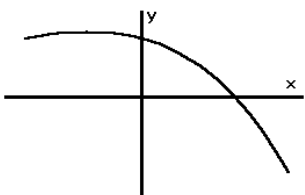


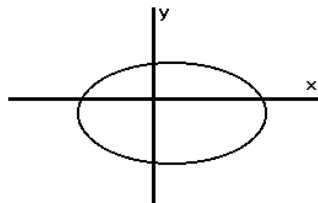
Math 101 Final Exam Review Problems
 Rockville Campus
 Revised : Fall 2009

1. For each graph below, explain why it is or is not a function.

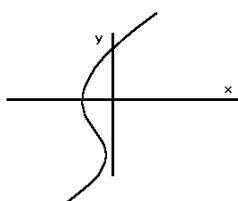
a.



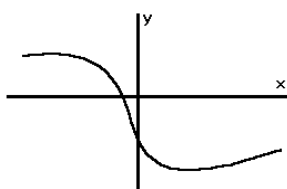
b.



c.



d.



2. Given $2x + 3y = 18$.

- a. Find the x -intercept.
- b. Find the y -intercept.
- c. Find the slope.
- d. Sketch the graph.
- e. Find the equation of a line parallel to this line passing through $(-3, -2)$

3. In 1970 the enrollment at a certain college was 2000 students; in 1990 there were 2800 students. Let $f(t)$ represent the enrollment t years after 1970. Assume $f(t)$ is a linear function.

- a. Write an equation for $f(t)$ expressing enrollment in terms of t .
- b. Predict the enrollment for the year 2000.
- c. Determine when the enrollment will reach 4000.

4. Given

$$f(x) = 3x^2 - 6x + 1$$

$$g(x) = -9x - 2x^2$$

For each function above, use algebra to answer the following questions:

- a. Find all x - and y - intercepts.
- b. Evaluate $f(2)$ and $f(-2)$.
- c. Sketch a graph that shows the significant features of the function, that is, the x -intercept(s), the y -intercept, the point symmetric to the y -intercept, and the vertex.

5. Simplify $\sqrt{48}$.

6. Let $f(x) = 3 - 4x$.

a. Find and simplify $f(t + 2)$

b. Find and simplify $f(-2)$

c. Find x when $f(x) = -2$

7. Simplify each expression below where possible and write your answer without using negative or fractional exponents. Assume that $x > 0$.

a. $8x^{1/3}$ b. $(-8x)^{1/3}$ c. $(8x)^{-1/3}$ d. $(3x^{3/4})(16x)^{1/4}$ e. $\frac{x^{1/2}}{x^{5/2}}$

8. Simplify $\frac{8 - \sqrt{36}}{4}$

9. Find all real solutions if any exist

a. $(x + 3)^2 - 81 = 0$

b. $3x^2 + 5x = 2$

c. $(x + 1)(x - 2) = 18$

d. $2x^2 - 4x + 5 = 0$

10. A company started business in 1995. Assume that a company has a profit per year shown in the table below. (Negative profits are losses.)

date	Profits in millions of dollars
1995	-2.4
1996	0
1997	2.0
1998	3.6
1999	4.8
2000	5.7
2001	6.1

Let $f(t)$ represent the amount of profit in millions of dollars, where t is the number of years since 1995. A possible formula for $f(t)$ is $f(t) = -0.19t^2 + 2.56t - 2.37$

a. Use f to predict the amount of profit in 2003.

b. Find t when $f(t) = 4.23$. What do your results mean in terms of the company's profits. (Use intersect feature of Calculator)

c. For what years is there likely model breakdown? (Hint: consider the past and future.)

d. When does $f(t) = 0$? (use either graphical or algebraic method to solve) What does this mean in terms of the situation?

e. When will the company have maximum profits?

11. The equation of the height of an object thrown upwards starting at 6 feet above the ground is $h(t) = 6 + 95t - 16t^2$ where t is time in seconds and h is height in feet.

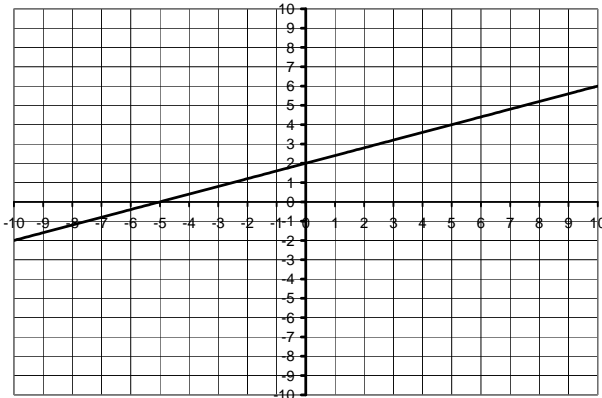
- When will the object hit the ground?
- When will it reach its maximum height?
- What is its maximum height?

12. Evaluate

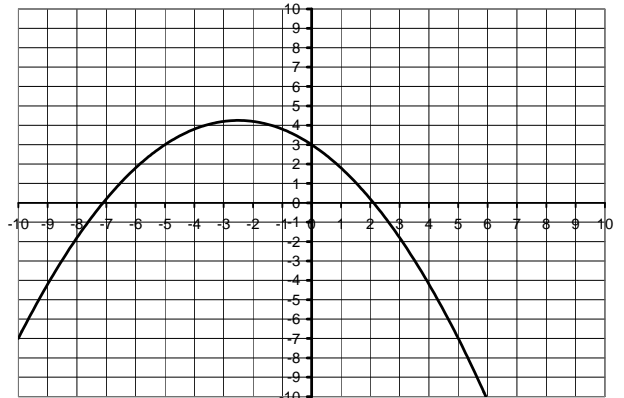
- $\log(1)$
- $\ln(e^5)$
- $\ln(5)$
- $\log_2 16$

13.

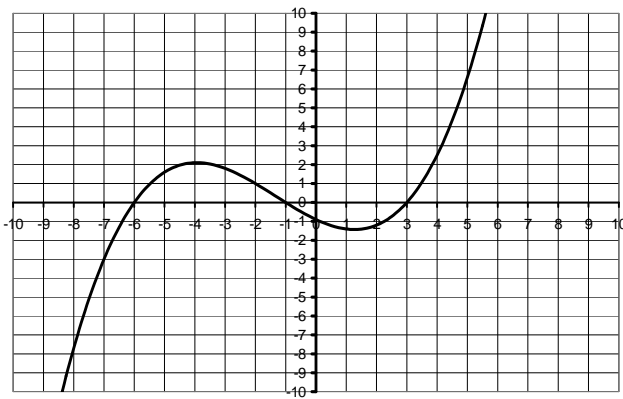
Function I



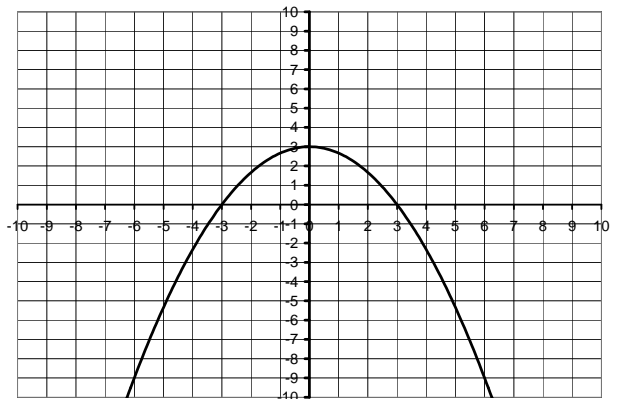
Function II



Function III



Function IV



- List all the functions for which $f(3) = 0$.
- List all the functions for which $f(0) = 3$.
- What are the zeros of function III?
- Approximate the equation of the line in function I

14. \$100 is deposited in a savings account that pays 4% interest compounded annually.

- How much is in the account after 25 years?
- Use logarithms to determine how many years it will take for the account to grow to \$1000. Confirm your results by graphing $y = A(t)$ in an appropriate window and using the intersect feature on your calculator.

15. Sketch the graph of a line with the following characteristics:

- a. $m > 0$ and $b < 0$ b. $m < 0$ and $b < 0$ c. $m = 0$ and $b > 0$

16. A retired man looks at his net worth since he retired. The data is in the table below.

Years since retirement	Net worth in thousands of dollars
0	400
1	366
2	339
3	307
4	275
5	244

- Create a scattergram of the data.
- Sketch a line that approximates the data.
- Find the equation of that line.
- Let $y = f(x)$ be the function that models the data. Find $f(10)$
- What is the x-intercept? What does it mean in terms of the model?
- What is the y-intercept? What does it mean in terms of the model?

17. Solve the following systems of equations.

a.
$$\begin{cases} 3s - 4t = 8 \\ 2s + 3t = -6 \end{cases}$$

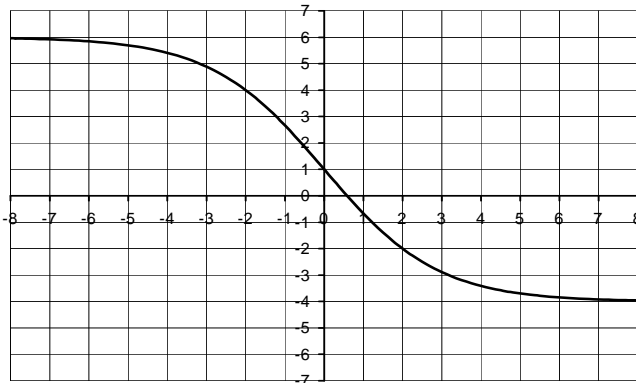
b.
$$\begin{cases} -8x + 9y = -7 \\ 6x - 15y = -3 \end{cases}$$

18. Solve $3 \cdot 5^x = 10$ algebraically.

- Convert $3^4 = 81$ to logarithmic notation.
- Convert $\log_{25} 5 = \frac{1}{2}$ to exponential notation.

20. a. If $f(x) = \frac{x}{7} - 3$ find $f^{-1}(x)$.

b. Below is the graph of $h(x)$. Approximate $h^{-1}(3)$



21. Find the equation for the exponential function of the form $y = ab^x$ that passes through the points $(0,2)$ and $(3,250)$.

22. Four tables are given below -- three are functions, and one is not. One of the functions is linear, and one is exponential.

- Which one is the linear function? What is the slope of the line?
- Which one is the exponential function? Explain how you recognize the exponential function.
- Which one is not a function? Explain how you know this relation isn't a function.

Table A	
x	y
-1	4
0	0
1	0
2	4

Table B	
x	y
-1	-2
1	-1
3	0
5	1

Table C	
x	y
0	-5
1	-3
1	3
0	5

Table D	
x	y
0	2
1	10
2	50
3	250

23. All State life insurance offers a \$25,000 life insurance policy for men who are smokers. The monthly rates are listed for various ages.

Age	Rate\$
30	50.85
35	61.74
40	92.27
45	134.97
50	193.25
55	290.18
60	444.54
65	674.06

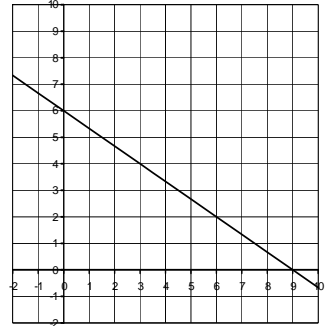
Let $f(t)$ represent the monthly rate in dollars for a man t years of age who smokes.

- Use your calculator to draw a scattergram of the data. What kind of function (linear, quadratic, or exponential) best fits the data?
- Use your calculator to find an equation for $f(t)$.
- Find $f(25)$ and interpret these results in the context of this problem.

Answers

1. a and d are functions because it is impossible to draw a vertical line that intersects the graph more than once. b and c are not functions because in each case, it *is* possible to draw a vertical line that intersects both these graphs twice.

2. a. $(9,0)$ b. $(0,6)$ c. $-\frac{2}{3}$ d. See the graph to the right.
 e. $y = -\frac{2}{3}x - 4$



3. a. $f(t) = 2000 + 40t$ b. 3200 c. In the year 2020

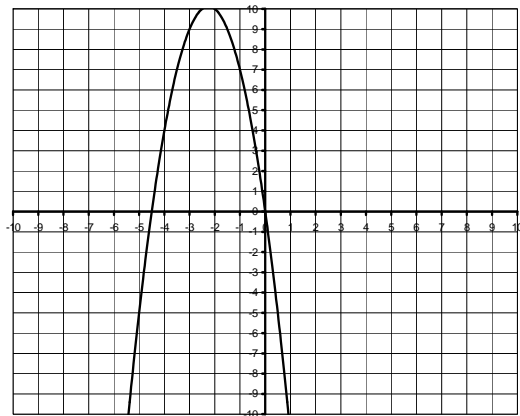
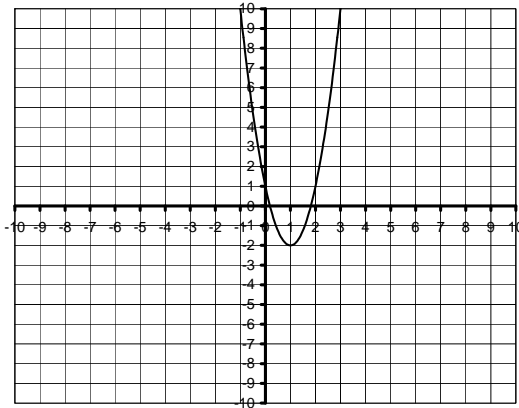
4.

	f	g	
a	$(0,1), (.184,0), (1.816,0)$	$(0,0), (-4.5,0)$	
b	$f(2) = 1, f(-2) = 25$	$g(2) = -26$ $g(-2) = 10$	

Graphs:

$$f(x) = 3x^2 - 6x + 1$$

$$g(x) = -9x - 2x^2$$



5. $4\sqrt{3}$

6. a. $-4t - 5$ b. 11 c. $5/4$

7. a. $8\sqrt[3]{x}$ b. $-2\sqrt[3]{x}$ c. $\frac{1}{2\sqrt[3]{x}}$ d. $6x$ e. $\frac{1}{x^2}$

8. $\frac{1}{2}$

9. a. 6, -12 b. $\frac{1}{3}, -2$ c. 5, -4 d. No real solutions

10. a. 5.95 million
 b. 10 or about 3.47. The company will make a profit of 4.23 million in 2005 and which is close to what it did in 1998.
 c. When t is negative the company did not exist. Also the model predicts losses after 2008.
 d. 1996, about 2008. The company would break even then.
 e. About 2002

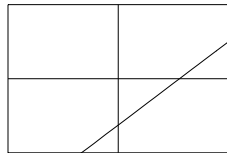
11. a. 6 seconds b. $95/32$ seconds c. $9409/64$ feet

12. a. 0 b. 5 c. 1.609 d. 4

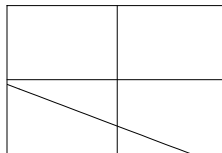
13. a. III and IV b. II and IV c. $-6, -1, 3$ d. $y = 0.4x + 2$

14. a. \$266.58 b. 58.7 years

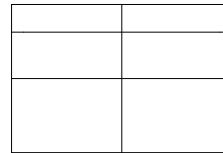
15. a.



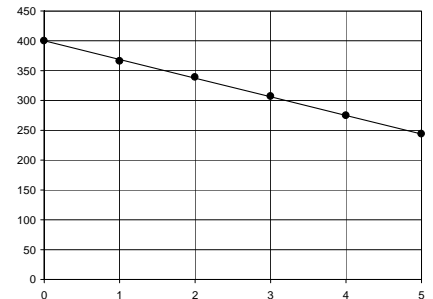
- b.



- c.



16. a. & b Graph to the right.
 c. $y = -31.25x + 400$ (Other answers possible.)
 d. 87.5
 e. 12.8 or about 13 years. He will run out of money in 12.8 years.
 f. 400. He started with a net worth of \$400,000 when he retired.



17. a. $(0, -2)$ b. $(2, 1)$

18. 0.748, or $\frac{\ln(\frac{10}{3})}{\ln(5)}$

19. a. $\log_3 81 = 4$ b. $25^{1/2} = 5$

20. a. $y = 7x + 21$
 b. -1.2 or -1.3

21. $y = 2(5)^x$

22. a. The linear function is Table B. The slope of the line is $1/2$.
 b. Table D is the exponential function. For each 1-unit increase in x , the y -coordinate increases by a multiplicative factor of 5.
 c. Table C is not a function because there are two output values (y) for same input number (x).

23. a. Exponential
 b. $f(t) = 4.6489(1.0785)^t$
 c. \$30.75; The monthly rate for a 25 year old who smokes is \$30.75.