

Name Key

**Test 2B**  
**College Algebra**  
**MATH 1314**  
**Mike Huff**  
**Spring 2009**

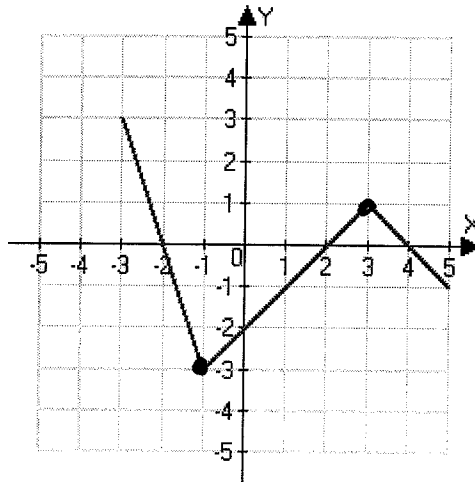
**Deadline: 4/10/2009**  
**Tools: any calculator**

Show all work on the test paper for partial credit.

(7 points)

1. Approximate the following for the given function.

- a. Where is  $f(x) = 0$ ?    b. Where is  $f(x) > 0$ ?    c. Where is  $f(x) < 0$ ?    d. Where is  $f(x)$  increasing?
- e. Where is  $f(x)$  decreasing?    f. If  $f(x)$  has a maximum, where does the maximum occur and what is the maximum?    g. If  $f(x)$  has a minimum, where does the minimum occur and what is the minimum?



a.  $x = -2, 2, 4$

b.  $3 \leq x < -2 \quad 2 < x < 4$

c.  $-2 < x < 2 \quad 4 < x \leq 5$

d.  $-1 < x < 3$

e.  $-3 < x < -1 \quad \text{or} \quad 3 < x < 5$

f. max is 1 at  $x = 3$

g. min is -3 at  $x = -1$

(5 points)

2. The median price of a home in Fort Worth, Texas for the years 2003 and 2004 are shown in the table below. Use the data to answer the following questions:

	2003	2004
Fort Worth	90,707	97,062

- a) Write a linear function that relates cost of a home in Fort Worth to the year.

$$f(x) = 6355(x - 2003) + 90707$$

- b) Interpret the slope and ~~y~~-intercept in terms of the variables given.

~~\$~~6355 per year increase in cost of home  
~~point~~

- c) Use the function to estimate the price of a home in Fort Worth in 2008.

$$\$122,482$$

(5 points)

3. For the function  $g(x) = 12.37x + 23.3$ , find the value of  $x$  for which  $g(x) = -11.1$ .

$$-11.1 = 12.37x + 23.3$$

$$12.37x = -34.4$$

$$x \approx -2.780921584$$

$$\approx -2.78$$

(5 points)

4. Solve *symbolically* and check your solution.

$$0.5(3.2t - 1.1) - .5(3t - 1) = 0.25(2t - 3)$$

$$1.6t - .55 - 1.5t + 0.5 = 0.5t - 0.75$$

$$0.1t - 0.05 = 0.5t - 0.75$$

$$-.4t = -0.7$$

$$t = 1.75$$

(6 points)

5. The tax,  $T$ , paid by a shopper varies directly as the amount of the purchase,  $p$ , made by the shopper. If the tax paid for a \$180 purchase is \$13.50, find the following:

- a) the constant of proportionality,

$$T = kP$$
$$k = \frac{T}{P} = \frac{13.50}{180} = 0.075$$

- b) the equation of variation, and

$$T = 0.075P$$

- c) the tax on a purchase of \$500.

$$T = 0.075(500)$$
$$= \$37.50$$

(4 points)

6. The percent of Americans who smoke can be modeled by the function  $S(t) = -0.59t + 42.28$  where  $t$  represents the number of years since 1965. Determine the years for which the percent of Americans who smoke is less than 18 percent.

$$-0.59t + 42.28 < 18$$

$$-0.59t < -24.28$$

$$t > 41.15$$

From 2006 on....

(4 points)

7. Matthew works at an appliance store on commission. He receives a weekly salary of \$850 plus 8% of any merchandise he sells.

a. Write a function that gives his gross wages,  $W$ , in terms of his total sales in dollars,  $x$ .

$$W(x) = 850 + .08x$$

b. How much will he earn if he sells \$4,000 of merchandise in a week?

$$W(4000) = 850 + .08(4000)$$
$$= \$1170$$

c. How much does he have to sell to earn \$1,250?

$$1250 = 850 + .08x$$

$$400 = .08x$$

$$x = \frac{400}{.08} = \$5,000$$

(4 points)

8. Solve symbolically:  $-4 < \frac{3-x}{4} < 5$ . Express the solution using interval notation. Check your work

$$-16 < 3 - x < 20$$

$$-19 < -x < 17$$

$$19 > x > -17$$

$$-17 < x < 19$$

$$(-17, 19)$$

(6 points)

9. For the following piecewise-defined function  $f(x) = \begin{cases} -2x & -4 < x \leq 0 \\ 2 & 0 < x < 2 \\ 2x - 3 & 2 \leq x < 4 \end{cases}$  answer the following

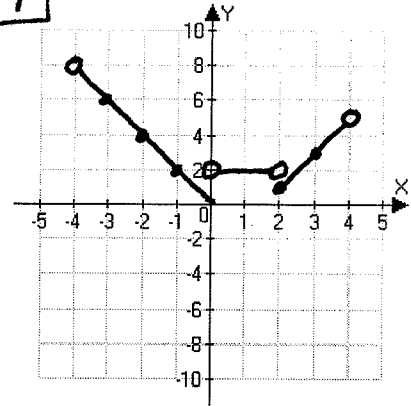
questions:

a. Find the domain of  $f$ .

$(-4, 4)$  or  $-4 < x < 4$

b. Evaluate at  $x = -2, -1, 0, 1, 2$ .

$f(-2) = 4$        $f(1) = 2$   
 $f(-1) = 2$        $f(2) = 1$   
 $f(0) = 0$



c. Sketch a graph.

d. Is  $f$  continuous? Explain.

No, it's discontinuous at  $x=0$  and  $x=2$

e. Find the values where  $f(x) = 0$ .

$x=0$  only

(8 points)

10. a. Solve:  $|3 - 2x| = \frac{2}{5}$

$3 - 2x = \frac{2}{5}$  or  $3 - 2x = -\frac{2}{5}$   
 $15 - 10x = 2$        $15 - 10x = -2$   
 $-10x = -13$        $-10x = -17$

$x = \frac{13}{10}$  or  $x = \frac{17}{10}$

b. Solve:  $|3 - 2x| \leq \frac{2}{5}$

$\frac{13}{10} \leq x \leq \frac{17}{10}$   
or  
 $[\frac{13}{10}, \frac{17}{10}]$

(4 points)

11. Write the function  $f(x) = 2x^2 - 12x + 14$  in vertex form and identify the vertex. Find the range of the function.

$$x = -\frac{b}{2a} = \frac{12}{2(2)} = 3$$

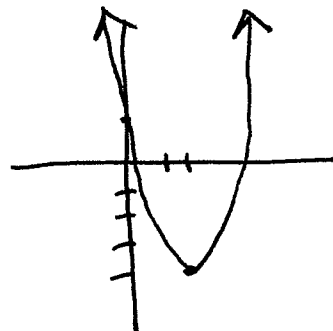
$$\begin{aligned} f(3) &= 2 \cdot 9 - 36 + 14 \\ &= 18 - 36 + 14 \\ &= -4 \end{aligned}$$

$$\begin{aligned} f(x) &= 2(x-3)^2 - 4 \\ \text{vertex} & (3, -4) \\ \text{range} & y \geq -4 \text{ or } [-4, \infty) \end{aligned}$$

(4 points)

12. List the transformations used to obtain the graph of  $g(x) = \frac{3}{2}(x-2)^2 - 4$  from  $f(x) = x^2$  and draw the graph of  $g$ .

expand by a factor of  $3/2$   
shift right 2 units  
shift down 4 units



(4 points)

13. Find values for  $a$ ,  $h$ , and  $k$  so that the function  $f(x) = a(x-h)^2 + k$  that models the data exactly:

$x$	-3	-2	-1	0	1
$f(x)$	-11	-5	-3	-5	-11

vertex at  $(-1, -3)$

$$\begin{aligned} f(x) &= a(x+1)^2 - 3 \\ -5 &= a(1)^2 - 3 \\ -2 &= a \end{aligned}$$

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

(6 points)

14. Put the quadratic function  $f(x) = x^2 + 4x + 1$  in vertex form and graph.

a) What transformations are used to transform the graph of  $g(x) = x^2$  into this graph?

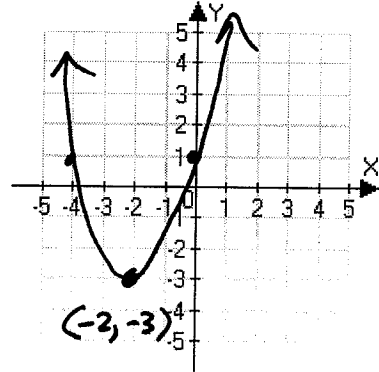
~~right~~ left 2  
down 3

b) What is the axis of symmetry of the graph of  $f$ ?

$$x = -2$$

c) What is the vertex of the graph? Label this clearly

$$(-2, -3)$$



d) The vertex form of the quadratic function

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

e) Intervals where the function is increasing

$$x > -2$$

f) Intervals where the function is decreasing

$$x < -2$$

$$x^2 + 4x + 1$$

$$(x + 2)^2 - 3$$

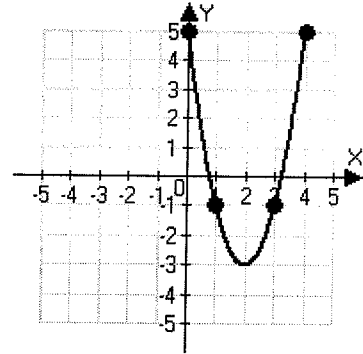
(6 points)

15. Use the graph of the quadratic function below to determine the following:

a) Vertex  $(2, -3)$

b) Axis of symmetry  $x = 2$

c) Sign of the leading coefficient  $a > 0$



d) The **vertex form** of the quadratic function

$$f(x) = a(x-2)^2 - 3$$
$$f(x) = 2(x-2)^2 - 3$$

$$5 = 4a - 3$$

$$4a = 8$$

$$a = 2$$

e) Intervals where the function is increasing

$$x > 2 \text{ or } (2, \infty)$$

~~$(-\infty, 2)$~~

f) Intervals where the function is decreasing

$$x < 2 \text{ or } (-\infty, 2)$$

(4 points)

16. A company is going to produce a new product. Its marketing department has estimated that the revenue for the new product will be given by the equation  $R(x) = 300x - 0.0003x^2$ . Where  $x$  is the number of units produced and  $R$  is the revenue measured in dollars. Find the following:

- a) The number of units that produces the maximum revenue.

$$x = 500,000 \text{ units}$$

- b) The maximum revenue.

$$\$75,000,000$$

- c) The cost of producing  $x$  units of the new product is given by  $C(x) = 60x + 2200$ . Find the profit function  $P(x)$  which is given by  $P(x) = R(x) - C(x)$ .

$$P(x) = -0.0003x^2 + 240x - 2200$$

- d) Find the number of units to produce to yield the maximum profit.

$$x = 400,000 \text{ units}$$

Solve the following quadratic equations. (6 points)

17.  $2x^2 + 7x = 15$

$$2x^2 + 7x - 15$$

$$(2x - 3)(x + 5)$$

$$x = -5, \frac{3}{2}$$

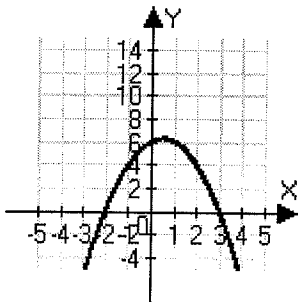
18.  $2x^2 - 7x + 3 = 0$

$$(2x - 1)(x - 3)$$

$$x = \frac{1}{2}, 3$$

(3 points)

19. The graph of  $f(x) = ax^2 + bx + c$  is given in the figure below. Solve the equation  $ax^2 + bx + c = 0$ .



$$x = -2, 3$$