

Test: Analyzing Linear Relations

Total _____ /55

Part I - multiple choice questions.

Circle the best answer. Show your work to justify your choice.

1. There are two major roads coming into a small town. The first road rises 8 m vertically for every 12 m run. The second road rises 6 m vertically for every 10 m run. Which statement is true?

- a. The first road is steeper than the second road.
- b. The second road is steeper than the first road.
- c. Both roads have the same slope.
- d. You cannot determine which road is steeper from the information given.

$$m_1 = \frac{8}{12} = \frac{2}{3} = 0.6$$

$$m_2 = \frac{6}{10} = \frac{3}{5} = 0.6$$

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2. Which statement best describes the two equations $y = \frac{1}{2}x - 3$ and $y = -2x + 3$

- a. Parallel line, same y-intercept.
- b. Perpendicular line.
- c. Same y-intercept.
- d. Parallel lines.

$$m = \frac{1}{2}$$

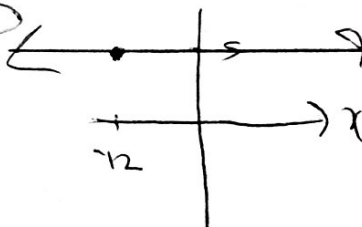
$$m = -2$$

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3. The equation of the line through $(-12, 5)$ parallel to the x-axis is

- a. $y = -12x + 5$
- b. $x = -12$
- c. $y = 5$
- d. $y = -\frac{12}{5}x$

$$m = 0$$

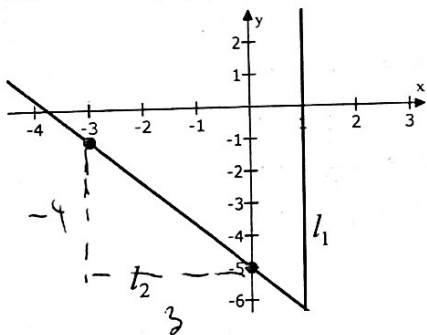


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Part II - full answers questions (show all the steps to receive full marks).

A) State the slope, y-intercept and the equation of the line (EoL) to the graph shown below.

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	l_1	l_2
Slope	undefined	$m = -4/3$
y-intercept	None	$b = -5$
EoL	$x = 1$	$y = -\frac{4}{3}x - 5$

B) Given the line $2x - 3y + 15 = 0$ determine:

i. The slope

$$2x + 15 = 3y$$

$$\frac{2}{3}x + \frac{15}{3} = y$$

$$\frac{2}{3}x + 5 = y$$

$$m = \frac{2}{3}$$

ii. The coordinates where it crosses the x-axis and the y-axis.

(x-intercept y-intercept)

let $y = 0$

$$2x - 3(0) + 15 = 0 \Rightarrow (-7.5, 0)$$

$$2x = -15$$

$$x = -7.5$$

y-intercept: let $x = 0$

 $2(0) - 3y = -15$ Total for this page ___ / 10

$(0, 5)$
 $y = 5$

c) Write the equation $y = -\frac{3}{4}x + \frac{1}{8}$ in the form $Ax + By + C = 0$. $lcd = 8$

$$8y = 8\left(-\frac{3}{4}x\right) + 8\left(\frac{1}{8}\right) \checkmark$$

$$8y = -6x + 1$$

$$6x + 8y - 1 = 0 \checkmark$$

D) Compare the lines $4x + 6y - 12 = 0$ and $y = \frac{3}{2}x - 1$. Discuss their:

- i. Steepness
- ii. direction and
- iii. whether they are perpendicular or parallel or neither.

iii) $m_1 = -\frac{2}{3}$
 $m_2 = \frac{3}{2}$

∴ They are \perp since slopes are negative reciprocals

Justify your reasoning.

$$4x + 6y - 12 = 0$$

$$6y = -4x + 12$$

$$y = \frac{-4x + 12}{6}$$

$$y = -\frac{2x}{3} + 2 \text{ --- (1)}$$

$$y = \frac{3}{2}x - 1 \text{ --- (2)}$$

(i) Line (2) is steeper than line (1) because $\frac{3}{2}$ is greater than $\frac{2}{3}$

(ii) Line (2) is a positive correlation and Line (1) is a negative correlation

E) Determine the equation of a line:

i. with slope $\frac{1}{3}$ and passing through

$(-6, -3)$.

$$y = mx + b$$

$$-3 = \frac{1}{3}(-6) + b$$

$$-3 = -2 + b$$

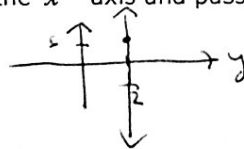
$$-3 + 2 = b$$

$$-1 = b$$

$$\therefore y = \frac{1}{3}x - 1$$

ii. perpendicular to the x -axis and passing

through $\left(\frac{1}{2}, 6\right)$.



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

iii. with x -intercept -6 & y -intercept 9 .

$(-6, 0)$ & $(0, 9)$

$$m = \frac{9 - 0}{0 - (-6)} = \frac{9}{6} = \frac{3}{2}$$

$$\therefore y = \frac{3}{2}x + 9$$

iv. Passing through $(-3, 3)$ and $(7, -5)$.

$$m = \frac{-5 - 3}{7 - (-3)} = \frac{-8}{10} = -\frac{4}{5}$$

$$y = mx + b$$

$$3 = -\frac{4}{5}(-3) + b$$

$$3 = \frac{12}{5} + b$$

$$15 = 12 + 5b$$

$$15 - 12 = 5b$$

$$\frac{3}{5} = b$$

$$\therefore y = -\frac{4}{5}x + \frac{3}{5}$$

v. with the same x -intercept as $4x + 3y + 12 = 0$ and parallel to $2x - 3y + 12 = 0$.

Step (1)

$$\text{let } y = 0 \Rightarrow 4x + 3(0) = -12$$

$$4x = -12$$

$$x = -3$$

$$\therefore (-3, 0)$$

Step (2)

$$2x - 3y + 12 = 0$$

$$2x + 12 = 3y$$

$$\frac{2}{3}x + 4 = y$$

$$m = \frac{2}{3}$$

Step (3)

$$y = mx + b$$

$$0 = \frac{2}{3}(-3) + b$$

$$0 = -2 + b$$

$$2 = b$$

$$\therefore y = \frac{2}{3}x + 2$$

F) The Radicals, a small high school band, recently signed a contract with a record label. Their earnings include a signing bonus plus an amount per CD sold, as shown in the table.

Number of CDs	Band Earnings (\$)
10 000	11 200
20 000	12 400

(i) Determine the earnings per CD.

$$m = \frac{12400 - 11200}{20000 - 10000}$$

$$= \frac{1200}{10,000}$$

$$= 0.12$$

They earn 12¢ / CD.

(ii) Find an equation relating Earning, E , in dollars, and n , number of CDs.

$$E = mn + b$$

$$11200 = 0.12(10000) + b$$

$$11200 = 1200 + b$$

$$11200 - 1200 = b$$

$$10,000 = b \quad \therefore E = 0.12n + 10,000$$

(iii) Using your equation, how many CD's will have to be sold if the band were to earn \$17 680?

$$17680 = 0.12n + 10,000$$

$$17680 - 10,000 = 0.12n$$

$$7680 = 0.12n$$

$$64000 = n$$

They need to sell 64,000 CD to make \$17680

G) Solve for the following system of equations.

$$\left. \begin{aligned} 3x + 2y &= 12 & \textcircled{1} \\ y &= -\frac{3}{2}x + 2 & \textcircled{2} \end{aligned} \right\}$$

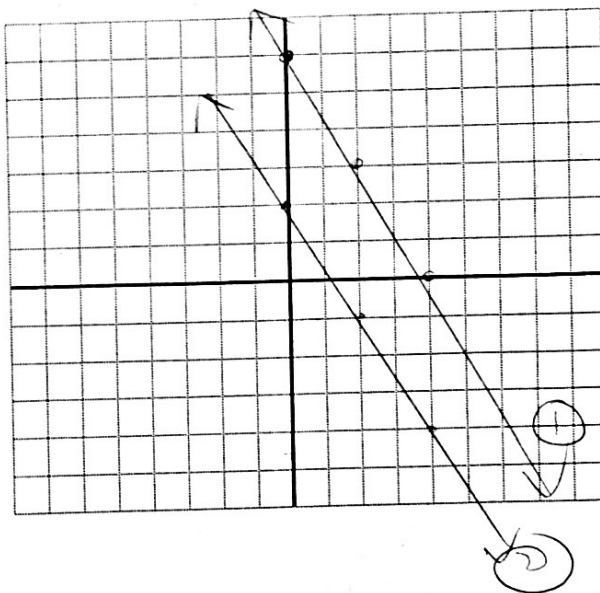
$$\textcircled{1} \quad 2y = -3x + 12$$

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

$$\boxed{m = -\frac{3}{2}} \quad b = 6$$

$$\textcircled{2} \quad y = -\frac{3}{2}x + 2$$

$$\boxed{m = -\frac{3}{2}}$$



Slopes are ~~parallel~~ equivalent
 \therefore lines are parallel thus No solution

H) Tamara wants to earn extra money selling lemonade in front of her house. It costs \$1.20 to start her business and each glass of lemonade costs \$0.06 to make. She plans to sell the lemonade for \$0.10 a glass.

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(i) Write an equation that represents her **cost**.

$$C = 0.06n + 1.20$$

(ii) Graph her cost equation to the right.

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(iii) Write an equation that represents her revenue (earnings).

$$E = 0.10n$$

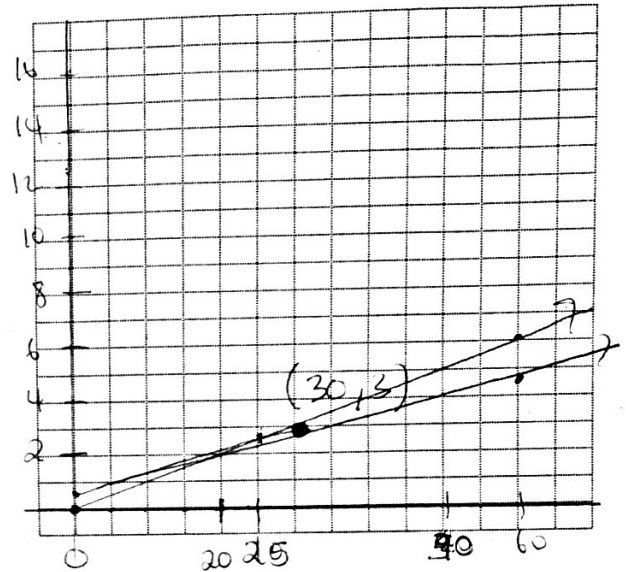
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(iv) Graph her revenue equation to the right.

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(v) What does the point of intersection represent?

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$$0.10n = 0.06n + 1.20$$

$$0.10n - 0.06n = 1.20$$

$$0.04n = 1.20$$

$$n = 30$$

POI (30, 3)

(vi) Does Tamara make a profit or lose money for

a) 20 glasses? Explain.

$$C = 0.06(20) + 1.20 = 2.40$$

$$R = 0.10(20) = 2$$

b) 50 glasses? Explain.

$$C = 0.06(50) + 1.20 = 4.80$$

$$R = 0.10(50) = 5$$

For 30 lemonades the cost = earnings will be the same \$3.00

Loses money 40¢

Makes money 20¢

I) Pierre missed the lesson on linear systems. Explain to him how you would verify (-3, 1) is the solution for the given linear system.

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$$y = \frac{1}{3}x + 2$$

$$y = -x - 2$$

$$\textcircled{1} \quad LS = \frac{1}{3}(-3) + 2 = -1 + 2 = 1$$

$$RS = 1 \quad \therefore LS = RS$$

$$\textcircled{2} \quad LS = -(-3) - 2 \quad RS = 1$$

$$= 3 - 2$$

$$= 1$$

$$\therefore LS = RS$$

\therefore POI (-3, 1)