## Guided Practice 6.2.2

**Example 1**

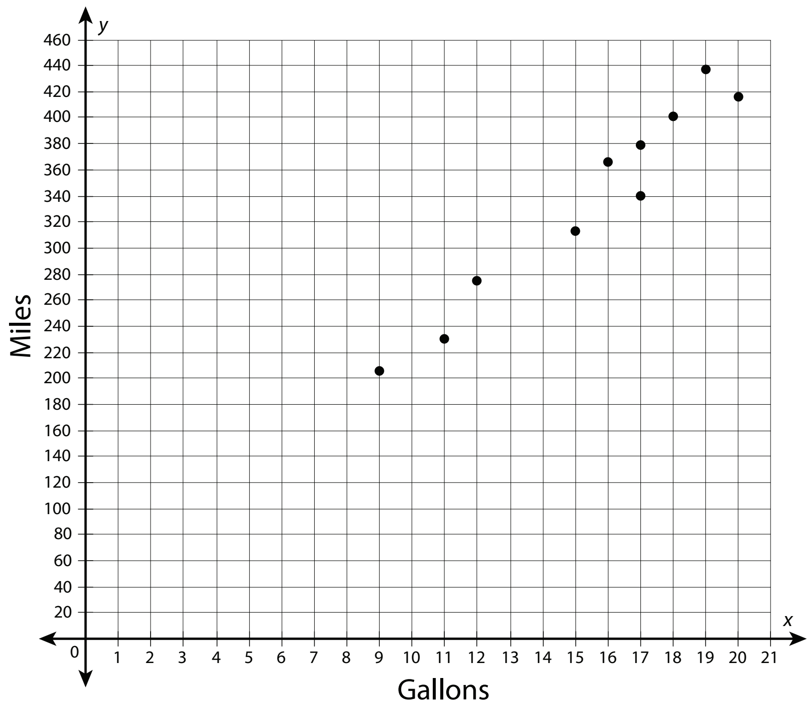
Andrew wants to estimate his gas mileage, or miles traveled per gallon of gas used. He records the number of gallons of gas he purchased and the total miles he traveled with that gas.

| Gallons | Miles |
|---|---|
| 15 | 313 |
| 17 | 340 |
| 18 | 401 |
| 9 | 205 |
| 12 | 275 |
| 17 | 379 |
| 11 | 230 |
| 19 | 437 |
| 16 | 366 |
| 20 | 416 |

Create a scatter plot showing the relationship between gallons of gas and miles driven. Which is a better estimate for the function that relates gallons to miles: $y = 10x$ or $y = 22x$? How is the equation related to his gas mileage?

1. Plot each point on the coordinate plane.

   Let the *x*-axis represent the number of gallons and the *y*-axis represent the number of miles.



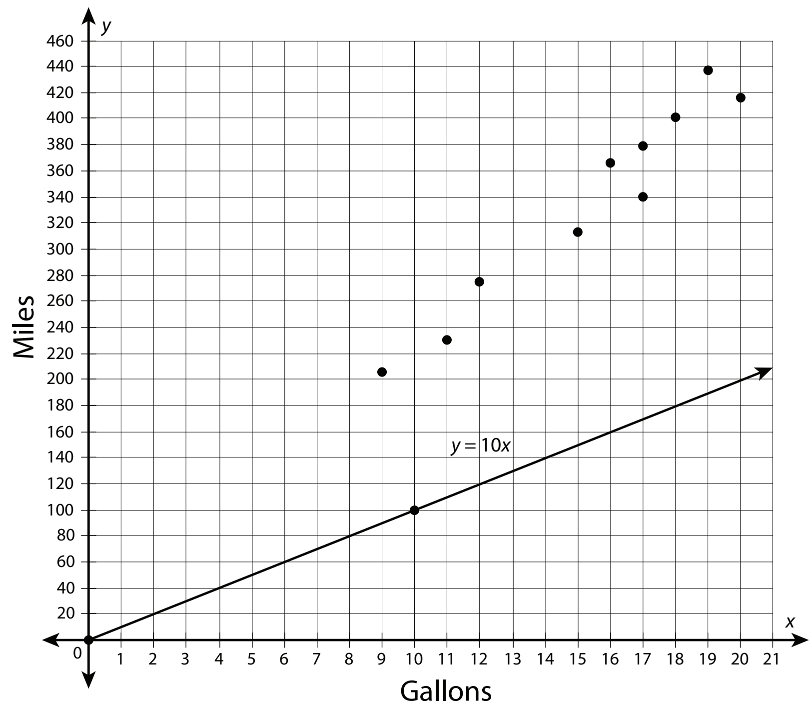
2. Graph the first function on the coordinate plane.

The function $y = 10x$ is linear, so only two points are needed to draw the line.

Evaluate the equation at two values of $x$, such as 0 and 10, and draw a line through these points on the scatter plot.

| | |
|---|---|
| $y = 10x$ | First equation |
| $y = 10(0) = 0$ | Substitute 0 for $x$. |
| $y = 10(10) = 100$ | Substitute 10 for $x$. |

Two points on the line are (0, 0) and (10, 100).



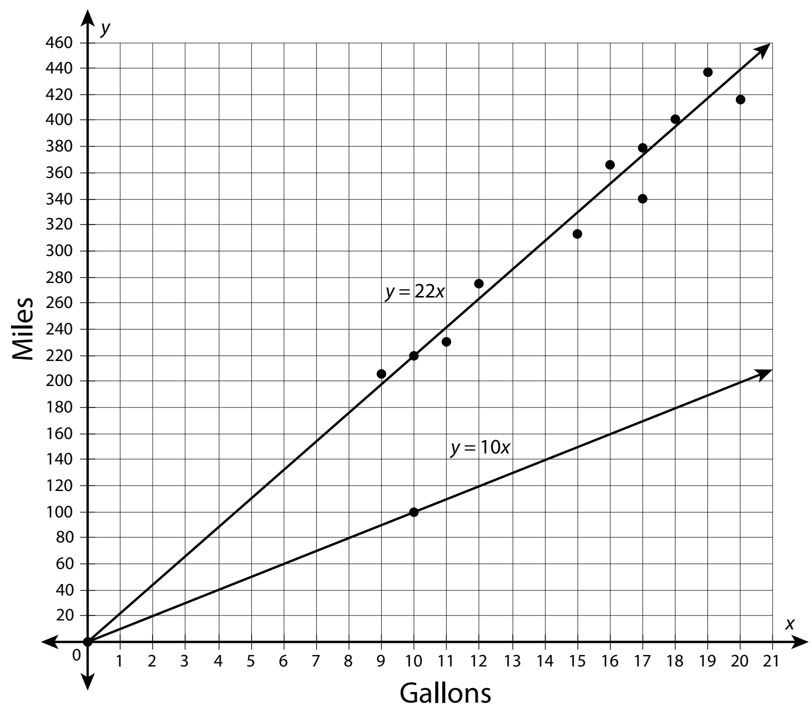
3. Graph the second function on the same coordinate plane.

   The function $y = 22x$ is also linear, so only two points are needed to draw the line.

   Evaluate the equation at two values of $x$, such as 0 and 10, and draw a line through these points on the scatter plot.

| | |
|---|---|
| $y = 22x$ | Second equation |
| $y = 22(0) = 0$ | Substitute 0 for $x$. |
| $y = 22(10) = 220$ | Substitute 10 for $x$. |

   Two points on the line are (0, 0) and (10, 220).



4. Identify which function comes closer to the data values.

   The function whose line comes closer to the data values is the better estimate for the data.

   The graph of the function $y = 22x$ goes through the points in the scatter plot, with some points falling above this line and some points falling below it. The function $y = 10x$ is not steep enough to match the data values. Therefore, the function $y = 22x$ is a better estimate of the data.

5. Interpret the equation of the function in the context of the problem, using the units of the $x$- and $y$-axes.

   For a linear equation in the form $y = mx + b$, the slope ($m$) of the equation is the rate of change, or the change in $y$ over the change in $x$. The $y$-intercept ($b$) of the equation is the initial value.

   In this example, $y$ is miles and $x$ is gallons. The slope is $\frac{\text{change in miles}}{\text{change in gallons}}$.

   For the equation $y = 22x$, the slope of 22 is equal to $\frac{22 \text{ miles}}{1 \text{ gallon}}$.

   The gas mileage of Andrew's car is the miles driven per gallon of gas used. The gas mileage is equal to the slope of the line that fits the data.

   Andrew's car has a gas mileage of approximately 22 miles per gallon.

**Example 2**

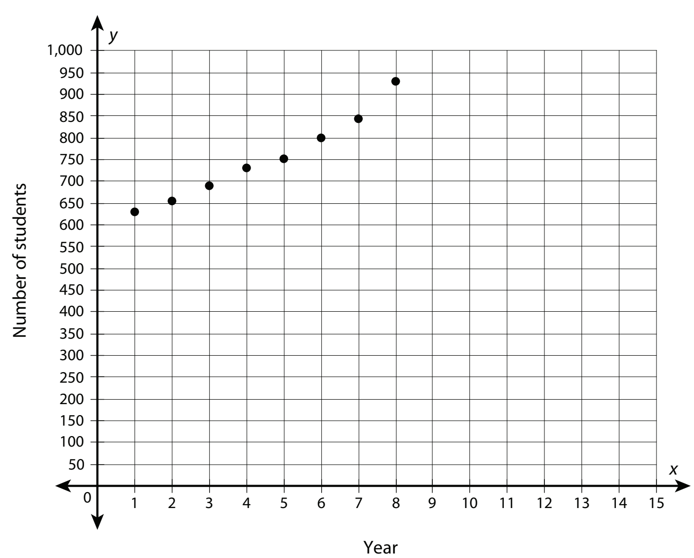
The principal at Park High School records the total number of students each year. The following table shows the number of students for each of the last 8 years.

| Year | Number of students |
|---|---|
| 1 | 630 |
| 2 | 655 |
| 3 | 690 |
| 4 | 731 |
| 5 | 752 |
| 6 | 800 |
| 7 | 844 |
| 8 | 930 |

Create a scatter plot showing the relationship between the year and the total number of students. Show that the function $y = 600(1.05)^x$ is a good estimate for the relationship between the year and the population. Approximately how many students will attend the high school in year 9?

1. Plot each point on the coordinate plane.

   Let the $x$-axis represent the year number and the $y$-axis represent the number of students.



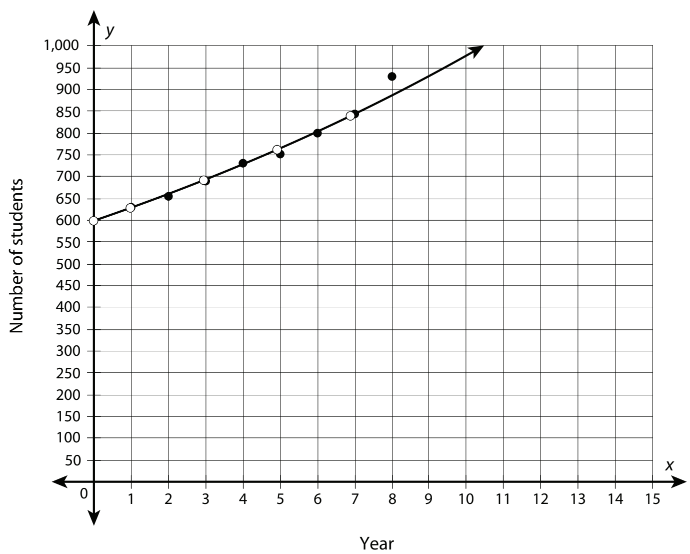
Instruction

2. Graph the given function on the coordinate plane.

   The function is $y = 600(1.05)^x$. Calculate the value of $y$ for at least five different values of $x$. Start with $x = 0$. Calculate the value of the function for at least four more $x$-values that are in the data table.

| $x$ | $y$ |
|---|---|
| 0 | $600(1.05)^0 = 600$ |
| 1 | $600(1.05)^1 = 630$ |
| 3 | $600(1.05)^3 = 694.575$ |
| 5 | $600(1.05)^5 = 765.769$ |
| 7 | $600(1.05)^7 = 855.260$ |

   Plot these points on the same coordinate plane. Connect the points with a curve. *Note*: The new points are plotted in white.



3. Compare the graph of the function to the scatter plot of the data.

   The graph of the function appears to be very close to the points in the scatter plot. Therefore, $y = 600(1.05)^x$ is a good estimate of the data.

4. Use the equation to answer the question.

   Use the equation to estimate the population in year 9.

   Evaluate the equation $y = 600(1.05)^x$ for year 9, when $x = 9$.

   $y = 600(1.05)^9 = 930.797$

   The equation $y = 600(1.05)^x$ is a good estimate of the population. There will be approximately 931 students in the school in year 9.

**Example 3**

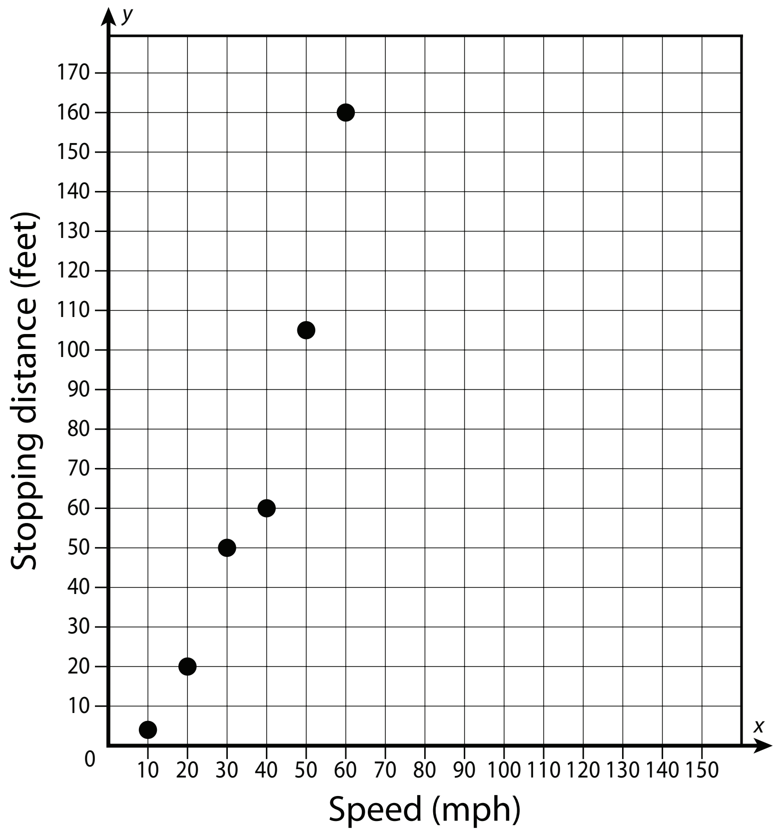
Thomas wants to know how long it will take his truck to stop based on how fast it is moving. The following table shows the distance the truck traveled after the brakes were applied while traveling at different speeds.

| Speed (mph) | Stopping distance (ft) |
|---|---|
| 10 | 4 |
| 20 | 20 |
| 30 | 50 |
| 40 | 60 |
| 50 | 105 |
| 60 | 160 |

Create a scatter plot showing the relationship between the speed of the truck and the distance it takes to stop once the brakes are applied. Show that the function $y = 0.045x^2$ is a good estimate for the relationship between the speed and the stopping distance. About how far would it take the truck to stop if it were traveling at 70 mph?

1. Plot each point on the coordinate plane.

   Let the *x*-axis represent the speed of the truck, and let the *y*-axis represent the stopping distance.

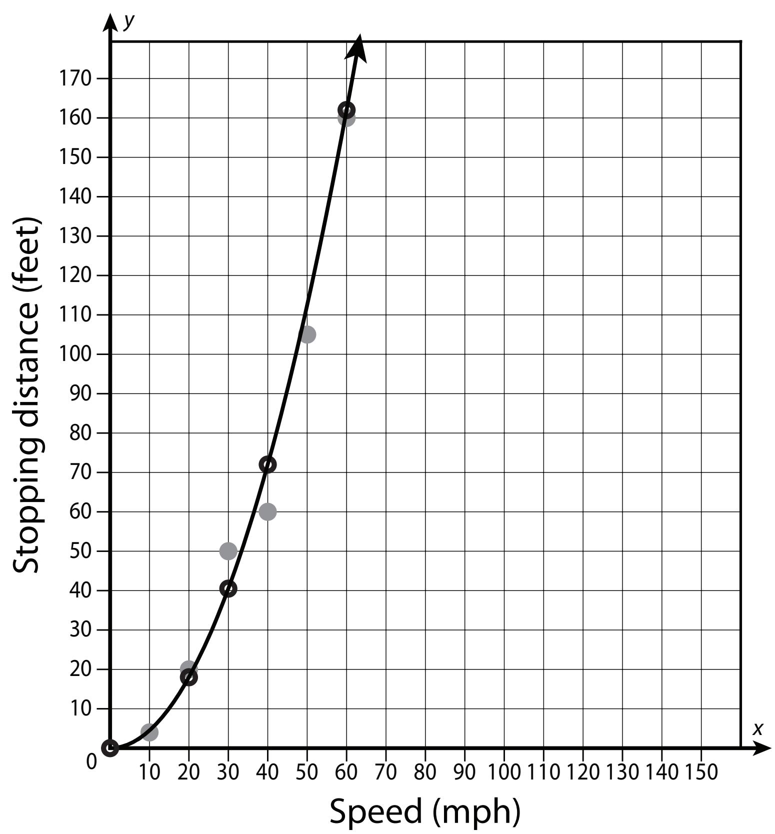


2. Graph the given function on the coordinate plane.

   The function is $y = 0.045x^2$. Calculate the value of $y$ for at least five different values of $x$. Start with $x = 0$, then calculate the value of the function for at least four more $x$-values in the data table.

| $x$ | $y$ |
|---|---|
| 0 | $0.045(0)^2 = 0$ |
| 20 | $0.045(20)^2 = 18$ |
| 30 | $0.045(30)^2 = 40.5$ |
| 40 | $0.045(40)^2 = 72$ |
| 60 | $0.045(60)^2 = 162$ |

   Plot these points on the same coordinate plane, then connect the points with a curve. *Note:* The new points are plotted as hollow dots.



3. Compare the graph of the function to the scatter plot of the data.

   The graph of the function appears to be very close to the points in the scatter plot. Therefore, $y = 0.045x^2$ is a good estimate of the data.

4. Use the equation to answer the question.

   Use the equation to estimate the stopping distance when the truck is travelling 70 mph.

   Evaluate the equation $y = 0.045x^2$ for the speed of 70 mph, when $x = 70$.

   $y = 0.045(70)^2 = 220.5$

   The equation $y = 0.045x^2$ is a good estimate of the stopping distance of the truck. The stopping distance is approximately 220.5 feet when the truck is traveling 70 mph.