PRACTICE WORKSHEET

Word Problems to Graphs

QUICK REFERENCE

Turning the story into math: First, figure out what x and y stand for. Usually x is the thing that counts up on its own (like hours or miles), and y is the result that depends on it. If neither one depends on the other (like notebooks and pens), let x be the one the story mentions first. Then decide which kind of story you have. Some stories give a starting amount and a rate: the starting amount (what you have when x is 0) becomes b, and whatever happens "per" or "every" becomes the slope, so you land right in y = mx + b form. Other stories have two things adding up to a total, like notebooks and pens that cost $4.50 altogether. There's no rate to hunt for in those! Multiply each price by how many there are, set the sum equal to the total, and you're already in standard form. Careful: "each" shows up in both kinds of stories, so read the whole problem before deciding.

Watch the tricky words: "Less than" flips the order, so "3 less than twice x" is 2x − 3, and the 3 goes last. "The difference of y and 3x" keeps the order it's said in: y − 3x. And when "of" comes after a fraction, it means multiply, so "one-fourth of x" is $\frac{1}{4}$x.

Two ways to write the same line: Slope-intercept form is y = mx + b, where m is the slope and b is where the line crosses the y-axis. Standard form is Ax + By = C, with x and y on the same side, whole numbers only (no fractions or decimals!), and A not negative. Got a fraction or decimal? Multiply every term by whatever clears it out (the denominator, or 2, 10, or 100). If A comes out negative, multiply everything by −1.

Decimals into fractions: You can't count 0.4 of a box on a grid, so turn decimal slopes into fractions before you graph. Some common ones: 0.5 = $\frac{1}{2}$, 0.4 = $\frac{2}{5}$, 1.5 = $\frac{3}{2}$, and 1.25 = $\frac{5}{4}$.

Graphing with slope: Plot b on the y-axis first. Then read the slope as rise over run: the top number tells you how far to go up (or down, if it's negative), and the bottom number tells you how far to go right. What about a whole number slope like 3? Every whole number has a secret denominator of 1, so 3 is really $\frac{3}{1}$: up 3, right 1. A slope of −2 is $\frac{-2}{1}$: down 2, right 1.

Running off the grid? Go in reverse! Flipping both signs gives you the exact same slope, so $\frac{2}{3}$ is the same as $\frac{-2}{-3}$. That means instead of going up 2 and right 3, you can go down 2 and left 3 and still land on your line. For a negative slope like $-\frac{2}{3}$, reverse means up 2 and left 3. Plot at least 3 points, connect them with a ruler, and put arrows on both ends.

Heads up: On story problems, graph the whole line, even the parts that wouldn't make sense in real life (like negative hours). We're practicing the graphing skill!

EXAMPLE

A phone plan costs $8 a month, plus $0.40 for every gigabyte (GB) of data you use. Write an equation for the monthly bill based on how much data you use.

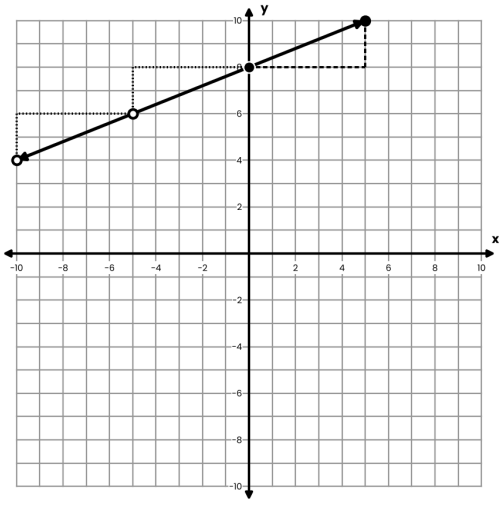
Step 1: Define the variables. The bill depends on how much data you use, so x is the number of GB used and y is the monthly bill in dollars.

Step 2: Translate. The $8 is what you pay even if you use 0 GB, so it's the starting amount: b = 8. The $0.40 happens for every GB, so it's the rate. That gives y = 0.40x + 8.

Step 3: Slope-intercept form. Turn the decimal into a fraction so we can graph it. 0.40 is $\frac{40}{100}$, which simplifies to $\frac{2}{5}$. So $\mathbf{y = \frac{2}{5}x + 8}$.

Step 4: Standard form. Multiply every term by 5 to clear the fraction: 5y = 2x + 40. Subtract 2x from both sides: −2x + 5y = 40. A is negative, so multiply everything by −1: **2x − 5y = −40**.

Step 5: Graph. Plot b at (0, 8). The slope $\frac{2}{5}$ means up 2, right 5, which lands on (5, 10). One more step would be (10, 12), and that's off the grid! So go in reverse: down 2, left 5 gives (−5, 6), then (−10, 4). Connect with a ruler.



PRACTICE

For each problem, decide what x and y stand for (if the problem doesn't already tell you), write the equation from the story, rewrite it in standard form and in slope-intercept form, then graph it using b and the slope. Remember: if your next point runs off the grid, go in reverse!

1 A number y is 3 less than twice a number x.

Equation from the story

_____

Standard form (Ax + By = C)

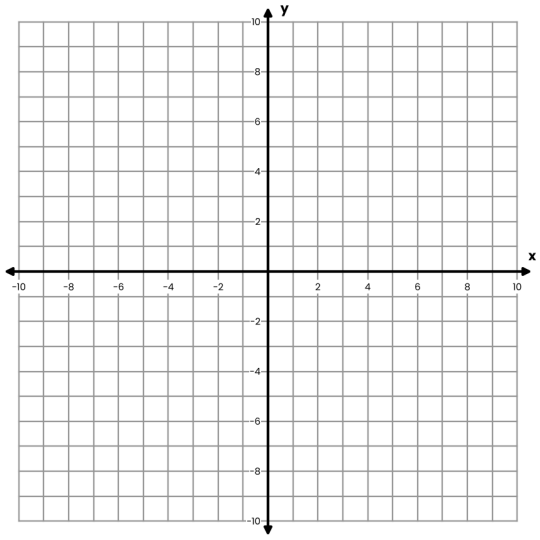
_____

Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



2 The difference of y and three times x is 7.

Equation from the story

_____

Standard form (Ax + By = C)

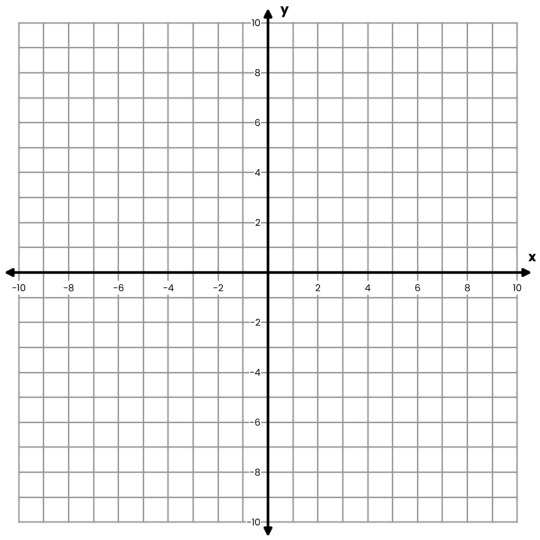
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Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



3 At the school store, notebooks cost $1.50 each and pens cost $0.50 each. Jordan bought some of each and spent exactly $4.50. Write an equation that shows every combination of notebooks and pens Jordan could have bought.

Define your variables

x = _____ y = _____

Equation from the story

_____

Standard form (Ax + By = C)

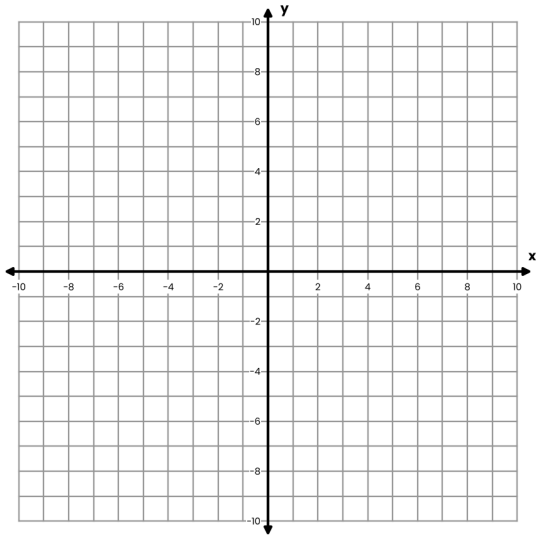
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Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



4 The drama club sold tickets to a small preview show. Student tickets cost $2 and adult tickets cost $3, and the club made $18 in all. Write an equation that shows every combination of tickets the club could have sold.

Define your variables

x = _____ y = _____

Equation from the story

_____

Standard form (Ax + By = C)

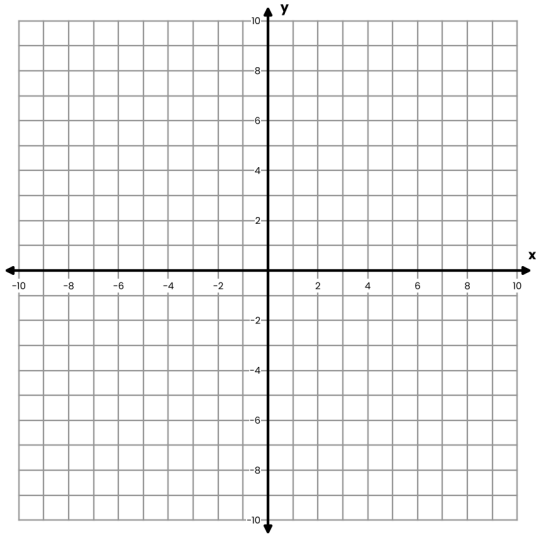
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Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



5 One-fourth of a number x, decreased by 5, is equal to a number y.

Equation from the story

_____

Standard form (Ax + By = C)

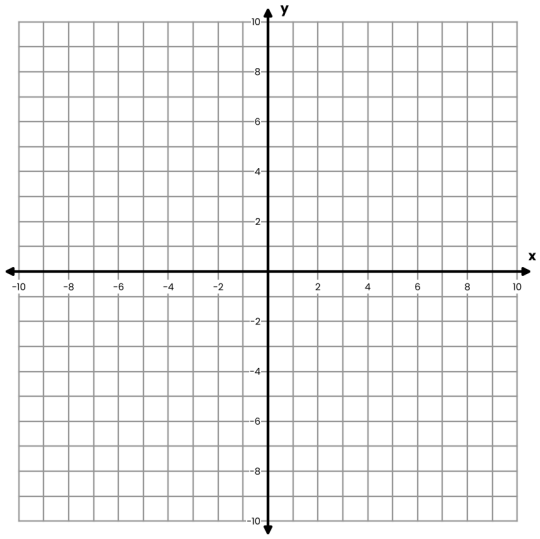
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Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



6 A bean plant is 5 cm tall when you start measuring, and it grows 3 cm every 4 weeks. Write an equation that gives the plant's height after any number of weeks.

Define your variables

x = _____ y = _____

Equation from the story

_____

Standard form (Ax + By = C)

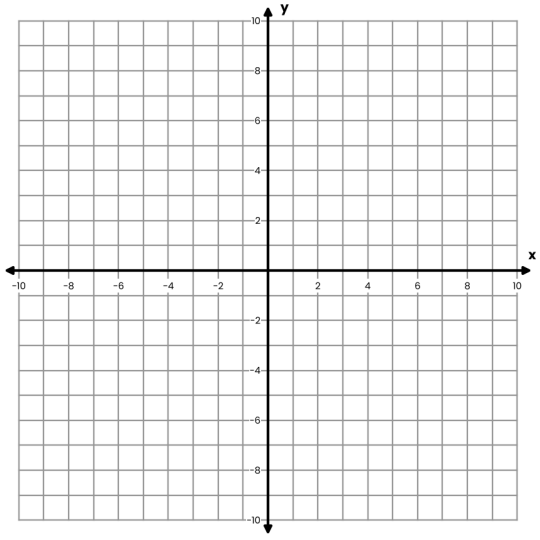
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Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



7 A candle is 8 inches tall when it's lit, and it burns down 0.5 inch every hour. Write an equation that gives the candle's height after any number of hours.

Define your variables

x = _____ y = _____

Equation from the story

_____

Standard form (Ax + By = C)

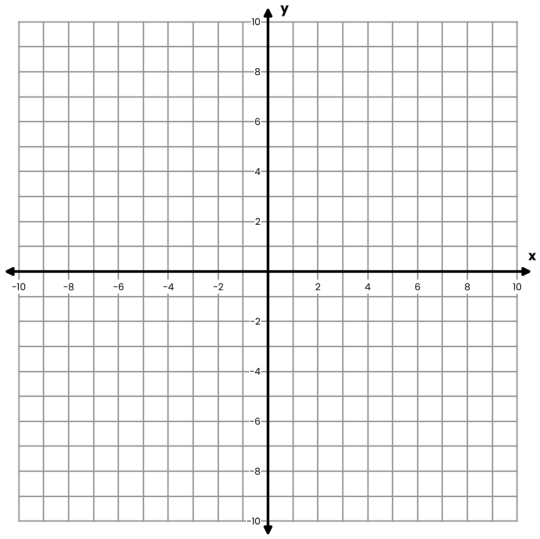
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Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



8 A rideshare charges a $3 pickup fee plus $1.50 for every mile. Write an equation that gives the total cost of a ride of any length.

Define your variables

x = _____ y = _____

Equation from the story

_____

Standard form (Ax + By = C)

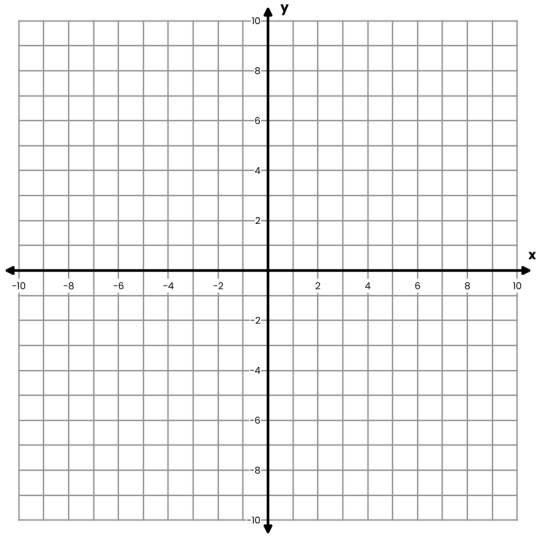
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Slope-intercept form (y = mx + b)

_____

Slope as rise over run **y-intercept (b)**

rise = _____ run = _____ b = _____



ANSWER KEY

In each graph, the big dot is the y-intercept. Solid dots with dashed steps go forward with the slope, and open dots with dotted steps go in reverse. Either direction lands on the same line, so any correct points earn full credit.

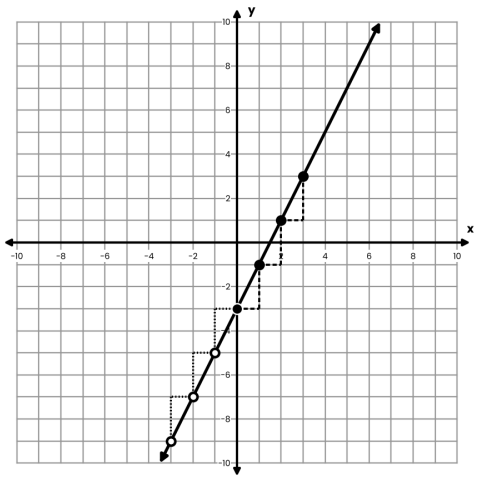
1 A *number y is 3 less than twice a number x.*

Translate: "Twice a number x" is 2x, and "3 less than" that means subtract 3 at the end: y = 2x − 3.

Slope-intercept: It's already in this form! **y = 2x − 3**

Standard form: Subtract 2x from both sides: −2x + y = −3. Multiply by −1 so A is positive: **2x − y = 3**

Graph: Plot (0, −3). The slope 2 is really $\frac{2}{1}$: up 2, right 1 to (1, −1), (2, 1), and (3, 3). Reverse works here too: down 2, left 1 to (−1, −5) and (−2, −7).



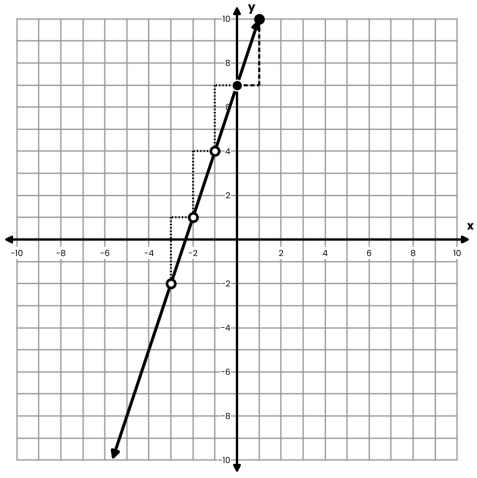
2 *The difference of y and three times x is 7.*

Translate: "The difference of y and three times x" keeps the order it's said in: y − 3x = 7.

Slope-intercept: Add 3x to both sides: **y = 3x + 7**

Standard form: Put the x term first: −3x + y = 7. Multiply by −1: **3x − y = −7**

Graph: Plot (0, 7). The slope 3 is $\frac{3}{1}$: up 3, right 1 lands on (1, 10), right at the edge. The next step is off the grid, so go in reverse: down 3, left 1 to (−1, 4), (−2, 1), and (−3, −2).



3 *At the school store, notebooks cost $1.50 each and pens cost $0.50 each. Jordan bought some of each and spent exactly $4.50. Write an equation that shows every combination of notebooks and pens Jordan could have bought.*

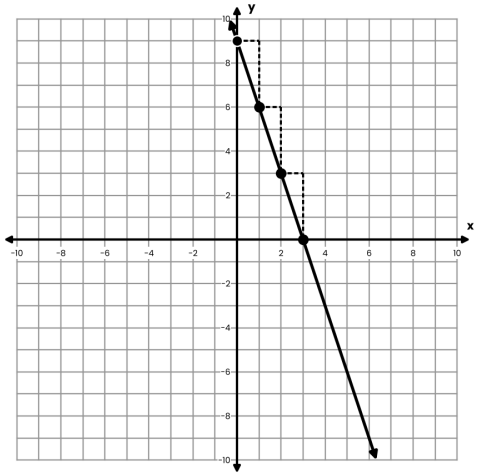
Variables: x = number of notebooks, y = number of pens, since notebooks are mentioned first. (Switched them? You'd get $y = -\frac{1}{3}x + 3$, which is this line flipped over the diagonal y = x. It describes the same purchases, so it's still correct.)

Translate: x notebooks at $1.50 each cost 1.50x, and y pens at $0.50 each cost 0.50y. Together they make $4.50: 1.50x + 0.50y = 4.50.

Standard form: Multiply every term by 2 to clear the decimals: **3x + y = 9**

Slope-intercept: Subtract 3x from both sides: **y = −3x + 9**

Graph: Plot (0, 9). The slope −3 is $\frac{-3}{1}$: down 3, right 1 to (1, 6), (2, 3), and (3, 0). This line heads downhill, so going forward stays on the grid. No reverse needed!



4 *The drama club sold tickets to a small preview show. Student tickets cost $2 and adult tickets cost $3, and the club made $18 in all. Write an equation that shows every combination of tickets the club could have sold.*

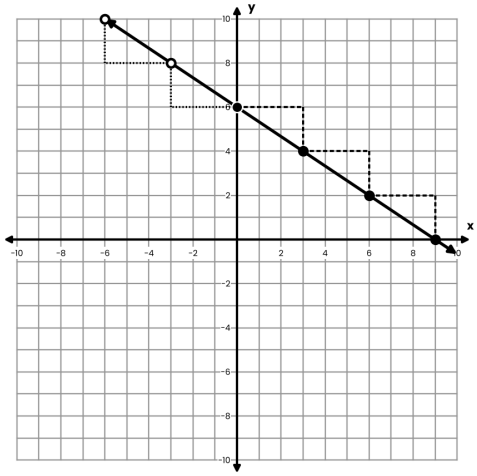
Variables: x = number of student tickets, y = number of adult tickets, since student tickets are mentioned first. (Switched them? You'd get $y = -\frac{3}{2}x + 9$, which is this line flipped over the diagonal y = x. It describes the same ticket sales, so it's still correct.)

Translate: Student tickets bring in 2x dollars and adult tickets bring in 3y dollars, for $18 total: 2x + 3y = 18.

Standard form: It's already in standard form! **2x + 3y = 18**

Slope-intercept: Subtract 2x from both sides: 3y = −2x + 18. Divide every term by 3: **$y = -\frac{2}{3}x + 6$**

Graph: Plot (0, 6). The slope $-\frac{2}{3}$ means down 2, right 3 to (3, 4), (6, 2), and (9, 0). Reverse: up 2, left 3 to (−3, 8) and (−6, 10).



5 *One-fourth of a number x, decreased by 5, is equal to a number y.*

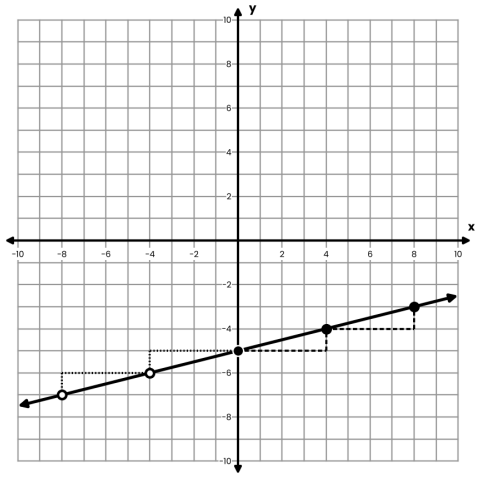
Translate: "One-fourth of x" means multiply: $\frac{1}{4}x$.

"Decreased by 5" subtracts 5: $y = \frac{1}{4}x - 5$.

Slope-intercept: It's already in this form! $\mathbf{y = \frac{1}{4}x - 5}$

Standard form: Multiply every term by 4: $4y = x - 20$. Subtract x from both sides: $-x + 4y = -20$. Multiply by −1: $\mathbf{x - 4y = 20}$

Graph: Plot (0, −5). The slope $\frac{1}{4}$ means up 1, right 4 to (4, −4) and (8, −3). Reverse: down 1, left 4 to (−4, −6) and (−8, −7).



6 *A bean plant is 5 cm tall when you start measuring, and it grows 3 cm every 4 weeks. Write an equation that gives the plant's height after any number of weeks.*

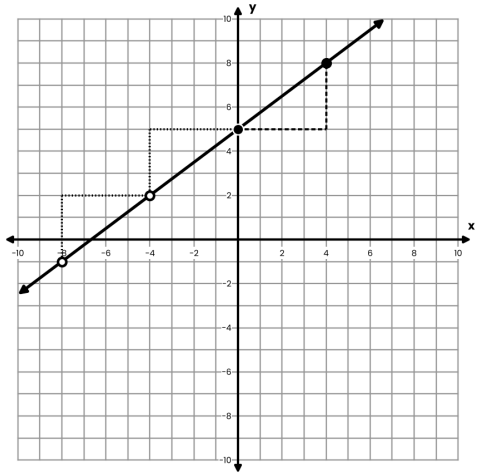
Variables: x = number of weeks, y = the plant's height in cm.

Translate: The starting height of 5 cm is b. Growing 3 cm every 4 weeks is a rate of $\frac{3}{4}$ cm per week: $y = \frac{3}{4}x + 5$.

Slope-intercept: $\mathbf{y = \frac{3}{4}x + 5}$

Standard form: Multiply every term by 4: $4y = 3x + 20$. Subtract 3x: $-3x + 4y = 20$. Multiply by −1: $\mathbf{3x - 4y = -20}$

Graph: Plot (0, 5). Up 3, right 4 lands on (4, 8). The next step, (8, 11), is off the grid, so go in reverse: down 3, left 4 to (−4, 2) and (−8, −1).



7 *A candle is 8 inches tall when it's lit, and it burns down 0.5 inch every hour. Write an equation that gives the candle's height after any number of hours.*

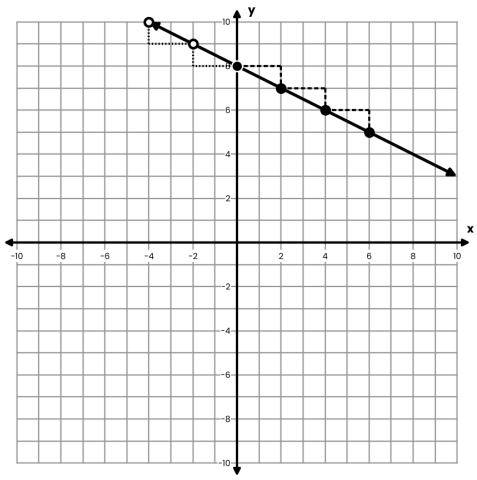
Variables: x = number of hours, y = the candle's height in inches.

Translate: The starting height of 8 inches is b. "Burns down" means the height goes down, so the rate is negative: y = −0.5x + 8.

Slope-intercept: 0.5 is the same as $\frac{1}{2}$, so **$y = -\frac{1}{2}x + 8$**

Standard form: Multiply every term by 2: 2y = −x + 16. Add x to both sides: **x + 2y = 16**

Graph: Plot (0, 8). Down 1, right 2 to (2, 7), (4, 6), and (6, 5). Reverse works too: up 1, left 2 to (−2, 9) and (−4, 10).



8 *A rideshare charges a $3 pickup fee plus $1.50 for every mile. Write an equation that gives the total cost of a ride of any length.*

Variables: x = number of miles, y = total cost in dollars.

Translate: The $3 pickup fee is b, and $1.50 for every mile is the rate: y = 1.50x + 3.

Slope-intercept: 1.50 is the same as $\frac{3}{2}$, so **$y = \frac{3}{2}x + 3$**

Standard form: Multiply every term by 2: 2y = 3x + 6. Subtract 3x: −3x + 2y = 6. Multiply by −1: **3x − 2y = −6**

Graph: Plot (0, 3). Up 3, right 2 to (2, 6) and (4, 9). The next step, (6, 12), is off the grid, so go in reverse: down 3, left 2 to (−2, 0), (−4, −3), and (−6, −6).

