

Exam 3
Chapters 3,4 and 5

Answer the following questions. *You must show your work to receive full credit.* Be sure to make reasonable simplifications. Give exact answers. Indicate your final answer with a box.

Simplify Using Exponent Rules (5 points)

1. $\sqrt{x^3 \sqrt[4]{x}}$

Factor Completely The Expression (5 points)

2. $x^2(x + 4) - 9(x + 4)$

Simplify The Rational Expression (5 points each)

3. $\frac{1}{x} - \frac{2}{x^2} - \frac{1}{x^3}$

4. $\frac{x^2+8x+16}{x^2-25} \div \frac{x+4}{x-5}$

5. (5 points) Find the domain of the function

$$f(x) = \frac{\sqrt{2x-2}}{x-2}.$$

6. (6 points) Consider the function given by

$$g(t) = 5\sqrt{t-1}.$$

- (a) What is the name of the function?
- (b) What letter represents the input?
- (c) What is the output?
- (d) Find $g(5)$. What does it represent?
- (e) What is its inverse?

7. Two entrepreneurs, Dirk Funk and Tom Gugliotta, drove 4500 miles from England to Timbuktu, Mali in a truck powered by chocolate. They used an ethanol that is made from old, unusable chocolate, and it took 17 pounds of chocolate to make 1 gallon of ethanol. The table below gives the data for the relationship between the amount of chocolate used and the number of miles driven. (8 points)

Miles Driven (mi)	Pounds of Chocolate Used (lbs)
20	17
40	34
60	51
80	68
100	85

- (a) Is a linear model appropriate? Justify your answer.
- (b) If so, determine the model for the relationship between pounds of chocolate used (as the output) and the number of miles driven (as the input).
- (c) How many pounds of chocolate are needed to drive 90 miles?
- (d) If Dirk and Tom only have 130 pounds of chocolate, how far can they drive?

8. (4 points) Find a function that models the number N of dimes in d dollars.
9. (4 points) Find the equation of the line going through the points $(4, 1)$ and $(0, -1)$.
10. (3 points) Consider the line given by $y = -2x + 4$. Is this line parallel, perpendicular or neither to the line found in the previous problem. Explain your reasoning.

11. The amount of trash in a county landfill is modeled by the function

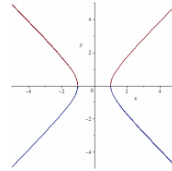
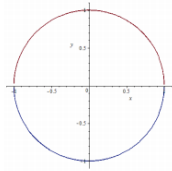
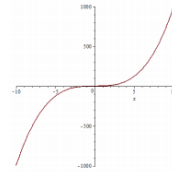
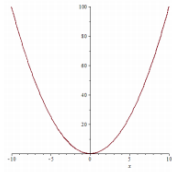
$$T(x) = 32,400 + 4x$$

where x is the number of days since January 1, 1996, and $T(x)$ is measured in thousands of tons.

- (a) Is T a linear function?(2 points)
- (b) What is the initial amount of trash in the landfill in 1996?(2 points)
- (c) At what rate is the landfill receiving trash? (2 points)

12. (7 points) The number of fish in a certain lake are measured on a yearly basis. It is found that everytime the fish are measured there are approximately 3 times as many fish as the previous year. Explain which type of function you would use to model the growth of the fish population and why. Finally, write the model for the number of fish assuming there are initially 108 fish.

13. Several graphs are given below. Determine which graphs are the graphs of functions. Justify your answers. If they are functions, determine if they are invertible. (2 points each)



Use Basic Properties of Logarithms to Evaluate(Do not use a calculator, show at least one step of work for credit.)(3 points each)

14. $\log_4\left(\frac{1}{16}\right)$

15. $\log_8(2)$

16. Scientists are studying the growth rate of two different strains of the same bacteria. Lab tests show the growth rates of the bacterium:

Strain A increases by 60% every 3 hours

Strain B increases by 40% every 2 hours

- (a) (5 points) Find the one-hour growth factor for each strain.
- (b) (2 point) Which strain has the larger growth rate?

17. (6 points) Let $f(x) = (x - 1)^2$ and $g(x) = 2x - 4$. Find $g(f(x))$.

18. (10 points) Sour Patch Kids is trying to model the supply and demand curves for their product. They have discovered that the supply curve grows at a rate of 7% per 10 cents they increase the price. Further, they have discovered the the demand curve decreases at a rate of 9% per 10 cents they increase the price.

- (a) Assume that at a price of 0 cents Sour Patch Kids supplies 3 boxes of candy. Write an appropriate model for the supply curve.
- (b) Assume that at a price of 0 cents the consumers demand 300 boxes of candy. Write an appropriate model for the demand curve.
- (c) Using the two models from parts (a) and (b), find the price at which supply and demand are equal. (This is called the equilibrium price.)

Bonus Question: (10 points) You are trying to decide whether to invest in a couple of different options. Option A requires that you invest \$4000 immediately and has an interest rate of 7% compounded semiannually. Option B requires that you invest \$2000 now and \$2000 again in 6 months and has an interest rate of 8% compounded quarterly. Assuming that both investments must be withdrawn two years from the initial investment date, will Option A or Option B have more money when it is withdrawn?