

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

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

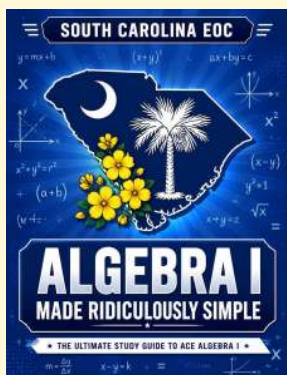
Step-by-Step Tutor Notes

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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