MAT 111 – section _____ **Name:** answers

Test # 2, version A

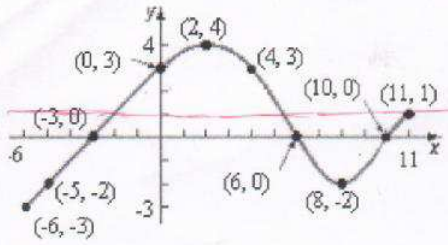
Chapters 3.1-3.5, 4.1-4.4 and 5.1 100 **Seat #:** _____ - _____

Directions: Show all work algebraically unless otherwise indicated. If solving graphically, label the graph and the solution on the graph. If rounding is necessary, round to the **nearest thousandth.**

(15 points)

1. Answer the following questions for the graph of $f(x)$ below.

(see 3.2 + 3.3)



pts

(2) a. f(2) = 4 f(-3)= 0

(1) b. Is f(8) positive or negative? negative

(1) c. How often does y = 1 intersect the graph? 3 times

(3) d. For what value(s) of x does $f(x) = 0$? $x = -3, 6, 10$

-1 if (-3, 4) -2 if gave domain [-6, 11]

(3) e. What is the range of $f(x)$. $-3 \le y \le 4$ or $[-3, 4]$

-1 pt if [2, 8] -2 pts if gave y-interval (4, -2)

(3) f. For what x-interval(s) is $f(x)$ decreasing? $(2, 8)$

(2) g. Find all local minimum point(s). $(8, -2)$

don't count off for (-6, -3)

(5 points)

2. Is the function $f(x) = x^3 - 4x$ odd, even or neither? odd 2 pts

(see 3.3) What type of symmetry does this function have? origin 1 pt.

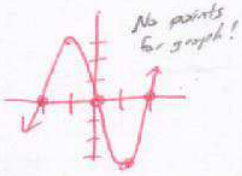
Justify your answer algebraically. (You may check graphically.)

(2 pts) $f(-x) = (-x)^3 - 4(-x)$

$= -x^3 + 4x$

$= -(x^3 - 4x)$

$= -f(x)$



optional

x	y
-2	0
2	0
-1	3
1	-1
0	0

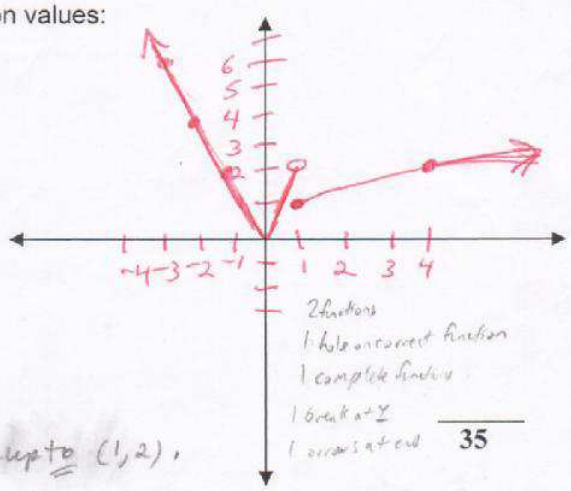
etc

(15 points)

(see 3.4) **3.** Draw an accurate graph of the following piecewise-defined function, find the domain and range, the x- and y-intercepts, and the indicated function values:

$$f(x) = \begin{cases} |2x| & \text{if } x < 1 \\ \sqrt{x} & \text{if } x \ge 1 \end{cases}$$

6 pts Graph:



2 pts a. domain all real #s or $(-\infty, \infty)$

3 pts b. range $y \ge 0$ or $[0, \infty)$

2 pts c. intercepts (0, 0)

1 pt d. $f(-1) = |2(-1)| = |-2| = 2$

1 pt e. $f(9) = \sqrt{9} = 3$

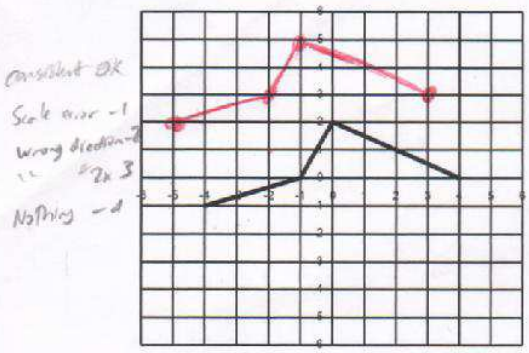
-1 pt if graph of $|2x|$ does not include part up to (1, 2).

OK if domain is written in 2 pieces $(-\infty, 1) \cup [1, \infty)$

35

(8 points)

4. If the graph below is y = f(x), **sketch** the graph of f(x + 1) + 3 on the same axis. **Describe** each transformation caused by the changes in the function.



Consistent OK
Scale error -1
Wrong direction -2 ea
Nothing -4

the graph will move to the left 1 and up 3.

-2 If moved same direction twice

(15 points)

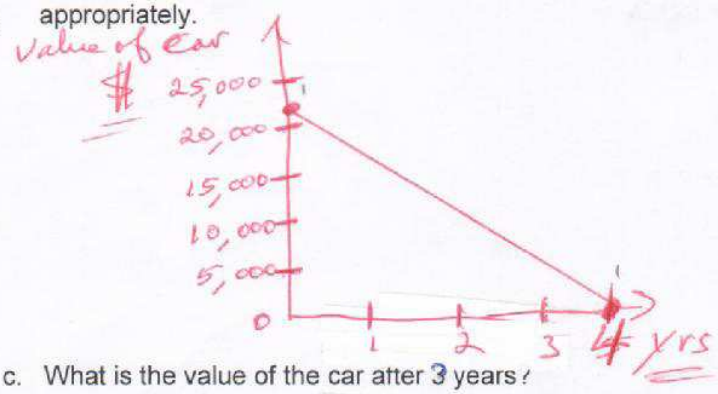
5. A business purchases a new company car for $22,000. The car's book value will be depreciated by the straight line method over a period of 4 years. **Show all your work** in solving this problem.

a. Let x = the age of the car in years, and V(x) = the book value of the car in dollars. Find a linear function for V(x).

$\frac{\Delta y}{\Delta x} = \frac{\Delta \#}{\Delta yrs} = \frac{-22000}{4} = -5500$

$V(x) = -5500x + 22000$

b. Draw a graph that represents the car's book value during those 5 years, labeling both axes appropriately.



c. What is the value of the car after 3 years?

$V(3) = -5500(3) + 22,000 = -16500 + 22,000 = \$5500$

d. Explain the meaning of the slope of the line for this function.

The change in the value of the car per year. $(m = \frac{\Delta \#}{\Delta yrs})$

e. What is the meaning of the y-intercept for this function?

The original value of the car is $22,000.

$x=-4 \quad x=1$

$y=-2(x+4)(x-1)$

$y=-2(x^2+3x-4)$

(15 points)

6. For this quadratic function, $y=-2x^2-6x+8$, ~~show your work~~ to determine whether:

1pt a. the parabola opens up or opens down — down because of −

3pts b. find the equation of the axis of symmetry — $x=\frac{-b}{2a}=\frac{-(-6)}{2(-2)}=-\frac{6}{4}=-\frac{3}{2}$ or -1.5 $=x$

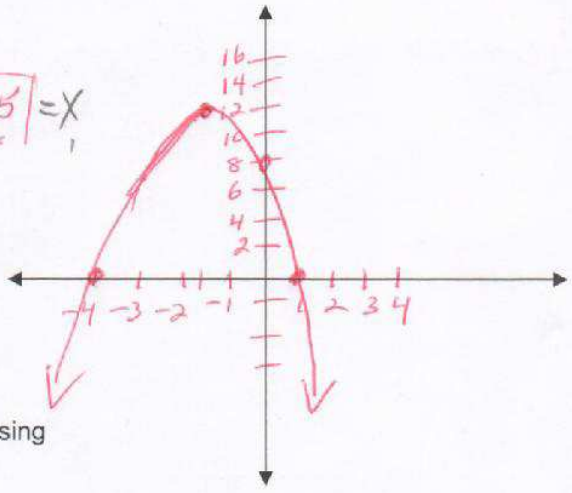
2pts c. find the vertex — $(-1.5, 12.5)$

2pts d. x-intercepts — $(-4,0)$ & $(1,0)$ Not Points OK

1pt e. y-intercept $(0,8)$

2pts f. state the interval(s) on which the function is decreasing — $(-1.5, \infty)$

4pts g. then use the information above to draw an accurate graph.



Shape 1
x/y int 2
Vertex 1

$(x-4)(2x+6)+(x+3)^2$
$2x^2+6x-24+x^2+6x+9$
$3x^2+12x-15$
$(x+3)(x-5)$

(15 points)

7. For this polynomial function: $f(x)=0.5(x-4)(x+3)^2$.

1pt a. What is the degree of this polynomial function? third or 3

1pt b. What is the maximum number of real zeros for the function? 3 — should match A

1pt c. What is the maximum number of turning points for the function? 2 — should be B-1

4pts d. List the zeros of the function and tell whether the graph crosses or touches the x-axis at each.

$0=0.5(x-4)(x+3)(x+3)$ — Crosses at 4 & touches at −3.

$x=4, -3, -3$

1pts e. What is the y-intercept for the function?

$f(0)=.5(-4)(3)^2=-18$

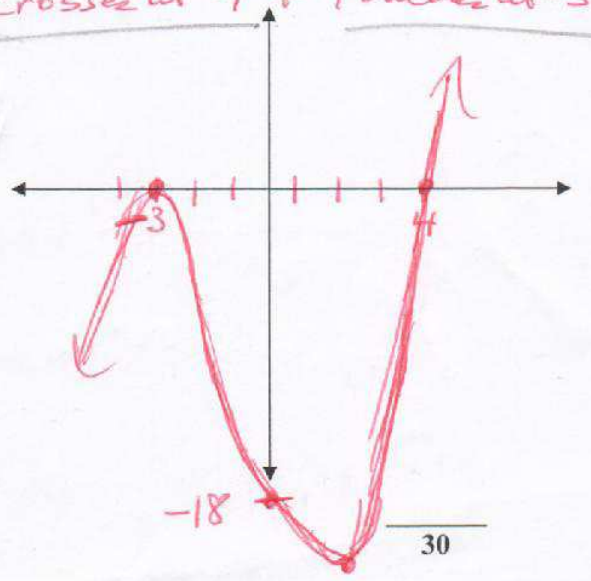
4pts f. What is the minimum for the function? [Round to thousandth.] -1 if rounded otherwise

~~$(2.553, -22.308)$~~

$(1.667, -25.407)$

3pts g. Sketch a graph of the function.

Shape
ints
min



$(2.553, -22.308)$

(12 points)

8.

30. Which Model? An engineer collects the following data showing the speed s of a Toyota Camry and its average miles per gallon, M.

Speed, s	Miles per Gallon, M
30	18
35	20
40	23
40	25
45	25
50	28
55	30
60	29
65	26
65	25
70	25

(a) Using a graphing utility, draw a scatter diagram of the data treating speed as the independent variable. What type of relation appears to exist between speed and miles per gallon?

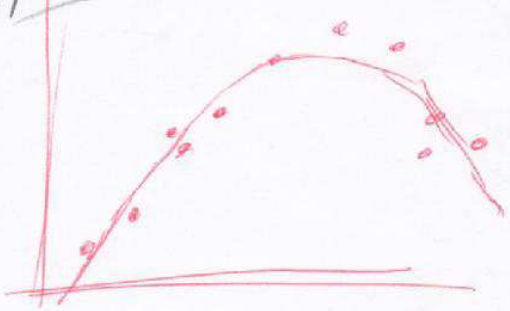
(b) Based on your response to part (a), find either a linear or quadratic model that describes the relation between speed and miles per gallon.

(c) Use your model to predict the miles per gallon for a Camry that is traveling 63 miles per hour.

Show how you calculated your answer to part c.

(d) Use your model to calculate the miles per gallon for a Camry that is traveling 73 mph.

optional graph



2pts a) Write answer to part a here.

Quadratic, because the mpg increase + then decrease

5pts b) Write your model equation here.
[Round decimals to the thousandth.]

$f(x)$ or $y = -.017x^2 + 1.935x - 25.341$

Value ? fraction ! rounding ! x^2 !

3pts $f(63) = -.017(63)^2 + 1.935(63) - 25.341$

1 reading 1 input 1 work

$= 29.091$ if using rounded eq.

(or $= 27.212$ if using more digits in calculator)

2pts 1 answer 1 reading $f(73) = 25.321$ if using rounded equation.

or $(f(73) = 22.803$ if using more digits in calculator)