MAT170 Review Problems for Exam 2

A. Zeros of a Polynomial – *Sections 2.3-2.5*
Algebraically solve $f(x) = 0$ for the following equations:

1. $f(x) = x^3 - 7x^2 + 11x$, given that 0 is a zero of $f(x)$.
2. $f(x) = 2x^3 + 3x^2 - 89x + 120$, given that 5 is a zero of $f(x)$.
3. $f(x) = x^3 - 3x^2 - x + 3$, given that 1 is a zero of $f(x)$.

B. Zeros and Multiplicities – *Section 2.3*
Algebraically find all the zeros and their multiplicities for the following functions:

1. $f(x) = 2x^3 - 3x^2 - 12x + 20$
2. $f(x) = x^3 - 3x + 2$
3. $f(x) = 3x^3 + 22x^2 + 15x - 100$

C. End Behavior of Polynomials – *Section 2.3*
Use the leading coefficient test to determine the end behavior of the following polynomial functions:

1. $f(x) = -2x^3 + x - 2$
2. $f(x) = -x^{10} - 3x^9 + x^2$
3. $f(x) = 2x^3 + x - 2$

D. Long or Synthetic Division – *Section 2.4*
Divide the following using long or synthetic division:

1. $\dfrac{2x^4 - 6x^2 + 1}{x + 1}$
2. $\dfrac{4x^2 - 8x + 1}{2x - 1}$
3. $\dfrac{2x^3 - 7x^2 + 2x + 3}{x - 3}$

E. More with polynomials and zeros – *Section 2.5*

1. Identify the zeros and the multiplicities of each zero for $f(x) = -2x^4(x+3)^2(x-7)^8$.

2. Construct a degree 4 polynomial with real coefficients with zeros at $3i$ (multiplicity 1), -4 (multiplicity 2) and with leading coefficient of 1.

3. Construct a degree 3 polynomial with real coefficients, with zeros at $2 + 3i$ (multiplicity 1), 5 (multiplicity 1), and with leading coefficient of 1.

F. Vertical Asymptotes – *Section 2.6*

Find the equation of the vertical asymptotes (if any) of the following functions:

1. $f(x)=\dfrac{3x+2}{x^2-1}$
2. $f(x)=\dfrac{x+4}{3x+1}$
3. $f(x)=\dfrac{x+2}{x^2-4}$

G. More with rational functions – *Section 2.6*

1. Construct a rational function with the following characteristics:
   i. x-intercepts at (2,0) and (7,0)
   ii. vertical asymptotes at $x = 4$ and $x = -5$
   iii. horizontal asymptote at $y = 9$

H. Applications of Rational Functions – *Section 2.6*

1. The following rational function in hundreds models the population of a certain species of animal, where t is measured in days. What number does the population approach in the long run?

$$p(t)=\frac{10t^3+2}{2t^3+1}$$

2. The average cost of producing a popular board game is given by the function: $\overline{C}(x)=\dfrac{1500+15x}{x}$, $x\geq 0$, when x is the number of the board game sold, identify the horizontal asymptote of the function and explain its meaning in this context.

3. The function $N(t)=\dfrac{0.8t+100}{5t+4}$, $t\geq 15$, gives the body concentration $N(t)$, in parts per million of a certain dosage of medication after time t, in hours. Find the horizontal asymptote of the graph and explain the meaning in the context of the problem.

I. Rewrite in the equivalent logarithmic form – *Section 3.1*

1. $a^{x+1}=65$
2. $e^{3x}=5$

J. Rewrite in the equivalent exponential form – *Section 3.2*

1. $\log_6(4x)=10$
2. $\ln(B)=A$

K. Compound interest – ***Section 3.4***

1. Find the accumulated value of an investment of $21,000 at an interest rate of 5.6% for 7 years:
   a) compounded monthly b) compounded continuously

2. a) What initial investment at 3.75% interest compounded continuously for 10 years will accumulate to $20,000?Round your answer to the nearest cent.
   b) What initial investment at 4.25% interest compounded monthly for seven years will accumulate to $20,000?Round your answer to the nearest cent.

L. Properties of Logarithms – ***Section 3.3***

Use properties of logarithms to write as a sum or difference logarithms with no exponents.

1. $\log\left(\frac{x^5 y^7}{z^3}\right)$ 2. $\ln\left((x-1)^{\frac{3}{2}}\sqrt{\frac{(y+3)^4}{z^8}}\right)$

Use properties of logarithms to express the following as a single logarithms

3. a) $2\ln(x) - 5\ln(y) + 9\ln(w)$ b) $\frac{3}{2}\ln(x+3) - \ln(x) - \frac{1}{2}\ln(x+3)$

4. a) $3\log(A) - 4\log(B) + 5\log(C) - 6\log(D)$ b) $\log(8) + \log(x^2 - 1) - \log(x) - \log(x+1)$

M. Exponential Equations – ***Section 3.4***

Solve the following for *x*

1. a) $2^{2x+17} = 8$ b) $10e^{3x-7} = 5$

2. a) $e^{2x} + 2e^x - 35 = 0$ b) $(7)^{2x} + 2\,(7)^x - 15 = 0$ c) $2e^{2x} + 3e^x - 20 = 0$

N. Domain of Logarithms function – ***Section 3.2***

Find the domain of the following function;

1. a) $f(x) = \ln(6-2x)$
   b) $f(x) = \log(4x+16)$

O. Logarithms Equations – ***Section 3.4***

1. Find the x-intercept of the following function:
   a) $f(x) = 4 - 2\log_3(2x-10)$
   b) $f(x) = \ln(2x+3)$

2. Solve the following for *x*:
   a) $\log_6(x) - \log_6(x-5) = 2$
   b) $\ln(x) + \ln(2x+1) = 0$

P. Applications of Exponential Equations – Section 3.5

1. How long will it take any quantity of iodine 131 to decay to 25% of its initial amount, knowing that it decays according to the function $A(t) = A_0 e^{-.087t}$ where t is the number of days?

2. The population of Merchantville was 20,000 in 1990 and 25,000 in 1995. If exponential growth is assumed, find a model for the population growth and then use the model to determine the population in 2008.

3. A sample of 500 grams of radioactive lead 210 decays to polonium 210 according to the function $A(t) = 500e^{-.032t}$ where t is in years. Find the amount of the sample remaining after
   (i) 4 years (ii) 8 years (iii) Find the half-life