Using Intercepts

Name: _____	Date: _____	Score: _____ / 41

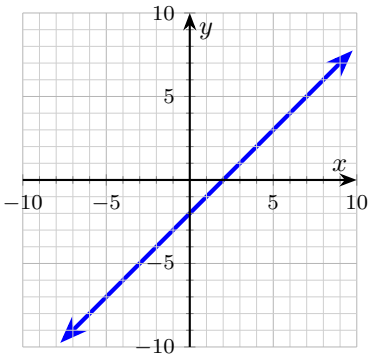
Quick Review

Intercepts are where the graph meets the axes. The x-intercept is the spot on the x-axis, so its y-coordinate is zero — write it as $(x_0, 0)$. The y-intercept lives on the y-axis, so its x-coordinate is zero — write it as $(0, y_0)$. The trick to remember: to find an x-intercept, *set* $y = 0$; to find a y-intercept, *set* $x = 0$. From **standard form** $Ax + By = C$ the intercepts pop out fast: x-intercept $(\frac{C}{A}, 0)$ and y-intercept $(0, \frac{C}{B})$. With two intercepts in hand, you have two points; slope is $m = \frac{y_2 - y_1}{x_2 - x_1}$, and the equation in slope-intercept form falls out. *Watch the signs*: when $-2y = 8$, dividing by -2 gives $y = -4$, not $y = 4$. And in contexts (cost, time, distance) the intercepts have meaning: a y-intercept often says "what's the starting amount?" and an x-intercept says "when does this hit zero?"

PRACTICE

Find the requested intercepts or equation.

1. Intercepts of $2x + 3y = 12$ _____
2. Intercepts of $4x - 2y = 8$ _____
3. Equation through $(0, -3)$ and $(5, 0)$. _____
4. Slope from y-intercept 5, x-intercept -2. _____
5. Equation with x-intercept $(3, 0)$ and y-intercept $(0, -6)$. _____
6. x-intercept of $y = -\frac{1}{4}x + 5$ _____
7. y-intercept of $7x - 3y = -21$ _____
8. Both intercepts of $6x - 5y = 30$ _____
9. Standard form to slope-intercept: $5x + 2y = 10$ _____
10. Find both intercepts of the line graphed below. _____



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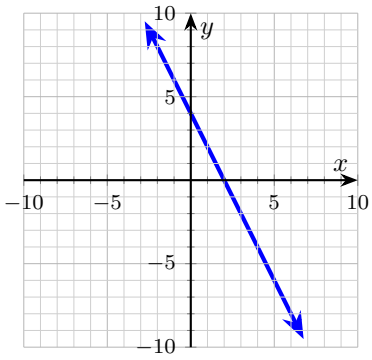
11. Write the equation in slope-intercept form for the line graphed below. _____



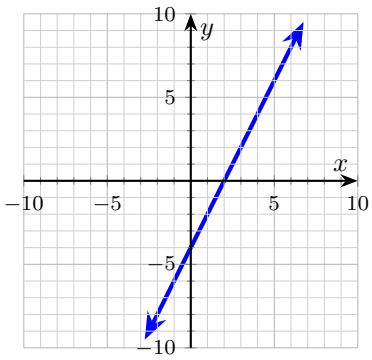
12. Intercepts of $x - 4y = 8$ _____

13. Equation through $(-4, 0)$ and $(0, 2)$. _____

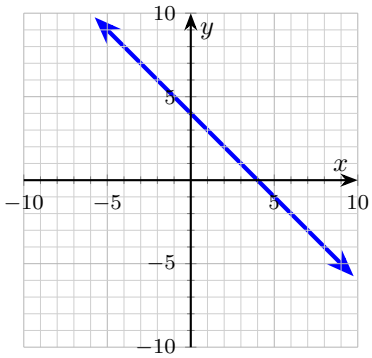
14. Intercepts of $y = 3x - 9$ _____

15. Standard form of the line with intercepts $(4, 0), (0, -3)$ _____

16. Read the x-intercept from the graph below. _____



17. Read the y-intercept from the graph below. _____



18. Equation with x-intercept $(-3, 0)$ and y-intercept $(0, 6)$. _____

19. The x-intercept of $8x + 4y = -24$. _____

20. Both intercepts of $3x + 5y = 15$ _____

♦ Word Problems

21. A printing company charges a flat $\$30$ setup fee plus $\$2$ per t-shirt. The total cost is $C = 2x + 30$, where x is the number of shirts. Interpret the C-intercept in context, and find the x-intercept (if any). _____

22. A balloon rises from the ground following $h = -3t + 24$, where h is the height (in meters, measured downward from a balcony) and t is seconds. Find both intercepts and explain what each one means. _____

23. A line in standard form $Ax + By = C$ has x-intercept $(6, 0)$ and y-intercept $(0, -9)$. Find one valid choice of A, B, and C in integer form. _____

24. A taxi charges a flat $\$3.50$ for the pickup plus $\$2.25$ per mile. Write the cost equation, find the y-intercept, and tell what the y-intercept means in context. _____

Additional Practice

25. Find both intercepts of $3x + 2y = 18$ _____

26. Find both intercepts of $5x - y = 10$ _____

27. Write an equation with intercepts $(4, 0)$ and $(0, 8)$ _____

28. Write standard form for intercepts $(-3, 0)$ and $(0, 6)$ _____

29. The line $y = -4x + 12$ crosses the axes where? _____

30. A cost model is $C = 15m + 45$. Interpret the C-intercept. _____

31. A tank has $V = -8t + 96$. Find and interpret the t-intercept. _____

32. Find k if $2x + ky = 24$ has y-intercept $(0, 6)$. _____

33. Find both intercepts of $-4x + 3y = 12$ _____

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34. Find both intercepts of $7x + y = -14$ _____

35. Write slope-intercept form for intercepts $(9, 0)$ and $(0, 3)$ _____

36. Write standard form for intercepts $(2, 0)$ and $(0, 5)$ _____

37. The line $C = 80 - 4n$ has what n-intercept? _____

38. A plan costs $P = 12x + 20$. What is the P-intercept? _____

39. Find b if $y = mx + b$ has y-intercept $(0, -7)$. _____

40. Find a if $ax + 6y = 18$ has x-intercept $(3, 0)$. _____

41. Find both intercepts of $x + 4y = -8$ _____

Answer Keys

1. x-int $(6,0)$, y-int $(0,4)$
2. x-int $(2,0)$, y-int $(0,-4)$
3. $y=\frac{3}{5}x-3$
4. $m=\frac{5}{2}$
5. $y=2x-6$
6. $(20,0)$
7. $(0,7)$
8. x-int $(5,0)$, y-int $(0,-6)$
9. $y=-\frac{5}{2}x+5$
10. x-int $(2,0)$, y-int $(0,-2)$
11. $y=-2x+4$
12. x-int $(8,0)$, y-int $(0,-2)$
13. $y=\frac{1}{2}x+2$
14. x-int $(3,0)$, y-int $(0,-9)$
15. $3x-4y=12$
16. $(2,0)$
17. $(0,4)$
18. $y=2x+6$
19. $(-3,0)$
20. x-int $(5,0)$, y-int $(0,3)$
21. C-int: \$30 setup; x-int: none for $x\geq 0$
22. h-int $(0,24)$, t-int $(8,0)$
23. $3x-2y=18$
24. $C=2.25m+3.50$; $(0,\$3.50)$

Additional Practice Answers

25. x-int $(6,0)$, y-int $(0,9)$
26. x-int $(2,0)$, y-int $(0,-10)$
27. $y=-2x+8$
28. $2x-y=-6$
29. x-int $(3,0)$, y-int $(0,12)$
30. \$45 starting fee
31. $(12,0)$; empty after 12 minutes
32. $k=4$
33. x-int $(-3,0)$, y-int $(0,4)$
34. x-int $(-2,0)$, y-int $(0,-14)$
35. $y=-\frac{1}{3}x+3$
36. $5x+2y=10$
37. $(20,0)$
38. $(0,20)$
39. $b=-7$
40. $a=6$
41. x-int $(-8,0)$, y-int $(0,-2)$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. Set $y=0$: $2x=12\Rightarrow x=6$. Set $x=0$: $3y=12\Rightarrow y=4$. (Write each as an ordered pair — don't shove the numbers in the wrong slots.)
2. Set $y=0$: $4x=8\Rightarrow x=2$. Set $x=0$: $-2y=8\Rightarrow y=-4$. (The minus on the $-2y$ flips the sign — a quick way to slip if you're moving fast.)
3. Two points $\Rightarrow$ slope first: $m=\frac{0-(-3)}{5-0}=\frac{3}{5}$. The y-intercept is -3. Equation: $y=\frac{3}{5}x-3$.
4. Points: $(0,5)$ and $(-2,0)$. $m=\frac{5-0}{0-(-2)}=\frac{5}{2}$. (The denominator $0-(-2)=2$, not -2.)
5. A careful way to see it: Slope: $m=\frac{-6-0}{0-3}=\frac{-6}{-3}=2$. y-intercept is -6. Equation: $y=2x-6$. That gives a quick check on the answer.
6. Keep the rule visible: Set $y=0$: $0=-\frac{1}{4}x+5\Rightarrow\frac{1}{4}x=5\Rightarrow x=20$. Point: $(20,0)$. This is the part to check before moving on, because it keeps the answer tied to the original question.
7. One steady path is: Set $x=0$: $-3y=-21\Rightarrow y=7$. Point: $(0,7)$. This is the part to check before moving on, because it keeps the answer tied to the original question.
8. Start with the key idea: $y=0$: $6x=30\Rightarrow x=5$. $x=0$: $-5y=30\Rightarrow y=-6$. This is the part to check before moving on, because it keeps the answer tied to the original question.
9. Subtract $5x$, then divide by 2: $2y=-5x+10$, so $y=-\frac{5}{2}x+5$. Intercepts: $(0,5)$ and $(2,0)$.
10. Read where the line meets each axis. It crosses the x-axis at $x=2$ (so the point $(2,0)$) and the y-axis at $y=-2$ (the point $(0,-2)$). Remember: at an x-intercept $y=0$, and at a y-intercept $x=0$.
11. One steady path is: y-intercept at $(0,4)$. From $(0,4)$ to $(1,2)$ is rise -2 over run 1, so $m=-2$. Equation: $y=-2x+4$. That gives a quick check on the answer.
12. Set $y=0$: the $-4y$ vanishes, leaving $x=8$. Set $x=0$: $-4y=8$, and dividing by -4 gives $y=-2$ (watch that negative). Intercepts $(8,0)$ and $(0,-2)$.
13. A careful way to see it: $m=\frac{2-0}{0-(-4)}=\frac{2}{4}=\frac{1}{2}$. y-intercept: $(0,2)$. Equation: $y=\frac{1}{2}x+2$. That gives a quick check on the answer.
14. This one is already in $y=mx+b$ form. Set $x=0$ to read the y-intercept straight off: $y=-9$. Set $y=0$ for the x-intercept: $0=3x-9\Rightarrow 3x=9\Rightarrow x=3$.
15. Slope $\frac{3}{4}$, y-intercept -3. Slope-intercept: $y=\frac{3}{4}x-3$. Multiply by 4: $4y=3x-12$, so $3x-4y=12$.
16. The x-intercept is where the line cuts the horizontal axis. Here that happens at $x=2$, and since any point on the x-axis has $y=0$, the intercept is the point $(2,0)$.
17. The y-intercept is where the line cuts the vertical axis. That's at height $y=4$, and every point on the y-axis has $x=0$, so the intercept is the point $(0,4)$.
18. Keep the rule visible: $m=\frac{6-0}{0-(-3)}=\frac{6}{3}=2$. y-intercept 6. Equation: $y=2x+6$. That gives a quick check on the answer.
19. Set $y=0$: $8x=-24\Rightarrow x=-3$. Point: $(-3,0)$. (Negative x-intercepts happen — don't blink at the sign.)
20. Start with the key idea: $y=0$: $3x=15\Rightarrow x=5$. $x=0$: $5y=15\Rightarrow y=3$. This is the part to check before moving on, because it keeps the answer tied to the original question.

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21. The C-intercept is the value of C when $x = 0$: $C = 30$, the setup fee with zero shirts. For an x-intercept, set $C = 0$: $2x + 30 = 0$, so $x = -15$. Since you can't print a negative number of shirts, no x-intercept exists in this real context.
22. At $t = 0$, $h = 24$ — the starting distance below the balcony is 24 m. Setting $h = 0$: $-3t + 24 = 0 \Rightarrow t = 8$. So at $t = 8$ seconds the balloon reaches the balcony (height equals zero).

23. Slope-intercept: slope $m = \dfrac{-9-0}{0-6} = \dfrac{3}{2}$, y-intercept -9, so $y = \dfrac{3}{2}x - 9$. Multiply both sides by 2 to clear the fraction: $2y = 3x - 18$, so $3x - 2y = 18$. (Any nonzero scalar multiple is also valid.)
24. Start with the key idea: $C = 2.25m + 3.50$. When $m = 0$ (no miles), the cost is $\$3.50$ — you still pay for the pickup. So the C-intercept is the flat pickup fee. That gives a quick check on the answer.

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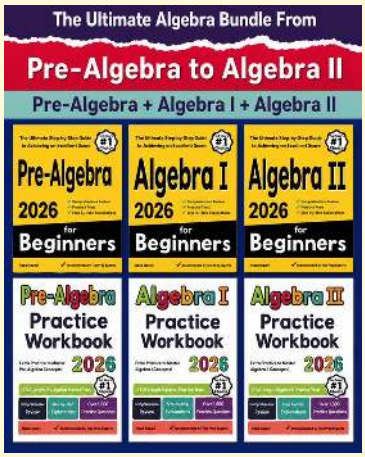

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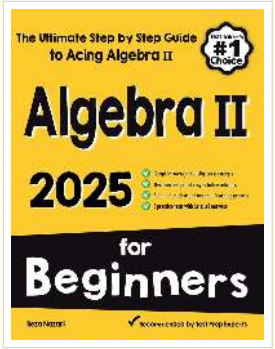

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