MPM 1D0 | **Semester 1, 2013 - 2014**

Grade 9 Academic Math
Unit 4 Test – Linear Relations

Ms. Kugavaratharajah, Mr. Nolfi

Victim: Mr. Solutions

Brilliant work Mr. K!!

KU	APP	TIPS	COM
22/22	21/21	14/14	10/10

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

✓ = ½ mark

Matching

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

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

F ✓ For a horizontal line, this is zero.
A ✓ These lines meet at 90°.
H ✓ For the line $y = 3x + 6$, this is 6.
G ✓ This is the name for an equation of a line in the form $Ax + By + C = 0$.
E ✓ These lines have the same slope.
D ✓ This is where two lines meet.
B ✓ The numbers 3 and $1/3$ are examples.
C ✓ 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 ✓ $x = 10$ is the equation of a **horizontal line**. **Change:** vertical line ✓

3. F ✓ The x-intercept of the line $5x - 2y = 10$ is **5**. **Change:** 2 ✓

4. F ✓ **$y = 3x + 7$** and $3x - y - 7 = 0$ represent the same line. **Change:** $y = 3x - 7$ ✓

5. F ✓ In a **speed-time** graph, the slope is the speed. **Change:** distance-time ✓

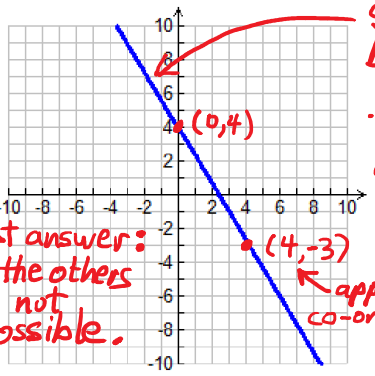
Multiple Choice

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

6. a ✓ 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 -5, and the y-intercept is -2.
(d) The x-intercept is 5, and the y-intercept is -2.

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



Slope must be negative
∴ (a) and (c) cannot be correct

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

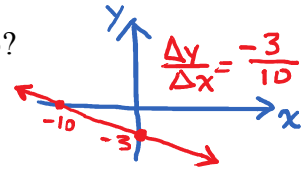
Best answer: All the others are not possible.

approximate co-ordinates

K	−0
A	−0
T	−0
C	−0

8. b ✓ What is the slope of the line with an x-intercept of −10 and a y-intercept of –3?

(a) $\frac{3}{10}$ **(b)** $-\frac{3}{10}$ **(c)** $\frac{10}{3}$ **(d)** $-\frac{10}{3}$



9. d ✓ What is the value of p so that the line passing through (6, 2) and (10, p) has a slope of –2?

(a) 10 **(b)** 6 **(c)** −10 **(d)** −6

$\frac{\Delta y}{\Delta x} = \frac{p-2}{10-6} = \frac{p-2}{4} = -2$

Problems

10. Determine the slope-y-intercept equation of the line passing through the points (−1, 5) and (4, −9). **(5 KU)**

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{-9-5}{4-(-1)}$

$= \frac{-14}{5}$ ✓

∴ the slope-y-intercept equation takes the form

$y = \frac{-14}{5}x + b$ ✓

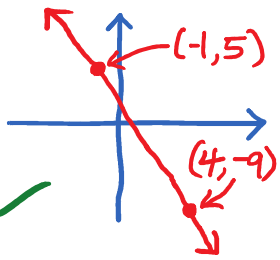
Since (-1, 5) lies on the line, its co-ordinates must satisfy the equation.

$\therefore 5 = \frac{-14}{5}\left(\frac{-1}{1}\right) + b$ ✓

$\therefore \frac{25}{5} = \frac{14}{5} + b$

$\therefore \frac{25}{5} - \frac{14}{5} = \frac{14}{5} + b - \frac{14}{5}$ ✓

$\therefore \frac{11}{5} = b$



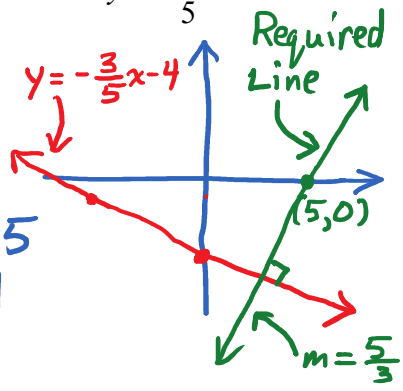
Therefore, the slope-y-intercept equation of the line is

$y = \frac{-14}{5}x + \frac{11}{5}$ ✓

(agrees with graph)

11. Determine the slope-y-intercept equation of the line that is ***perpendicular*** to the line $y = -\frac{3}{5}x - 4$ and has an ***x-intercept*** of 5. **(5 KU)**

$m = \frac{5}{3}$ because perpendicular lines have negative reciprocal slopes ✓



(5,0) ✓ lies on the line because its x-intercept is 5

∴ the equation takes the form $y = \frac{5}{3}x + b$ and

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

$\therefore 0 = \frac{25}{3} + b$

$\therefore 0 - \frac{25}{3} = \frac{25}{3} + b - \frac{25}{3}$ ✓

$\therefore b = -\frac{25}{3}$

Therefore, the slope-y-intercept equation of the required line is $y = \frac{5}{3}x - \frac{25}{3}$ ✓ (agrees with graph)

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

12. The following questions deal with the equation $7x-3y-11=0$, 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)**

$7x-3y-11=0$

$\therefore 7x-3y-11-7x+11=0-7x+11$ ✓

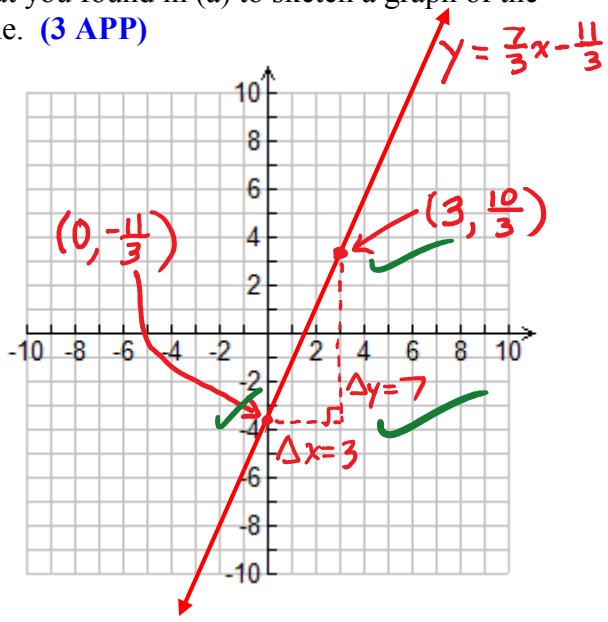
$\therefore -3y=-7x+11$

$\therefore \frac{-3y}{-3}=\frac{-7x}{-3}+\left(\frac{11}{-3}\right)$ ✓

$\therefore y=\frac{7}{3}x-\frac{11}{3}$ ✓

$\therefore m=$ $\frac{7}{3}$ and $b=$ $-\frac{11}{3}$ ✓

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

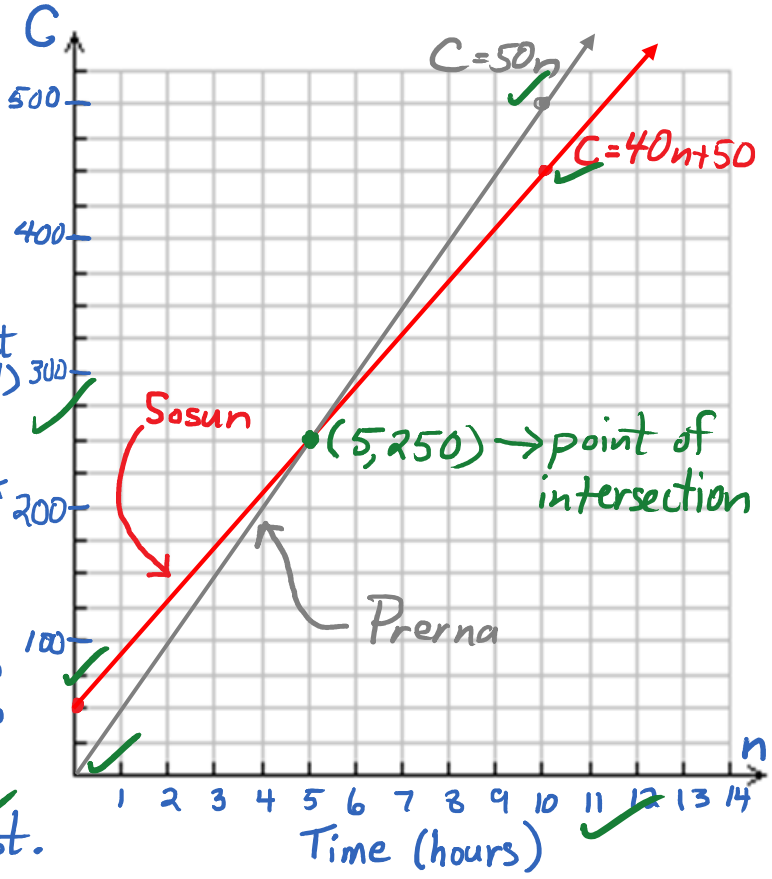


13. Sosun and Prerna are both plumbers. Sosun charges a flat fee of \$50 ***plus*** \$40 per hour. Prerna, on the other hand, doesn't charge a flat fee; she simply charges \$50 per hour. Let C represent the total amount charged and let n represent the number of hours worked.

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

Sosun: $C=40n+50$ ✓ ✓ Prerna: $C=50n$ ✓

(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: Both plumbers ✓ charge \$250 for 5 hours work

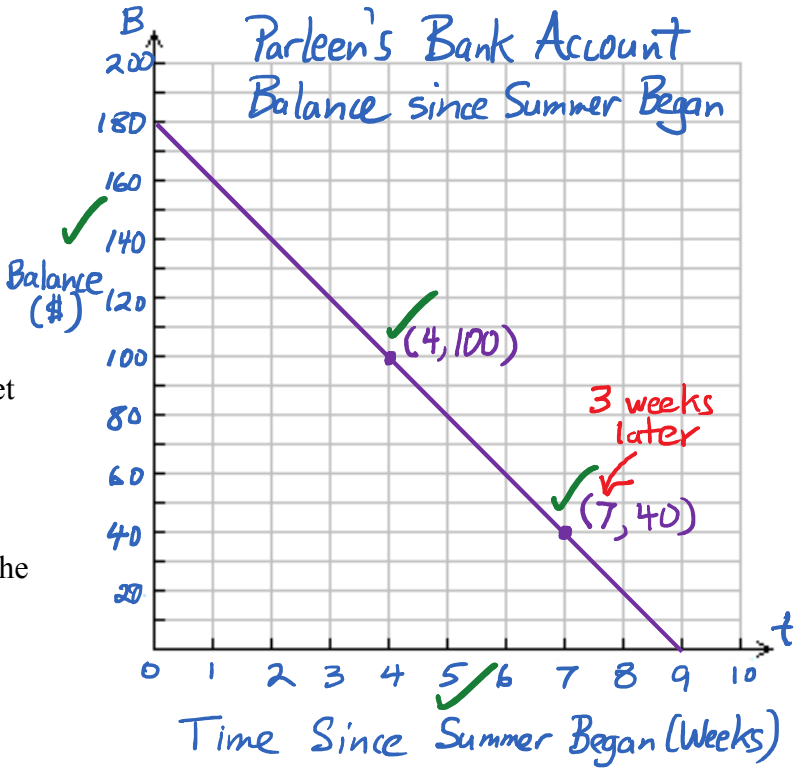
(d) How would you decide which plumber to hire? Explain. **(3 APP)**

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

I would hire Prerna for jobs that require fewer than five hours of work ✓ and Sosun for jobs that require more than 5 hours of work. ✓ The lower graph represents lower cost. ✓

14. By shovelling snow during the winter, Parleen saved some money, all of which she deposited into her bank account. Once summer arrived, she stopped saving money and began spending on bungee jumping. Four weeks after summer began, Parleen had $100 left in her bank account. Three weeks later, she had only $40 left.

(a) Sketch a graph that shows how Parleen's bank account balance decreased over the summer. (Assume that the relation is linear. Don't forget to set suitable scales and to label the axes!) **(4 TIPS)**



(b) Write an equation, in slope-y-intercept form, that relates Parleen's bank account balance to the number of weeks that have passed since the summer began. **(3 TIPS)**

$m = \frac{40-100}{7-4} = \frac{-60}{3} = -20$ ✓

$b = 180$ (from graph)

$B = -20t + 180$ ✓ ✓

t - time in weeks

B - bank account balance in dollars

(c) Explain the ***meaning*** of the slope and y-intercept in this context. **(2 TIPS)**

Meaning of Slope: Parleen's bank account balance decreases at a rate of $20/week ✓

Meaning of y-intercept: Parleen's bank account balance was $180 when summer began ✓

(d) What was the balance of Parleen's bank account balance after 24 ***days***? **(2 TIPS)**

$t = 24$ days $= \frac{24}{7}$ weeks, $B = ?$

$\therefore B = \frac{-20}{1}\left(\frac{24}{7}\right) + 180$ ✓

$\doteq 111.43$ ✓

Her balance was $111.43.

(e) Use an algebraic method to determine how long it took Parleen to spend half the money that she saved. Express your answer in weeks. **(3 TIPS)**

She saved $180 altogether (initial value)

$\therefore B = \frac{180}{2} = 90$, $t = ?$

$\therefore 90 = -20t + 180$ ✓

$\therefore 90 - 180 = -20t + 180 - 180$

$\therefore -90 = -20t$

$\therefore \frac{-90}{-20} = \frac{-20t}{-20}$

$\therefore 4.5 = t$ ✓

It took Parleen 4.5 weeks to spend half the money she saved.

✓ showing work

K	−0
A	−0
T	−0
C	−0