MATH 120
WINTER 2015 NAME:
EXAM 4

1. [10 pts.] Use synthetic division to perform the division:

$$\frac{3x^4 - 4x^2 + 2}{x + 1}$$

2. [10 pts.] Factor

$$f(x) = x^4 + 2x^3 - 7x^2 - 20x - 12$$

into linear factors given that -2 is a zero of f with multiplicity 2.

3. Let $f(x) = x^4 + 2x^3 + x^2 + 8x - 12$.
   (a) [5 pts.] List the possible rational zeros of f.
   (b) [10 pts.] Find all zeros of f, including complex zeros. Give exact values.
   (c) [5 pts.] Factor $f(x)$ into linear factors.

4. [10 pts.] Find a polynomial function f of degree 3 that has real coefficients, zeros -2, 1, 0, and is such that $f(-1) = 6$.

5. [10 pts.] Find a polynomial function of lowest degree with rational coefficients that has $2 - i$ and -1 as some of its zeros.

6. [5 pts. each] Let $f(x) = \dfrac{x(x-2)}{(x+3)^2}$.
   (a) Find the domain of f.
   (b) Find the intercepts of f.
   (c) Find all vertical asymptotes of f.
   (d) Find the horizontal or oblique asymptote of f.
   (e) Find all points where f intersects its horizontal or oblique asymptote.
   (f) Sketch the graph of f, finding additional points as needed.

7. [5 pts. each] Suppose that \$1000 is invested at 9.2% interest, compounded quarterly.
   (a) Find the function for the amount to which the investment grows after t years.
   (b) Find the amount of money in the account at time $t = 5$ and $t = 10$ years.

8. [10 pts.] Express $2\log_5 a - 3\log_5 b^2$ as a single logarithm with coefficient 1.

9. [10 pts. each] Solve the equation algebraically.

   (a) $5^{4x-7} = 125$

   (b) $3^x = 2^{x-1}$

   (c) $\log_2(10 + 3x) = 5$

   (d) $\log_2(x + 1) + \log_2(x - 1) = 3$

10. [10 pts.] Find the time required for an investment of \$5000 to grow to \$7500 at an annual interest rate of 9% per year, compounded monthly.

11. [10 pts.] Find the doubling time of an investment earning 3.6% interest if interest is compounded continuously.

12. [15 pts.] Pinky and the Brain have 150 grams of radioactive narfzortium-343 in the lab. Upon returning from a frenzied spin around town in a nitro powered funny car one hour later, they find that 148 grams of ^{343}Nz remain. After how many hours will only 100 grams remain? (Recall that the basic model for a radioactive decay process is $A(t) = A_0 e^{-kt}$, so here A_0 and k will need to be determined first.)

Some formulas that may be useful:

$$A = Pe^{rt}$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$