



# Calculus 1 Workbook

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Graphing functions

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MATH

## EQUATION MODELING

1. A car and a truck were driven for a week. The car traveled 75 miles more than the truck. Each vehicle had different fuel mileage. Write an equation using  $t$  (where  $t$  is the number of miles the truck traveled) to calculate the number of gallons  $g$ , used during the week.

	Car	Truck
Mileage	28 mpg	14 mpg
Distance	$c$ miles	$t$ miles

2. A motorcycle and a car were driven for a month. The motorcycle traveled 120 miles more than the car. Each vehicle had different fuel mileage. Write an equation using  $m$  (where  $m$  is the number of miles the motorcycle traveled) to calculate the number of gallons  $g$ , used during the month.

	Motorcycle	Car
Mileage	33 mpg	22 mpg
Distance	$m$ miles	$c$ miles

3. A baseball is thrown at a speed of 21 ft/s straight down from a high platform. The distance it travels can be calculated using  $D = 16t^2 + 21t$ , where  $t$  is the amount of time in seconds that it's been falling. The average



speed of any object can be calculated using  $V = D/t$ . Write an equation giving the time of the fall in terms of  $V$ .

■ 4. A rock is thrown at a speed of 8 ft/s straight down from a high platform. The distance it travels can be calculated using  $D = 16t^2 + 8t$ , where  $t$  is the amount of time in seconds that it's been falling. The average speed of any object can be calculated using  $V = D/t$ . Write an equation giving the time of the fall in terms of  $V$ .

■ 5. Managers at a company are each paid \$45,000 in base salary. The company's owner wants to divide \$162,000 in annual bonus money evenly among the managers. Write an expression, in terms of the number of managers  $m$ , that gives the amount  $a$  each manager earns per month.

■ 6. Managers at a company are each paid \$37,800 in base salary. The company's owner wants to divide \$102,000 in annual bonus money evenly among the managers. Write an expression, in terms of the number of managers  $m$ , that gives the amount  $a$  each manager earns per month.

■ 7. The Jones and Anderson family go on vacation together with each family driving in their own car. The Anderson family travels 50 miles further than the Jones family. Each family averages 65 mph on the trip. Write an



equation using  $D_a$  (where  $D_a$  is the total miles the Anderson family drove) to calculate the total time  $T$  both families spent driving to their destination.

	Jones	Anderson
<b>Distance</b>	$D_j$ miles	$D_a$ miles
<b>Rate</b>	65 mph	65 mph
<b>Time</b>	$T_j$ hours	$T_a$ hours

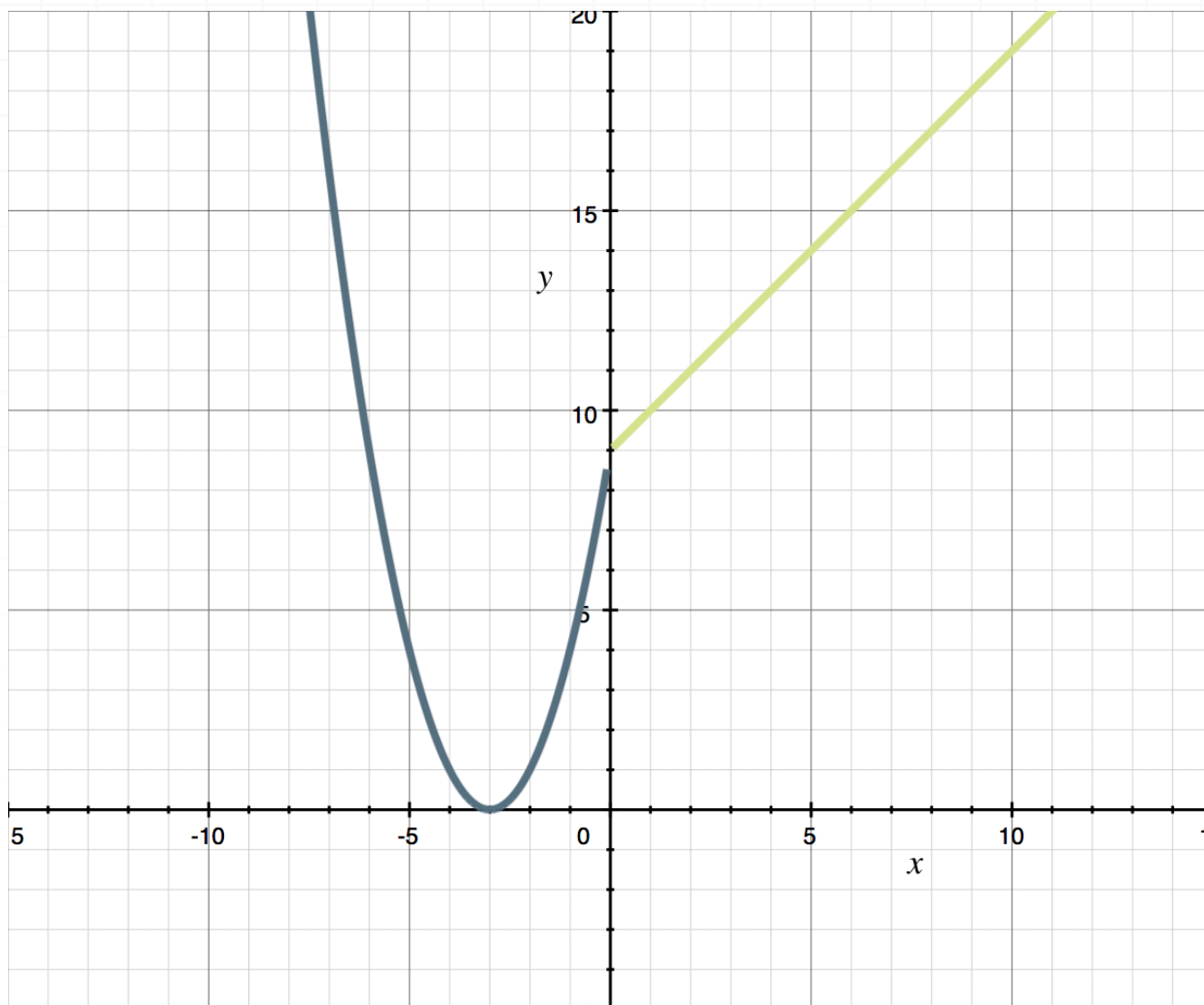
■ 8. The Frank and Harrington family go on vacation together with each family driving in their own car. The Frank family travels 120 miles less than the Harrington family. Each family averages 50 mph on the trip. Write an equation using  $D_f$  (where  $D_f$  is the total miles the Frank family drove) to calculate the total time  $T$  both families spent driving to their destination.

	Frank	Harrington
<b>Distance</b>	$D_f$ miles	$D_h$ miles
<b>Rate</b>	50 mph	50 mph
<b>Time</b>	$T_f$ hours	$T_h$ hours



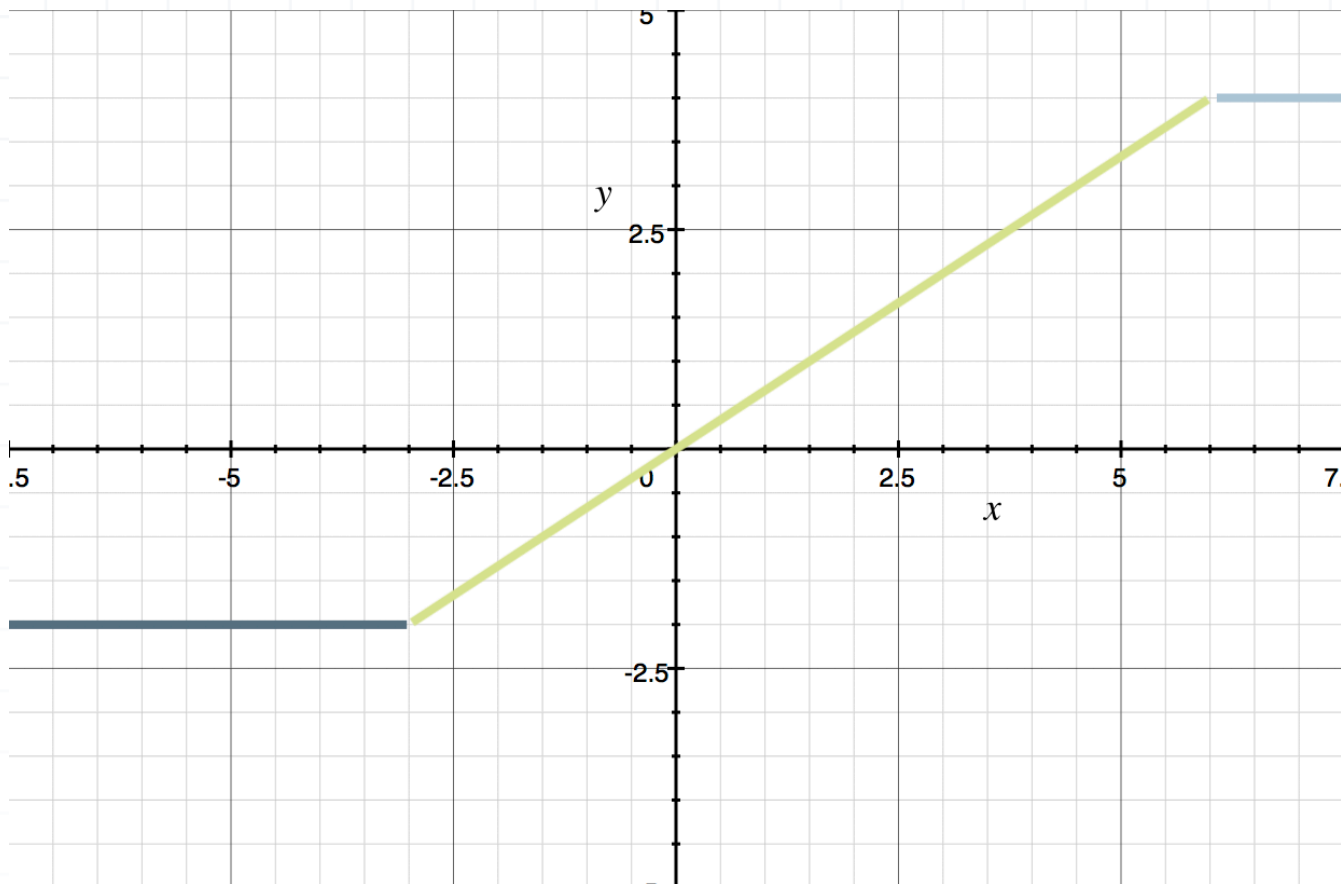
## MODELING A PIECEWISE-DEFINED FUNCTION

- 1. Find the equation of the piecewise function.

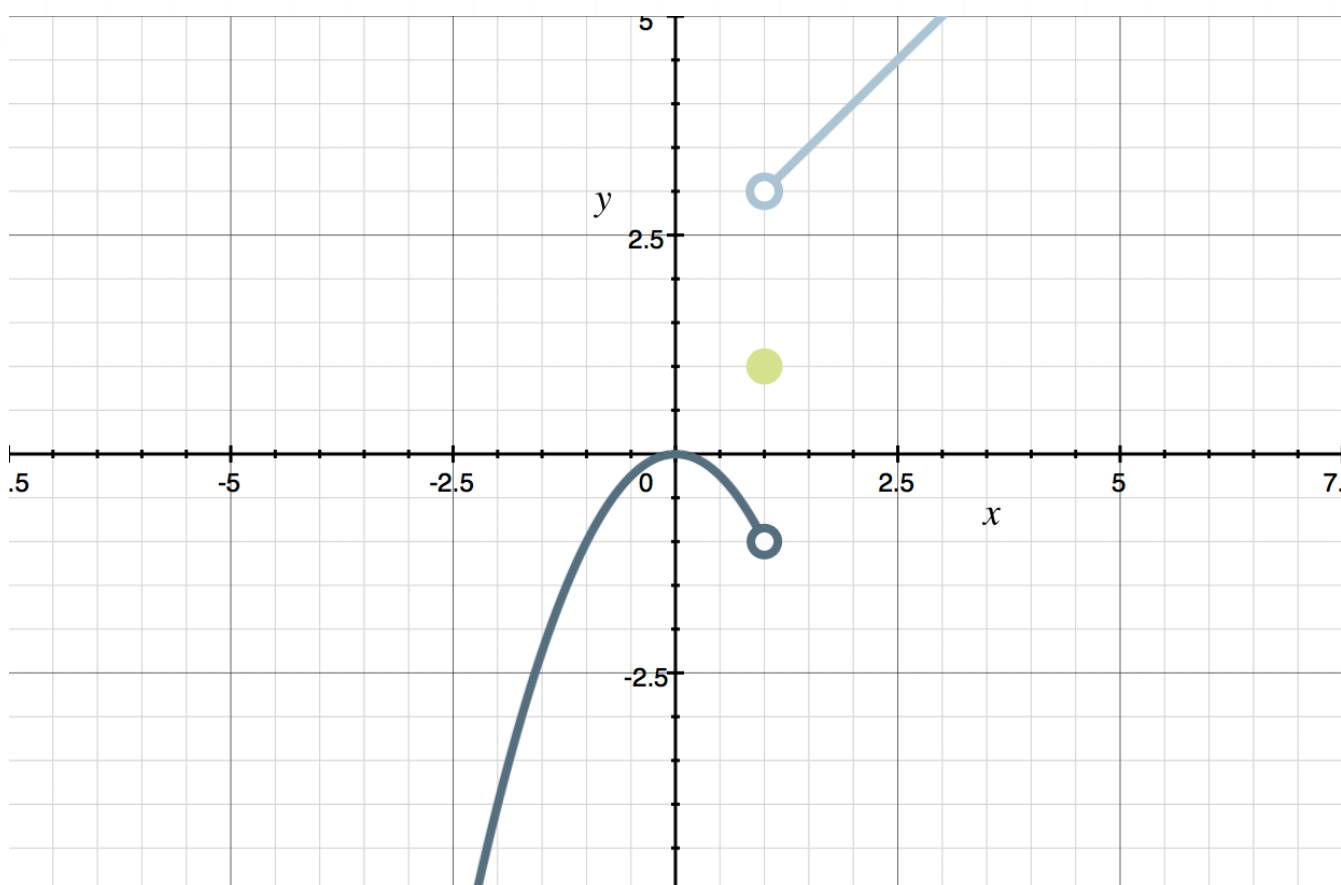


- 2. Find the equation of the piecewise function.

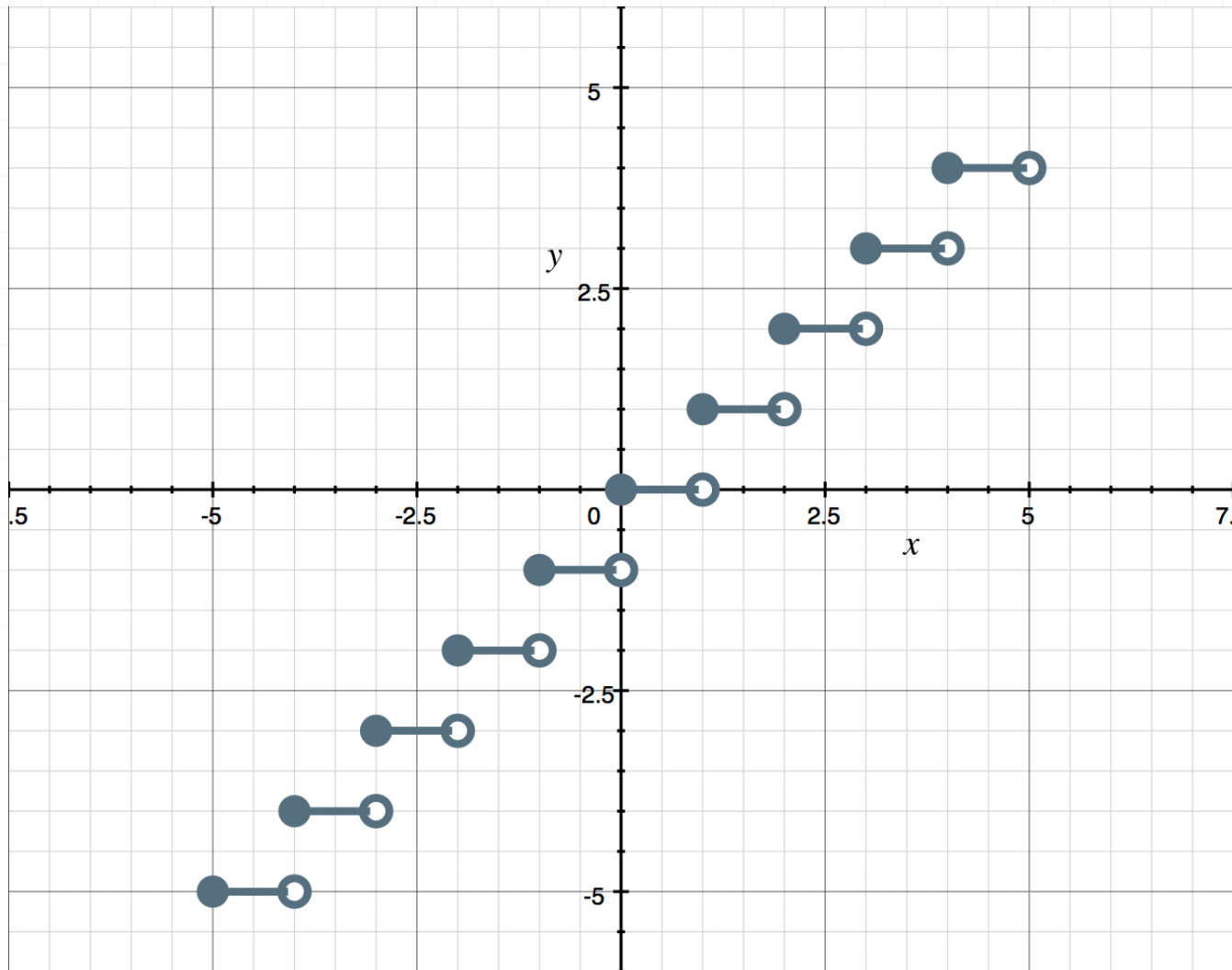




3. Find the equation of the piecewise function.



4. Find the equation of the piecewise function.



5. Graph the piecewise function.

$$f(x) = \begin{cases} x^2 & x < -1 \\ \frac{1}{2}x - 3 & x \geq -1 \end{cases}$$

6. Graph the piecewise function.

$$f(x) = \begin{cases} x^2 - 2 & x < 0 \\ 4 & x = 0 \\ -x^2 + 8 & x > 0 \end{cases}$$



■ 7. Graph the piecewise function.

$$f(x) = \begin{cases} -x + 1 & x < -4 \\ 5 & -4 < x \leq 3 \\ -2x + 11 & x > 3 \end{cases}$$

■ 8. Graph the piecewise function.

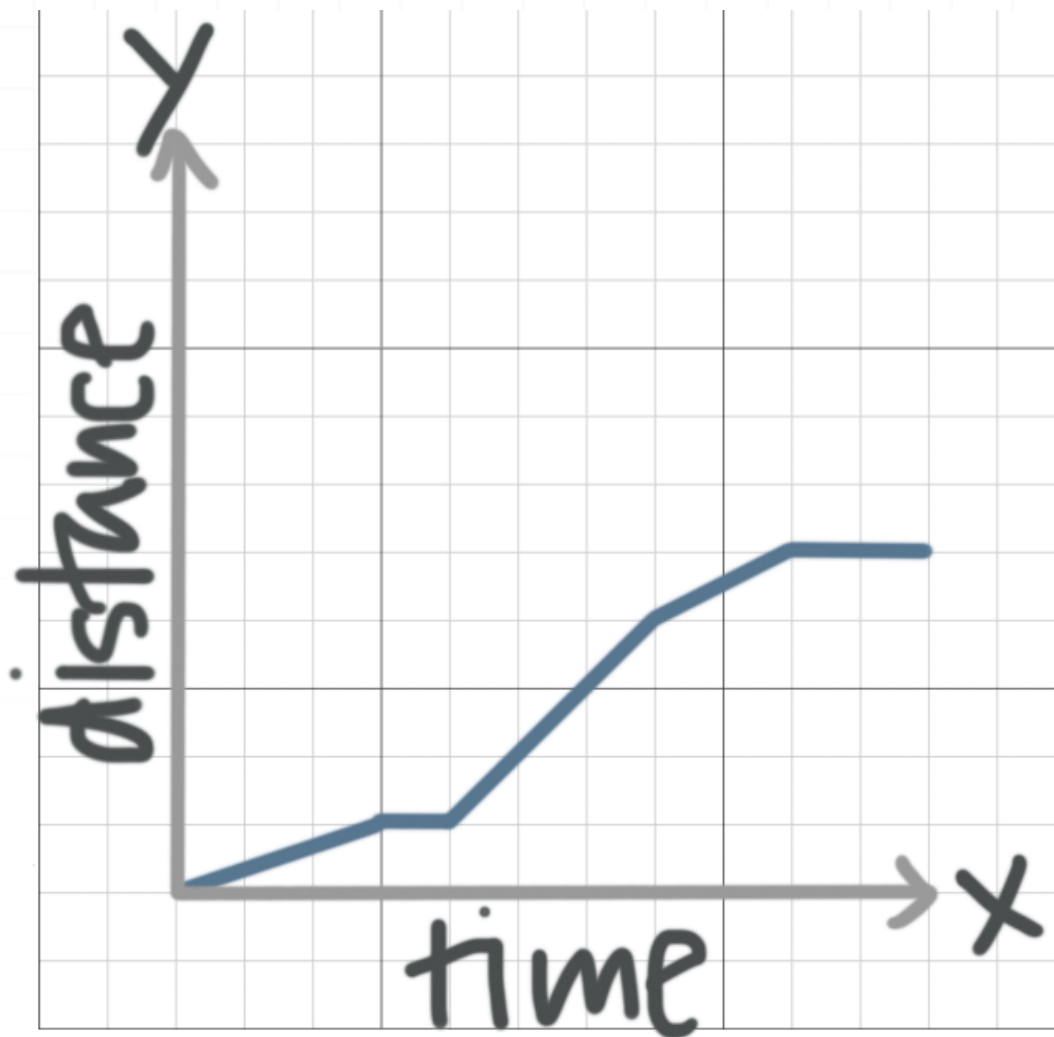
$$f(x) = [x]$$





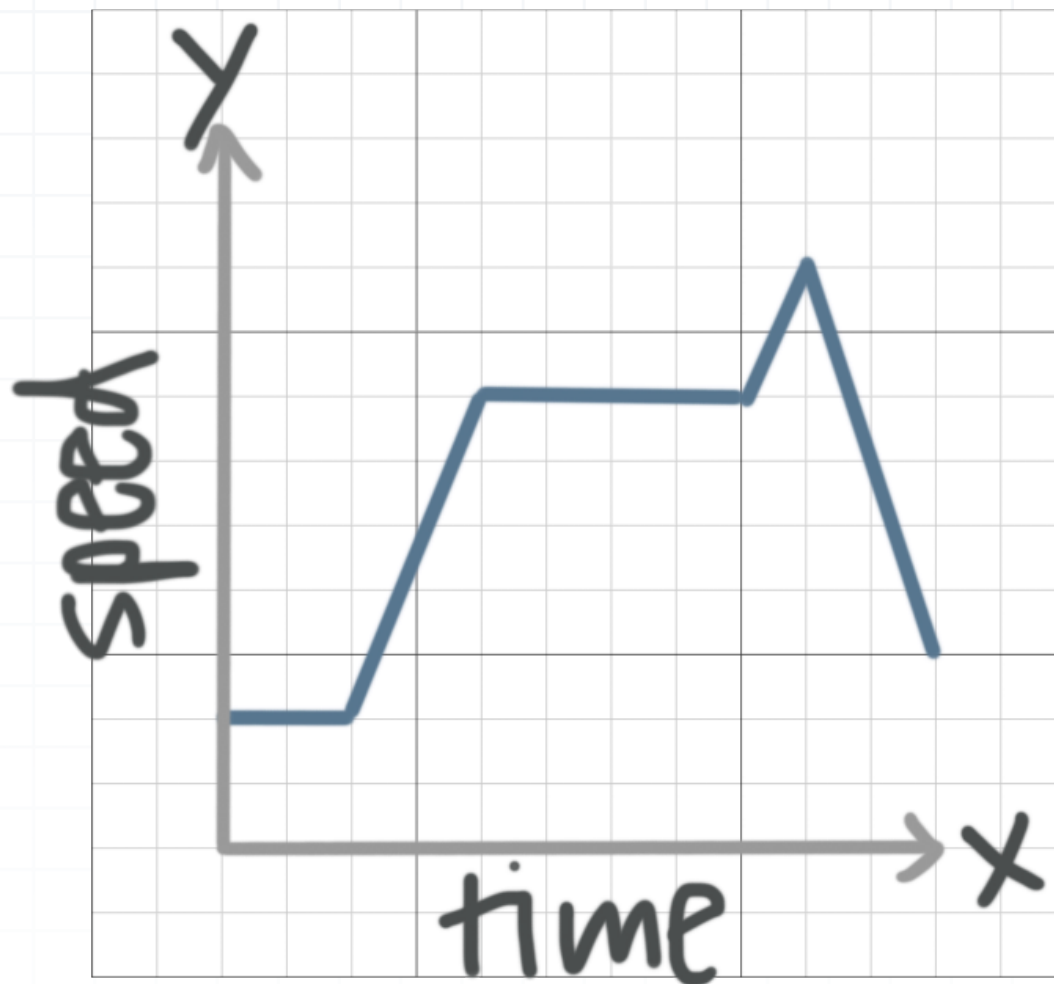
## SKETCHING GRAPHS FROM STORY PROBLEMS

- 1. Alex left in his car to visit his grandparents' house. The graph shows his distance from his house over time. Write a possible story to go along with the graph.



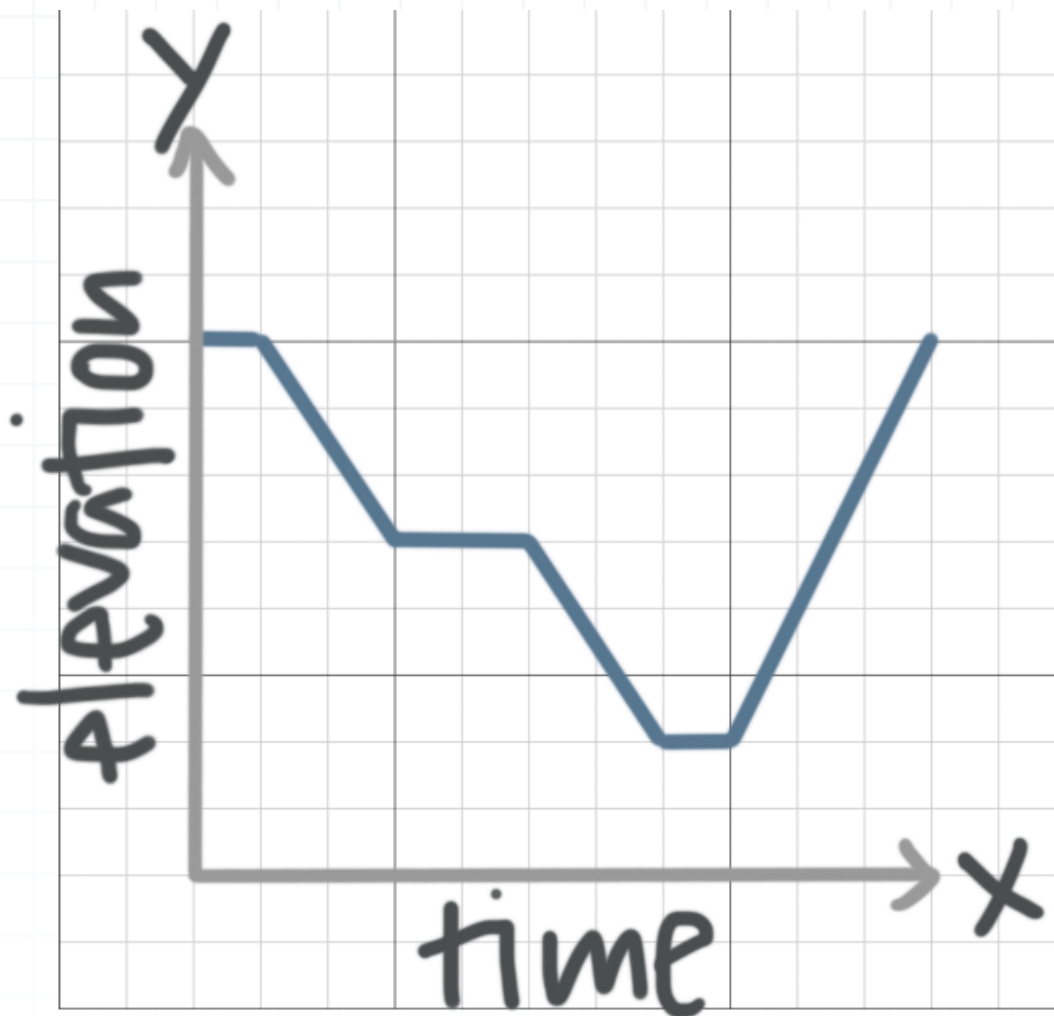
- 2. A horse is practicing for a race. The graph shows the horse's speed over time. Write a possible story to go with the graph.





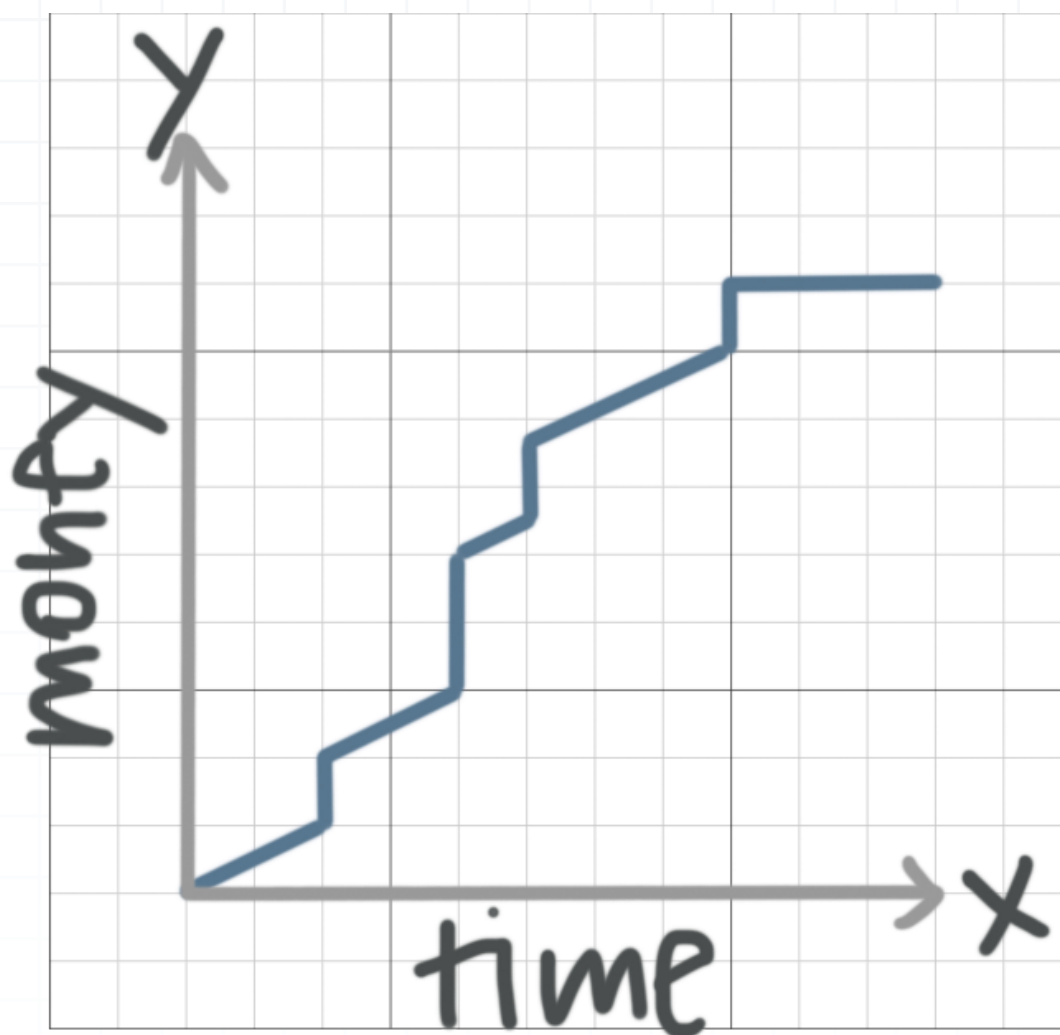
- 3. A scuba diver takes a dive to explore the ocean. The graph below shows the diver's elevation over time. Write a possible story to go with the graph.





- 4. Janet delivers packages and get paid an hourly rate in addition to \$1 for every package she delivers. The graph shows Janet's pay over the course of the day. Write a possible story to go with the graph.





■ 5. A plane takes off and then cruises at 30,000 feet for several hours before rising in elevation to 35,000 feet to avoid turbulence for the last few hours. The plane then reaches its destination and lands. Sketch a graph representing the situation.

■ 6. The temperature throughout a summer day starts at  $65^{\circ}\text{F}$  at 6:00 a.m.. Over the next few hours the temperature rises steadily until it reaches  $85^{\circ}\text{F}$  at 1:00 p.m.. At 1:15 p.m., a rainstorm begins and cools the temperature down to  $75^{\circ}\text{F}$ . The temperature then steadily decreases until it reaches  $70^{\circ}\text{F}$  at 9:00 p.m.. Sketch a graph representing the situation.

■ 7. Brett goes for a hike up a mountain. He starts hiking up steadily for several hours with two stops for water. Then Brett stops for an hour to eat lunch and rest. He then continues up the mountain, summits, and spends a little time at the top of the mountain before climbing down. Sketch a graph representing Brett's elevation over time.

■ 8. Heather went for a bike ride. She started at 12 mph to warm up, but quickly increased her speed to 20 mph and maintained that speed for most of the ride. Near the end of her bike ride, Heather decreased her speed to 15 mph until she reached her destination. Sketch a graph representing Heather's speed over time.



## EQUATION OF A LINE IN POINT-SLOPE FORM

- 1. Find the equation of the line that passes through  $(3,0)$  with slope  $-2$ .
- 2. Name two (of four possible) pieces of information about a line that are required to write an equation of the line in point-slope form.
- 3. Find the equation of the line that passes through the points  $(-2,3)$  and  $(2, -4)$ .
- 4. Find the equation of the line that passes through  $(-2, -5)$  with a slope  $6$ .
- 5. Identify the point  $(x_1, y_1)$  and slope  $m$  in the equation of the line.

$$y + 3 = \frac{1}{4} (x - 6)$$

- 6. Write the following equation in point-slope form.

$$y = -\frac{1}{2} x + 4$$



■ 7. Find the equation of the line that passes through the points  $(5, -4)$  and  $(6,0)$ .



## EQUATION OF A LINE IN SLOPE-INTERCEPT FORM

■ 1. Find the equation of a line through the point  $(0,5)$  with slope  $-2$ . Write the solution in slope-intercept form.

■ 2. Identify the  $y$ -intercept and slope  $m$  defining the line.

$$y = -\frac{1}{4}(x + 12)$$

■ 3. Convert the following point-slope equation into a slope-intercept equation.

$$y - 3 = \frac{1}{3}(x - 6)$$

■ 4. Find the equation of a line that passes through the points  $(1, -1)$  and  $(0,3)$ . Write the solution in slope-intercept form.

■ 5. Determine the  $y$ -intercept of a line with slope  $-3$  that passes through the point  $(1,1)$ . Write your solution as a coordinate point.





- 6. Name two (of four possible) pieces of information about a line that are required to write an equation of the line in point-slope form.
- 7. Find the equation of a line that passes through the points  $(-3, -2)$  and  $(2, -4)$ . Write the solution in slope-intercept form.



## GRAPHING PARABOLAS

- 1. Write the equation in vertex form.

$$y = x^2 + 8x + 5$$

- 2. Write the equation in vertex form.

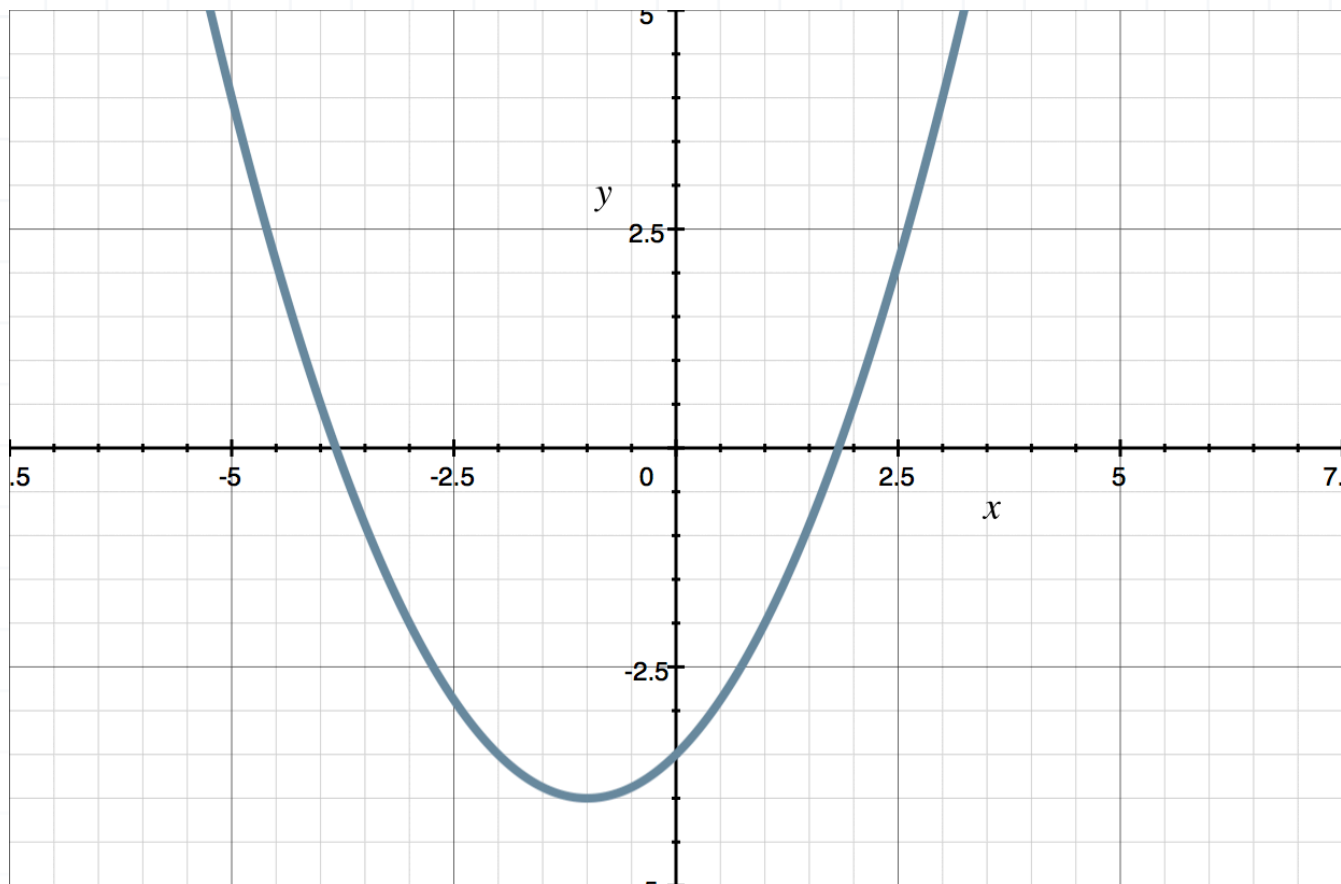
$$y = -2x^2 + 24x - 68$$

- 3. Find the vertex and axis of symmetry of  $y = x^2 + 5x + 6$ .

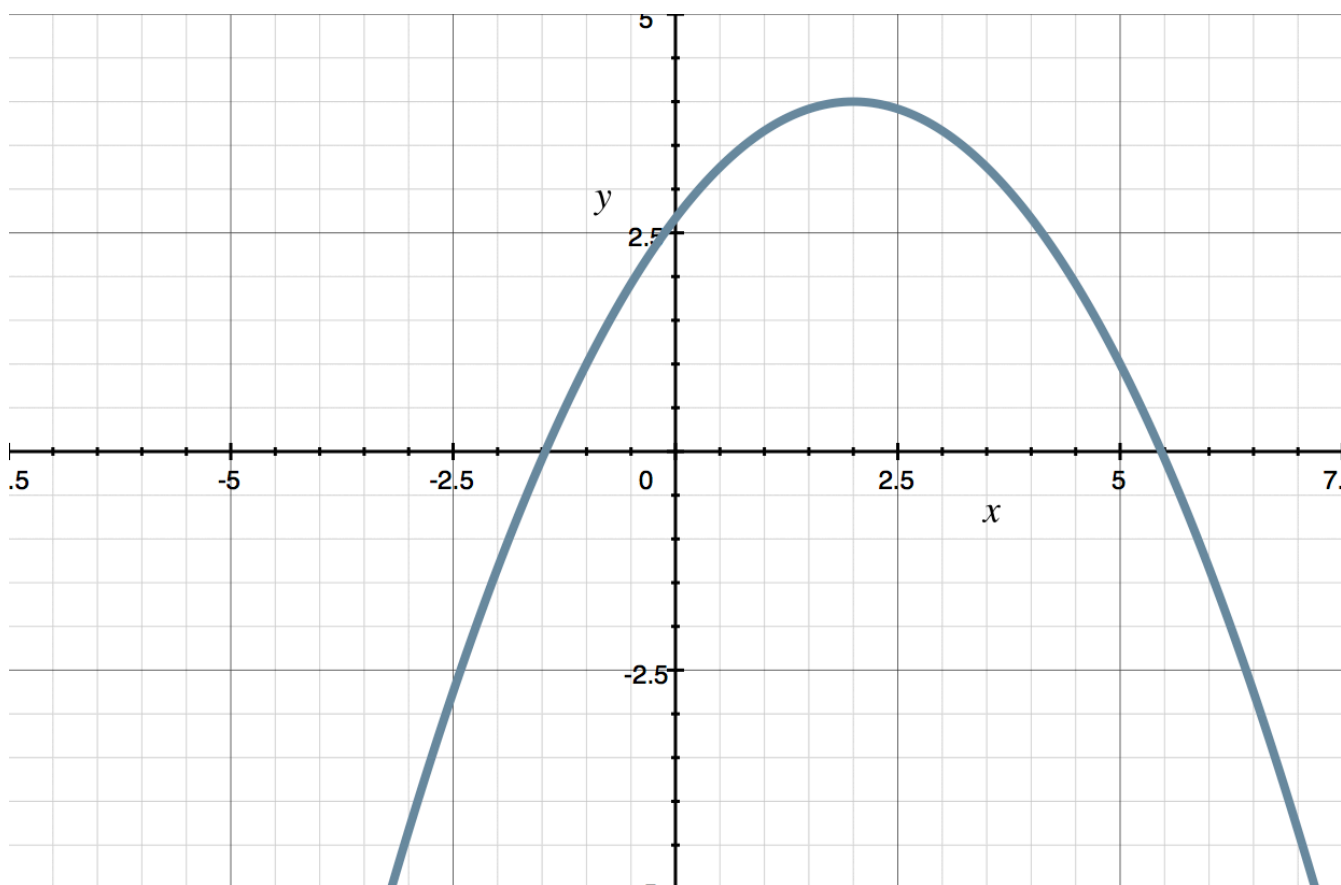
- 4. Find the vertex and axis of symmetry of  $y = 3(x + 2)^2 + 6$ .

- 5. Identify the vertex and axis of symmetry from the graph of the parabola.

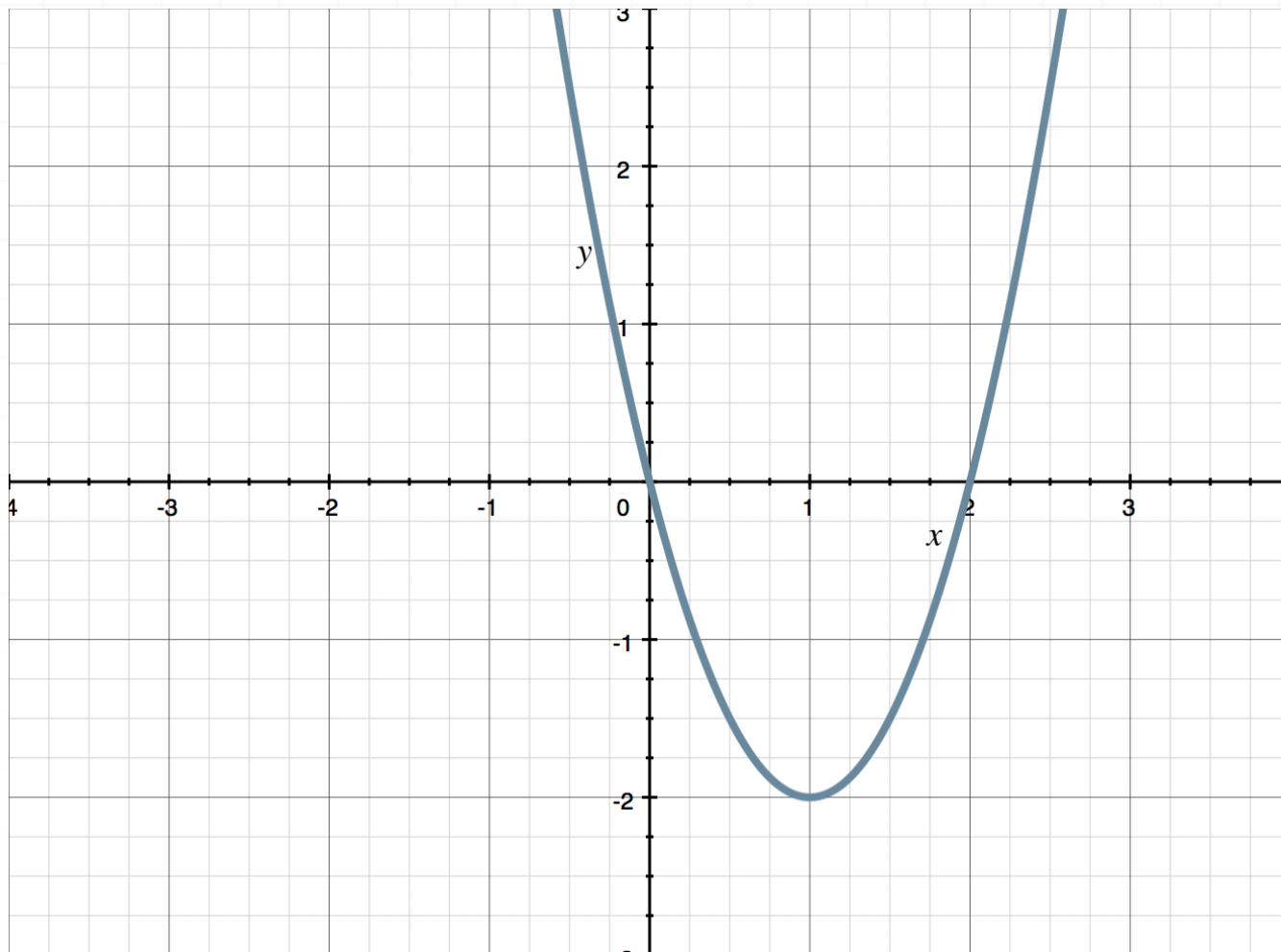




6. Using the graph below, find the equation of the parabola in standard form.



- 7. Using the graph, find the equation of the parabola in standard form.



- 8. Complete the square to graph the parabola  $y = x^2 + 6x + 5$ .

- 9. Complete the square to graph  $y = -x^2 - 4x - 6$ .



## FINDING CENTER AND RADIUS OF A CIRCLE

- 1. Find the center and radius of the circle.

$$x^2 + y^2 - 2x - 3 = 0$$

- 2. Find the center and radius of the circle.

$$x^2 + y^2 + 14x + 22y + 145 = 0$$

- 3. Find the center and radius of the circle.

$$16x^2 + 16y^2 - 8x - 24y - 150 = 0$$

- 4. Find the center and radius of the circle.

$$4x^2 + 4y^2 + 32x - 4y + 41 = 0$$

- 5. Find the center and radius of the circle.

$$9x^2 + 9y^2 - 30x - 6y - 118 = 0$$

- 6. Find the center and radius of the circle.



$$x^2 + y^2 + 4x - 2y = 0$$

- 7. Find the center and radius of the circle.

$$x^2 + y^2 - 12x + 10y - 3 = 0$$

- 8. Find the center and radius of the circle.

$$x^2 + y^2 - \frac{1}{4} = 0$$

- 9. Find the center and radius of the circle.

$$16x^2 + 16y^2 + 96x - 160y + 543 = 0$$

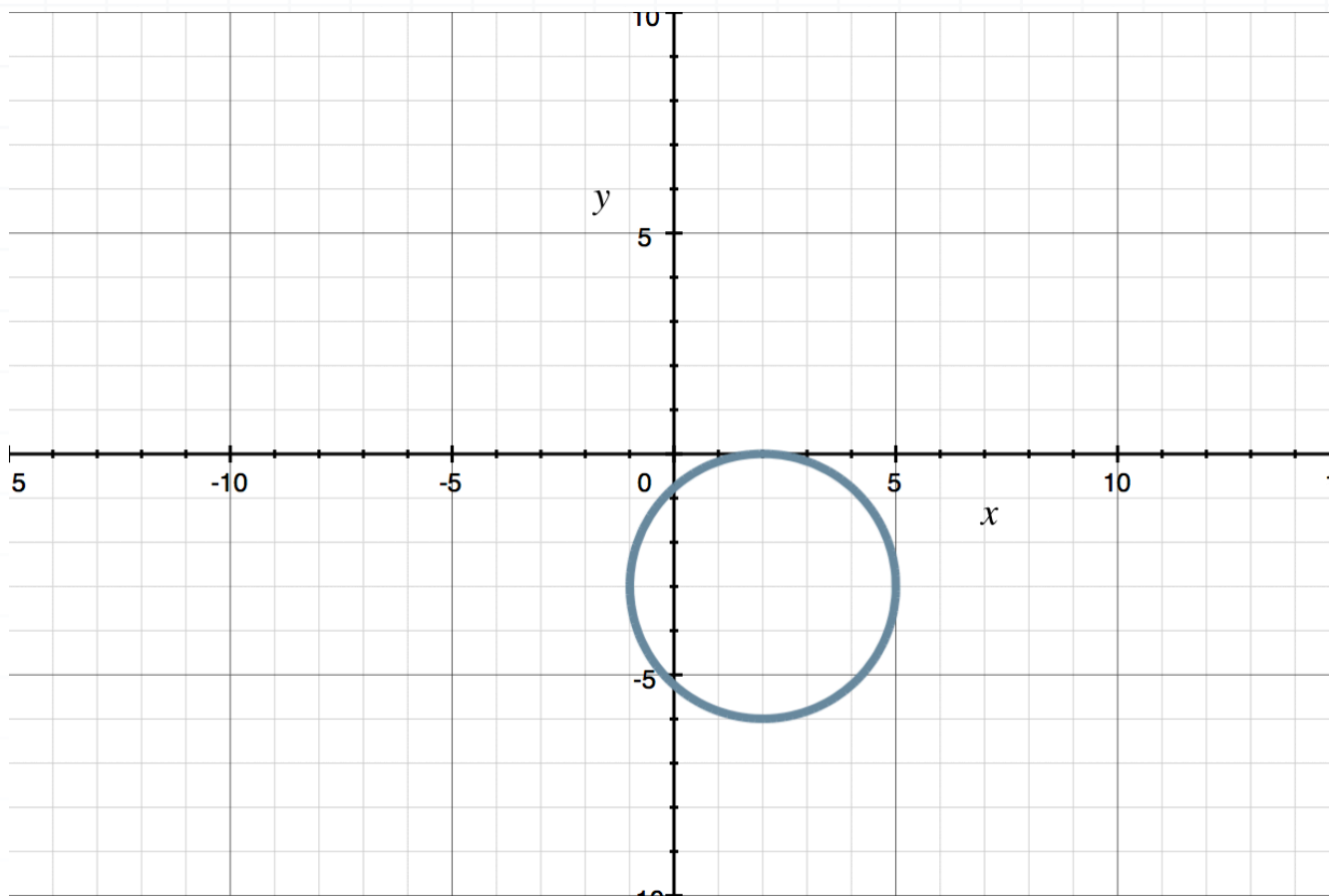
- 10. Find the center and radius of the circle.

$$9x^2 + 9y^2 - 72x + 12y - 77 = 0$$



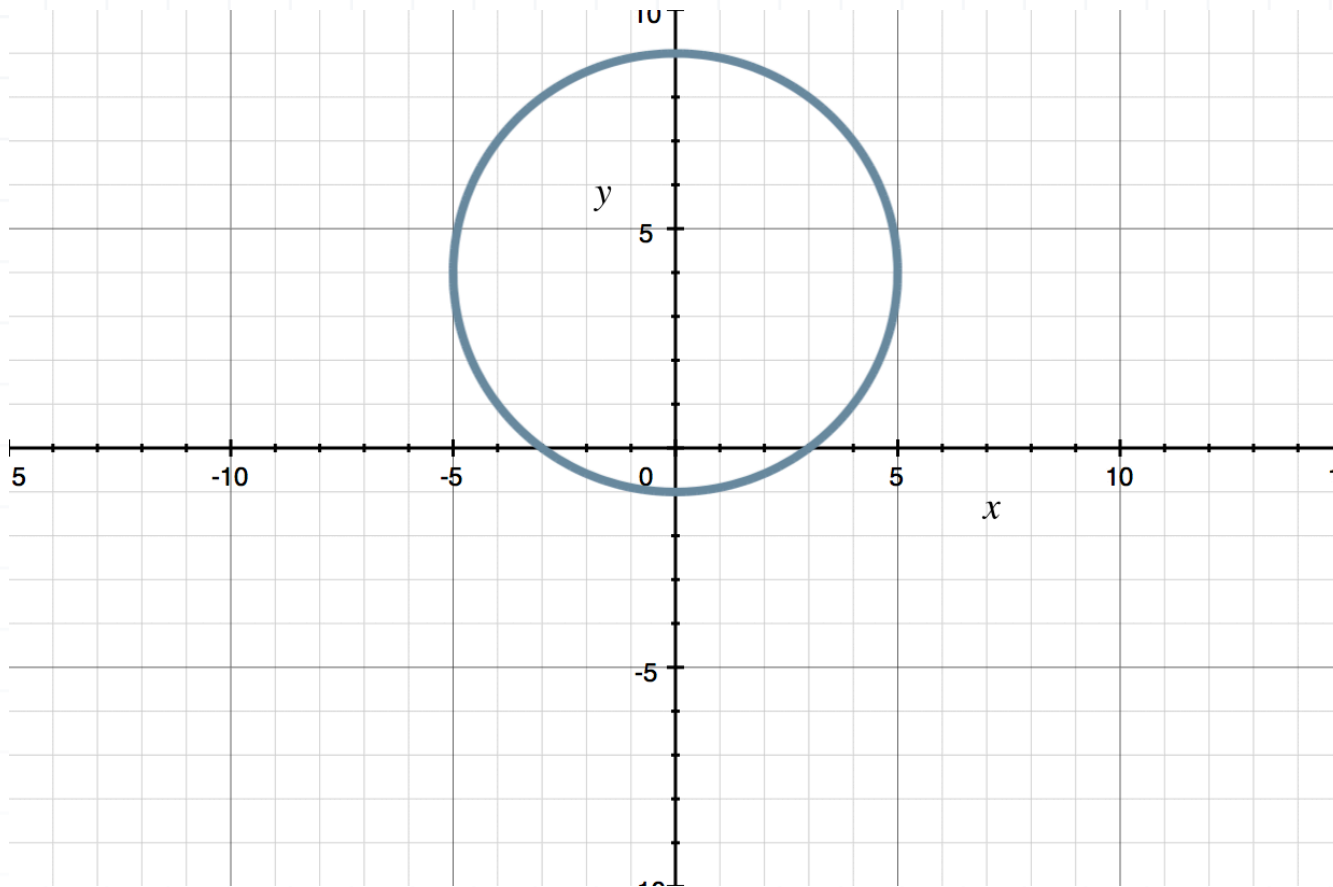
## GRAPHING CIRCLES

- 1. Find the equation of the circle.



- 2. Find the equation of the circle.





■ 3. Graph the circle  $(x - 1)^2 + (y - 2)^2 = 4$ .

■ 4. Graph the circle  $(x + 3)^2 + (y - 4)^2 = 25$ .

■ 5. Graph the circle  $x^2 + (y - 3)^2 = 16$ .

■ 6. Graph the circle  $x^2 + y^2 + 2x + 2y - 14 = 0$ .

■ 7. Graph the circle  $x^2 + y^2 - 8x - 4y + 11 = 0$ .





■ 8. Graph the circle  $x^2 + y^2 + 6x - 8y - 11 = 0$ .



