

MAT117 Review Problems for Exam 1

Equation represents a function

1. Determine whether the following equations define y as a function of x .

a. $3x^2 - y^2 = 5$ b. $3y - x = x^2 + 7$

2. Determine whether the following equations define y as a function of z .

a. $y^3 = 4z - 1$ b. $y^4 - 3z = 5$

Find the value of the function

3. If a rock falls from a height of 20 meters on Earth the height H (in meters) after x seconds is approximately. $H(x) = 20 - 4.9x^2$ What is the height after 2 seconds?

4. The function $P(d) = 1 + \frac{d}{33}$ gives the pressure, in atmospheres (atm), at a depth d feet in the sea. Find the depth when the pressure is 3 (atm).

Domain of function

5. Find the domain of the following function: $f(x) = \frac{3x}{x^2 - 1}$

6. Find the domain of the following function: $f(x) = \frac{2x - 1}{x^2 + 5x}$

7. Find the domain of the following function: $f(x) = \sqrt{6 - 2x}$

8. Find the domain of the following function: $f(x) = \sqrt[4]{3x + 15}$

Difference quotient

9. Find and simplify the difference quotient, $\frac{f(x+h) - f(x)}{h}$, $h \neq 0$ for the function $f(x) = \frac{1}{3x}$

10. Find and simplify the difference quotient, $\frac{f(x+h) - f(x)}{h}$, $h \neq 0$ for the function $f(x) = -x^2 - 3x + 1$

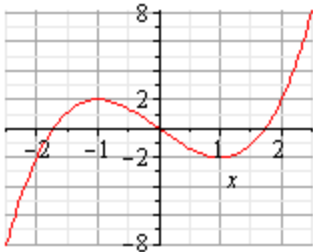
Combining functions

11. A firm is considering a new product. The accounting department estimates that the total cost, $C(x)$, of producing x units will be $C(x) = 65x + 3500$. The sales department estimates the revenue, $R(x)$, from selling x units will be $R(x) = 85x$, but no more than 600 units can be sold at that price. Find and interpret $(R - C)(600)$.

12. A firm is considering a new product. The accounting department estimates that the total cost, $C(x)$, of producing x units will be $C(x) = 85x + 2750$. The sales department estimates the revenue, $R(x)$, from selling x units will be $R(x) = 75x$, but no more than 550 units can be sold at that price. Find and interpret $(R - C)(550)$.

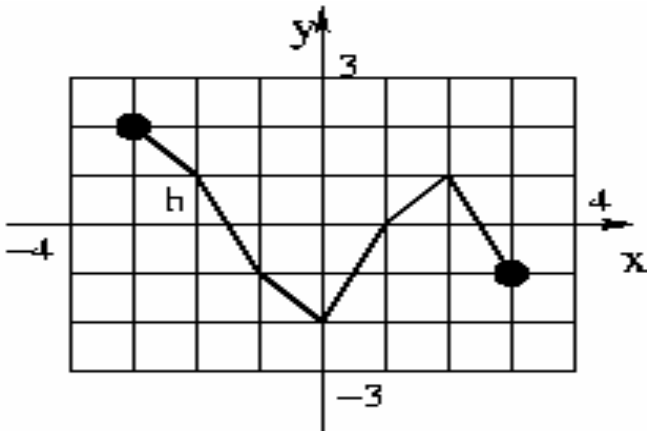
Obtaining information from graphs

13. Given the graph of $y = f(x)$



- a. For what value(s) of $f(x) = 2$ b. For what value(s) of $f(x) = -2$

14. Given the graph of $y = f(x)$



- a. Find the range of $y = f(x)$ b. Find the domain of $y = f(x)$

15. Suppose $f(x) = \frac{7x}{x - 3x^2}$, is the point $(1, \frac{7}{2})$ on the graph of $f(x)$?
16. Suppose $f(x) = 3x - \sqrt{4x + 5}$ is the point $(1, 0)$ on the graph of $f(x)$?

Even/Odd

17. Perform the algebraic tests for even and odd to determine if the function $f(x) = x^3 - 2x$ is even, odd or neither.
18. Perform the algebraic tests for even and odd to determine if the function $f(x) = 3x^2 - |x|$ is even, odd or neither.

Increasing/Decreasing/Constant and Local Min/Max

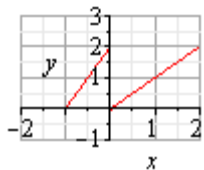
19. Using your calculator graph the function $f(x) = \frac{1}{3}x^3 - \frac{3}{2}x^2 + 1$
- Determine the open interval for which the function is increasing or decreasing.
 - What are the local maximum and local minimum?
20. Using your calculator graph the function $f(x) = x^4 - x^2$
- Determine the open interval for which the function is increasing or decreasing.
 - What are the local maximum and local minimum?
21. The height s of a ball (in feet) thrown with an initial velocity of 80feet per second from an initial height of 6 feet is given as a function of the time t (in seconds) by $s(t) = -16t^2 + 80t + 6$
- Determine the time at which the height is maximized.
 - What is the maximum height?
22. The profit P in dollars generated by selling x units of a certain commodity is given by $P(x) = -1500 + 12x - .0004x^2$
- How many units must be sold in order to maximize profits.
 - What is the maximum profit?

Average rate of change

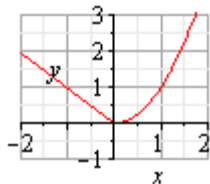
23. Find the average rate of change for $f(x) = x^2 - 3x + 2$ from $x = 1$ to $x = 3$.
24. Find the average rate of change for $f(x) = -x^3 + 4$ from $x = -1$ to $x = 1$.

Piecewise defined function

25. Write the definition (formula) for the function $f(x)$.



26. Write the definition (formula) for the function $f(x)$.



27. Evaluate the piecewise function at the given value of the independent variable.

$$f(x) = \begin{cases} 4x - 3 & \text{if } x \leq -1 \\ -3x + 7 & \text{if } x > -1, \text{ at a.) } x = -2 \text{ and b.) } x = 3 \end{cases}$$

28. Evaluate the piecewise function at the given value of the independent variable.

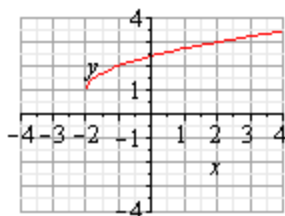
$$f(x) = \begin{cases} x^2 & \text{if } x \leq 0 \\ -3x + 7 & \text{if } x > 0 \end{cases}, \text{ at a.) } x = 0 \text{ and b.) } x = 2$$

Transformations

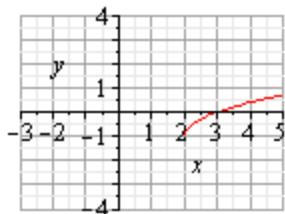
29. Starting with the base function $y = x^2$, describe in words the transformed function $f(x) = (x - 3)^2 + 1$

30. Starting with the base function $y = x^2$, describe in words the transformed function $f(x) = (x + 4)^2 - 3$

31. The following graph of $g(x)$ is the transformation of the graph of $f(x) = \sqrt{x}$. Find an equation (formula) for $g(x)$.



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Linear functions and their applications

33. The price p and the quantity x sold of a certain product obey the demand equation: $p = -\frac{1}{3}x + 150$ What is the revenue when 300 units are sold?

34. The price p and the quantity x sold of a certain product obey the demand equation: $p = -\frac{1}{5}x + 300$ What is the revenue when 250 units are sold?

35. Identify the slope (m) and the y-intercept (b) for the linear function $3x - 6y = 7$

36. Identify the slope (m) and the y-intercept (b) for the linear function $2y + 5x = 11$

37. The revenue for a firm is given by $R(x) = 8x$ and the cost is given by $C(x) = 4.5x + 17500$, where x is the number of units produced and sold. Find the break-even point for the firm.

38. The revenue for a firm is given by $R(x) = 12x$ and the cost is given by $C(x) = 9x + 30000$, where x is the number of units produced and sold. Find the break-even point for the firm.

39. The data listed in the following table represents the appearance temperature vs. the relative humidity in a room.

Relative Humidity (%) x	Apparent Temperature y
10	65
30	68
50	71
70	73

- Use your calculator to find (linear regression) the line of best fit to the data
- Using the regression in part (a) approximate the room temperature when the relative Humidity is 80%.

40. The aver life expectancy in the United States has been rising steadily over the past few decades, as shown in the table below.

Year (after 1900)	Life Expectancy
60	69.79
70	70.8
80	73.7
90	75.4

- Use your calculator to find (linear regression) the line of best fit to the data
- Using the regression in part (a) approximate the life expectancy in the year 1995.

MAT 117 Test 1 Review Answers

Note: There is a reasonable assumption that most of these answers are not incorrect.

1. a. No b. Yes	21. a. $t = 2.5$ seconds b. $s = 106$ feet
2. a. Yes b. No	22. a. $x = 15000$ units b. \$88,500
3. 0.4 meters	23. 1
4. 66 feet	24. -1
5. $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$	25. $f(x) = \begin{cases} x & \text{if } x \geq 0 \\ 2x+2 & \text{if } -1 \leq x < 0 \end{cases}$
6. $(-\infty, -5) \cup (-5, 0) \cup (0, \infty)$	26. $f(x) = \begin{cases} x^2 & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$
7. $(-\infty, 3]$	27. a. -11 b. -2
8. $[-5, \infty)$	28. a. 0 b. 1
9. $\frac{-1}{3x(x+h)}$	29. shift right by 3 units; shift up 1 unit
10. $-2x - 3 - h$	30. shift left 4 units; shift down 3 units
11. \$8500 means profit, income exceeds cost	31. $g(x) = \sqrt{x+2} + 1$
12. -\$8250 means loss, cost exceeds income	32. $g(x) = \sqrt{x-2} - 1$
13. a. $x = -1$ and 2 b. $x = 1, -2$	33. \$15,000
14. a. $[-2, 2]$ b. $[-3, 3]$	34. \$62,500
15. No	35. $m = \frac{1}{2}; b = -\frac{7}{6}$
16. Yes	36. $m = -\frac{5}{2}; b = \frac{11}{2}$
17. odd	37. $x = 5000$
18. even	38. $x = 10,000$
19. a. decreasing $(0, 3)$; increasing $(-\infty, 0) \cup (3, \infty)$ b. local maximum 1; local minimum $-\frac{7}{2}$	39. a. $y = 0.135x + 63.85$; b. 74.65
20. a. decreasing $(-\infty, -\frac{1}{\sqrt{2}}) \cup (0, \frac{1}{\sqrt{2}})$ increasing $(-\frac{1}{\sqrt{2}}, 0) \cup (\frac{1}{\sqrt{2}}, \infty)$ b. local maximum 0; local minimum $-\frac{1}{4}$	40. a. $y = 0.1973x + 57.625$; b. 76.37