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

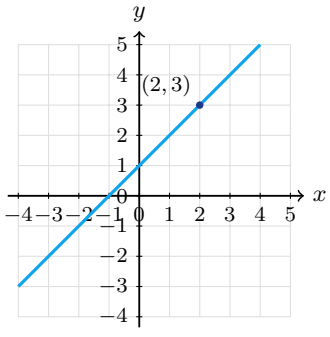
Check membership, complete coordinates, or interpret graphs.

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

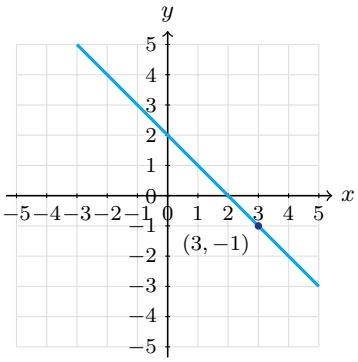
Use the graph, table, chart, or diagram to answer the question.

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: _____

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

Step-by-Step Tutor Notes

1. Start with the definition the problem is testing, then apply it directly. $3(2)+1 = 7$. ✓. 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. $3(-1) = -3$. ✓. 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. $2(4) + 0 = 8$. ✓. So the answer is yes.
7. Start with the definition the problem is testing, then apply it directly. $5 - 2 = 3$. ✓. 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. $2(1) - 1 = 1$. ✓. So the answer is yes.
11. This is a good place to slow down, check the notation, and simplify cleanly. $5(0) = 0$. ✓ (Direct variation always includes origin.). So the answer is yes.
12. Start with the definition the problem is testing, then apply it directly. $-2(2) + 1 = -3$. ✓. 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. $(-2)^2 = 4$. ✓. 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. $-7+3 = -4$. ✓. So the answer is yes.
20. Start with the definition the problem is testing, then apply it directly. $3(2) - 5 = 1$. ✓. 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 $x = 8$: $y = 25$. ✓.
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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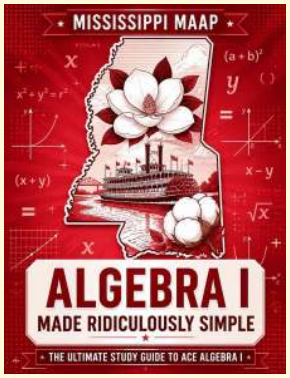

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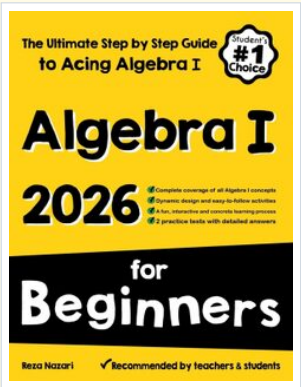

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