# Math 9 Linear Relations Lesson Solutions

- Two-variable linear relations using graphing, interpolation and extrapolation
- Two-variable continuous linear relations; includes rational coordinates
- Horizontal and vertical lines
- Graphing relation and analyzing
- Interpolating and extrapolating approximate values
- Spirit canoe journey predictions and daily checks

1. Plot the point $(2, -4)$
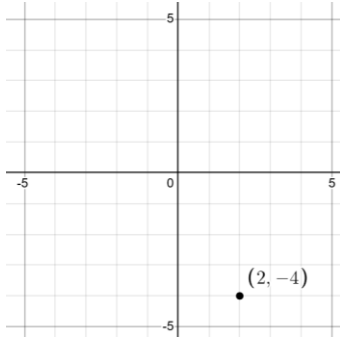
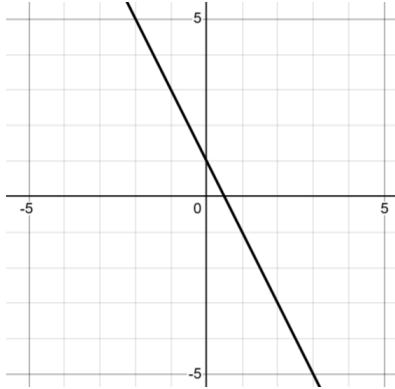2. $y = 3x + 2$

    a. Sketch this line
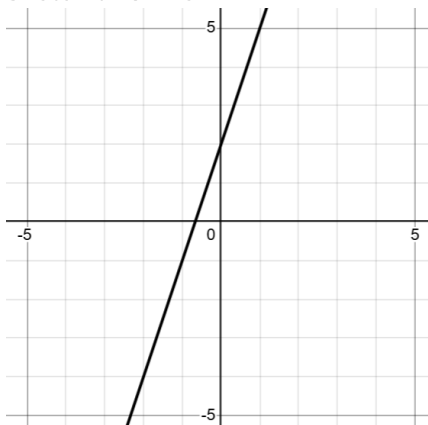
    b. Slope?

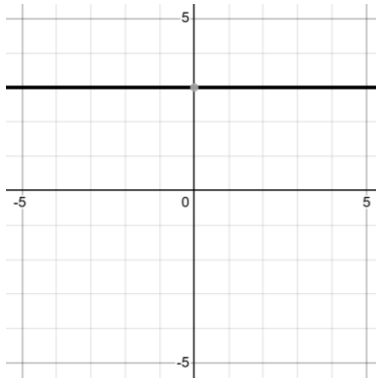   3

    c. y-intercept?

       2

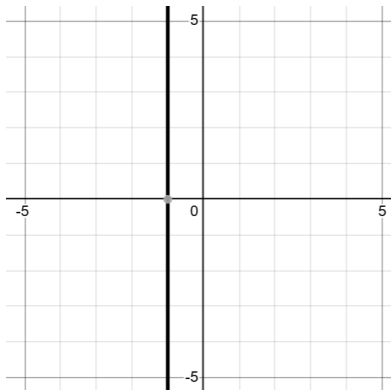3. Sketch the line $y = -2x + 1$

4. $y = 3$
   a. Sketch this line

   b. What quadrants is this line in?
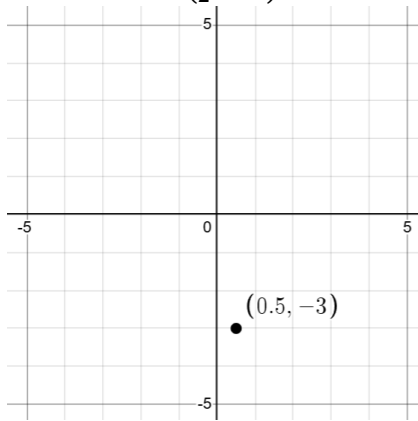   Quadrants I and II

5. $x = -1$
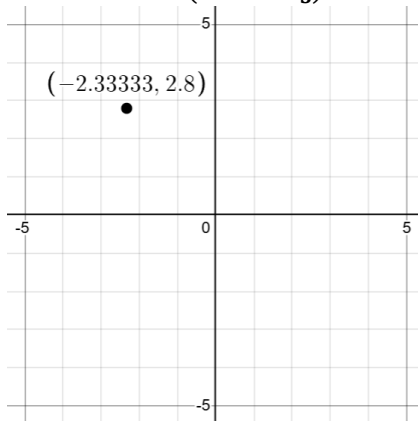   a. Sketch the line

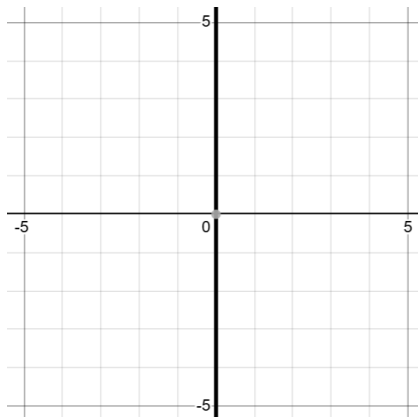   b. What quadrants is this line in?
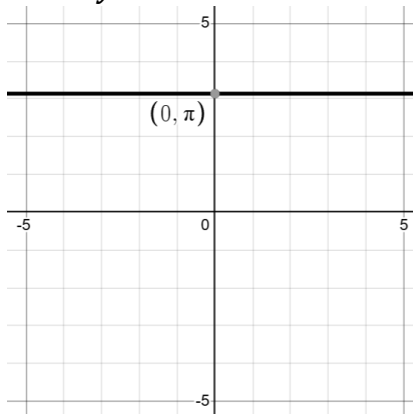   Quadrants II and III

6. Plot the point $\left(\frac{1}{2}, -3\right)$

$(0.5, -3)$

7. Plot the point $\left(-2.\overline{3}, 2\frac{4}{5}\right)$

$(-2.33333, 2.8)$

8. Sketch $x = 0$

9. Sketch $y = \pi$

10. $y = 2x + 3$
    a. Create a table of values

x	$2x + 3$
-2	-1
-1	1
0	3
1	5
2	7
3	9
4	11

    b. Sketch the graph
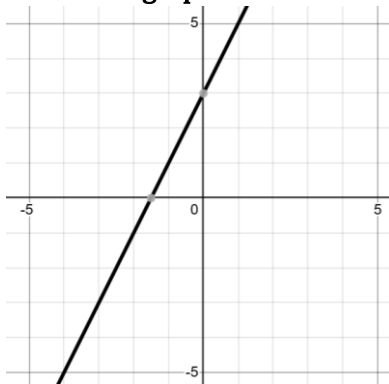
    c. State the x-intercept
       $y = 2x + 3$
       $0 = 2x + 3$
       $-3 = 2x$
       $-\dfrac{3}{2} = x$

    d. When $x = 4$, what is the value of y?
       $y = 2(4) + 3 = 11$

11. Given $y = mx + b$ what is the meaning of:

Visit hunkim.com/9

a. *m?*
   Slope

b. *b?*
   y-intercept

12. Sketch $y = 2 - 3x$
    $y = -3x + 2$
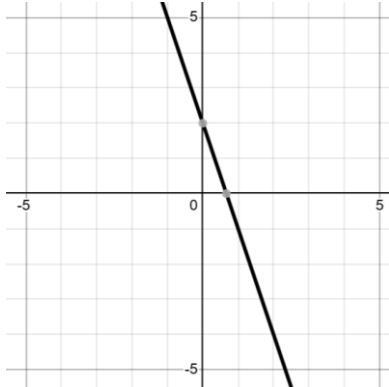
13. Sketch: $y = \frac{-2}{3}x + 3$

14. Sketch $y = 0.\overline{6} - \frac{x}{3}$

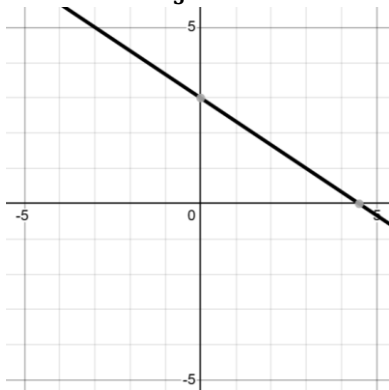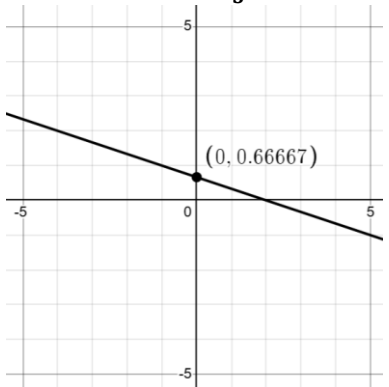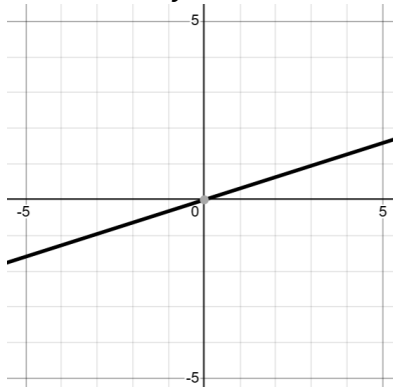$(0, 0.66667)$

15. Sketch $x = \pi y$

16. Given the points $(0, 2)$ and $(8, 4)$
    a. Find the slope
       $m = \frac{4-2}{8-0} = \frac{2}{8} = \frac{1}{4}$

    b. Find the line equation in slope-point form: $y - y_1 = m(x - x_1)$
       $y - 2 = \frac{1}{4}(x - 0)$ or $y - 4 = \frac{1}{4}(x - 8)$

    c. Find the line equation in slope-intercept form: $y = mx + b$
       $y = \frac{1}{4}x + 2$

17. Given the points $(3, -3)$ and $(-1, -1)$
    a. Find the slope
       $m = \frac{-1-(-3)}{-1-3} = \frac{-1+3}{-4} = \frac{2}{-4} = -\frac{1}{2}$

    b. Find the line equation in slope-point form: $y - y_1 = m(x - x_1)$
       $y + 3 = -\frac{1}{2}(x - 3)$ or $y + 1 = -\frac{1}{2}(x + 1)$

    c. Find the line equation in slope-intercept form: $y = mx + b$
       $y = -\frac{1}{2}x + \frac{3}{2} - \frac{6}{2} = -\frac{1}{2}x - \frac{3}{2}$

18. Given the point $\left(2\frac{1}{2}, -\frac{1}{2}\right)$ and $\left(4, -2\frac{1}{4}\right)$ find the slope.
    Same as $\left(\frac{5}{2}, -\frac{1}{2}\right)$ and $\left(4, -\frac{9}{4}\right)$
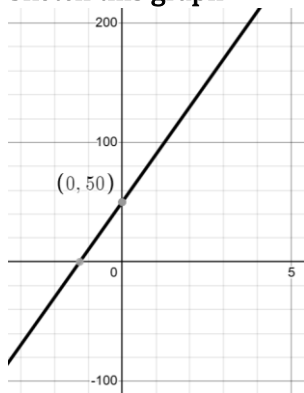 $m = \frac{-\frac{9}{4}+\frac{1}{2}}{4-\frac{5}{2}} = \frac{-\frac{9}{4}+\frac{2}{4}}{\frac{8}{2}-\frac{5}{2}} = -\frac{7}{4} \div \frac{3}{2} = -\frac{7}{4} \times \frac{2}{3} = -\frac{7}{6}$

19. You make $50 for showing up to your job site and you charge $40 per hour
    a. What is the equation of the graph?
       $y = 40x + 50$

b. Sketch this graph

c. How much do you make for working 8 hours?
$$y = 40(8) + 50 = 320 + 50 = \$370$$

d. How long do you have to work to earn \$290?
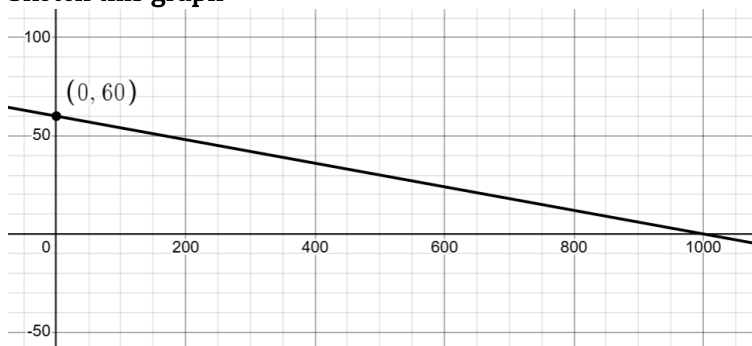$$290 = 40x + 50$$
$$240 = 40x$$
$$x = 6 \text{ hours}$$

20. Your car burns 6L per 100 km and has a full tank of gas of 60L.
  a. Write the equation of the Volume distance graph.
$$y = -\frac{6}{100}x + 60 = -\frac{3}{50}x + 60 \text{ or } V = -\frac{3}{50}d + 60$$

  b. Sketch this graph

  c. How much fuel do you have left in the tank after driving 300 km?
$$y = -\frac{3}{50}(300) + 60 = -18 + 60 = 42 \text{ L}$$

  d. What is the meaning of the x-intercept?
  Distance travelled before running out of fuel
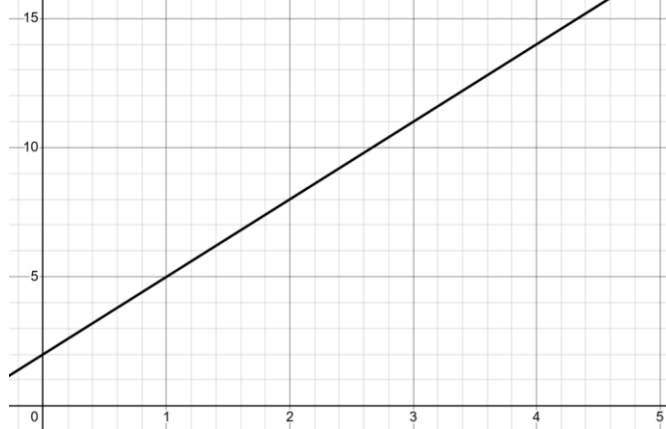
  e. What is the meaning of the slope of the graph?
  Fuel efficiency

21. A canoe starts at 2 km away from home. Each day the canoe travels 3 more km away from home.
   a. Sketch a line graph that models the distance from home.
      $$y = 3x + 2$$

   b. Model this graph as a line equation.

   c. How far away is the canoe from home after a week?
      $$y = 3(7) + 2 = 23$$

   d. Interpolate the distance from home after 2.5 days.
      $$y = 3(2.5) + 2 = 7.5 + 2 = 9.5$$

   e. Extrapolate the distance from home after a month (30 days).
      $$y = 3(30) + 2 = 92$$

   f. Why is interpolating data more accurate than extrapolating data?
      Interpolation involves estimating values within the range of known data points. Since the data points are closer to where you are making predictions, there's less uncertainty.

22. See figures 1, 2, and 3 below respectively:

   a. How many circles are in figure 100?
      $$y = 3x + 2$$
      $$y = 3(100) + 2 = 302$$

   b. What figure number contains 131 circles?
      $$131 = 3x + 2$$
      $$129 = 3x$$
      $$x = 43$$

23. 10, 7, 4, 1, −2, ... Find the 100th number
    $$y = -3x + 13$$
    $$y = -3(100) + 13 = -300 + 13 = -287$$