Year 9 Worksheet 4: Linear Relationships

Question 1: Answer the following.

(1) What are the y- and x-intercepts of the graph 4x - 2y = 16?

A. y-int = 4, x-int = 8

B. y-int = 4, x-int = -8

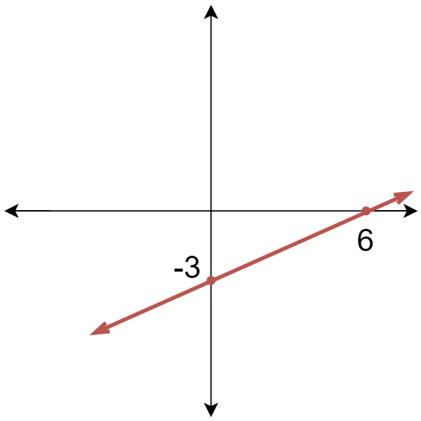
C. y-int = -4, x-int = 8

D. y-int = -8, x-int = 4

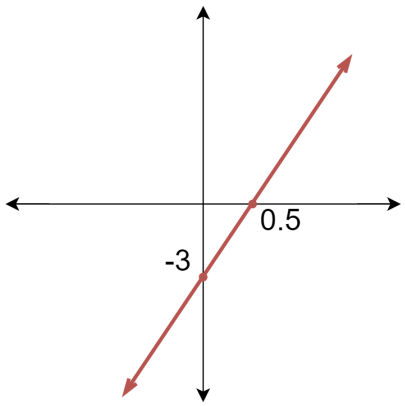
E. y-int = -8, x-int = -4

(2) The graph of y = 6x - 3 is represented by:

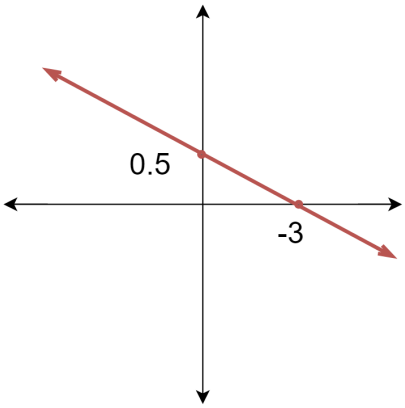
A.



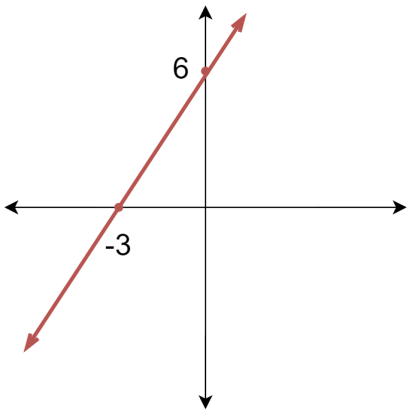
B.



C.



D.



(3) Given a line y = -7x + 9, which point below does not lie on this line?

A. (0, 9) B. (1, 2) C. (-1, 16) D. (2, -5) E. (3, -11)

(4) Find the gradient of the line passing through (-2, 3) and (0, -7).

A. -2 B. 3 C. -5 D. -7 E. 0

(5) The linear graph that does not have a gradient of 4 is:

A. y = 4x-8 B. ¼y = x+3 C. 4x+y = -1

D. y - 4x = 4 E. 2y = 8x+2

(6) In a direct proportion, if y = 4 when x = 8, what is the value of y when x = 12?

A. 6 B. 8 C. 12 D. 16 E. 24

(7) Given a line with a slope of -4 and passing through the point (2, 6), what is the equation of the line in the form y = mx + b?

A. y = -4x - 2 B. y = -2x - 4 C. y = 2x - 4

D. y = 4x - 2 E. y = 6x - 4

(8) Given 2 endpoints A(3, 5) and B(9, 11), what are the coordinates of the midpoint of the line segment AB?

A. (3, 5) B. (6, 8) C. (12, 16) D. (4, 6) E. (8, 11)

(9) The gradient of a line perpendicular to the equation $y = 3x + 2$ would be:

A. $\frac{1}{3}$ B. -3 C. 3 D. $-\frac{1}{3}$ E. 2

(10) The point of intersection of $y = x + 3$ and $y = 2x - 1$ is:

A. (-1, 2) B. (1, 4) C. (2, 5) D. (-2, 1) E. (4, 7)

Question 2: Answer the following.

1	Sketch the following linear graphs labeling x- and y-intercepts a. $y = -x + 3$ b. $3x - 9y = 6$ c. $-5x + 15y = 40$

2	Oliver departs from his workplace in his car and heads to his favorite hiking trail. The distance "d" kilometers from his workplace after "t" hours is described by the equation d = 120 - 45t. a. Determine the distance between Oliver's workplace and his hiking trail. b. How much time does it take for Oliver to arrive at his hiking trail? c. Create a graphical representation of Oliver's journey from his workplace to the hiking trail.

3	By first plotting the given points, find the gradient of the line passing through the points. State the y-intercept and then sketch using the gradient–intercept method. a. (2, 6) and (1, 11) b. (1, -20) and (-1, -36)

4	A garden pond is being filled with water using a garden hose. It takes 6 hours to fill 17,000 liters, and initially, there are 5,000 liters in the pond. a. What is the flow rate of water into the pond? b. Create a graph depicting the relationship between volume (V in liters) and time (t in hours) for a time interval of 0 to 6 hours. c. By calculating the slope of the graph, determine the equation representing V as a function of t. d. Use the equation to determine how long it will take to fill 27,000 liters of water into the pond.

5	For each of the following equations, find the gradient, y-intercept, x-intercept. Sketch both equations on the same graph using the gradient-intercept method, then find the point of intersection. a. $3x - 5y = 8$ b. $2y - 4x - 15 = 0$

6	Sketch both lines on the same graph using the gradient-intercept method by determine the linear equation that is: a. parallel to the line y = -3x + 7 and passes through the point (1, -3). b. perpendicular to the line y = - ¼ x - 6 and passes through the point (-2, 7).

7	For the line segment joining the following pairs of points, find the: i. midpoint ii. length (to two decimal places where applicable) a. (2, 7) and (5, 9) b. (8, 3) and (11, 6) c. (-4, 2) and (4, -9)

8	Find the missing coordinate n if the: a. line joining (-3, 7) and (2, n) has gradient 4 b. line segment joining (-2, 5) and (-8, n) has length $\sqrt{205}$, n > 0 c. midpoint of the segment joining (n, 8) and (4, -1) is (0.5, 3.5)

9	Find the point of intersection of the following straight lines. Sketch both lines on the same graph using the gradient-intercept method a. $y = 3x + 2$ and $y = 5 - 4x$ b. $2x - 5y = 9$ and $y = -3x - 7$

10	Samantha needs to determine the selling price of these sculptures to ensure a weekly profit. Samantha has found that the cost of producing 7 sculptures in a week is $190, and the cost of producing 12 sculptures in a week is $250. a. Find a linear equation that relates the production cost, $C, to the number of sculptures produced, s. b. Use your equation to determine: i. The initial cost of materials each week. ii. The ongoing cost of production per sculpture. Samantha decides to sell the sculptures at a price of $25 each, and she calculates her weekly profit using the formula P = 5s - 100. c. How many sculptures must she sell in order to make a profit?

Personalised English & Math Tutoring

Redeem Free Assessment

Question 1: Answer the following.

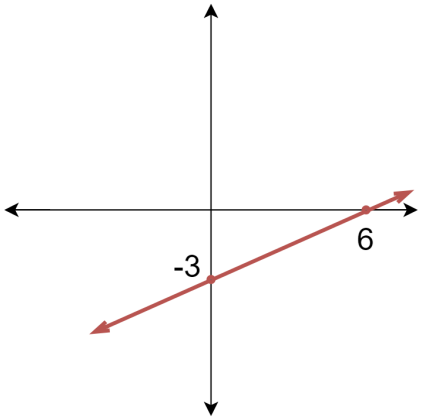
(1) What are the y- and x-intercepts of the graph 4x - 2y = 16?

A. y-int = 4, x-int = 8 B. y-int = 4, x-int = -8 C. y-int = -4, x-int = 8 D. y-int = -8, x-int = 4 E. y-int = -8, x-int = -4

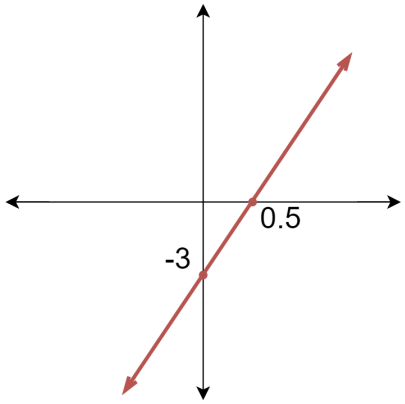
Answer: D. y-int = -8, x-int = 4

(2) The graph of y = 6x - 3 is represented by:

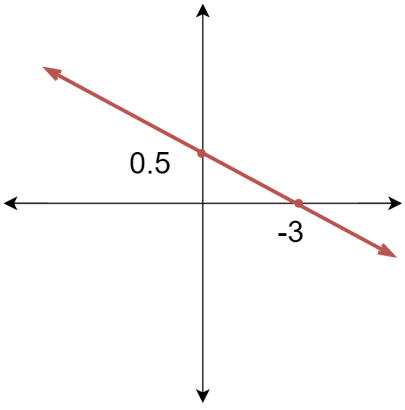
A.



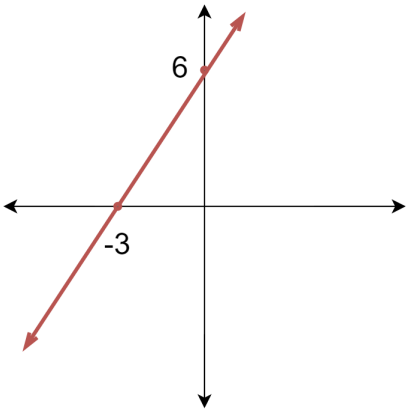
B.



C.



D.



Answer: B

(3) Given a line y = -7x + 9, which point below does not lie on this line?

A. (0, 9) B. (1, 2) C. (-1, 16) D. (2, -5) E. (3, -11)

Answer: E. (3, -11)

(4) Find the gradient of the line passing through (-2, 3) and (0, -7).

A. -2 B. 3 C. -5 D. -7 E. 0

Answer: C. -5

(5) The linear graph that does not have a gradient of 4 is:

A. $y = 4x-8$ B. $\frac{1}{4}y = x+3$ C. $4x+y = -1$ D. $y - 4x = 4$ E. $2y = 8x+2$

Answer: C. $4x+y = -1$

(6) In a direct proportion, if $y = 4$ when $x = 8$, what is the value of y when $x = 12$?

A. 6 B. 8 C. 12 D. 16 E. 24

Answer: A. 6

(7) Given a line with a slope of -4 and passing through the point (2, 6), what is the equation of the line in the form $y = mx + b$?

A. $y = -4x - 2$ B. $y = -2x - 4$ C. $y = 2x - 4$ D. $y = 4x - 2$ E. $y = 6x - 4$

Answer: A. $y = -4x - 2$

(8) Given 2 endpoints A(3, 5) and B(9, 11), what are the coordinates of the midpoint of the line segment AB?

A. (3, 5) B. (6, 8) C. (12, 16) D. (4, 6) E. (8, 11)

Answer: B. (6, 8)

(9) The gradient of a line perpendicular to the equation y = 3x + 2 would be:

A. ⅓ B. -3 C. 3 D. -⅓ E. 2

Answer: D. -⅓

(10) The point of intersection of y = x + 3 and y = 2x - 1 is:

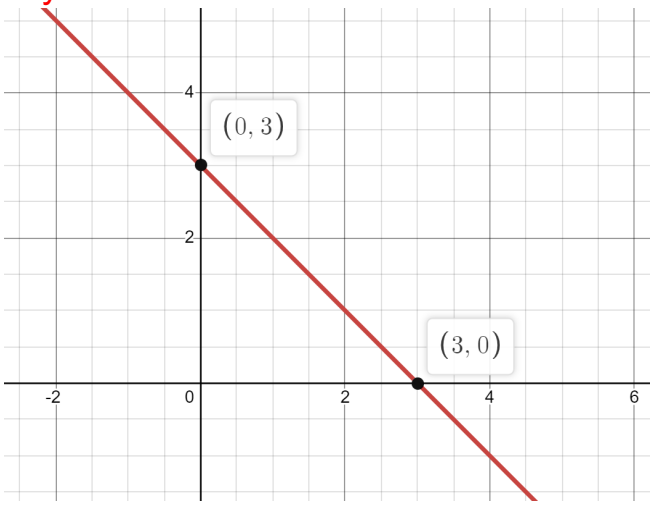
A. (-1, 2) B. (1, 4) C. (2, 5) D. (-2, 1) E. (4, 7)

Answer: E. (4, 7)

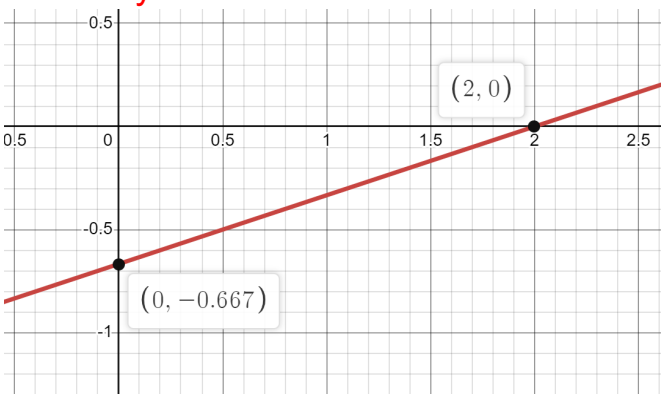
Question 2: Answer the following.

1

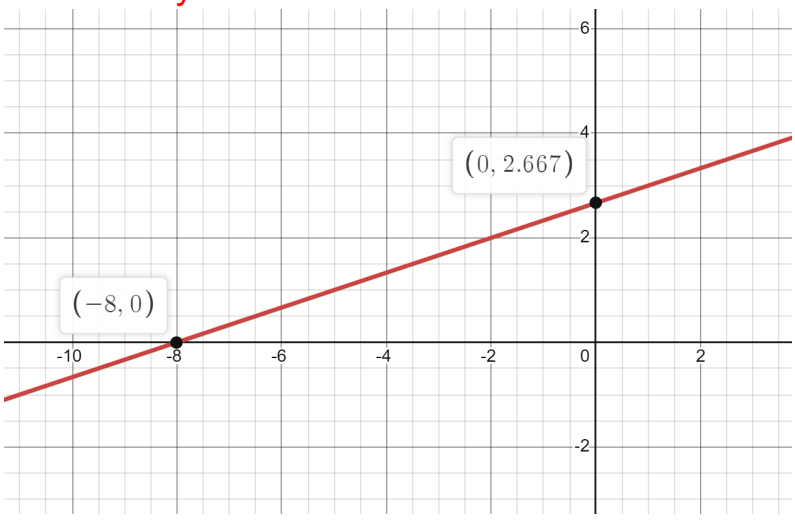
a. y = -x + 3

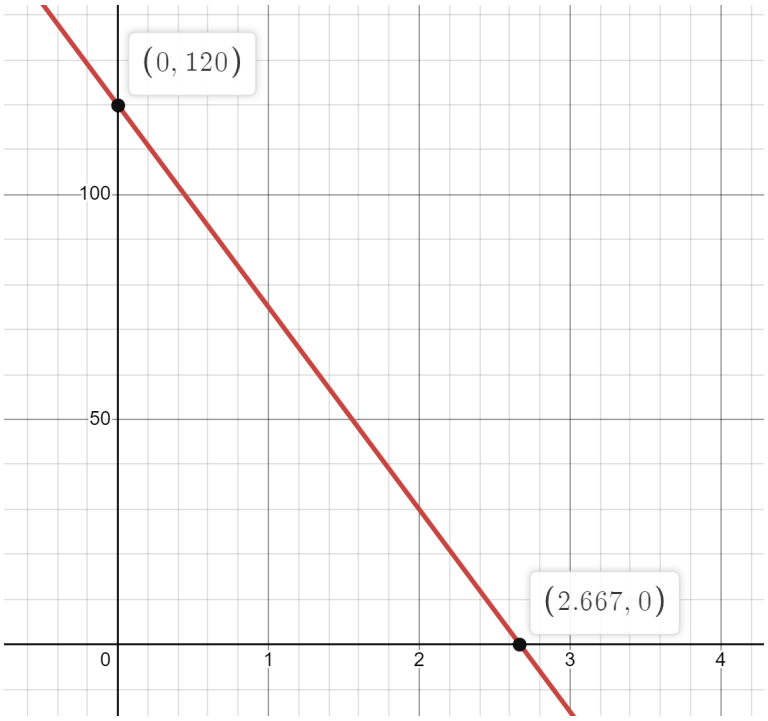


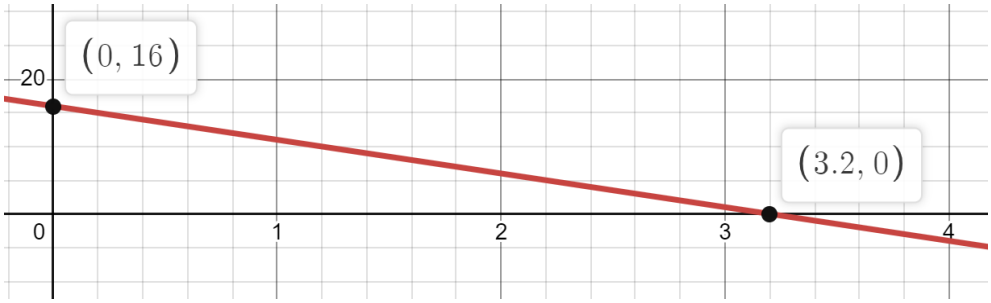
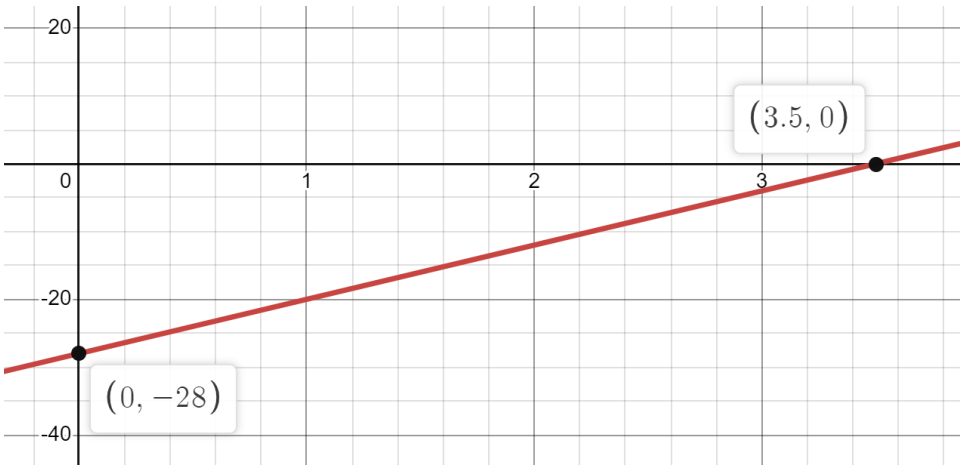
b. 3x - 9y = 6

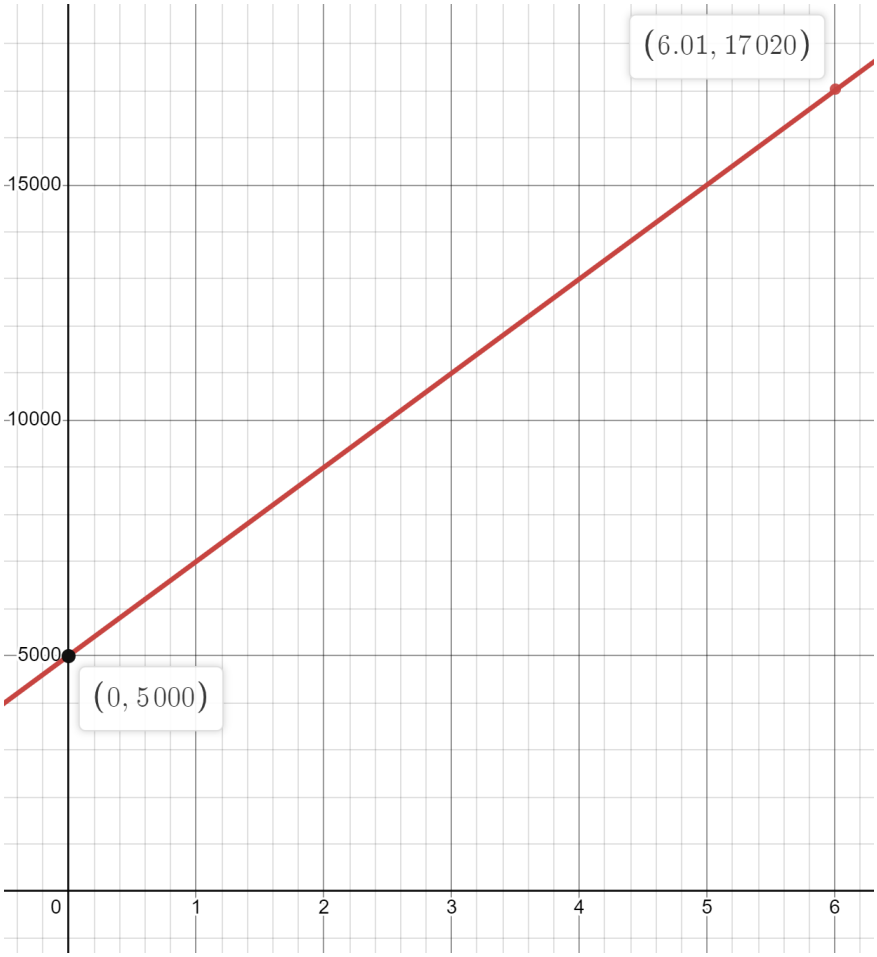


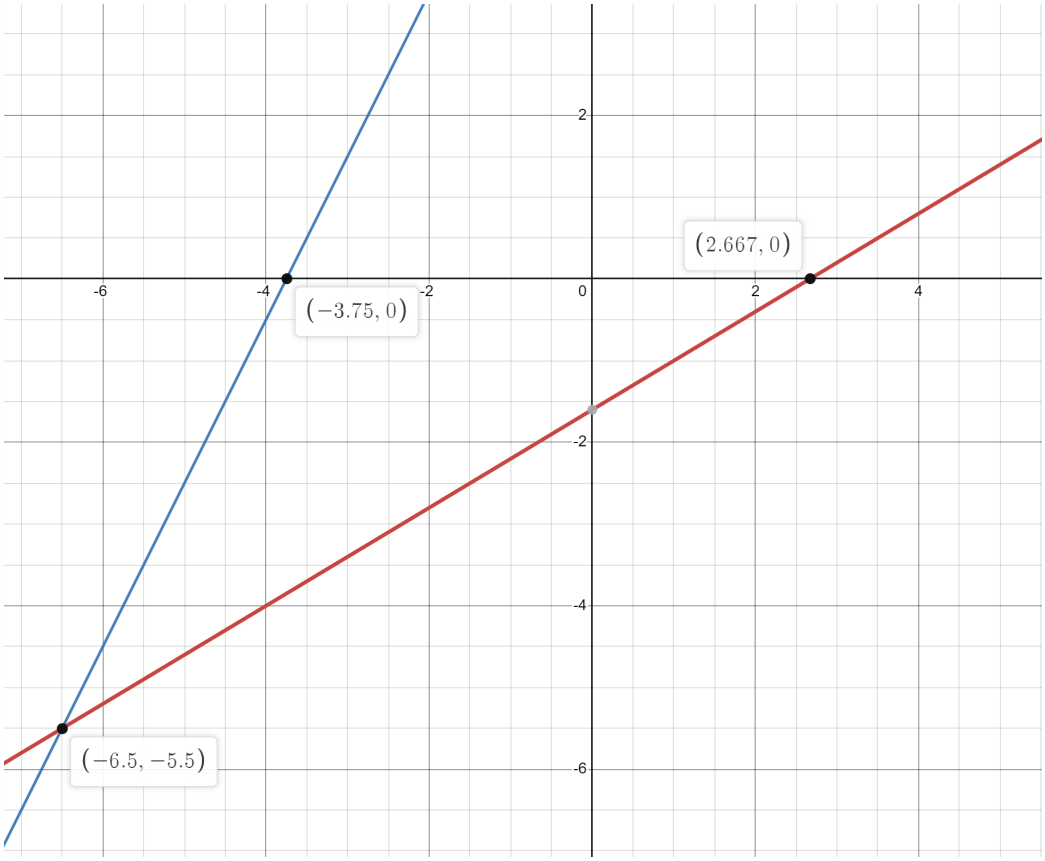
c. -5x + 15y = 40

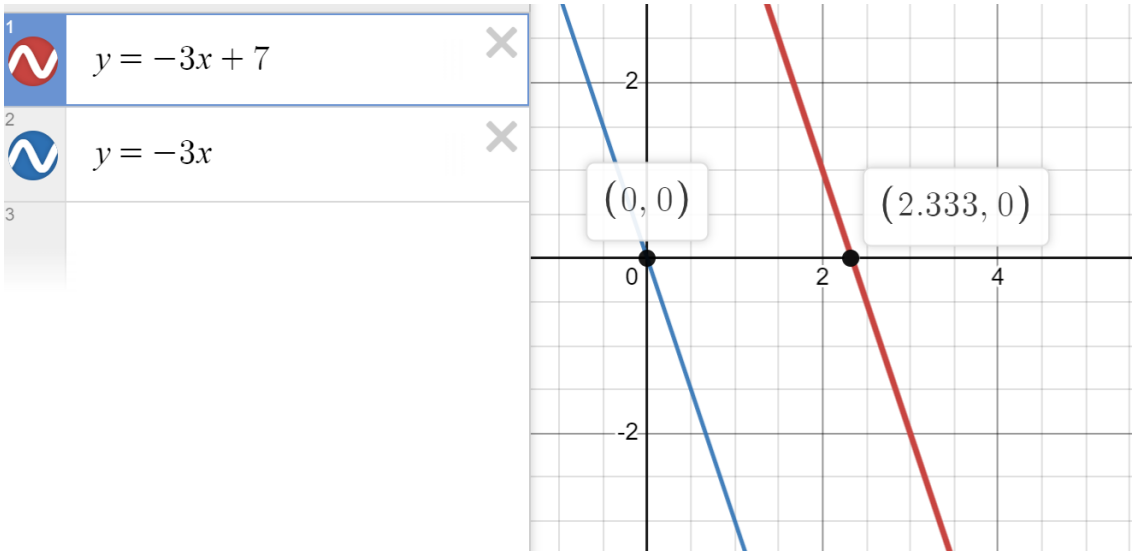


2	a) The distance between Oliver's workplace and his hiking trail is 120 kilometers. b) Oliver takes 2.67 hours (approximately 2 hours and 40 minutes) to reach his hiking trail. c)The graph of Oliver's journey will be ● a straight line ● a negative slope ● starts at 120 kilometers (the workplace) ● decreases at a rate of 45 kilometers per hour ● eventually reaching 0 kilometers (the hiking trail) at approximately 2.67 hours. 

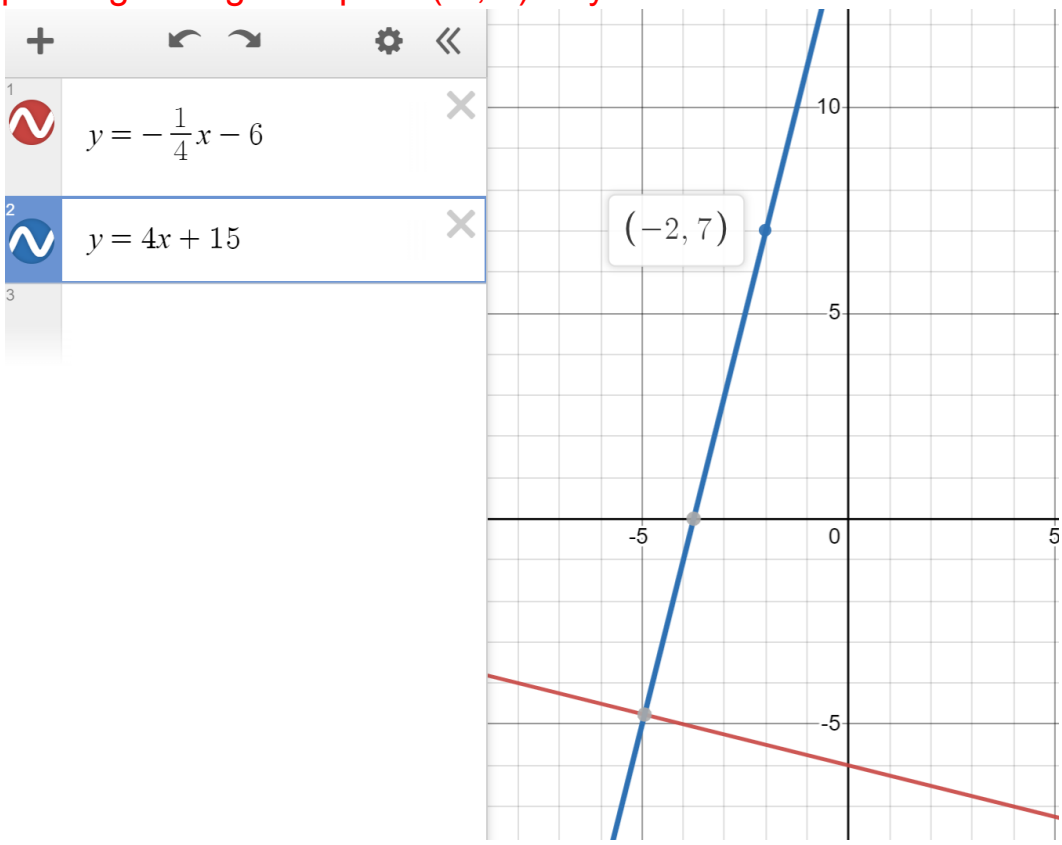
3	a. (2, 6) and (1, 11) y= -5x + 16 gradient = -5 Y-intercept = 16  b. (1, -20) and (-1, -36) y = 8x - 28 gradient = 8 Y-intercept = -28 

4	a. The flow rate of water into the pond can be calculated by dividing the change in volume (17,000 liters - 5,000 liters) by the time it takes to fill that change in volume (6 hours - 0 hours): Flow Rate = Change in Volume / Time Flow Rate = (17,000 liters - 5,000 liters) / (6 hours - 0 hours) Flow Rate = 2,000 liters per hour So, the flow rate of water into the pond is 2,000 liters per hour. b. Here's a graph depicting the relationship between volume (V in liters) and time (t in hours) for 0 ≤ t ≤ 6 hours:  c. So, the equation representing V as a function of t is: V(t) = 2,000t + 5,000

	d. To determine how long it will take to fill 27,000 liters of water into the pond using the equation we derived in part c, we can set V(t) equal to 27,000 and solve for t: 27,000 = 2,000t + 5,000 t = 11 hours So, it will take 11 hours to fill 27,000 liters of water into the pond.
5	a. m (gradient) = 3/5 b (y-intercept) = -8/5 x-intercept = 8/3 b. m (gradient) = 2 b (y-intercept) = 15/2 x-intercept = -15/4  Intersection point (-13/5, -11/5)

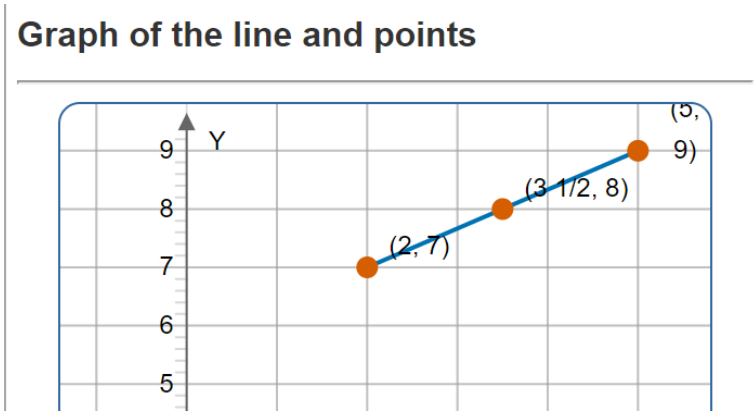
6	a. y = mx + b where "m" is the slope (which is -3) and "b" is the y-intercept. Now, plug in the values: -3 = (-3)(1) + b Solve for "b": -3 = -3 + b, b = 0 So, the equation of the line parallel to y = -3x + 7 and passing through the point (1, -3) is: y = -3x  b. We can use the fact that perpendicular lines have slopes that are negative reciprocals of each other. The given line has a slope of -1/4. The negative reciprocal of -1/4 is 4. So, the equation of the perpendicular line can be written as: y = mx + b where "m" is the slope (which is 4) and "b" is the y-intercept. Now, plug in the values: 7 = (4)(-2) + b Solve for "b": 7 = -8 + b, b = 15

So, the equation of the line perpendicular to y = -1/4 x - 6 and passing through the point (-2, 7) is: y = 4x + 15

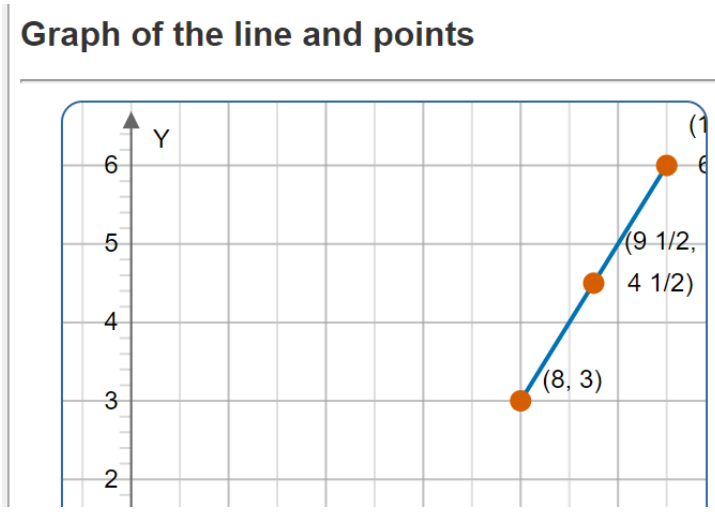


7

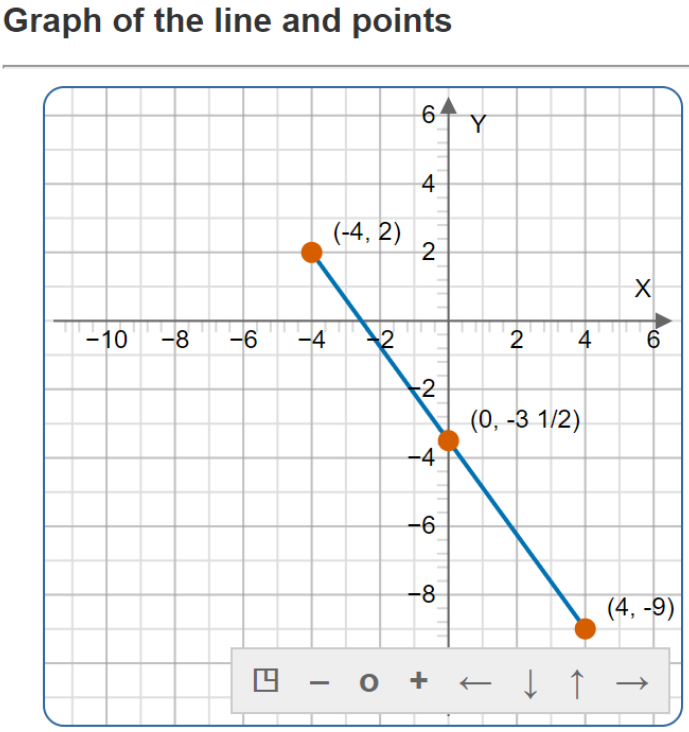
a. The midpoint is (3.5, 8), and the length is approximately $\sqrt{13}$ or 3.605.

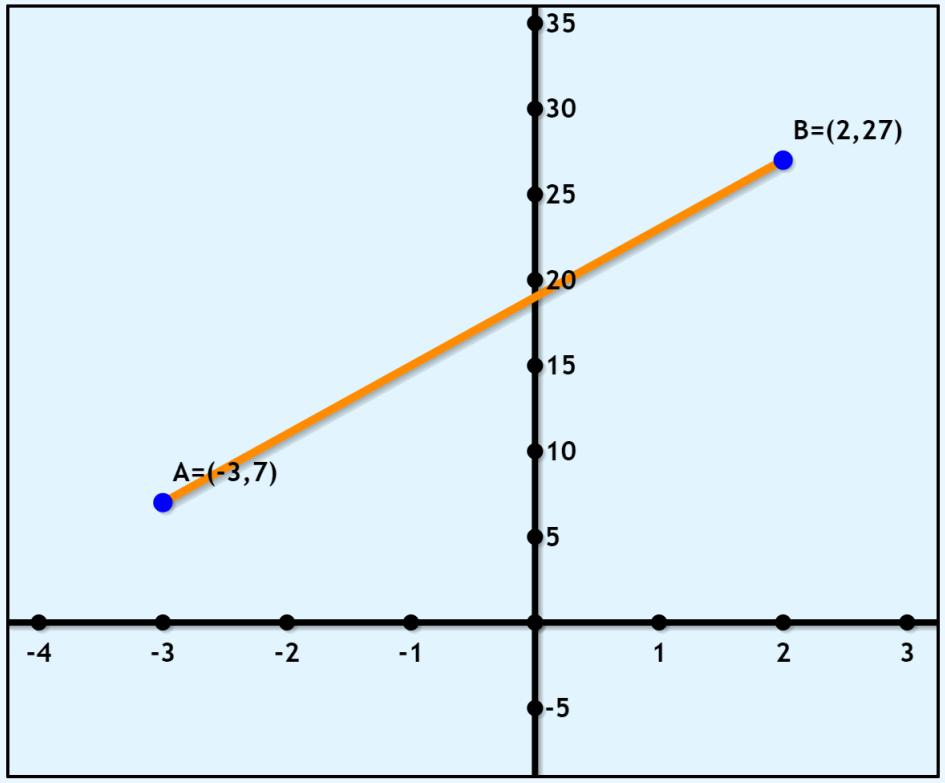


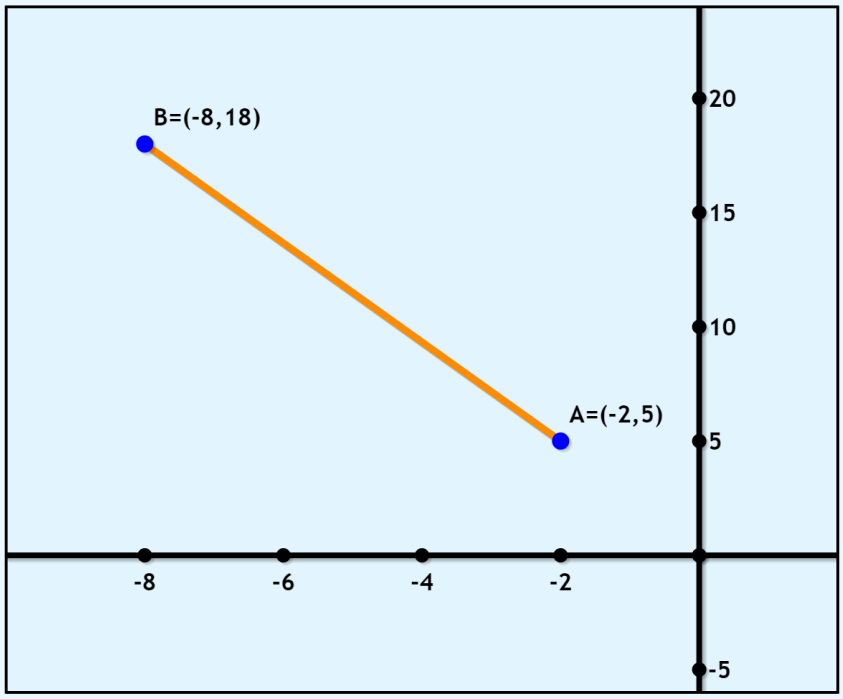
b. The midpoint is (9.5, 4.5), and the length is approximately $3\sqrt{2}$ or 4.24.



c. The midpoint is (0, -3.5), and the length is approximately $\sqrt{113}$ 10.63.

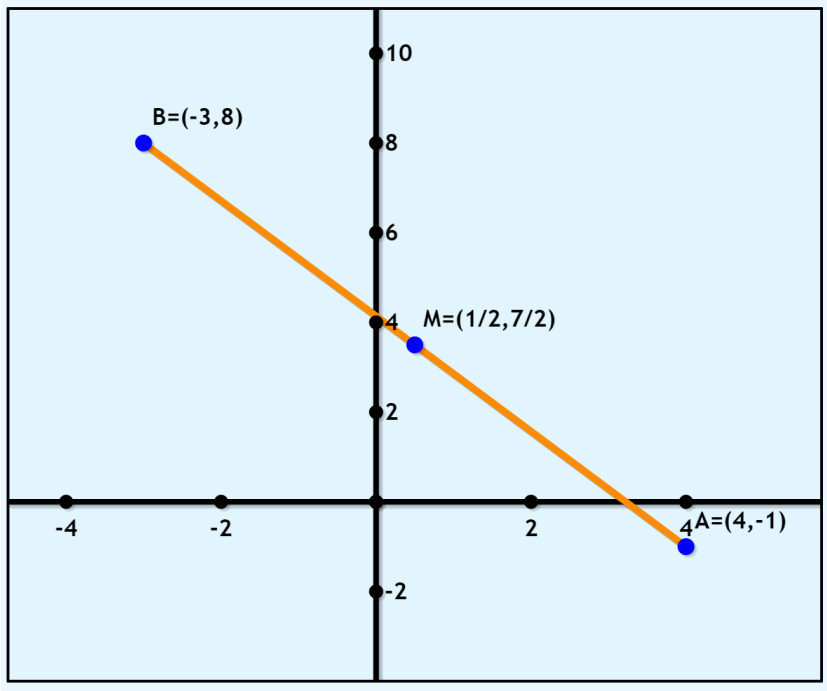


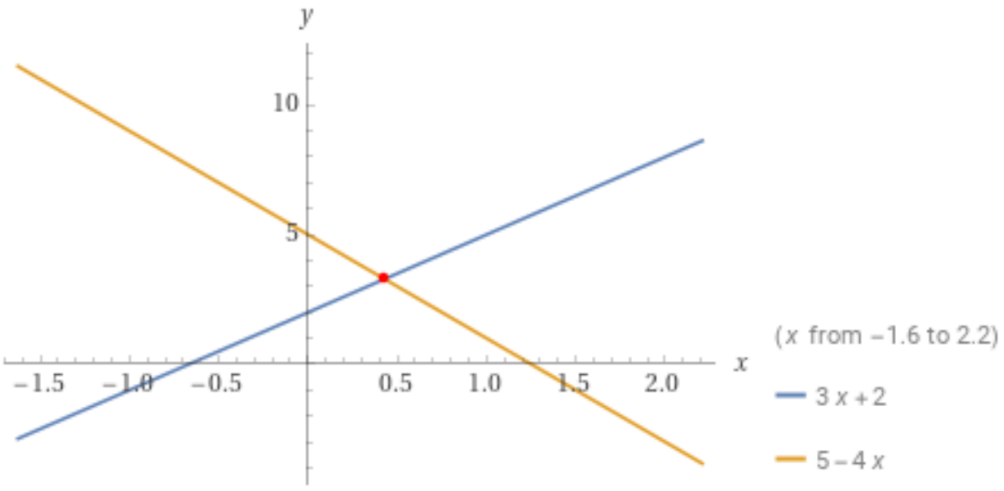
8	a. For the line joining (-3, 7) and (2, n) to have a gradient of 4, we can use the formula for the gradient: Gradient (m) = (Change in y) / (Change in x) So, for the points (-3, 7) and (2, n): 4 = (n - 7) / (2 - (-3)) 4 = (n - 7) / 5 Now, solve for n: n = 27 So, the missing coordinate is n = 27.  b. To find the missing coordinate in the line segment joining (-2, 5) and (-8, n) with a length of 205, we can use the distance formula: Distance = $\sqrt{((x2 - x1)^2 + (y2 - y1)^2)} = \sqrt{205}$ $205 = \sqrt{((-8 + 2)^2 + (n - 5)^2)}$ Now, solve for n: n = 18



c. Midpoint = ((x1 + x2) / 2, (y1 + y2) / 2)
(0.5, 3.5) = ((n + 4) / 2, (8 - 1) / 2)

Now, solve for "n": n = -3



9	a. To find the point of intersection of the lines y = 3x + 2 and y = 5 - 4x, we can set these two equations equal to each other: 3x + 2 = 5 - 4x Now, solve for x: 3x + 4x = 5 - 2 x = 3/7 Now that we have found x, we can substitute it into either equation to find y. Let's use the first equation: y = 3(3/7) + 2 y = 23/7 So, the point of intersection is (3/7, 23/7). $x = \frac{3}{7}$ and $y = \frac{23}{7}$ Plot  b. To find the point of intersection of the lines 2x - 5y = 9 and y = -3x - 7, we can substitute the expression for y from the second equation into the first equation: 2x - 5(-3x - 7) = 9

x = -26 / 17

Now that we have found x, we can substitute it into the second equation to find y:

y = -3(-26 / 17) - 7
y = -41 / 17

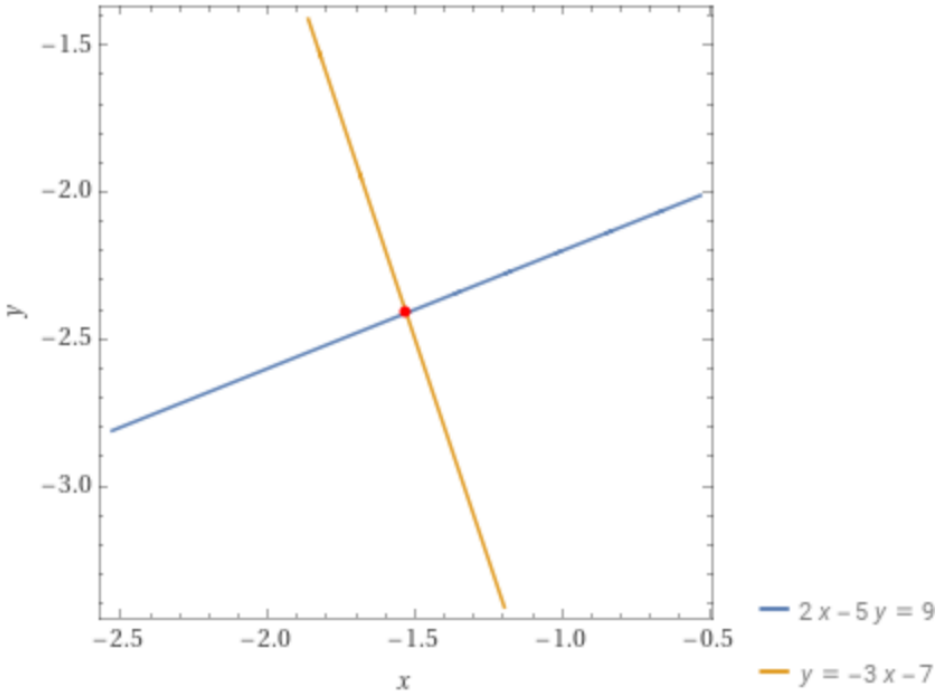
So, the point of intersection is (-26/17, -41/17).

Result

Approximate form

$$x = -\frac{26}{17} \text{ and } y = -\frac{41}{17}$$

Implicit plot



10	a. To find a linear equation relating production cost (C) to the number of sculptures produced (s), we can use the given data points (7 sculptures, cost $190) and (12 sculptures, cost $250). We can find the slope (cost per sculpture) and the y-intercept (initial cost of materials). Using these points: Slope (m) = (Cost at 12 sculptures - Cost at 7 sculptures) / (12 - 7) Slope (m) = ($250 - $190) / 5 Slope (m) = $60 / 5 Slope (m) = $12 per sculpture Now, we can use one of the points to find the y-intercept (b). Let's use the point (7 sculptures, cost $190): $190 = $12 per sculpture * 7 sculptures + b $190 = $84 + b Now, solve for b: b = $190 - $84 b = $106 So, the linear equation relating production cost (C) to the number of sculptures produced (s) is C = 12s + 106. b. i. The initial cost of materials each week is $106. ii. The ongoing cost of production per sculpture is $12. c. To find out how many sculptures Samantha must sell to make a profit, we can use the profit formula P = 5s - 100 and set it equal to zero: 5s - 100 = 0 Now, solve for s: 5s = 100 s = 20 Samantha must sell 20 sculptures to make a profit.