

Name: _____ Date: _____

IM 3 UNIT TEST V2 - Working with Functions
Teacher: Mr. Santowski and Ms. Aschenbrenner

Score: _____

168

PART 1 - CALCULATOR ACTIVE QUESTIONS

Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided the answer is supported by written working. Solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer.

1. Given the function $f(x) = 4 - \sqrt{5 - x}$, determine the:

(7 marks)

a. the domain and range of $f(x) = 4 - \sqrt{5 - x}$.

D: $\{x \in \mathbb{R} \mid x \leq 5\}$ ✓

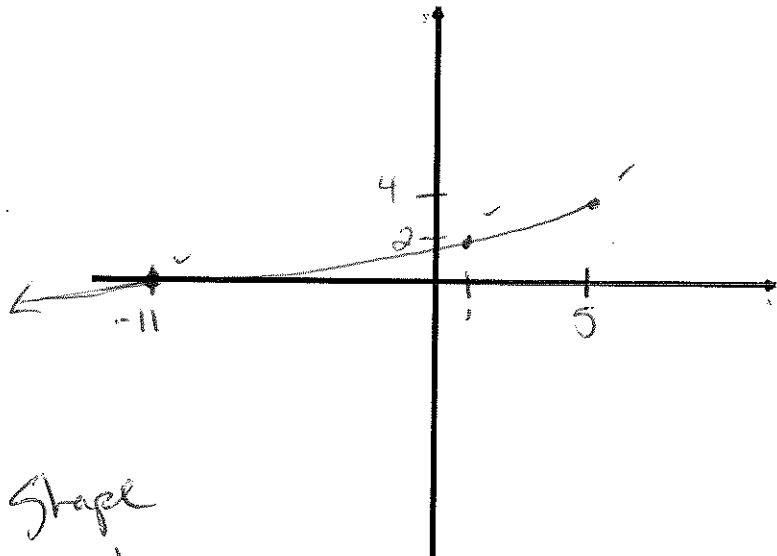
R: $\{y \in \mathbb{R} \mid y \leq 4\}$ ✓

b. the x-intercept(s) and y-intercept(s).

$(-11, 0)$ ✓

$(0, 1.76)$ ✓

c. sketch the function and label 3 data points.



(1) shape
(2) points

2. Given the function $f(x) = (\sqrt{x+3})(x-5)^2$ and the X window settings of $X_{\min} = -5$ and $X_{\max} = 10$, determine:

(9 marks)

a. Appropriate Y window settings.

✓ $y_{\min} : -10 \rightarrow$ must be less than 0
 $y_{\max} : 55 \rightarrow$ must be greater than ~~50~~

b. The critical point(s).

✓ max: $(-1.4, 51.8)$

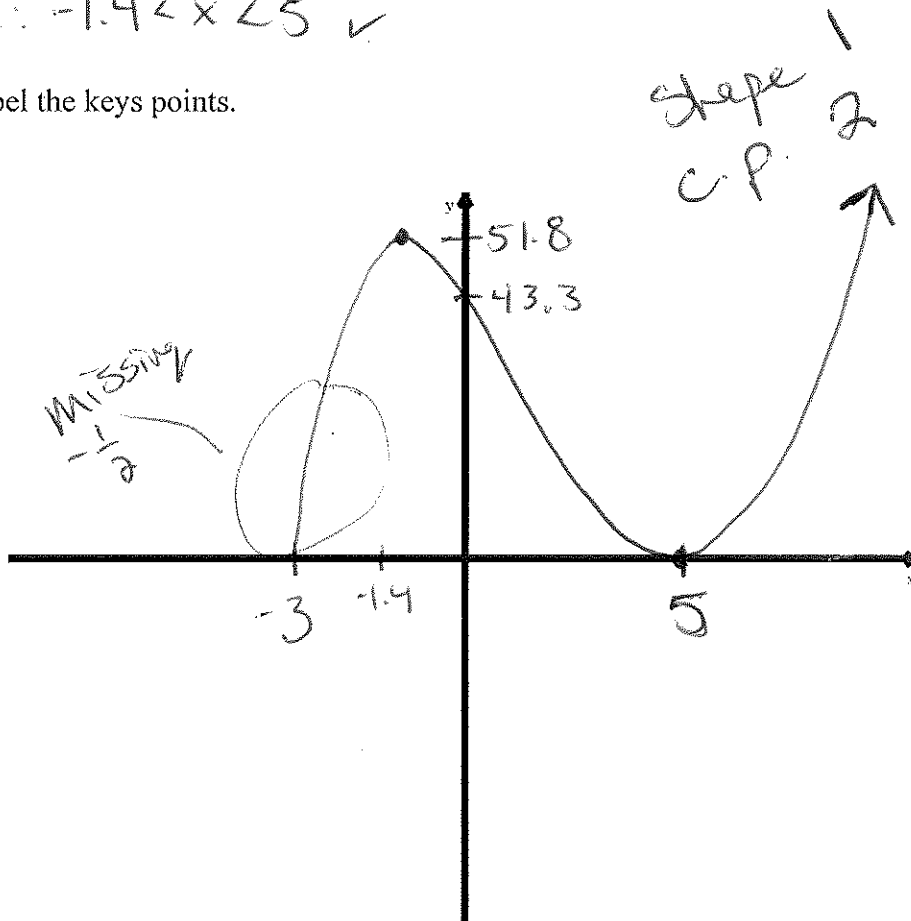
✓ min: $(5, 0)$ $(-3, 0)$

c. The interval(s) of increase and decrease. ✓

increase: $-3 < x < -1.4$ and $x > 5$ ✓

decrease: $-1.4 < x < 5$ ✓

d. Sketch and label the keys points.





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PART 1 - CALCULATOR INACTIVE QUESTIONS

Show all work and write all answers in the spaces provided. Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided the answer is supported by written work.

1. In this question, you will graph an inverse of a function.

(6 marks)

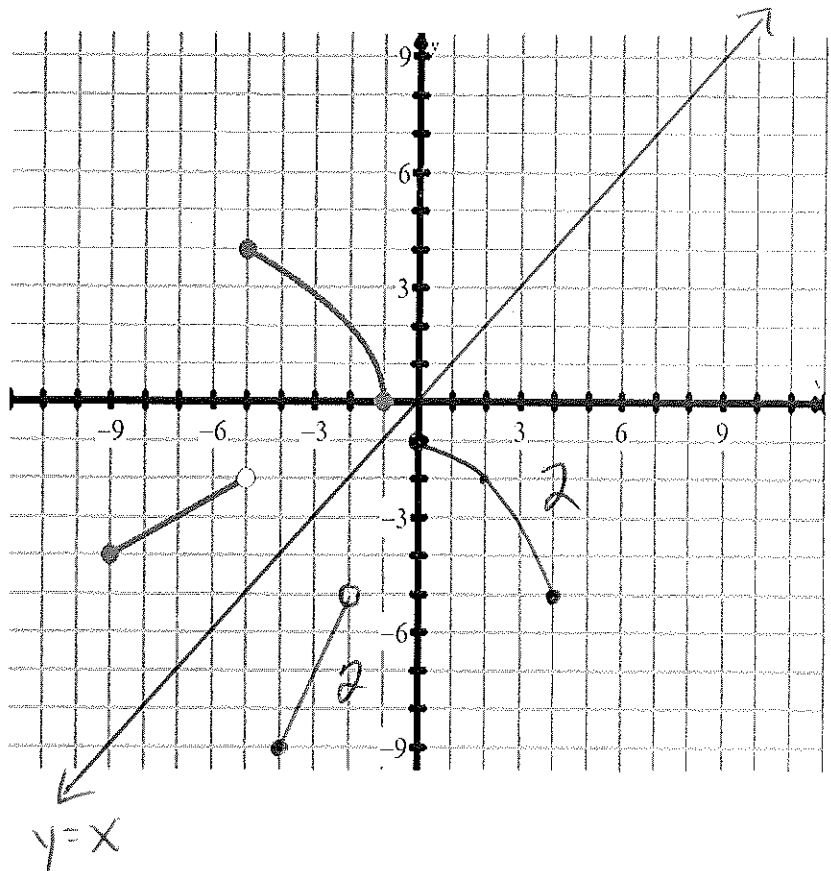
a. Explain how to draw the graph of an inverse of any function.

switch the x & y values of the points on the original function
✓

b. Graph the line $y = x$ on the graph provided.

✓

c. Given your answers to these previous 2 questions, graph the inverse of this function on the graph provided. Show supporting work (if necessary).



6

2. You are going to work with the linear function $f(x) = -\frac{3}{4}x - 2$. As you work through and answer the following questions, **ALWAYS** show your work OR explain your reasoning.

(12 marks)

a. Would the point (12, -11) be on the graph of this linear function? Show necessary work.

$$-11 = -\frac{3}{4}(12) - 2 \checkmark$$

$$-11 = -9 - 2 \checkmark$$

$$-11 = -11$$

Yes, (12, -11) is on the line

b. What is the x-intercept of the inverse function?

Handwritten work for question b:

$$f(x) = 0 \quad \checkmark (-2, 0)$$

$$0 = -\frac{3}{4}x - 2$$

$$-\frac{4}{2} \cdot 2 = -\frac{3}{1}x - \frac{4}{1}$$

$$-\frac{8}{3} = x$$

Handwritten notes: $y = -mx$ of $f(x)$ is $(0, -2)$

c. Determine the equation of the inverse of $f(x) = -\frac{3}{4}x - 2$.

$$x = -\frac{3}{4}y - 2 \checkmark$$

$$4(x + 2) = -\frac{3}{4}y \cdot 4 \checkmark$$

$$\frac{4x + 8}{-3} = \frac{-3y}{-3} \checkmark$$

$$-\frac{4}{3}x = \frac{8}{3} = y$$

d. Malak **PREDICTS** the value of $f^{-1}(-11)$ to be 12. Explain the reasoning/thinking for her prediction.

Yes because the x + y values switch from a function to it's inverse therefore if $f(12) = -11$ then $f^{-1}(-11) = 12 \checkmark$

e. Now, use your equation for $f^{-1}(x)$ from Q2c to evaluate $f^{-1}(-11)$. Show your work.

$$f^{-1}(-11) = -\frac{4}{3}(-11) - \frac{8}{3} \checkmark$$

$$= \frac{44}{3} - \frac{8}{3}$$

$$= \frac{36}{3}$$

$$= 12 \checkmark$$

f. What do your answers from Q2d and Q2e mean about your work in Q2c?

I correctly found my inverse equation \checkmark

3. Mr. Santowski is studying the relationship between the number of hours that students spend studying, h , and the marks they get on their December Semester exams, M . Included below is a sample data set from his study.

Hours Studied, h	2	5	3.5	1	8	3	9	12
Exam Mark (%), M	68	61	81	48	85	75	93	88

(14 marks)

- a. What does the domain of this relation represent?

The number of hours studied ✓

- b. Does this relation HAVE to be a function? Why or why not?

✓ No, different students could study the same amount of time but have different scores ✓

- c. Evaluate $M(3.5)$ and explain what it means in the context of this problem.

$M(3.5) = 81$ ✓
study for 3.5 hrs to earn an 81 on the exam ✓

- d. Solve $M(h) = 68$ and explain what it means in this context.

$M(h) = 68 \rightarrow h = 2$ ✓
If you get a 68 on the exam, you studied for 2 hours. ✓

- e. After marking all student exams, Ms. A suggests that we apply a transformation to this relation and suggests an equation: $y = M(h) + 5$. Explain what this transformation would do to the graph of the relation and to the student marks.

The transformation will shift the scores of the exams up by 5. Students marks will increase by 5 points. ✓

Omar wonders about the meaning of the inverse of this relation.

- f. What is the meaning of the range of this inverse relation?

The number of hours studied to receive the given exam score ✓

- g. ESTIMATE a reasonable value of $M^{-1}(70)$ and EXPLAIN what would the result mean?

2.2 ✓ (between 2+3)
~~2.2~~ ✓ to get 70 → study 2.2 hours

- h. Given your answers to the previous 2 questions, how would students make use the equation for the inverse? (What is the point of this inverse relation? (HINT: Think about your answer for Q3(f) and Q3(g))

You can use the inverse to determine how many hours you need to study to get a certain exam score. ✓

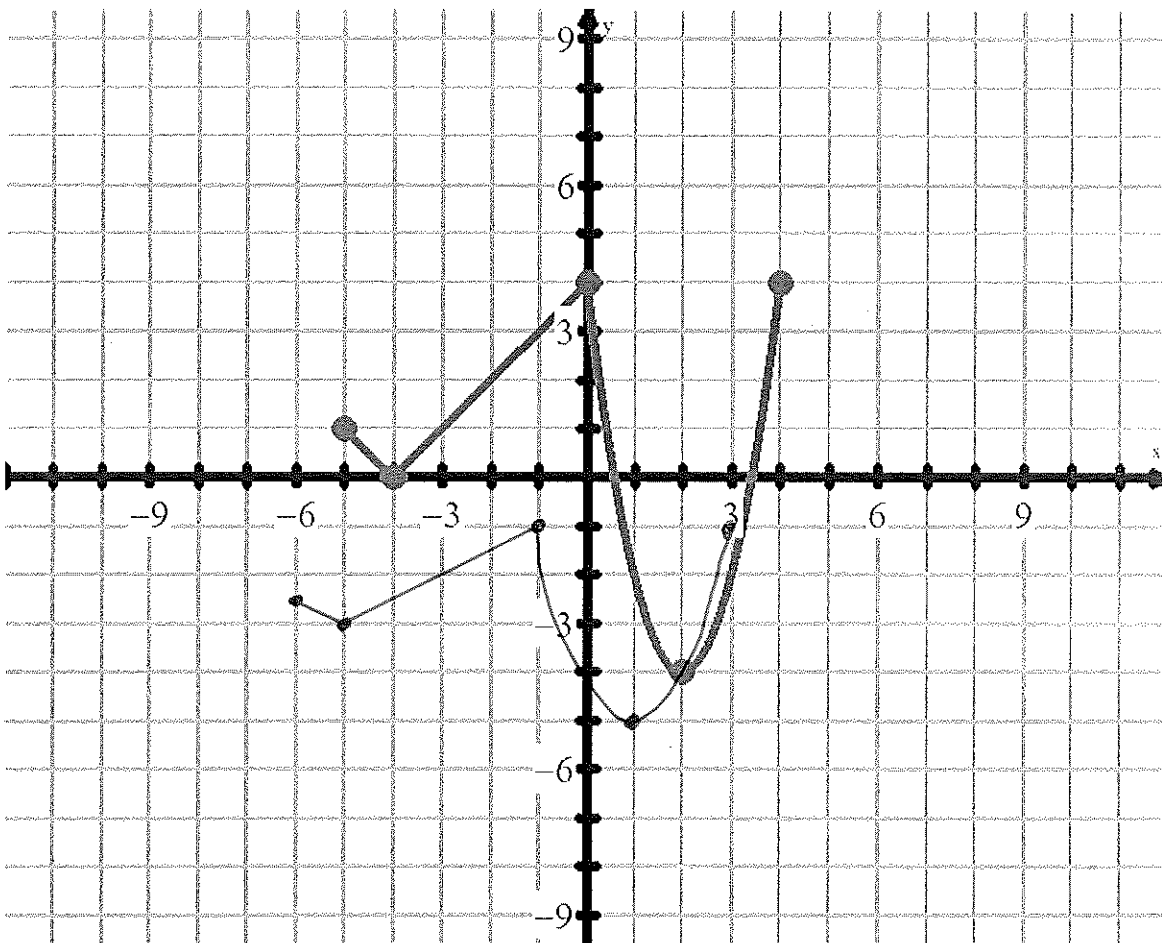
4. You have been provided with a graph of a piecewise function, $y = f(x)$, which is pictured below.

(8 marks)

a. Given the NEW equation of $y = \frac{1}{2}f(x+1) - 3$, list what transformations will be applied to $y = f(x)$

shift left 1 ✓ compress vertically by $\frac{1}{2}$ ✓
 shift down 3 ✓

b. Now apply the transformations to $y = f(x)$ and sketch the new transformed function. Show all necessary work to support your sketch of the new function.

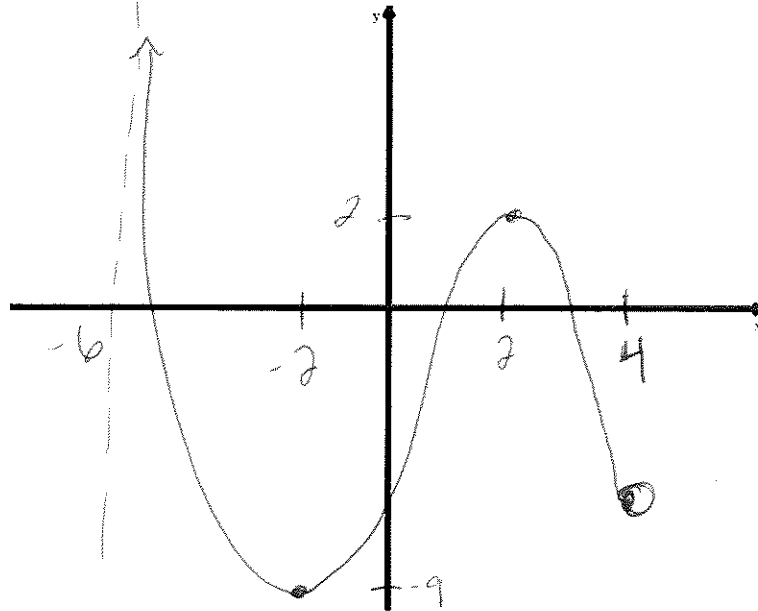


1 pt for (,)

5. Characteristics of Functions: You will produce a sketch of a function that meets the following requirements:

(12 marks)

- The domain is to be $\{x \in \mathbb{R} \mid x < 4\}$. ✓
 - The function is to be increasing ONLY on the interval of $\{x \in \mathbb{R} \mid -2 < x < 2\}$. ✓
 - The absolute minimum point must be at $(-2, -9)$. ✓
 - The function must have an asymptote. ✓
- decrease elsewhere*



a. Label your KEY POINTS.

✓ ✓

b. Explain why the range of your function is $\{y \in \mathbb{R} \mid y \geq -9\}$.

The lowest point is at $(-2, -9)$ therefore the range is all y -values at or above -9 .

c. EXPLAIN what would you have to do with your KEY POINTS in order to graph the new function $y = f(x-2) + 4$.

*The key points would be translated 2 units right and 4 units up.
Add two to the x -values.
Add four to the y -values.*

d. Is ^{the} inverse of your function also a function? Explain why or why not.

NO, there would be x -values with more than 1 y -value.