MATH 120
SPRING 2013 NAME:
EXAM 4

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

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

2. [10 pts.] Factor

$$f(x) = 2x^3 + (3 - 2i)x^2 + (-8 - 5i)x + (3 + 3i)$$

into linear factors given that $1 + i$ is a zero of f.

3. Let $f(x) = x^3 + 5x^2 + 2x - 8$.
   (a) [5 pts.] List the possible rational zeros of f.
   (b) [10 pts.] Find all zeros of f.
   (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, 4, and is such that $f(2) = 12$.

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 $f(x) = \dfrac{x^2}{x^2 - x - 2}$.
   (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 \$750 is invested at 8% 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. [5 pts. each]

   (a) Convert $p^k = 3$ to a logarithmic equation.

   (b) Convert $\log_a M = -x$ to an exponential equation.

9. [10 pts.] Express $\ln(x^2 - 9) - \ln(x + 3)$ as a single logarithm, and simplify if possible.

10. [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) $\log_2(x + 1) + \log_2(x - 1) = 3$

11. [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.

12. [10 pts.] Find the doubling time of an investment earning 3.6% interest if interest is compounded continuously.

13. The number of fish of a certain species is given by the formula

$$n(t) = 12e^{0.012t},$$

    where t is measured in years and $n(t)$ is measured in millions.

    (a) [5 pts.] What will the population of fish be after four years?

    (b) [10 pts.] After how many years will the number of fish reach 35 million?

Some formulas that may be useful:

$$A = Pe^{rt}$$

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