Math 196L **PROBLEM SET 6** **NAME:**

Instructions: Read each problem. Write a sentence or two about the approach you might take to solve each problem. Draw a picture to illustrate the scenario. Write a formula that might be needed to help set up or solve the problem.

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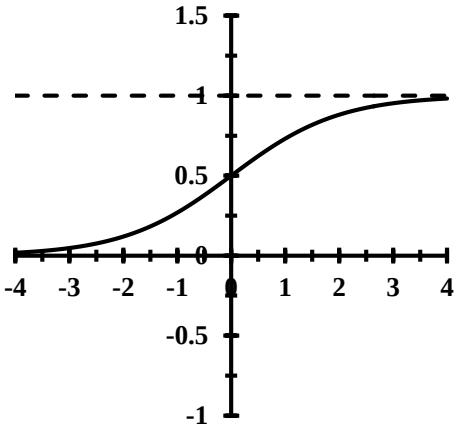
1. Use the graph of the function $y = M(x)$ shown below to answer the following questions.



(A) Determine the intercepts and asymptotes for the function $y = M(x)$.

(B) Sketch a graph of $y = M^{-1}(x)$.

(C) Determine the intercepts and asymptotes for the function $y = M^{-1}(x)$.

(D) Sketch a graph of $y = \dfrac{1}{M(x)}$.

(E) Determine the intercepts and asymptotes for the function $y = \dfrac{1}{M(x)}$.

2. If $x=-2$ is a zero of $f(x)=x^3-3x^2-kx+12$, algebraically determine the two other zeros.

3. (A) Can the graph of $f(x)=\dfrac{ax+b}{cx+d}$ cross its horizontal asymptote ? If yes, for what constants?

Note *a, b, c,* and *d* are real constnats.

(B) Can a rational function cross its vertical asymptote?

(C) Can a rational function cross its horizontal asymptote?

4. You just bought a new $50,000 Porsche with the loan you were supposed to use for your tuition.

a) Sadly, you learn that this car loses 15% of its value every year. Write an equation to represent the value of your car as a function of time since you purchased it.

b) Suppose your insurance company calculates its premiums based on the value of a car. Instead of using your formula in part A, they assume that the value of the car will depreciate by $4,000 every year. Write an equation to represent their value of your car as a function of time since you purchased it.

c) Sketch a graph of both equations on the same coordinate system. Will the insurance company be over or under charging during the first few years?

5. Consider three possible savings accounts. One account offers an interest rate of 2.5% compounded annually, the second earns 2.4% compounded quarterly, and the third has a 2.3% interest rate compounded continuously. Answer the following questions.

a) Which savings account grows the fastest? How do you know?

b) What is the doubling time of each investment? Round each to the nearest month.

6. Consider the following population scenarios. In each, determine if an exponential, linear, or neither of these models would be a suitable fit. Explain your choice. If exponential or linear, find an equation to describe the population as a function of time measured in years, assuming that at $t = 0$ the population is 500,000.

a) Each year, the town's population grows by roughly 1000 residents.

b) Each year, the town's population grows by roughly 9%.

c) Each year, the town's population is decreasing at a continuous rate of 4%.

d) Each year, the town's population shrinks by roughly 15%.

e) Each year, the town loses roughly 1000 residents.

f) Each year, the town's population roughly varies between a high of 800,000 and a low of 200,000.