

# Understanding Graphs as Solution Sets

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 30

## Quick Review

Every point on the graph of an equation is a **solution** of that equation. The graph *is* the solution set drawn out. To check whether a point is on a line, substitute its  $(x, y)$  into the equation — if both sides come out equal, the point lies on the line. To find an unknown coordinate of a point on a line, substitute what you know and solve for the missing variable. For inequalities, the graph is a half-plane (one side of the line). For systems, the solution is the intersection point (or set of points). The big idea: a graph is a picture of all the input–output pairs that make the equation true, and you can move freely between the picture and the equation.

## PRACTICE

Check membership, complete coordinates, or interpret graphs.

- |   |  |
|---|--|
| 1. Is $(2, 7)$ on $y = 3x + 1$ ? _____  | 10. Is $(1, 1)$ on $y = 2x - 1$ ? _____  |
| 2. Is $(0, 4)$ on $y = 2x - 1$ ? _____  | 11. Is $(0, 0)$ on $y = 5x$ ? _____  |
| 3. Is $(-1, -3)$ on $y = 3x$ ? _____  | 12. Is $(2, -3)$ on $y = -2x + 1$ ? _____  |
| 4. A snack stand uses the model $y = 4x - 2$ for its profit after selling $x$ combo meals. What is $y$ when $x = 3$ ? _____ | 13. On $y = x^2$ , is $(3, 9)$ ? _____   |
| 5. A delivery model is $y = -x + 5$ . If the output is 2, what input $x$ makes the point land on the graph? _____           | 14. On $y = x^2$ , is $(-2, 4)$ ? _____  |
| 6. Is $(4, 0)$ on $2x + y = 8$ ? _____  | 15. Two intercepts: $(3, 0), (0, -6)$ . Equation? _____  |
| 7. Is $(5, 2)$ on $x - y = 3$ ? _____   | 16. Is $(4, 16)$ on $y = x^2$ ? _____  |
| 8. A line has equation $3x + y = 12$ . What $y$ -value completes the solution point when $x = 2$ ? _____                    | 17. For the graph of $2x - 3y = 6$ , what is the $y$ -intercept? In other words, find $y$ when $x = 0$ . _____ |
| 9. A graph is represented by $y = \frac{1}{2}x + 1$ . What output belongs with the input $x = 6$ ? _____                    | 18. For the graph of $2x - 3y = 6$ , what is the $x$ -intercept? In other words, find $x$ when $y = 0$ . _____ |
|   | 19. Is $(7, -4)$ on $y = -x + 3$ ? _____   |
|   | 20. On $y = 3x - 5$ , does $(2, 1)$ work? _____  |

## VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. Is  $(2, 3)$  a solution of the graphed line  $y = x + 1$ ?

Answer: \_\_\_\_\_

22. Is  $(3, -1)$  a solution of the graphed line?

Answer: \_\_\_\_\_



## ◆ Word Problems

23. A delivery route is modeled by a line through  $(2, 7)$  and  $(5, 16)$ , where  $x$  is hours and  $y$  is miles from the starting point. Does the point  $(8, 25)$  also belong on this route graph?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_

24. A cell phone plan's cost equation is  $C = 15 + 0.05t$  (texts  $t$ ). If Maria has \$25 to spend, how many texts can she send?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_

25. A used car's value, in thousands of dollars, is modeled by  $V = 20 - 1.5t$ , where  $t$  is the number of years after purchase. When does the graph show the car is worth \$8,000?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_

26. A water tank starts with 500 gallons and drains at a steady rate. Its volume is modeled by  $V = 500 - 25t$ , where  $t$  is hours. At what time is the tank half full, with 250 gallons left?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_

27. A theater ticket plan is modeled by  $C = 12n + 30$ , where  $n$  is the number of tickets and  $C$  is the total cost in dollars. Is  $(8, 126)$  on the graph, and what does that point mean?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_

28. A delivery driver's distance graph follows  $d = 55t$ , where  $d$  is miles and  $t$  is hours. Is  $(3, 165)$  a solution, and what does it mean in the situation?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_

29. A graph contains all points that satisfy  $3x + 2y = 18$ . If a point on the graph has  $x = 4$ , what  $y$ -coordinate completes the solution point  $(4, y)$ ?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_

30. A plumber charges a service fee plus an hourly rate, modeled by  $C = 45 + 35h$ . Does the point  $(4, 185)$  belong on the graph, and what would it represent?

Model: \_\_\_\_\_

Answer: \_\_\_\_\_



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## Answer Keys

- |   |   |
|---|---|
| <p>1. <input type="text" value="yes"/></p> <p>2. <input type="text" value="no"/></p> <p>3. <input type="text" value="yes"/></p> <p>4. <input type="text" value="10"/></p> <p>5. <input type="text" value="3"/></p> <p>6. <input type="text" value="yes"/></p> <p>7. <input type="text" value="yes"/></p> <p>8. <input type="text" value="6"/></p> <p>9. <input type="text" value="4"/></p> <p>10. <input type="text" value="yes"/></p> <p>11. <input type="text" value="yes"/></p> <p>12. <input type="text" value="yes"/></p> <p>13. <input type="text" value="yes"/></p> <p>14. <input type="text" value="yes"/></p> <p>15. <input type="text" value="y = 2x - 6"/></p> | <p>16. <input type="text" value="yes"/></p> <p>17. <input type="text" value="-2"/></p> <p>18. <input type="text" value="3"/></p> <p>19. <input type="text" value="yes"/></p> <p>20. <input type="text" value="yes"/></p> <p>21. <input type="text" value="yes"/></p> <p>22. <input type="text" value="yes"/></p> <p>23. <input type="text" value="yes"/></p> <p>24. <input type="text" value="t = 200"/></p> <p>25. <input type="text" value="t = 8 years"/></p> <p>26. <input type="text" value="t = 10 hours"/></p> <p>27. <input type="text" value="yes; 8 tickets cost \$126"/></p> <p>28. <input type="text" value="yes"/></p> <p>29. <input type="text" value="y = 3"/></p> <p>30. <input type="text" value="yes"/></p> |
|---|---|

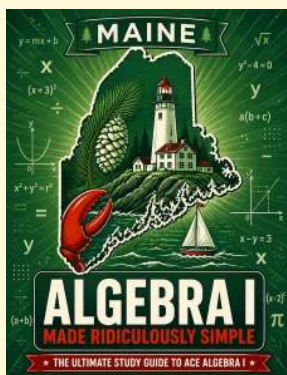
### Step-by-Step Tutor Notes

1. Start with the definition the problem is testing, then apply it directly.  $3(2) + 1 = 7$ .  $\checkmark$ . So the answer is yes.
2. Use the clue in the question first, then let the arithmetic finish the job.  $2(0) - 1 = -1 \neq 4$ . So the answer is no.
3. Use the clue in the question first, then let the arithmetic finish the job.  $3(-1) = -3$ .  $\checkmark$ . So the answer is yes.
4. Use the input from the question:  $4(3) - 2 = 10$ . The point  $(3, 10)$  belongs on the graph.
5. Set the output equal to 2:  $2 = -x + 5$ . Subtract 5 to get  $-3 = -x$ , so  $x = 3$ .
6. Take it one clear step at a time and keep the original question in mind.  $2(4) + 0 = 8$ .  $\checkmark$ . So the answer is yes.
7. Start with the definition the problem is testing, then apply it directly.  $5 - 2 = 3$ .  $\checkmark$ . So the answer is yes.
8. The safest move is to replace the variable, keep the arithmetic organized, and simplify one step at a time. Substitute  $x = 2$ :  $3(2) + y = 12$ . Then  $6 + y = 12$ , so  $y = 6$ . That confirms the final answer is 6.
9. Put the given value into the expression first, then simplify from the inside out. Substitute the input:  $y = \frac{1}{2}(6) + 1 = 3 + 1 = 4$ . That confirms the final answer is 4.
10. This is a good place to slow down, check the notation, and simplify cleanly.  $2(1) - 1 = 1$ .  $\checkmark$ . So the answer is yes.
11. This is a good place to slow down, check the notation, and simplify cleanly.  $5(0) = 0$ .  $\checkmark$  (Direct variation always includes origin.) So the answer is yes.
12. Start with the definition the problem is testing, then apply it directly.  $-2(2) + 1 = -3$ .  $\checkmark$ . So the answer is yes.
13. Use the clue in the question first, then let the arithmetic finish the job.  $3^2 = 9$ . (Solution sets work for curves too.) So the answer is yes.
14. Take it one clear step at a time and keep the original question in mind.  $(-2)^2 = 4$ .  $\checkmark$ . So the answer is yes.
15. Compare the change in output to the change in input, because slope is a rate of change. Slope:  $\frac{-6-0}{0-3} = 2$ .  $y$ -int  $-6$ . So the requested value is  $y = 2x - 6$ .
16. Focus on the main idea of the problem, then simplify carefully.  $4^2 = 16$ . So the answer is yes.
17. Use the clue in the question first, then let the arithmetic finish the job. At the  $y$ -intercept,  $x = 0$ . Then  $-3y = 6$ , so  $y = -2$ . So the answer is  $-2$ .
18. Focus on the main idea of the problem, then simplify carefully. At the  $x$ -intercept,  $y = 0$ . Then  $2x = 6$ , so  $x = 3$ . So the answer is 3.
19. Focus on the main idea of the problem, then simplify carefully.  $-7 + 3 = -4$ .  $\checkmark$ . So the answer is yes.
20. Start with the definition the problem is testing, then apply it directly.  $3(2) - 5 = 1$ .  $\checkmark$ . So the answer is yes.
21. Put the given value into the expression first, then simplify from the inside out. Substitute  $x = 2$ :  $2 + 1 = 3$ . The point is on the line. That confirms the final answer is yes.
22. Use the clue in the question first, then let the arithmetic finish the job. The point  $(3, -1)$  lies on the graphed line, so it is a solution. So the answer is yes.
23. Slope:  $\frac{16-7}{5-2} = 3$ . Equation:  $y - 7 = 3(x - 2) \Rightarrow y = 3x + 1$ . At  $x = 8$ :  $y = 25$ .  $\checkmark$ .
24. For a table question, slow down and locate the exact row, column, or cell before calculating. Set  $C = 25$ :  $25 = 15 + 0.05t \Rightarrow 10 = 0.05t \Rightarrow t = 200$  texts. This gives  $t = 200$ .
25. Read the table by matching the correct row and column first, then use the count or total that fits the question. Set  $V = 8$  (in thousands):  $8 = 20 - 1.5t \Rightarrow -12 = -1.5t \Rightarrow t = 8$  years. This gives  $t = 8$  years.
26. For a table question, slow down and locate the exact row, column, or cell before calculating.  $250 = 500 - 25t \Rightarrow -250 = -25t \Rightarrow t = 10$  hours. This gives  $t = 10$  hours.
27. Substitute  $n = 8$ :  $C = 12(8) + 30 = 126$ . Since the point works, it means 8 tickets cost \$126.
28. At  $t = 3$ ,  $d = 55(3) = 165$ . The point matches the equation, so it is on the graph.
29. Substitute  $x = 4$ :  $3(4) + 2y = 18$ , so  $12 + 2y = 18$ . Then  $2y = 6$  and  $y = 3$ .
30. Substitute  $h = 4$ :  $C = 45 + 35(4) = 45 + 140 = 185$ . The point is on the graph.



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