-2 i$ and satisfies $f(2)=64$.
4. (15 pts) Solve: $2 x-1 \leq x+4<3 x+2$.
5. (15 pts) Find all roots, real and complex, of $x^{3}-3 x^{2}+x+5=0$.
6. ( 15 pts ) Suppose you put $\$ 2000$ into a savings account with an interest rate of $5 \%$, compounded quarterly. How long will it take for the account balance to reach $\$ 2250$ ?
7. ( 15 pts ) Find all solutions to the equation: $4^{x}=3^{2 x-3}$.
