CAC
CAIRO AMERICAN COLLEGE

Name: _____ Date : _____

IM 3 UNIT TEST - Linear Functions
Teacher: Mr. Santowski and Ms. Aschenbrenner

Score: 16/17

## 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. In this question, you will work with the linear system defined by the equations $y+12=\frac{2}{5}(x-10)$ and $5x-3y+27=0$.

**(9 marks)**

a. SHOW THAT $y+12=\frac{2}{5}(x-10)$ is the equation $y=\frac{2}{5}x-16$ in slope-intercept form.

**(1M)** $y+12=\frac{2}{5}x-4$

$y=\frac{2}{5}x-16$

b. SHOW THAT $5x-3y+27=0$ is the equation $y=\frac{5}{3}x+9$ in slope intercept form.

**(1M)** $5x+27=3y$

$\frac{5}{3}x+9=y$

c. Use your graphing calculator to determine a GRAPHIC solution to this linear system.

**(1M)** $(-19.7, -23.9)$

19.73684 -23.89474

d. State APPROPRIATE window settings that could be used to determine the intersection point.

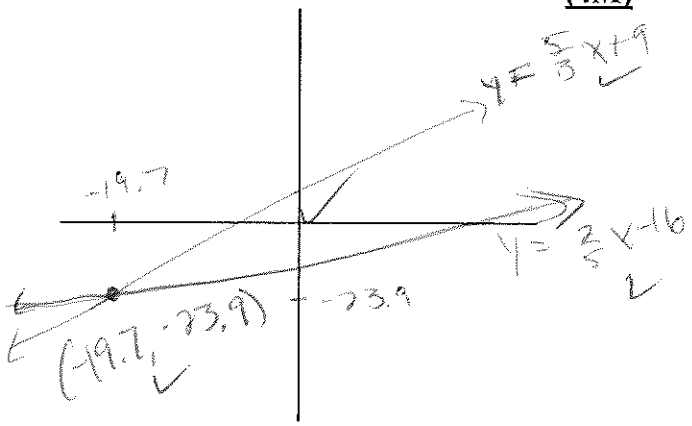
Xmin = -20 Ymin = -30

Xmax = 10 Ymax = 10

**(2M)**

e. Provide a PROPERLY LABELED SKETCH of your linear system on the grid provided. ***Label each function & the intersection point.***

**(4M)**



2. The following questions deal with determining domains and/or ranges of several functions, working from their equations and/or your TI-84 graphing calculator.

**(10 marks)**

a. State the RANGE of the linear function $f(x) = 2 - \frac{3}{4}x$ given the domain of $\{x \in R \mid -8 \le x < 12\}$. Show/explain the key steps of your solution.

**(4M)**

$f(-8) = 8$

$f(12) = -7$

$\{y \in R \mid -7 < y \le 8\}$

b. State the DOMAIN of the linear function $2x - 3y = 10$, given the range of $\{y \in R \mid -4 < y \le 2\}$. Show/explain the key steps of your solution.

**(4M)**

$2x + 12 = 10$ $\quad 2x - 6 = 10$

$x = -1$ $\quad x = 8$

$\{x \in R \mid -1 < x \le 8\}$

3. ALGEBRAICALLY, verify whether $(3,-4)$ is the solution to the linear system $\begin{cases} 5x - 4y = 17 \\ y = -\frac{8}{3}x + 4 \end{cases}$.

**SPECIAL NOTE:** If no algebraic working is shown, FULL MARKS ARE NOT AWARDED!!!!

**(4 marks)**

$-4 = -\frac{8}{3}(3) + 4$

$-4 = -8 + 4$

$-4 = -4$

$5(3) - 4(-4) = 17$

$15 + 16 = 17$

$31 \neq 17$

No $(3,-4)$ is not the solution

4. Ms. A inherited a sum of money from a relative. She deposits some of the money at 16% in her ETrade account. Then she deposits $4000 more than that amount at 12% in her Bank of America account. She earns $3840 in interest per year. How much did she invest at each rate?

**(11 marks)**

a. One equation is $y = x + 4000$.
EXPLAIN WHY this equation is correct.

**(1M)** The second account, y, has 4000 more deposited than the first account, x

b. Another equation is $0.16x + 0.12y = 3840$.
EXPLAIN WHY this equation is correct.

The interest earned is the % times the amount in the account and the sums will add to 3840.

**(1M)**

c. Explain what the variables x and y mean in context of this problem.

**(2M)** x = $ deposited in 1st account

y = $ " " 2nd account

d. Use your graphing calculator (in any way) to solve this system. State your solution.

x = 12000

y = 16000

**(1M)**

e. Provide an ALGEBRAIC VERIFICATION (using any method) to the linear system you defined to answer this word problem.

$16000 = 12000 + 4000$

$16000 = 16000$ ✓

$0.16(12000) + 0.12(16000) = 3840$

$3840 = 3840$ ✓

**(4M)**

f. State a domain and range that would be reasonable for this context. Explain the reasoning of your domain and range.

$0 \leq x \leq 24000$

$0 \leq y \leq 32000$

0 is the least she can deposit in either account. To earn the required interest with only 1 account means max 24000 in first and 32000 in second

**(2M)**

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## PART 2 - 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 working.***

1. In this multiple choice question, you are being asked to predict the number of solutions for each of the linear systems. CIRCLE the answer from the options listed and then EXPLAIN why you selected the answer you did.

**(Total 6 marks)**

a. The two linear equations are: $y = -3x + 5$, $7x + 2y = 12$

$2y = -7x + 12$

$y = -\frac{7}{2}x + 6$

This system would have:

(i) no solutions

(ii) one solution

(iii) infinitely many solutions

(iv) there is not enough information to help make the prediction

b. Explain/show the reasoning behind your choice.

$-3x + 5 = -\frac{7}{2}x + 6$

$-6x + 10 = -7x + 12$

$x = 2$ $\quad y = -7 + 6$

$y = -1$

c. You are given the linear system with these two equations: $5x + 2y = -3$, $ax - 6y = b$. Determine the values of $a$ and $b$ such that this system has infinitely many solutions. Explain how the graphs of the equations will be related.

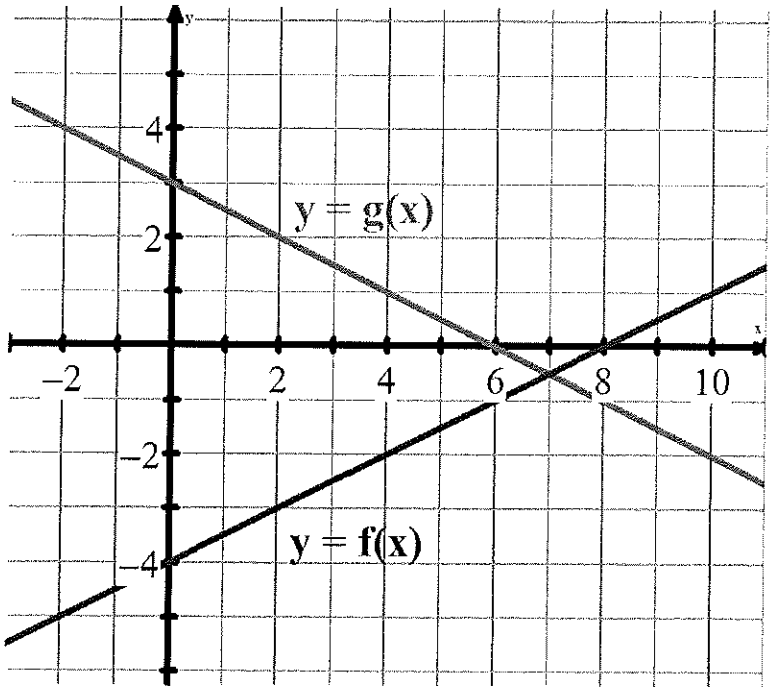
$a = 15 \quad b = +9$

The graphs will be the same line.

6

2. This question concerns the linear system as graphed in the diagram provided. Use the graph to answer the following questions:

**(Total 8 marks)**




a. Estimate the solution of this system (in other words, solve $f(x) = g(x)$).

$(7, -\frac{1}{2})$

**(1M)**

b. Mr. S. thinks the equation of $f(x)$ is $2x - 4y - 16 = 0$. Is he correct? Show/explain your reasoning.

**(3M)**

$2x - 16 = 4y$

$\frac{1}{2}x - 4 = y$

Yes correct slope + y-int

c. The equation of Line 2 is $y - 2 = -\frac{1}{2}(x - 2)$. Use an algebraic method of your choosing to determine the exact point at which the two functions intersection.

**(4M)**

$\frac{1}{2}x - 4 - 2 = -\frac{1}{2}(x - 2)$

$\frac{1}{2}x - 6 = -\frac{1}{2}x + 1$

$x = 7$

$y = \frac{1}{2}(7) - 4$

$y = \frac{7}{2} - \frac{8}{2}$ $y = -\frac{1}{2}$

$(7, -\frac{1}{2})$

8

3. Here is a graph of piecewise function, $y = f(x)$.

**(total 10 marks)**

a. State the domain and range of the function as graphed. **(2M)**

$D: \{x \in \mathbb{R} \mid 1 \le x < 11\}$

$R: \{y \in \mathbb{R} \mid 3 \le y \le 11\}$

b. State one point on Line 2 of $y = f(x)$ **(1M)**

$(5, 11)$

$(10, 9)$

c. Evaluate $f(2)$. **(1M)**

5

d. Solve for x if $9 = f(x)$. **(2M)**

$x = 4, 10$

e. Calculate the slope of the Line #2 **(1M)**

$\frac{11-9}{5-10} = \frac{2}{-5}$

$\boxed{-\frac{2}{5}}$

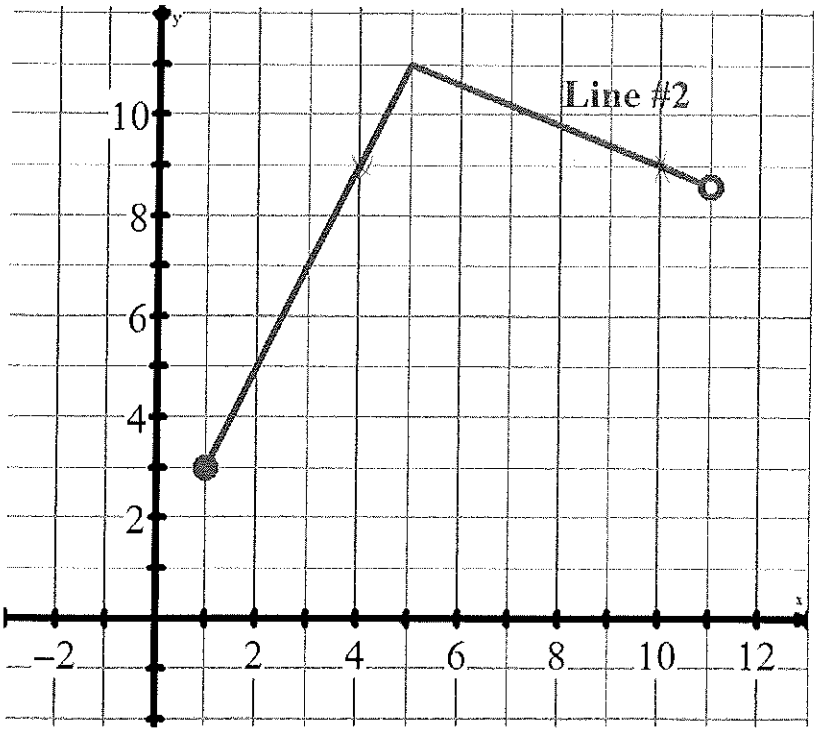
f. Write the equation of Line #2 in standard form. **(3M)**

$y - 11 = -\frac{2}{5}(x-5)$

$y - 11 = -\frac{2}{5}x + 2$

$\frac{2}{5}x + y = 13$

$2x + 5y = 65$




g. (HL Extension/BONUS) Write the equation of this piecewise function.

$$f(x) = \begin{cases} 2x+1 & 1 \le x < 5 \\ -\frac{2}{5}x + 13 & 5 \le x < 11 \end{cases}$$

4. Snow White really loves apples and is trying to find the best store in which to buy her apples. FRUITZ Shop sells apples for 25 cents per apple, regardless of how many apples she buys.

**(Total 11 marks)**

a. How much would 12 apples cost her at FRUITZ Shop?

**(1M)**

$12(0.25) = \$3$

However the APPLE Shop has a special deal wherein she can buy apples at 40 cents, but if she buys MORE than 6 apples, each additional apple (over the first 6) only costs 15 cents per apple!

b. How much would it cost to buy 12 apples

**(2M)**

$6(0.4) + 6(0.15)$

$2.4 + 0.9$

$\$3.30$

c. If she only had 3 dollars to spend, how many apples could she buy?

**(2M)**

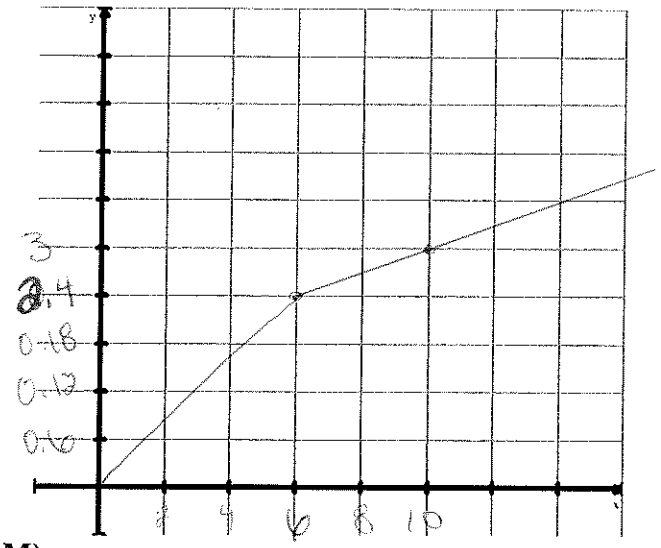
$3 = 2.4 + 0.15x$

$0.6 = 0.15x$

$4 = x$

10 apples

d. Draw a graph showing the relationship between number of apples and cost for the APPLE Shop.




**(2M)**

e. What would be the slope of this linear relation? Explain your answer.

**(2M)**

0.4 for the first 6 apples

0.15 for any number of apples purchased after 6 apples

At some point, you can spend the same amount of money for the same amount of apples at BOTH STORES (i.e. the intersection point, if we created a linear system).

f. Determine the value of this intersection point. Show/explain how you determined your answer.

**(2M)**

$0.25x = 2.4 + 0.15x$

$0.1x = 2.4$

$x = 24$

$0.25(24) = 6$

24 apples for \$6