MATH 120
SUMMER 2015 NAME:
EXAM 4

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

$$\frac{2z^4 - 3z^2 + 4z - 9}{z + 2}$$

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 $f(x) = 2x^3 - 3x^2 - 17x + 30$.
   (a) [5 pts.] List the possible rational zeros of f.
   (b) [10 pts.] Find all zeros of f, including any 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 3, -2, 0, and is such that $f(-1) = 16$.

5. [10 pts.] Find a polynomial function of lowest degree with real coefficients that has $1 + 3i$ and -4 as some of its zeros.

6. [5 pts. each] Let $h(x) = \dfrac{x^3 + x^2}{x^2 - 4}$.
   (a) Find the domain of h.
   (b) Find the intercepts of h.
   (c) Find all vertical asymptotes of h.
   (d) Find the horizontal or oblique asymptote of h.
   (e) Find all points where h intersects its horizontal or oblique asymptote.
   (f) Sketch the graph of h, finding additional points as needed.

7. [5 pts. each] Suppose that \$1000 is invested at 8.75% interest, compounded monthly.
   (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 $t = 7$ and $t = 14$ years.

8. [10 pts.] Express $2\log(a + 1) - 3\log(b^2) + \log(4c)$ as a single logarithm with coefficient 1.

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

   (a) $5^{4x+1} = 625$

   (b) $3^x = 8^{x+2}$

   (c) $\log_6(8 - 3x) = 2$

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

10. [10 pts.] Find the interest rate, as an annual percentage, that an investment must realize in order to grow in value from \$4,000 to \$5,750 in just 3 years, if interest is compounded continuously.

11. [10 pts.] Find the tripling time of an investment earning 5.33% interest if interest is compounded quarterly.

12. [15 pts.] Pinky and the Brain have 230 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 198 grams of ^{343}Nz remain. After how many hours will only 9 grams remain? (Recall that the basic model for a radioactive decay process is $A(t) = A_0e^{-kt}$, so here A_0 and k will need to be determined first.)

Some formulas that may be useful:

$$A = Pe^{rt}$$

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