Math 10 Linear Functions Canvas

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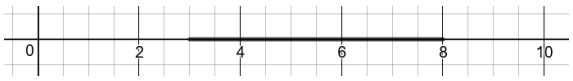
- Slope: positive, negative, zero, and undefined
- Types of equations and lines (point-slope, slope-intercept, and general)
- Equations of parallel and perpendicular lines
- Equations of horizontal and vertical lines
- Connections between representations: graphs, tables, equations

1. How long is the line segment below?



$8 - 3 = 5$

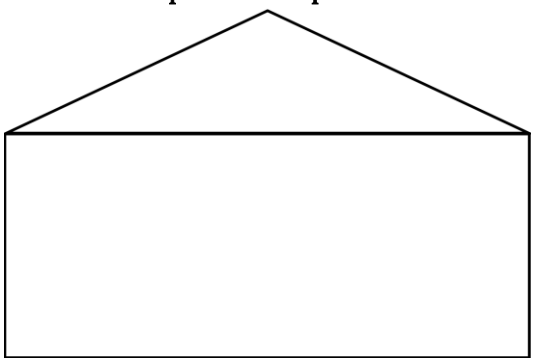
2. $A(2, -4)$ and $B(6, 4)$. Slope?

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-(-4)}{6-2} = \frac{8}{4} = 2$

3. Points $\left(2, \frac{2}{3}\right)$ and $\left(-3, -2\frac{1}{2}\right)$. Slope?

$m = \frac{-\frac{5}{2} - \frac{2}{3}}{-3-2} = \frac{19}{30}$
The slope is $\frac{k}{30}$
Find k
$k = 19$

4. Estimate the positive slope of the house roof below:



Multiple Choice
Using a ruler, the slope is approximately: $\frac{3}{6.5} = \frac{6}{13} \approx 0.46$ or 0.5

5. Points $(3, 5)$ and $(k, 19)$. Given the slope of this line segment is -2 find k.

$-2 = \frac{19-5}{k-3}$
$-2(k-3) = 14$
$-2k + 6 = 14$
$-8 = 2k$

$k = -4$

6. $y = 3x - 2$. Slope?

   3

7. $y = 5x - 2$. y-intercept?

   -2

8. $y = \frac{x}{2} + 4$. x-intercept?

   $0 = \frac{x}{2} + 4$
   $0 = x + 8$
   $x = -8$

9. $y = \pi x - 3$. Find the value of the slope.

   π

10. $y = 0.5x + 2$. If the rise portion of the slope is 4 find the run.

    8

11. $y = -1$. Slope?

    0

12. $x = y$. If possible, find the value of the slope.

    Multiple Choice
    1

13. $x = 1$. If possible, find the value of the slope.

    Multiple Choice
    Undefined

14. $x = 3$. What Quadrants is this line in?
    Choose MORE than one answer.

    I, IV

15. $y = 3x - 2$. What Quadrants is this line in?
    Choose MORE than one answer.

    I, III, IV

16. In what Quadrants is $y = 3 - \frac{x}{2}$? Choose MORE than one answer.

Quadrant I
Quadrant II
Quadrant IV

17. In what Quadrants is $y = \frac{2}{-3}x - 0.5$? Choose MORE than one answer.

Quadrant II
Quadrant III
Quadrant IV

18. $y = 3x + 4$. Find the coordinates of the y-intercept in the form (a, b).

$(0, 4)$

19. $f(x) = 5x - 3$. Evaluate $f(4)$.

17

20. $f(x) = 5x - 3$. Given $f(x) = 52$, find x.

$52 = 5x - 3$
$55 = 5x$
$x = 11$

21. $y = f(x) = 3x + 2$. Is the point $(7, 15)$ on this line?

When $x = 7$
$y = 3x + 2 = 3(7) + 2 = 23$
$23 \neq 15$ thus $(7, 15)$ is not on this line

Method 2:
$y = 3x + 2$
$15 =? 3(7) + 2$
$15 =? 21 + 2$
$15 =? 23$
$LS \neq RS$
No

22. $y = f(x) = 3x + 2$. Is the point $(-5, -13)$ on this line?

When $x = -5$
$y = 3x + 2 = 3(-5) + 2 = -15 + 2 = -13$
$-13 = -13$ thus $(-5, -13)$ is on the line

Method 2:
$y = 3x + 2$
$-13 =? 3(-5) + 2$
$-13 =? -15 + 2$

$-13 =? -13$
$LS = RS$
Yes this point is on the line.

23. A line has an x-intercept of 4 and goes through the point $(1, 2)$
The slope-intercept equation is: $y = -\frac{2}{3}x + \frac{k}{3}$. Find k.

$m = -\frac{2}{3}$
Use either point $(4, 0)$ or $(1, 2)$

Slope-point form line equation:
$y - y_1 = m(x - x_1)$

$y - 0 = -\frac{2}{3}(x - 4)$
$y = -\frac{2}{3}x + \frac{8}{3}$

$k = 8$

24. A line goes through the points $(2, 3)$ and $(7, -1)$
The line equation in slope-intercept form is $y = -\frac{4}{5}x + \frac{k}{5}$.
Find k only.

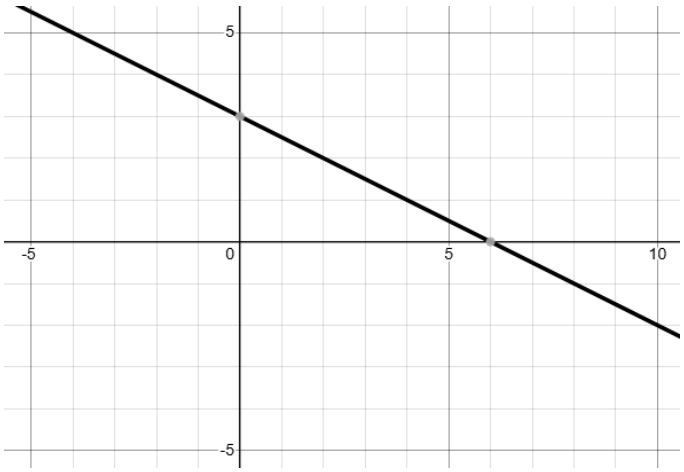
$m = \frac{-1-3}{7-2} = -\frac{4}{5}$
$y - 3 = -\frac{4}{5}(x - 2)$
$y = -\frac{4}{5}x + \frac{8}{5} + \frac{15}{5} = -\frac{4}{5}x + \frac{23}{5}$

Find k
$k = 23$

25. What information is enough by itself to determine the equation of a line?
Choose MORE than one answer.

-> A point and the slope
Just the slope
Just one point
-> Two points
Just the x-intercept
Just the y-intercept

26. The equation of the line below can be written as:
$y - 0 = -\frac{1}{2}(x + k)$. Find k only.



$y - 0 = -\frac{1}{2}(x - 6)$
$k = -6$

27. $\frac{2}{3}y - \frac{3}{4}x = \frac{1}{2}$
Find the equation in General Form: $Ax + By + C = 0, A > 0$
The answer is $ax + by + c = 0$
Evaluate $a + c$ only!

Multiply both sides by 12
$8y - 9x = 6$
$0 = 9x - 8y + 6$
$9x - 8y + 6 = 0$
$9 + 6 = 15$

28. $\frac{2}{3}x + \frac{y}{2} = 5$. Find the value of the x-intercept in the form a/b.

$\frac{2x}{3} + 0 = 5$
$2x = 15$
$x = 15/2$

29. $\frac{2}{3}x + \frac{y}{2} = 5$. Find the value of the y-intercept.

Set $x = 0$
$\frac{y}{2} = 5$
$y = 10$

30. True of False: $y = -0.\overline{6}x + \frac{1}{5}$ is the same line as $0 = 10x + 15y - 3$

Focus on $0 = 10x + 15y - 3$
Isolate for y
$-10x + 3 = 15y$
Divide by 15
$-\frac{10}{15}x + \frac{3}{15} = y$

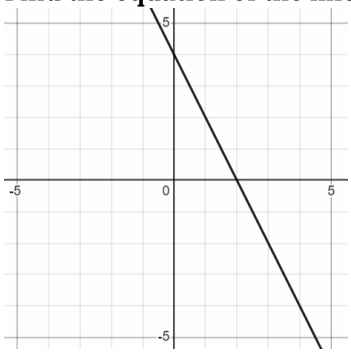
$y = -\frac{2}{3}x + \frac{1}{5}$

Or

$y = -\frac{2}{3}x + \frac{1}{5}$
Multiply by 15
$15y = -10x + 3$
$10x + 15y - 3 = 0$
$0 = 10x + 15y - 3$
True

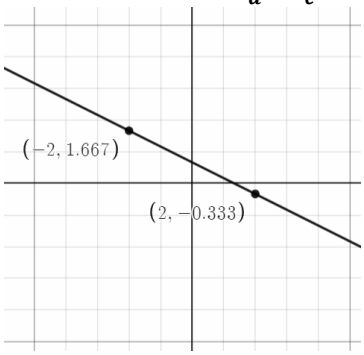
Note: A line written in the form $Ax + By + C = 0$ is in general form

31. Find the equation of the line below in the form $y = mx + b$.



$y = -2x + 4$

32. Find the equation of the line below in the form $y = mx + b$.
The answer is $y = \frac{-x}{a} + \frac{b}{c}$. Evaluate $a + b + c$.



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

$y = -\frac{1}{2}x + \frac{2}{3}$
$\left(-2, \frac{5}{3}\right), \left(2, -\frac{1}{3}\right)$
$m = \frac{-\frac{1}{3} - \frac{5}{3}}{2-(-2)} = \frac{-\frac{6}{3}}{2+2} = -\frac{2}{4} = -\frac{1}{2}$
$y - y_1 = m(x - x_1)$
This is called slope-point form.
Substitute any point on the line.
Substitute $\left(-2, \frac{5}{3}\right)$

$y - \frac{5}{3} = -\frac{1}{2}(x - (-2))$
$y - \frac{5}{3} = -\frac{1}{2}(x + 2)$
$y - \frac{5}{3} = -\frac{1}{2}x - 1$
$y = -\frac{1}{2}x - 1 + \frac{5}{3}$
$y = -\frac{1}{2}x - \frac{3}{3} + \frac{5}{3}$
$y = -\frac{1}{2}x + \frac{2}{3}$
$2 + 2 + 3 = 7$

33. A line contains the points $(1, 2)$ and $(5, 0)$
These points are on which of the following lines?

Multiple Choice
$y - 0 = -\frac{1}{2}(x - 5)$
$y - 2 = -\frac{1}{2}(x - 1)$
$y = -\frac{1}{2}x + \frac{5}{2}$
$y + 2 = -\frac{1}{2}(x - 9)$
All of these

Equation in the form
$y - y_1 = m(x - x_1)$?
$y - 2 = -\frac{1}{2}(x - 1)$ or
$y - 0 = -\frac{1}{2}(x - 5)$

Equation in the form $y = mx + b$?
We previously found the slope $m = -\frac{1}{2}$
$y = mx + b$
$y = -\frac{1}{2}x + b$
Now substitute either point. We substitute the point $(1, 2)$
$2 = -\frac{1}{2}(1) + b$
$2 + \frac{1}{2} = b = \frac{5}{2}$
Thus $y = -\frac{1}{2}x + \frac{5}{2}$

34. The line $2x + \frac{1}{2} = \frac{y}{3}$ is in which Quadrants?
Choose MORE than one answer.

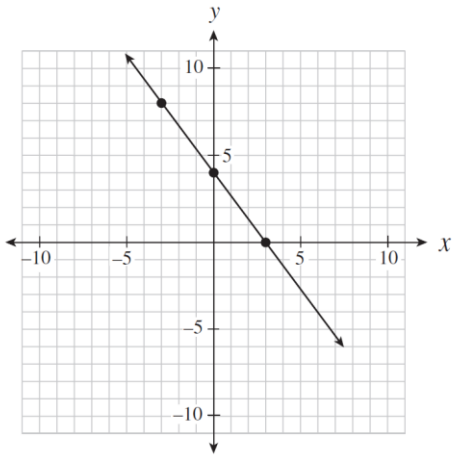
Quadrant I
Quadrant II
Quadrant III

35. Write $2x + \frac{1}{2} = \frac{y}{3}$ in Standard Form: $Ax + By = C$, where $A > 0$

Multiply by 2
$12x + 3 = 2y$

$12x - 2y = -3$

36. See graph below:



Which of the following equations describes the linear relation graphed above? Choose MORE than one answer.

I. $y = \frac{4}{3}x + 4$
II. $y - 8 = -\frac{4}{3}(x + 3)$
III. $4x + 3y - 12 = 0$

Points on line: $(0, 4)$ and $(3, 0)$
$m = \frac{0-4}{3-0} = -\frac{4}{3}$ (thus eliminate choice I)

III: $3y = -4x + 12 \rightarrow y = -\frac{4}{3}x + 4$

$y - y_1 = m(x - x_1)$
Substitute point $(0, 4)$
$y - 4 = -\frac{4}{3}(x - 0)$
$y = -\frac{4}{3}x + 4$ (which is the same line as III)

II: $y = -\frac{4}{3}x - 4 + 8 = -\frac{4}{3}x + 4$ (which is the same line as well)

Thus II, and II are the same line

37. Consider the pattern $11, 7, 3, -1, \ldots$ Represent this pattern in the form $y = mx + b$

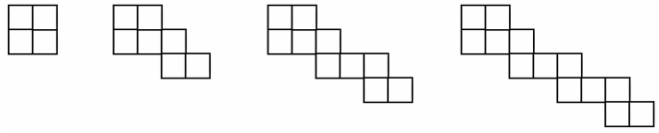
$y = -4x + 15$

38. Consider the pattern $11, 7, 3, -1$. Find the 1000th number

$y = mx + b$
$y = -4(1000) + 15 = -3985$ or

In a later chapter we will learn the arithmetic sequence formula:
$t_n = t_1 + (n - 1)d$
$t_{1000} = 11 + (1000 - 1)(-4) = -3985$

39. See diagram below.
How many squares are in figure 43?



$y = 3x + 1$
$y = 3(43) + 1 = 130$

40. Do the following table of values represent points on a line?

x	y
0	2
1	5
2	8
4	11

No. The x-values do not increase uniformly by one.

Slower way:
$(0, 2)$ and $(1, 5)$
$m = \frac{5-2}{1-0} = \frac{3}{1} = 3$
$y - 2 = 3(x - 0)$
$y = 3x + 2$
Now test every other point.
Try $(4, 11)$
$11 =? 3(4) + 2$
$LS = 11$ and $RS = 12 + 2 = 14$
$LS \neq RS \therefore (4, 11)$ is NOT on the line.

41. Do the following table of values represent points on a line?

x	y
-2	-4
-1	-1
0	2
2.5	19/2

Yes

$m = \frac{-1-(-4)}{-1-(-2)} = \frac{3}{1} = 3$
Use point $(-2, -4)$
$y - y_1 = m(x - x_1)$
$y + 4 = 3(x + 2)$
$y = 3x + 2$
Substitute $x = 0$
$y = 3(0) + 2 = 2$ (point $(0, 2)$ is on the line)

Substitute $x = 2.5 = \frac{5}{2}$
$y = 3\left(\frac{5}{2}\right) + 2 = \frac{19}{2}$ (point $\left(2.5, \frac{19}{2}\right)$ is on the line)

42. The following table of values represents a line.
Find the missing value below:

x	y
-2	3
2	15
5	?

$m = \frac{15-3}{2-(-2)} = \frac{12}{4} = 3$
$y - y_1 = m(x - x_1)$
$y - 3 = 3(x + 2)$
$y = 3x + 9 = 3(5) + 9 = 24$

43. Money is a function of time in hours: $M(t) = 20t + 50$
How much do you get paid if you work for 8 hours?

$M(8) = 20(8) + 50 = \$210$

44. Money is a function of time in hours: $M(t) = 20t + 50$
How many hours do you have to work to earn \$280?
Assume there is no overtime pay. Answer as decimal number.

$280 = 20t + 50$
$230 = 20t$
$11.5 = t$

45. True or False: $y = 4x - 3$ is parallel to $2y - 8x = 1$

True

The first line has a slope of 4.

Focus on the second line:
$2y = 8x + 1$
$y = 4x + 1$

The second line also has a slope of 4.

Line L_1 has a slope of 4. L_2 is $\perp$ (perpendicular) to L_1.
Find the slope of L_2 in the form a/b.

$-1/4$

46. Find the equation of a line that is parallel to $y = 3x - 2$
and goes through the point $(3, 2)$ in the form $y = mx \pm b$

$m = 3$
$y - 2 = 3(x - 3)$
$y = 3x - 9 + 2$
$y = 3x - 7$

47. Find the equation of a line that is perpendicular to $y = -\frac{x}{3} + 1$
and has an x-intercept of 2. Write your answer in the form $y = mx \pm b$

Original line has a slope of $-\frac{1}{3}$

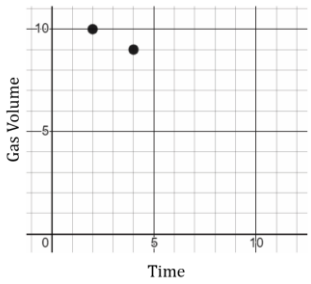
$m = \frac{3}{1} = 3$

$(2, 0)$

$y - 0 = 3(x - 2)$

$y = 3x - 6$

48. See the gas – time graph below.
When do you run out of gas?



Points: $(2, 10)$ and $(4, 9)$

$m = \frac{9-10}{4-2} = -\frac{1}{2}$

$y - 10 = -\frac{1}{2}(x - 2)$

$y = -\frac{1}{2}x + 11$

$0 = -\frac{1}{2}x + 11$

$\frac{x}{2} = 11 \rightarrow x = 22$

49. A hot-dog vendor makes a profit of $100 when he sells 90 hot dogs a day.
He has a loss of $30 when he sells 25 hot dogs a day. How many hot dogs do you need to sell to break even (not lose money but not gain money)?

$(90, 100)$ and $(25, -30)$

$m = \frac{-30-100}{25-90} = \frac{-130}{-65} = 2$

$y - 100 = 2(x - 90)$

$y = 2x - 180 + 100$

$y = 2x - 80$

$0 = 2x - 80$

$80 = 2x$

$x = 40$

50. Given the equation $Ax + By + C = 0$, which of the following conditions must be true for the graph of the line to have a positive slope and a positive y-intercept?

A. $A > 0, B > 0, C > 0$
B. $A > 0, B < 0, C > 0$
C. $A < 0, B > 0, C > 0$
D. $A > 0, B < 0, C < 0$

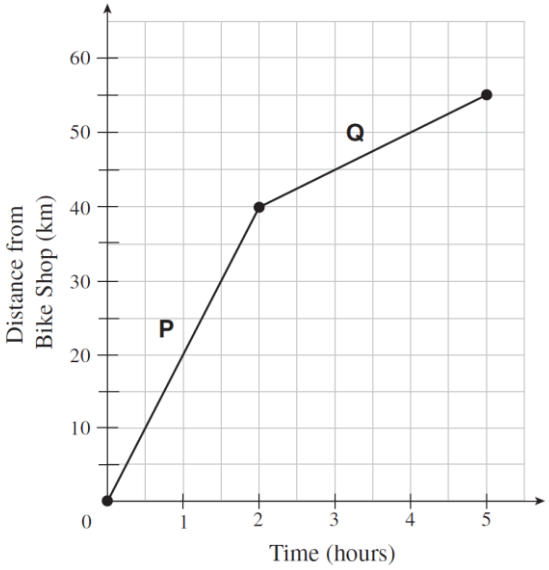
$By = -Ax - C$

$y = -\frac{A}{B}x - \frac{C}{B}$

A and B should have different signs and $C < 0$

B is the answer

51. The graph below models a bicycle's distance from a bike shop over time.
Calculate the change in the speed of the bike from segment P to segment Q.



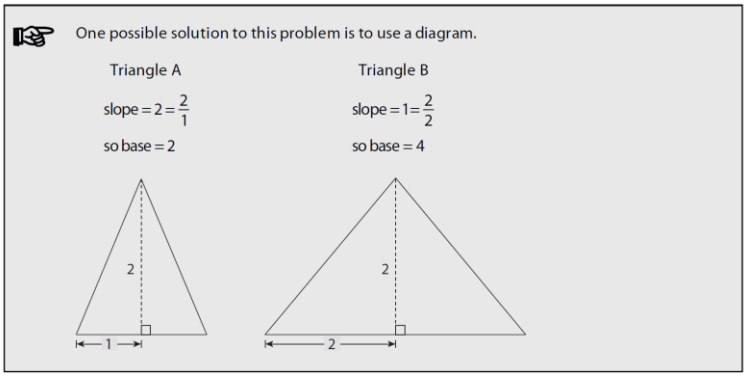
Multiple Choice

$m_1 = \frac{40}{2} = 20$

$m_2 = \frac{15}{3} = 5$

20 kph down to 5 kph means decrease by 15 kph.

52. Two isosceles triangles have the same height. The slopes of the sides of triangle A are double the slopes of the corresponding sides of triangle B. How do the lengths of their bases compare?



Multiple Choice

Triangle B is twice as wide