Review for Test 1 July 14, 2003

Sections 1.1, 1.3, 2.1-2.3, 3.1-3.3, 4.1, 4.2

1. Understand functional notation and use the graph, table, equation, or verbal description. Section 1.1 #6, 7, 8, 10, 18 and Chapter 1 Review #31b, 32 and Section 3.1 #1, 5, 9 11 and Chapter 3 Review#1
2. Determine if *y* is a function of *x*. Determine if *x* is a function of *y*. Section 5.1 #9a, 20, 21 and Example 9 on page 6 and Chapter 1 Review #1, 2, 7
3. Identify whether a function is a (totally) increasing or decreasing function or identify intervals on which it is increasing and decreasing Section 1.3 Example 2, 3, 4 and Chapter 1 Review 8, 31c
4. Understand the geometric interpretation of the average rate of change and the function notation for the average rate of change. Read bottom of page 25 and page 26 Section 1.3 #4, 8, 9, 10, 15 and Chapter 1 Review #8 and Chapter 2 Review 14c
5. Given the equation of a linear function, find and interpret its slope and axis intercepts as well as sketch its graph. Section 2.1 # 2, 3, 13, 16-18 and Section 2.2 #22, 23, 24, 29, 30 and Section 2.3 # 9, 19, 20 and Chapter 2 Review #10, 18
6. Find a linear model if given an initial value and an average rate of change. Section 2.1 #8, 9 and Section 2.2 #10 and Chapter 2 Review #9, 11
7. Understand the geometric properties of linear functions including:
   - when two lines are parallel and when they are perpendicular
   - when their *y*-intercepts are positive or negative
   - when they are increasing or decreasing (or neither)

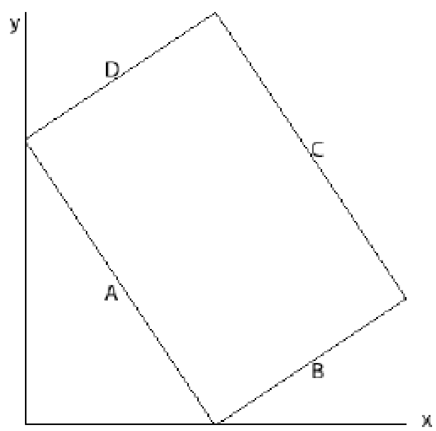
   Section 2.3 #3, 7, 8, 13, 14, 15, 16 and Chapter 2 Review #5
8. Find a linear model if given any value (not necessarily its initial value) and an average rate of change. Section 2.2 #12, 14, 15, 25, 27, 29
9. Find a linear model if given two points. Section 2.2 #11, 16, 19, 21, 22 and Section 2.3 #22 and Chapter 2 Review #12, 17,
10. Determine if a function is linear. Section 2.1 - #1, 2
11. Find a linear models for budget constraint type problems. Section 2.2 #20, 30 and Chapter 2 Review #8 and Example 3 on pages 48-49
12. Use the linear model to solve problems and make predictions. Section 2.2 # 11,16, 18,19, 21-29 odd Chapter 2 Review #4, 17
13. Construct linear models and find intersection points to solve problems and make predictions. Section 2.3 # 17, 19, 20 and Chapter 2 Review #10, 11, 15
14. Interpret expressions or equations which involve function notation and inverse function notation. Section 3.1 # 1, 3, 14 and Section 3.2 #17 and Chapter 3 Review #25, 27, 28
15. Evaluate functions with values that are *expressions* as well as *numbers*. Section 3.2 #1, 6 and Chapter 3 Review # 18, 19
16. Solve equations and inequalities and interpret the results. Section 3.2 #16 and Chapter 3 Review #21
17. Interpret expressions or equations which describe changes in the input and output of a function. Section 3.2 #9, 10, 13, 20 and Chapter 3 Review #26
18. Understand the domain and range of a function. Section 3.3 #6 through 17, 18 through 21 and Chapter 3 Review #14, 15, 16
19. Given a formula, get an annual growth rate or decay rate, as well as an initial amount. Section 4.1 – 15, 19, 20 and 4.2 – 25 and Chapter 4 Review –1
20. Work with exponential models:
    a. Given an annual growth rate or decay rate and an initial amount, write a formula $y = ab^x$.
    b. Predict a future value of *y* for some *x*

    Section 4.1 - 4, 6, 7 , 8 and 4.2 - 23 and Chapter 4 Review –2
21. a. Given some data (which is not an initial amount) write a formula for an exponential function
    b. Know what *a* means in the formula $y = ab^x$.
    c. Given a value of *y*, find a value of *x*.
    d. Explain what *b* means in the formula $y = ab^x$.
    Section 4.2- 5, 8b, 11, 13, 14, 15, 21, 29 and Chapter 4 Review - 6, 7, 8, 9, 17, 18, 20, 21

Note: Answers to even problems are found in the solutions manual on reserve at the service desk at the Helmke Library.

Sample Questions and Quizzes

1. Choose the equation defining each line in this rectangle, by matching its letter to one of the formulas that follow.



____ $y = 220 - \frac{3}{2}x$

____ $y = 90 + \frac{3}{2}x$

____ $y = 90 - \frac{3}{2}x$

____ $y = 90 + \frac{2}{3}x$

____ $y = 40 + \frac{3}{2}x$

____ $y = 40 + \frac{2}{3}x$

____ $y = -40 - \frac{3}{2}x$

____ $y = -40 + \frac{2}{3}x$

Note: You filled in all of the blanks, you have not answered this question correctly.

2. Sketch the graph of a single function $y = f(x)$ satisfying all of these conditions:
   I. The domain of f is [-2, 3].
   II. The range of f is [0, 2].
   III. f is increasing so long as $x < 2$.
   IV. f is decreasing so long as $x > 2$.

   For clarity, make sure your sketch is large, well-labeled, and unambiguous.

3. Suppose the promotions manager for the Wizards baseball team can buy athletic jackets for \$10 each and caps for \$5 each. The total budget for buying jackets and caps is \$15000. Let j be the number of jackets and c be the number of caps they would purchase.

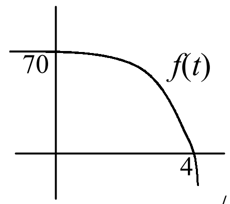
   (a) Write an equation which relates c and j.

   (b) Write c as a function of j.
   Sketch a graph, where the number of jackets, j, is on the horizontal axis and the number of caps, c, is on the vertical axis
   i. What are the coordinates of the y–axis intercept of this function? (_____, _____) (Write as an ordered pair).
   Explain what this means in the context of the Wizard's promotion strategy.
   ii. What are the coordinates of the x–axis intercept of this function? (_____, _____) (Write as an ordered pair).
   Explain what this means in the context of the Wizard's promotion strategy.
   iii. What is the slope of your function?
   Explain what this means in the context of the Wizard's promotion strategy.

MA 153 Name ______________________
QUIZ: **1.1, 1.3** Row_____
SHOW WORK

(2) 1. You are going to graph $w = f(q)$. Which variable goes on the horizontal axis? _____

(2) 2. Use the graph to fill in the missing values: (a) $f(\_\_\_) = 0$ (b) $f(0) = \_\_\_$



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3. Consider the following table.

x	0	1	2	3	4
y	3	4	0	1	0

(4) (a) Is y a function of x? ______ (b) Is x a function of y? _____

(4) 4. Items in clearance are 25% off. Express the total cost, C, of an item in clearance in terms of the regular price P.

(4) 5. The population of the world was 1 billion in 1804, 2 billion in 1927, 3 billion in 1960, 4 billion in 1974, 5 billion in 1987, and 6 billion in 1999. Find the average rate of change of the world population, in people per minute, over the following two intervals. Assume that 1 year = 365.25 days.

SHOW WORK

___/10

(a) 1804 to 1927

(b) 1987 to 1999

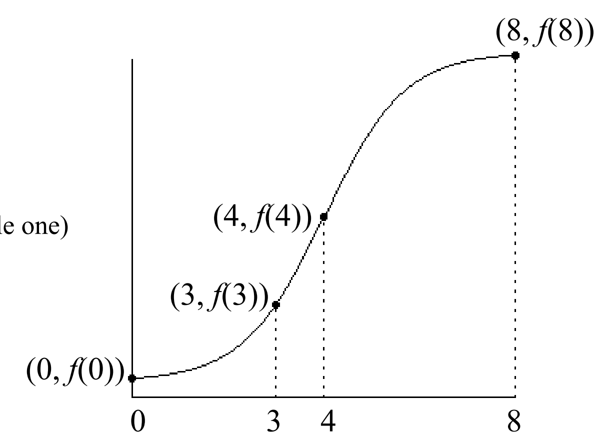
6. Let $y = f(x)$ be given by the graph.

(4) a. Over which of the three intervals below is the average rate of change, $\frac{\Delta y}{\Delta x}$, the **greatest**? (Circle one)

I. between $x = 0$ and $x = 3$

II. between $x = 3$ and $x = 4$

III. between $x = 4$ and $x = 8$



(5) b. The ratio $\frac{\Delta y}{\Delta x}$ between $x = 0$ and $x = 3$ has a geometric significance. Explain precisely what this ratio represents on the graph of f

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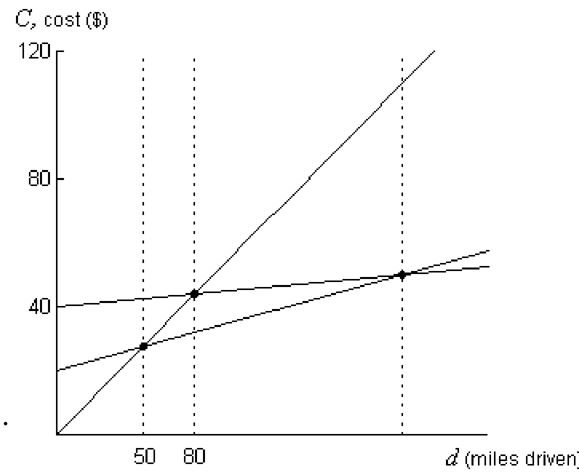
MA 153 Name ______________________
QUIZ: **2.1, 2.2, 2.3** Row_____
SHOW WORK

(3) 1. The population of a town is 80,000 in year $t = 0$ and grows by 250 people per year. Find a possible formula $P(t) = b + mt$ for the population P as a function of t, assuming growth is linear.

2. You need to rent a car for a road trip.
   - **Agency 1** charges $0.55 per mile driven.
   - **Agency 2** charges $40 plus $0.05 per mile.
   - **Agency 3** charges $20 plus $0.15 per mile driven.
   The graphs for the three agencies' plans are shown.



Let d represent the number of miles driven and C_1, C_2, C_3 represent the cost of using Agency 1, 2, and 3, respectively.

(3) a. Label the graphs to show clearly which is C_1, C_2, and C_3.

(6) b. Find formulas for C_1, C_2, and C_3 as functions of d.

C_1 = ____________ C_2 = ____________ C_3 = ____________

(4) c. Use the graph and any equations to find under what circumstances **Agency 3** would be the cheapest. Write an equation, solve it algebraically and show work below.

3. Acme Cars has found that the amount of money, d, it spends on advertising is related to the number of cars, C it sells:

Thousands of dollars, d, spent on advertising	*Number of cars sold, C*
100	700
125	800
150	900
175	1000
200	1100

(2) a. Explain how you can tell at a glance that C is a linear function of d.

(3) b. Find a formula for $C(d)$.

(2) c. What is the slope? (Provide units) __________________
What is the meaning of the slope <u>in terms of the problem</u>? Write in a complete sentence.

(2) d. What is the y-intercept? __________
What is its meaning in terms of this problem? Write in a complete sentence.

MA 153 Name ______________________

QUIZ: **3.1, 3.2, 3.3** Row_____ Section: 1:30 2:30

SHOW WORK

1. Let $A = f(c)$ be the amount of food, in pounds, of feeding c cats at a pet store. Interpret each of the following. Be specific.

(4) a. $f(20)$

(5) b. $f^{-1}(20)$

(4) 2. A drug affects a patient's blood pressure. The patient's blood pressure, p in millimeters of mercury (mm), soon after the drug is given is a function of the dose, q mg, so $p = f(q)$. Match each statement in (a)–(d) with one of the formulas.

i) $f(q) + 10$ ii) $f(q) - 10$ iii) $f(q + 10)$ iv) $f(q - 10)$

v) $f(q) + 0.1$ vi) $f(q) - 0.1$ vii) $0.9f(q)$ viii) $0.1f(q)$

ix) $1.1f(q)$

__________ (a) The dose remains the same but the blood pressure is increased by 10 mm.

__________ (b) The dose is increased by 10 mg.

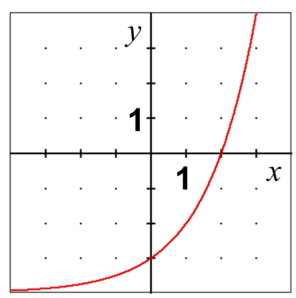
__________ (c) The blood pressure is decreased by 10%, while maintaining the same dose.

__________ (d) The blood pressure is increased by 10%, while maintaining the same dose.

(4) 3. Use the graph of $y = h(x)$ to complete the following.

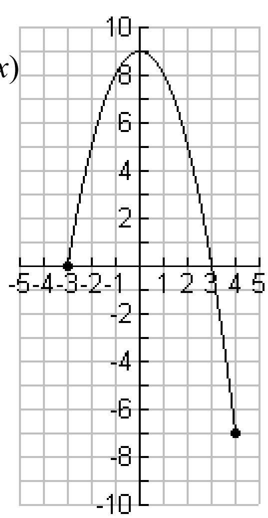
a. $h(0) =$ _________ b. $h($_________$) = 0$

c. $h^{-1}(0) =$ _________ d. $h^{-1}($_________$) = 0$



$y = h(x)$

$y = g(x)$



4. Use the graph of $y = g(x)$ to complete the following.

a. Solve $g(x) \geq 5$ ___________

b. Find $g(1) - g(-2)$

(4) c. Draw a vertical line segment <u>on the y-axis</u> that

(2) illustrates the calculation in part c.

(2) d. Report the domain and range of g:

Domain: ______________ Range: ____________

MA 153 Name ______________________
QUIZ: **4.1-4.2** Row_____

(4) 1. The population of town P (in thousands) t years after 1970 is given by $P(t) = 80(1.035)^t$.

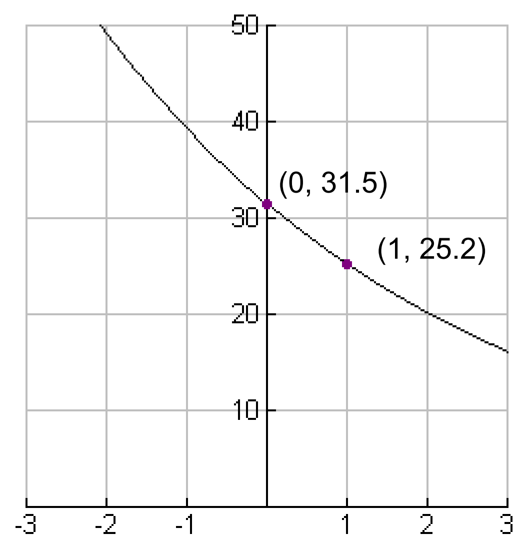
a. By what percent does the town increase in size each year? __________

b. What does the number 80 mean? Be specific in terms of the context of the situation.

(4) 2. Mr. Chips takes a 15 mg. dose of a mood altering drug. He then reads the possible side effects on the bottle and decides a single dose is enough. If 4% of the drug leaves the body each hour through the natural processes of elimination, find a possible formula $A(t)$ for the amount of mg of drug A in the body t hours after taking it.

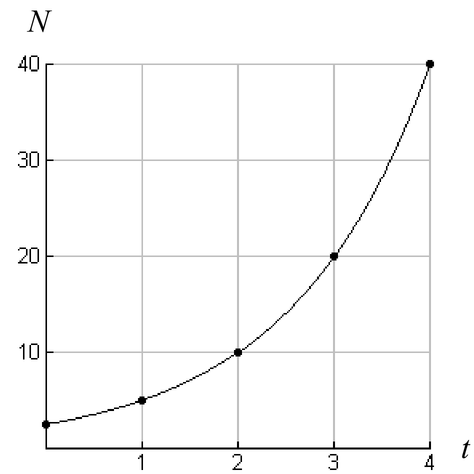
$A(t)$ = ________________

(4) 3. Find a formula for the exponential function $f(x)$ if it passes through the points (0, 31.5) and (1, 25.2).



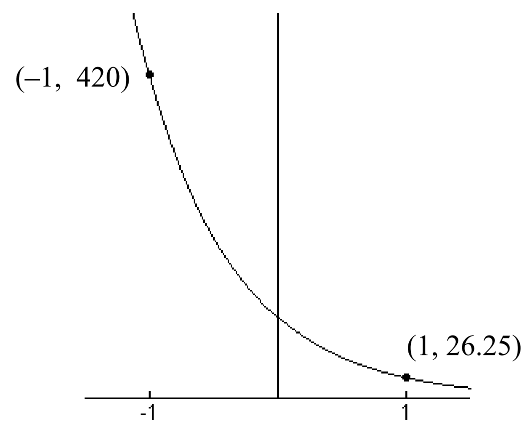
(5) 4. The graph shows N, the number of packets of information sent per month across the Internet (in billions), as a function of t, the number of years since 1990.

a. Find a possible formula for $N(t)$.



(2) b. Use the formula to find how many billions of packets of information was sent across the Internet in the year 2000.

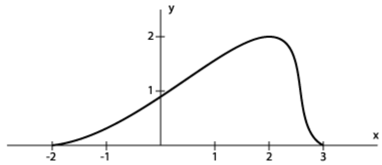
(6) 5. Find a possible formula $y = ab^x$ for the exponential function whose graph is given.



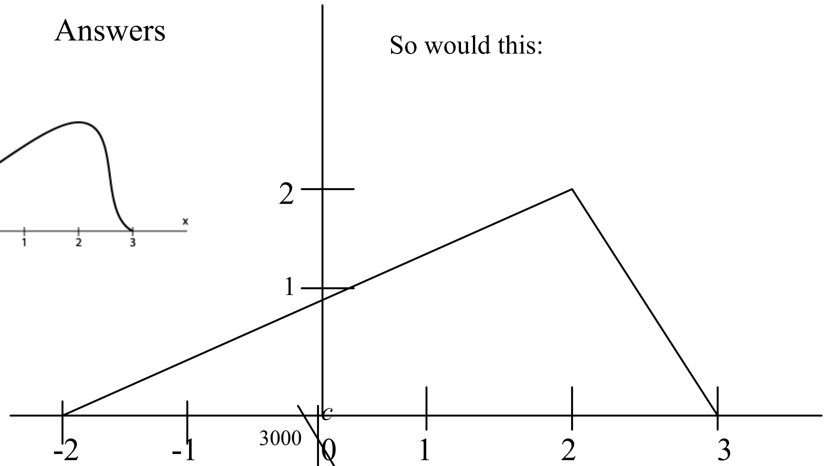
Answers

1. _C_ $y = 220 - \frac{3}{2}x$
   ___ $y = 90 + \frac{3}{2}x$
   _A_ $y = 90 - \frac{3}{2}x$
   _D_ $y = 90 + \frac{2}{3}x$
   ___ $y = 40 + \frac{3}{2}x$
   ___ $y = 40 + \frac{2}{3}x$
   ___ $y = -40 - \frac{3}{2}x$
   _B_ $y = -40 + \frac{2}{3}x$

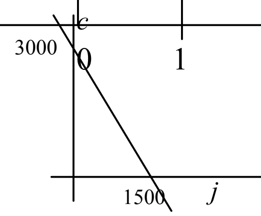
2. This will work:



So would this:

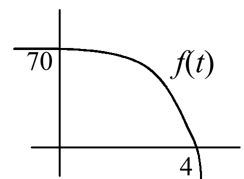


3. (a) $10j + 5c = 15000$
   (b) Write $c = 3000 - 2j$.
   i. (0, 3000)
   They bought no jackets and 3000 caps.
   ii. (1500, 0)
   They bought no caps and 1500 caps.
   iii. slope is -2 (or -2caps per jacket)
   Every purchase of 2 caps means 1 less jacket, or
   Every purchase of 1 jacket means 2 less caps.



Answers to QUIZ on 1.1 and 1.3

1. You are going to graph $w = f(q)$. Which variable goes on the horizontal axis? q
2. Use the graph to fill in the missing values: (a) $f(\underline{4}) = 0$ (b) $f(0) = \underline{70}$
3. (a) Yes (b) No
4. $C = 0.75P$



5. The population of the world was 1 billion in 1804, 2 billion in 1927, 3 billion in 1960, 4 billion in 1974, 5 billion in 1987, and 6 billion in 1999. Find the average rate of change of the world population, in people per minute, over the following two intervals. Assume that 1 year = 365.25 days.

   (a) 1804 to 1927

$$\frac{\Delta P}{\Delta t} = \frac{1 \text{ billion}}{123 \text{ yr}} = \frac{10^9 \text{ people}}{123 \text{ yr}} \cdot \frac{1 \text{ yr}}{365.25 \text{ day}} \cdot \frac{1 \text{ day}}{24 \text{ hr}} \cdot \frac{1 \text{ hr}}{60 \text{ min}} \approx \boxed{15.46 \text{ people per minute}}$$

   (b) 1987 to 1999

$$\frac{\Delta P}{\Delta t} = \frac{1 \text{ billion}}{12 \text{ yr}} = \frac{10^9 \text{ people}}{12 \text{ yr}} \cdot \frac{1 \text{ yr}}{(365.25)(24)(60) \text{ min}} \approx \boxed{158.4 \text{ people per min}}$$

6. Let $y = f(x)$ be given by the graph.

   a. choice II. $\frac{\Delta y}{\Delta x}$ between $x = 3$ and $x = 4$ is greatest.

   b. The ratio $\frac{\Delta y}{\Delta x}$ between $x = 0$ and $x = 3$ is the slope of the line containing $(0, f(0))$ and $(3, f(3))$.