

Grade 9 Academic Math
Unit 4 Test – Linear Relations

Ms. Matei, Mr. Nolfi

Victim: Mr. Identities

inspiring solutions Mr. I.!!

KU	APP	TIPS	COM
22/22	21/21	16/16	10/10

INSTRUCTIONS – Read each question *carefully!!* For full marks, show all work where required.

Matching

1. Match each item with the correct statement below. (4 KU)

- | | | | |
|-----------------------------------|-----------------------------|------------------------------|-------------------------------------|
| A. perpendicular lines | B. standard form | C. parallel lines | D. reciprocals |
| E. slope | F. y-intercept | G. x-intercept | H. point of intersection |

E ✓ For a horizontal line, this is zero.

A ✓ These lines meet at 90°.

F ✓ For the line $y = 3x + 6$, this is 6.

B ✓ This is the name for an equation of a line in the form $Ax + By + C = 0$.

C ✓ These lines have the same slope.

H ✓ This is where two lines meet.

D ✓ The numbers 3 and $1/3$ are examples.

G ✓ For a vertical line, the value of x is constant and equal to this.

Modified True/False

Indicate whether each statement is *true* or *false*.

If false, *change* the underlined part to make the statement true. (4 KU)

2. F ✓ $x = 4$ is the equation of a horizontal line.

Change: $y = 4$ ✓

3. F ✓ The x-intercept of the line $x - y = 3$ is -3.

Change: y-intercept ✓

4. F ✓ $y = 5x + 4$ and $5x - y - 4 = 0$ represent the same line.

Change: $y = 5x - 4$ ✓

5. F ✓ In a distance-time graph, the y-intercept is the speed.

Change: slope ✓

Multiple Choice

Identify the choice that best completes the statement or answers the question. (4 KU)

6. d ✓ For the line $2x - 5y - 10 = 0$, which statement is true?

~~(a)~~ The x-intercept is 5, and the y-intercept is 2.

~~(b)~~ The x-intercept is -5, and the y-intercept is -2.

~~(c)~~ The x-intercept is -2, and the y-intercept is 5.

~~(d)~~ The x-intercept is 5, and the y-intercept is -2.

7. b What are the slope and y-intercept of the given line?

- ~~(a)~~ $m = \frac{7}{4}, b = 4$
- ~~(c)~~ $m = \frac{4}{7}, b = 4$

(b) $m = -\frac{7}{4}, b = 4$

~~(d)~~ $m = -\frac{4}{7}, b = 4$

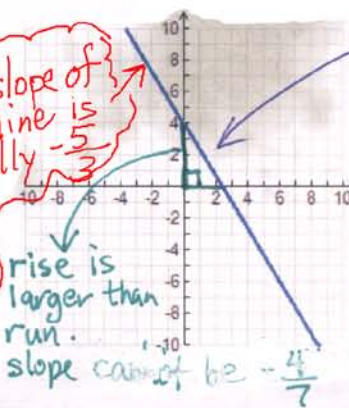
can't be correct because slope must be negative

The slope of this line is actually $-\frac{5}{3}$

$-\frac{7}{4}$ is the best answer.

rise is larger than run.

∴ slope cannot be $-\frac{4}{7}$



slope must be negative

K	-0
A	-0
T	-0
C	-0

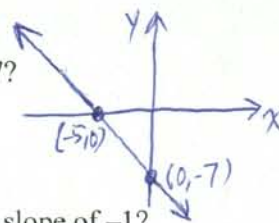
8. C ✓ What is the slope of the line with an x-intercept of -5 and a y-intercept of -7?

(a) $-\frac{5}{7}$

(b) $\frac{5}{7}$

(c) $-\frac{7}{5}$

(d) $\frac{7}{5}$



9. a ✓ What is the value of p so that the line passing through $(6, 2)$ and $(9, p)$ has a slope of -1?

(a) -1

(b) 3

(c) 1

(d) -3

$$\frac{p-2}{9-6} = -1 \therefore \frac{p-2}{3} = -1$$

Problems

10. Determine the slope-y-intercept equation of the line passing through the points $(-5, -7)$ and $(9, 7)$. (5 KU)

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{7 - (-7)}{9 - (-5)} \\ &= \frac{14}{14} \\ &= 1 \end{aligned}$$

$\because (9, 7)$ lies on the line, its co-ordinates must satisfy the equation

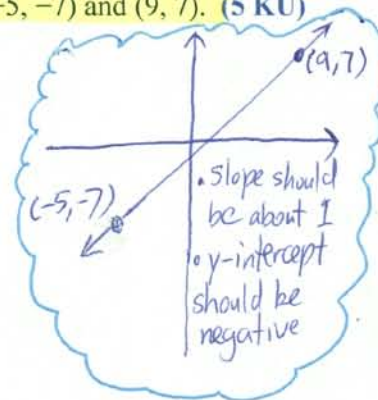
$$\therefore 7 = 1(9) + b$$

$$\therefore 7 = 9 + b$$

$$\therefore b = 7 - 9 = -2$$

\therefore the equation of the line takes the form $y = 1x + b$

\therefore the slope-y-intercept equation of the line must be $y = x - 2$



11. Determine the slope-y-intercept equation of the line that is perpendicular to the line $y = -\frac{5}{3}x + 7$

and has an x-intercept of -5. (5 KU)

$(-5, 0)$ lies on the line

slope must be $\frac{3}{5}$

\because the required line is perpendicular to $y = -\frac{5}{3}x + 7$

$$m = \frac{3}{5} \text{ (negative reciprocal slopes)}$$

\therefore the equation must take the form

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

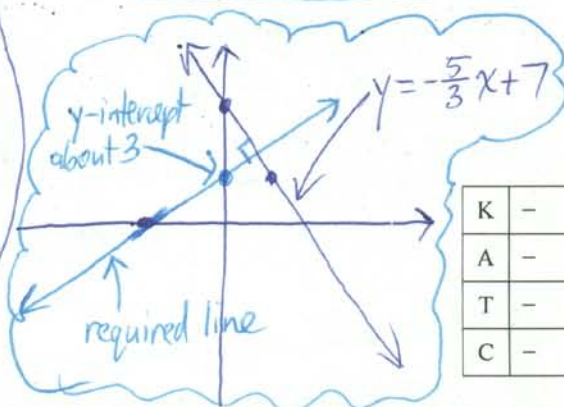
\because the x-intercept is -5, $(-5, 0)$ lies on the line and its co-ordinates must satisfy the equation

$$\therefore 0 = \frac{3}{5}\left(-\frac{5}{1}\right) + b$$

$$\therefore 0 = -3 + b$$

$\therefore b = 3$
 \therefore the slope-y-intercept equation of the line must be

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



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A	-
T	-
C	-

12. The following questions deal with the equation $5x - 6y - 18 = 0$, an equation of a line in standard form.

- (a) Write the equation in the form $y = mx + b$ and state the slope and y-intercept. (4 APP)

$$5x - 6y - 18 = 0$$

$$\therefore 5x - 6y - 18 - 5x + 18 = 0 - 5x + 18$$

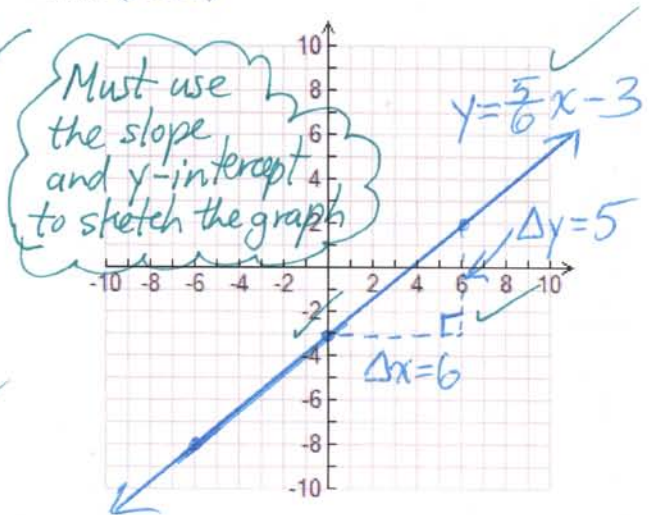
$$\therefore -6y = -5x + 18$$

$$\therefore \frac{-6y}{-6} = \frac{-5x}{-6} + \frac{18}{-6}$$

$$\therefore y = \frac{5}{6}x - 3$$

$$\therefore m = \frac{5}{6} \text{ and } b = -3$$

- (b) Use the slope-y-intercept form of the equation that you found in (a) to sketch a graph of the line. (3 APP)



13. Deja and Delsie are both plumbers. Deja charges a flat fee of \$50 plus \$40 per hour. Delsie, on the other hand, doesn't charge a flat fee; she simply charges \$50 per hour. Let C represent the total amount charged and let n represent the number of hours worked.

- (a) For each plumber, write an equation relating C to n . (3 APP)

Deja: $C = 40n + 50$

Delsie: $C = 50n$

- (b) Using the grid at the right, sketch the graphs of both equations from part (a). Be sure to label the graph and axes appropriately. Use an appropriate scale on both axes. (6 APP)

- (c) State the point of intersection and explain what it represents in this situation. (2 APP)

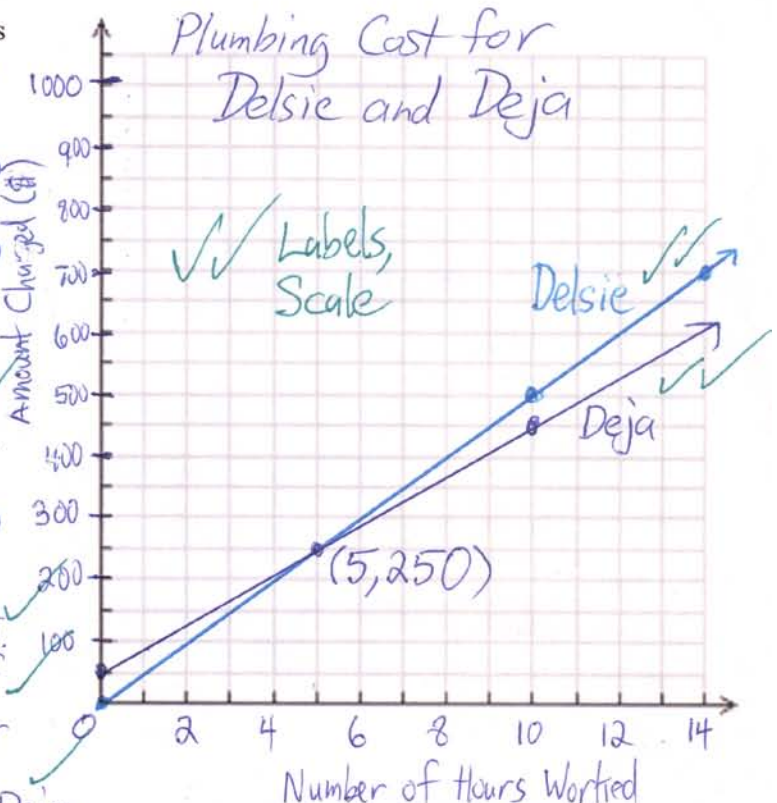
Point of Intersection: (5, 250)

Meaning: For 5 hours of work, both plumbers charge \$250.

- (d) How would you decide which plumber to hire? Explain. (3 APP)

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T	-
C	-

For fewer than five hours of work, Delsie charges less. For more than five hours of work, Deja charges less. For small jobs I would hire Delsie. For larger jobs, I would hire Deja.



14. By shovelling snow during the winter, Daniel was able to save some money, all of which he deposited into his bank account. Once summer arrived, he stopped saving money and began spending his money on go-cart racing.

(a) How much money did Daniel save altogether? Explain.

He saved \$180. This is the amount of money he had at time zero weeks. (y-intercept)

(b) How long will it take Daniel to spend all his money?

Explain. It will take Daniel nine weeks to spend all his money. At nine weeks, his account balance is zero. (x-intercept)

(c) How much money will he have after 3 weeks? Explain.

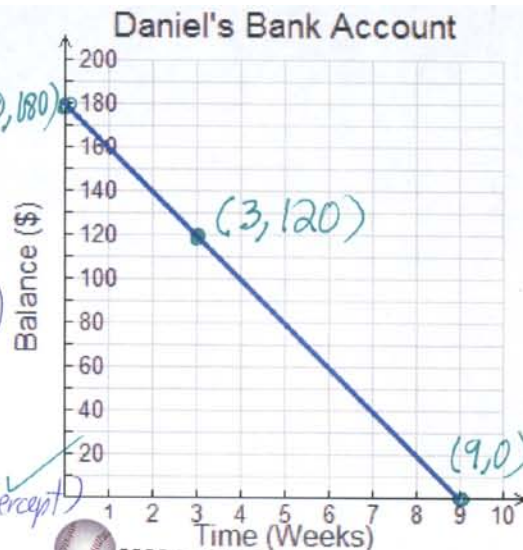
He will have \$120 after 3 weeks.

This can be seen by noticing that the point (3, 120) lies on the line.

(d) Calculate the slope and explain what it means in this situation. (2 TIPS)

$$m = \frac{0 - 180}{9 - 0} = \frac{-180}{9} = -20$$

This means that Daniel spends \$20 per week.



Ha, ha suckers! You're gonna crash!

Look out Jahvon! I can't control my descent! HEEEEELLLP!

15. Nick and Jahvon are flying in separate hot-air balloons. Nick's balloon is 200 m directly above Jahvon's balloon and falling at a speed of 15 m per minute. Jahvon's balloon is 800 m above the ground and falling at a speed of 10 m per minute.

Assuming that the balloons are both moving vertically, will they collide before reaching the ground?

If the balloons do collide, at what time does the collision take place? How high above the ground are the balloons when they collide? (8 TIPS)

$d \rightarrow$ distance above ground in metres, $t \rightarrow$ time in minutes

Nick: $d = -15t + 1000$ Jahvon: $d = -10t + 800$

Nick's balloon is 200 m above Jahvon's at first. \therefore its initial height must be $800 + 200$

By sketching the graph of each equation, it is clear that the balloons WILL collide after about 45 minutes, at which time each balloon is about 375 m above the ground.

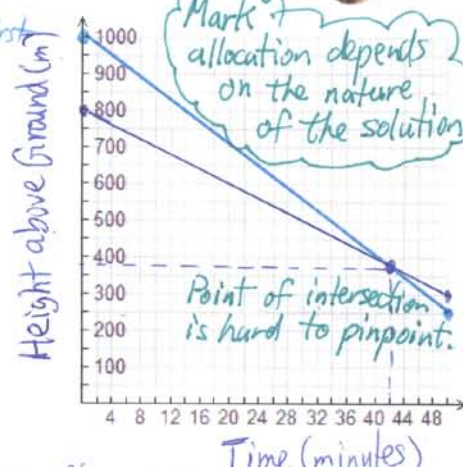
To confirm this, we can solve

$$-15t + 1000 = -10t + 800$$

$$\therefore -5t = -200$$

$$\therefore t = 40$$

The collision takes place after 40 minutes, 400 m above the ground.



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