# Chapter 2 Linear Equations and Functions

## Ex 2.6

### Answer 1e.

A set of data points plotted on a rectangular coordinate plane is called a scatter plot. If the correlation coefficient for such a set lies close to $\pm 1$, then the data can be modeled using a line. Such a line that is as close as possible to all the data points is called a best-fitting line.

The given statement can thus be completed as "A line that lies as close as possible to a set of data points $(x, y)$ is called the **best-fitting line** for the data points.

### Answer 1gp.

We know that if the correlation coefficient $r$ lies near 1, then the points are close to the line with positive slop. If $r$ lies near $-1$, then the points are close to the line with negative slope. If $r$ lies near 0, then the points do not lie close to any line.

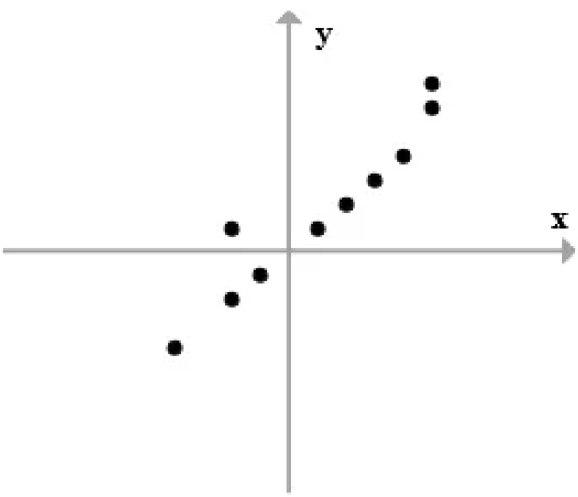
In the given data, we can see that the scatter plot shows approximately no correlation. This means that the points are not close to any line.

Thus, the value of the correlation coefficient $r$ will be close to 0.

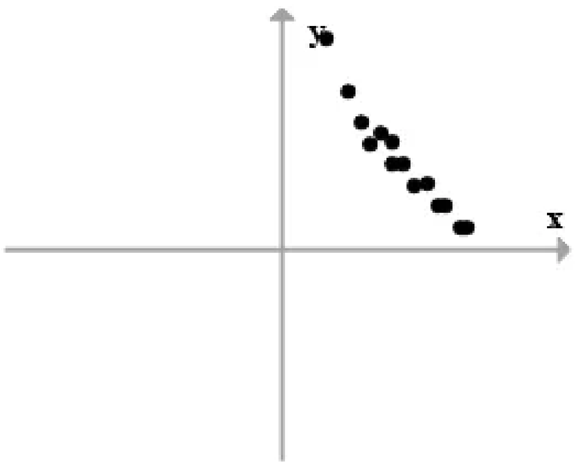
### Answer 2e.

We have to describe how a set of data points shows a positive correlation, a negative correlation, or approximately no correlation.

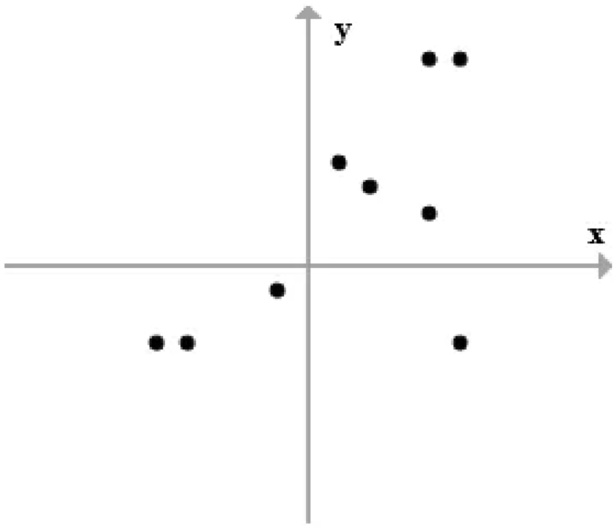
A scatter plot is a graph of a set of data pairs $(x, y)$.
Case 1:
The data have a positive correlation if $y$ tends to increase as $x$ increases.



Case 2:
The data have a negative correlation if $y$ tends to decrease as $x$ increases.

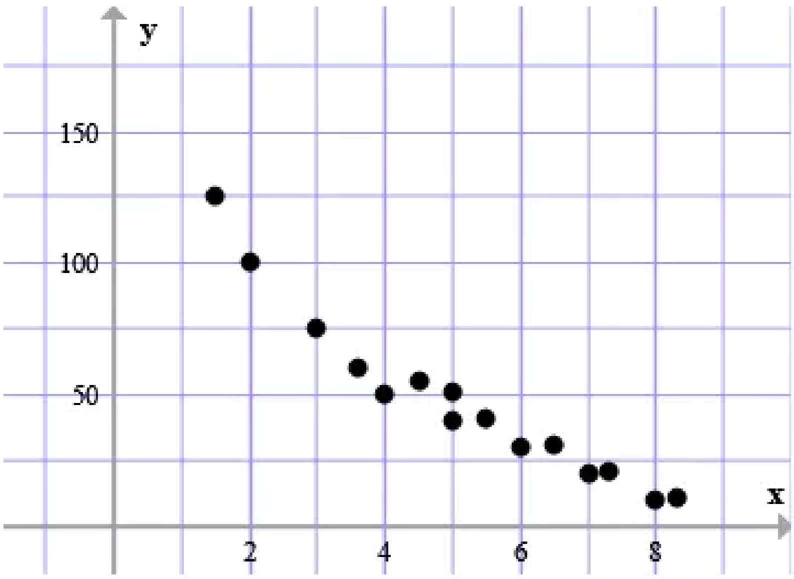



Case 3:
The data have approximately no correlation, if the points show no obvious pattern.




**Answer 2gp.**

The given scatter plot is,



(a)

We need to estimate whether the data have a positive correlation, a negative correlation, or approximately no correlation.

The given scatter plot shows a **negative correlation**, because as the number of units in $x$ direction increased, the no of units in the $y$ direction tended to decrease.

(b)

We need to estimate whether the correlation coefficient is closest to $-1, -0.5, 0, 0.5,$ or $1$.

A correlation coefficient, denoted by $r$, is a number from $-1$ to $1$ that measures how well a line fits a set of data pairs $(x, y)$. If $r$ is near 1, the points lie close to a line with positive slope. If $r$ is near $-1$, the points lie close to a line with negative slope. If $r$ is near 0, the points do not lie close to any line.

The scatter plot shows a strong negative correlation. So, the best estimate given is $\boxed{r = -1}$.

## Answer 3e.

We know that in a scatter plot, if $y$ tends to increase as $x$ increases, then the data will have a positive correlation. If $y$ decreases with increase in $x$, then the data will have a negative correlation. If the points show no specific pattern, then the data will have approximately no correlation.

In the given data, we can see that $y$ is increasing with the decrease in $x$.

Thus, the data have a negative correlation.

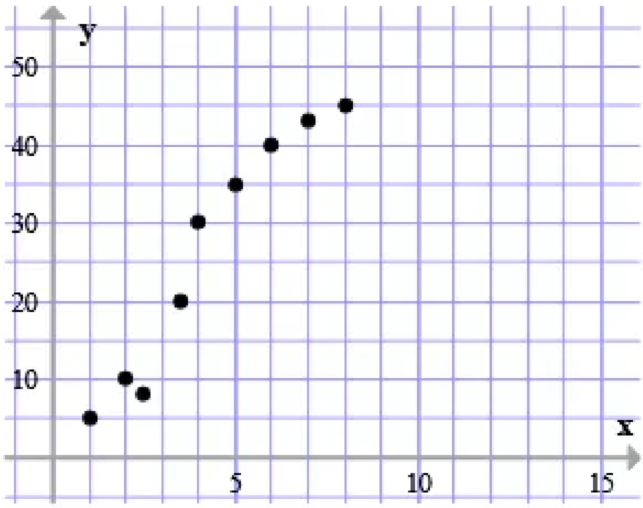
We know that if the correlation coefficient $r$ lies near 1, then the points are close to the line with positive slop. If $r$ lies near $-1$, then the points are close to the line with negative slope. If $r$ lies near 0, then the points do not lie close to any line.

In the given data, we can see that the scatter plot shows approximately no correlation. This means that the points are not close to any line.

Thus, the value of the correlation coefficient $r$ will be close to 0.

## Answer 4e.

The given scatter plot is,




We need to estimate whether the data have a positive correlation, a negative correlation, or approximately no correlation.

The given scatter plot shows a **positive correlation**, because as the number of units in $x$ direction increased, the no of units in the $y$ direction tended to increase.

## Answer 4gp.

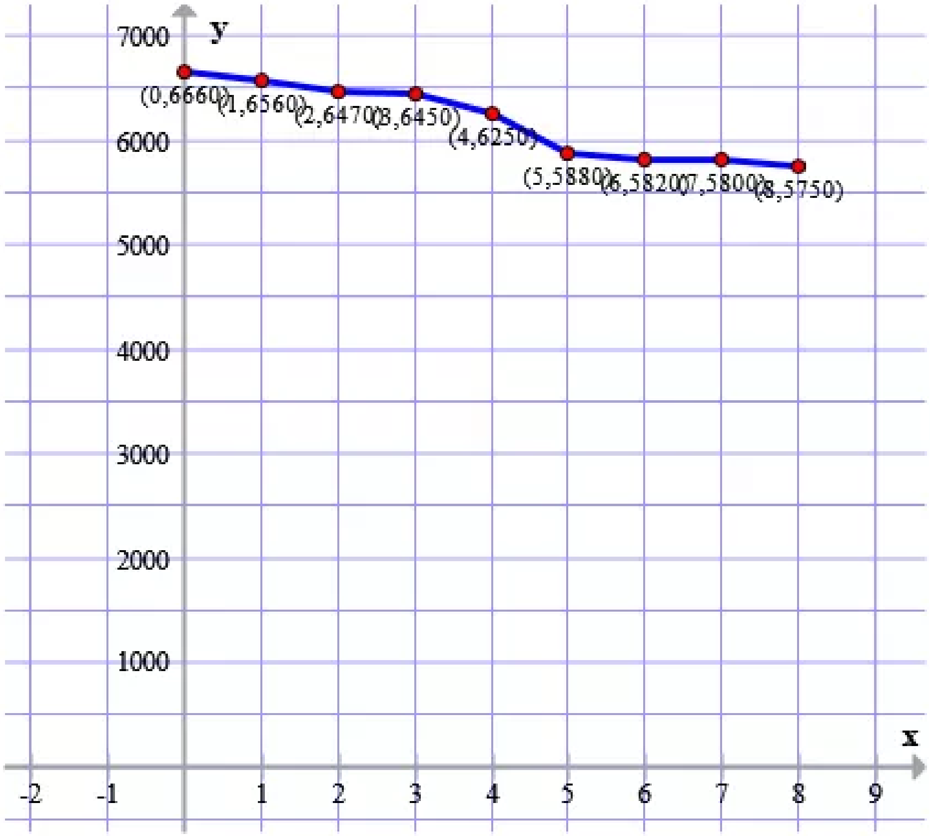
The table for U.S. daily oil production is,

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $x$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| $y$ | 6660 | 6560 | 6470 | 6450 | 6250 | 5880 | 5820 | 5800 | 5750 |

Oil production is in $y$ direction (in thousands of barrels) and years in $x$ direction.

(a)

We need to approximate the best fitting line for the data.
At first we draw the scatter plot of the data.




Now we choose two points that appear to lie on the line. The chosen points are, $(1.5, 6547)$ which is not an original data point and $(7, 5800)$ which is an original data point.

Now we have to write an equation of the line. For this we need to find the slope using the points $(1.5, 6547)$ and $(7, 5800)$.

$$\text{Slope}, m = \frac{5800 - 6547}{7 - 1.5} = \frac{-747}{5.5} = -135.8$$

Now we use point-slope form to write the equation. We choose $(x_1, y_1) = (1.5, 6547)$.

$$y - y_1 = m(x - x_1) \quad \text{[point-slope form]}$$

$$y - 6547 = -135.8(x - 1.5) \quad [\text{Substitute for } m, x_1, y_1]$$

$$y - 6547 = -135.8x + 203.7$$

$$y \approx -135.8x + 6750.7 \quad \text{[Simplify]}$$

Therefore an approximation of the best-fitting line is $\boxed{y \approx -135.8x + 6750.7}$.

(b)

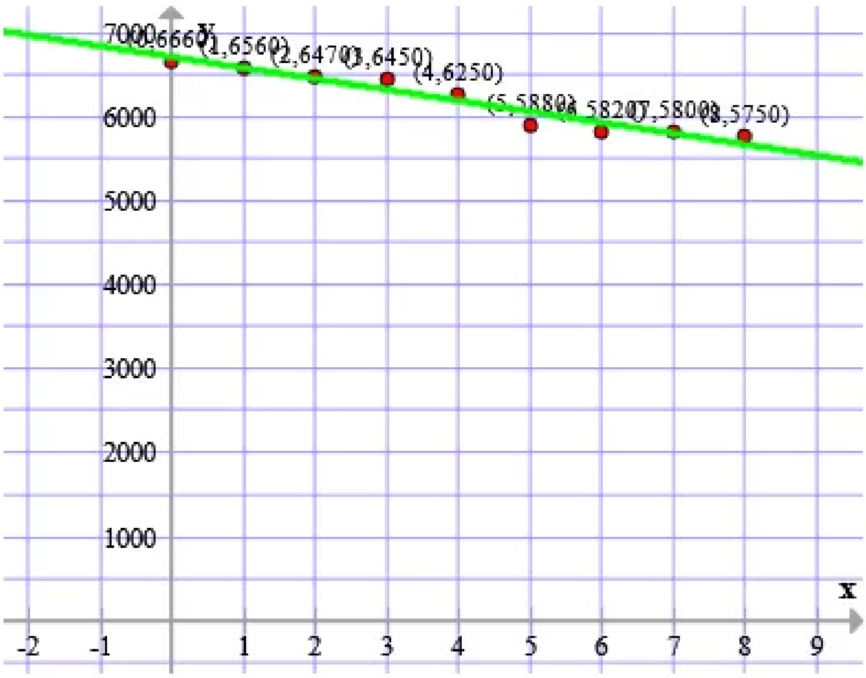
Because 2009 is 15 years after 1994, we substitute 15 for $x$ in the equation $y=-135.8x+6750.7$.

$$\begin{aligned} y &= -135.8x+6750.7 \\ &= -135.8(15)+6750.7 \\ &= -2037+6750.7 \\ &= 4713.7 \end{aligned}$$

Therefore, there will be oil production of $\boxed{4713.7 \text{ thousand barrels}}$ in 2009.

(c) We need to use a graphing calculator to find and graph an equation of the best fitting line.

The graph of the best fitting line by using the graphing calculator is as follows:




The equation of the best-fitting line using the graphing calculator is

$\boxed{y=-129.83333*x+6701.5556}$

By using the part (b), we have $x=15$.

$$\begin{aligned} y &= -129.83333x+6701.5556 \\ &= -129.83333(20)+6701.5556 \\ &= 4104.889 \end{aligned}$$

Therefore, there will be oil production of $\boxed{4104.889 \text{ thousand barrels}}$ in 2009 by using the graphing calculator.

## Answer 5e.

We know that in a scatter plot, if $y$ tends to increase as $x$ increases, then the data will have a positive correlation. If $y$ decreases with increase in $x$, then the data will have a negative correlation. If the points show no obvious pattern, then the data will have approximately no correlation.

In the given data, we can see that there is no specific pattern.

Thus, the data have approximately no correlation.

## Answer 6e.

We need to explain how we can determine the type of correlation for a set of data pairs by examining the data in a given table.

A scatter plot is a graph of a set of data pairs $(x, y)$. If $y$ tends to increase as $x$ increases Then the data have a positive correlation. If $y$ tends to decrease as $x$ increases, Then the data have a negative correlation. If the points show no obvious pattern, then the data have approximately no correlation.

In the given table,

(i)

If the $y$ values tend to increase with increasing values of $x$ then the data pairs have positive correlation.

(ii)

If the $y$ values tend to decrease with increasing values of $x$ then the data pairs have negative correlation.

(iii)

If there are no obvious pattern of the values of $x$ and $y$, then the data pairs have approximately no correlation.

## Answer 7e.

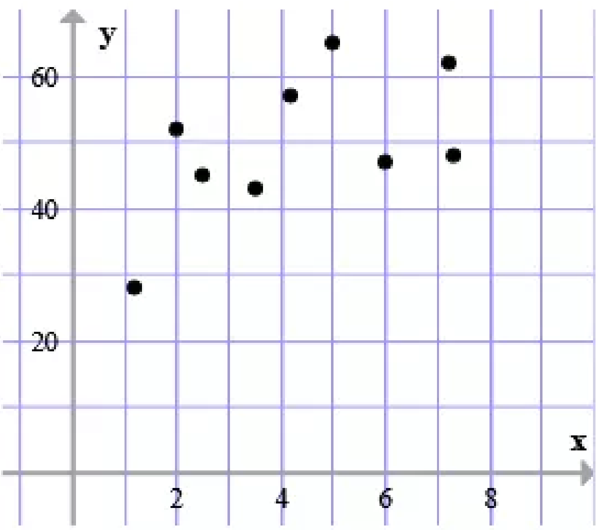
We know that if the correlation coefficient $r$ lies near 1, then the points are close to the line with positive slope. If $r$ lies near $-1$, then the points are close to the line with negative slope. If $r$ lies near 0, then the points do not lie close to any line.

In the given data, we can see that the scatter plot shows approximately no correlation. That is, the points are not close to any line.

Thus, the value of the correlation coefficient $r$ will be close to 0.

## Answer 8e.

The given scatter plot is,




We need to estimate whether the correlation coefficient is closest to $-1, -0.5, 0, 0.5,$ or $1$.

A correlation coefficient, denoted by $r$, is a number from $-1$ to 1 that measures how well a line fits a set of data pairs $(x, y)$. If $r$ is near 1, the points lie close to a line with positive slope. If $r$ is near $-1$, the points lie close to a line with negative slope. If $r$ is near 0, the points do not lie close to any line.

The scatter plot shows a clear but fairy weak positive correlation. So, $r$ is between 0 and 1, but not too close to either one. So the best estimate given is $\boxed{r = 0.5}$.

## Answer 9e.

We know that if the correlation coefficient $r$ lies near 1, then the points are close to the line with positive slop. If $r$ lies near $-1$, then the points are close to the line with negative slop. If $r$ lies near 0, then the points do not lie close to any line.

In the given data, we can see that the scatter plot shows a strong negative correlation. That is, the points lie close to the line with negative slop.

Thus, the value of the correlation coefficient $r$ will be close to $-1$.

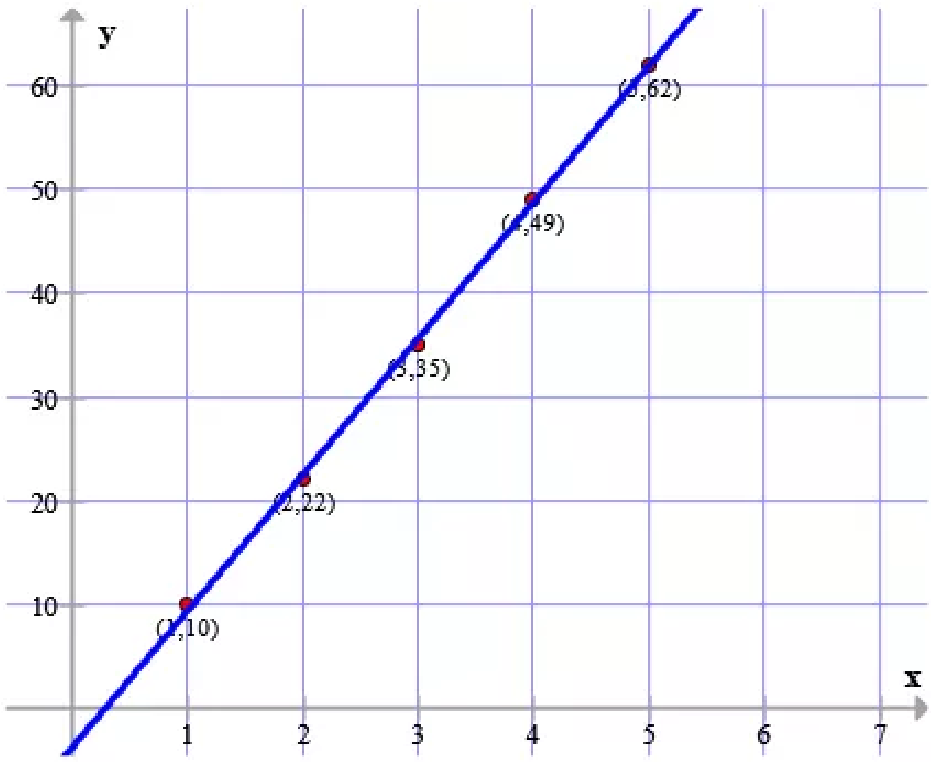
## Answer 10e.

The given table of data is,

| $x$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $y$ | 10 | 22 | 35 | 49 | 62 |

(a)

We have to draw a scatter plot of the data.
The scatter plot for the given data is drawn below:



(b)
We need to approximate the best-fitting line.
Now we choose two points that appear to lie on the line. The chosen points are, $(1.5,16)$ which is not an original data point and $(3,35)$ which is an original data point.
Now we have to write an equation of the line. For this we need to find the slope using the points $(1.5,16)$ and $(3,35)$.

$$\begin{aligned}\text{Slope, } m &= \frac{35-16}{3-1.5} \\ &= \frac{19}{1.5} \\ &= 12.67\end{aligned}$$

Now we use point-slope form to write the equation. We choose $(x_1, y_1)=(1.5,16)$.

$$\begin{aligned}y-y_1 &= m(x-x_1) && [\text{point-slope form}] \\ y-16 &= 12.67(x-1.5) && [\text{Substitute for } m, x_1, y_1] \\ y-16 &= 12.67x-19.005 \\ y &\approx 12.67x-3 && [\text{Simplify}]\end{aligned}$$

Therefore an approximation of the best-fitting line is $\boxed{y=12.67x-3}$.

(c)
We need to estimate $y$ when $x=20$.
An approximation of the best-fitting line is $y=12.67x-3$.
By substituting 20 for $x$ in this equation, we have

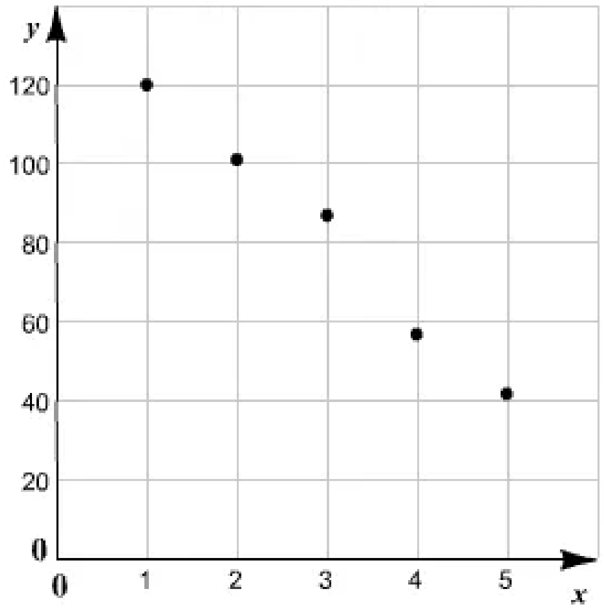
$$\begin{aligned}y &= 12.67x-3 \\ &= 12.67(20)-3 \\ &= 250.4\end{aligned}$$

Therefore the value of $y$ when $x=20$ is $\boxed{250.4}$.

## Answer 11e.

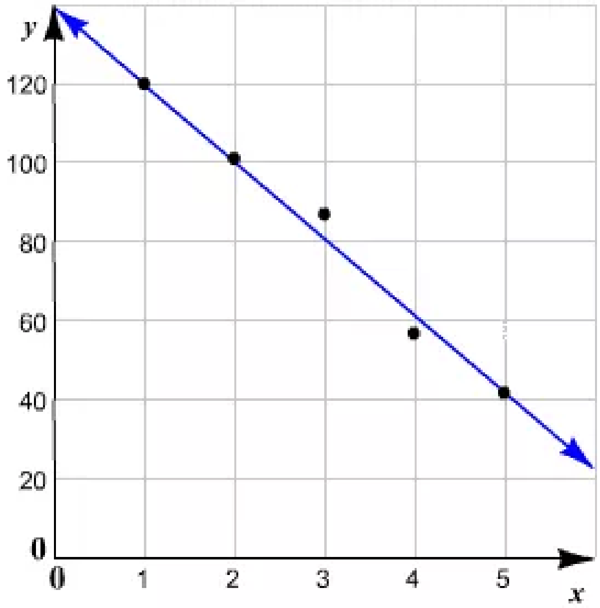
**(a)** The given data can be represented in the ordered pair form as (1, 120), (2, 101), (3, 87), (4, 57), and (5, 42).

Plot the above points on a graph to get the scatter plot.



**(b)** The line that follows the trends given by the data points most closely is called a best-fitting line.

First, sketch the line that best fits the data.




Now, choose two data points that appear to lie on the line. Let the points be (2, 101) and (5, 42).

Find the slope m using these points.

$$m = \frac{42 - 101}{5 - 2}$$
$$= \frac{-59}{3}$$
$$\approx -20$$

The point slope form of an equation is $y - y_1 = m(x - x_1)$. Choose (2, 101) as the point $(x_1, y_1)$.

Substitute −20 for $m$, 2 for $x_1$, and 101 for $y_1$ in the above equation.
$$y - 101 = -20(x - 2)$$

Simplify.
$$y - 101 = -20x + 40$$

Add 101 to both the sides of the equation.
$$y - 101 + 101 = -20x + 40 + 101$$
$$y = -20x + 141$$

Thus, an approximation of the best fitting line is $y = -20x + 141$.

**(c)** Substitute 20 for $x$ in the equation $y = -20x + 141$ and simplify.

$$\begin{aligned} y &= -20(20) + 141 \\ &= -400 + 141 \\ &= -259 \end{aligned}$$

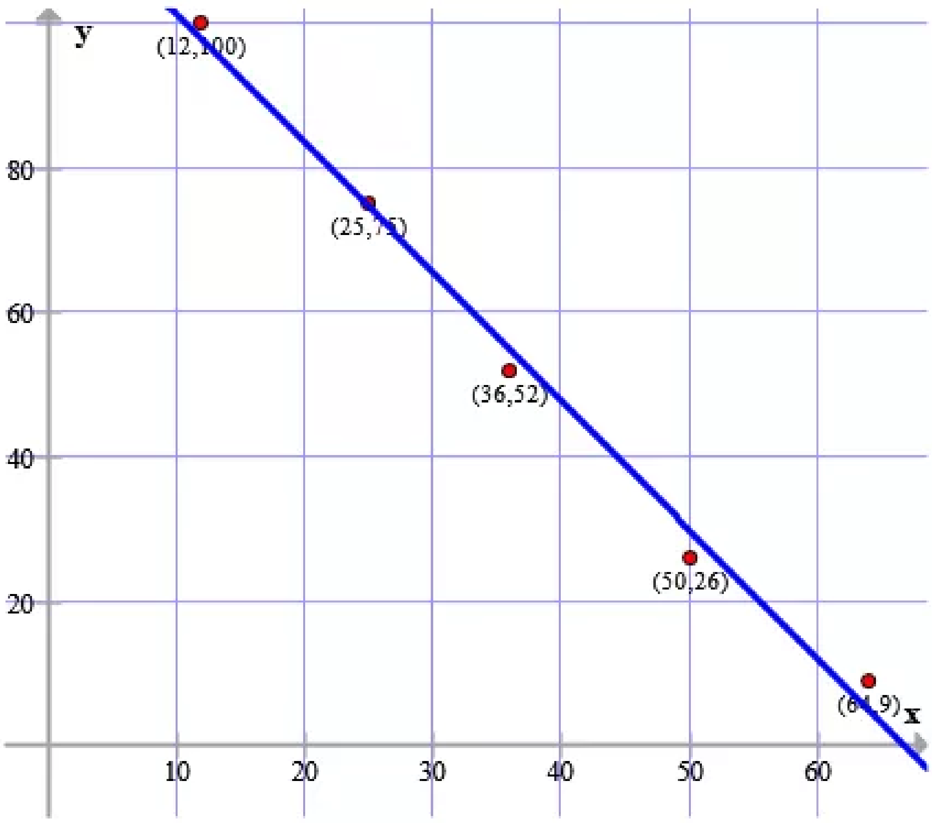
Therefore, when $x$ is 20 the value of $y$ is $-259$.

## Answer 12e.

The given table of data is,

| $x$ | 12 | 25 | 36 | 50 | 64 |
|---|---|---|---|---|---|
| $y$ | 100 | 75 | 52 | 26 | 9 |

(a)
We have to draw a scatter plot of the data.
The scatter plot for the given data is drawn below:




(b)
We need to approximate the best-fitting line.
Now we choose two points that appear to lie on the line. The chosen points are, $(40, 44.5)$ which is not an original data point and $(50, 26)$ which is an original data point.
Now we have to write an equation of the line. For this we need to find the slope using the points $(40, 44.5)$ and $(50, 26)$.

$$\begin{aligned} \text{Slope}, m &= \frac{26 - 44.5}{50 - 40} \\ &= -\frac{18.5}{10} \\ &= -1.85 \end{aligned}$$

Now we use point-slope form to write the equation. We choose $(x_1, y_1) = (40, 44.5)$.

$$y - y_1 = m(x - x_1) \qquad [\text{point-slope form}]$$
$$y - 44.5 = -1.86(x - 40) \qquad [\text{Substitute for } m, x_1, y_1]$$
$$y - 44.5 = -1.86x + 74.4$$
$$y \approx -1.86x + 118.9 \qquad [\text{Simplify}]$$

Therefore an approximation of the best-fitting line is $\boxed{y = -1.86x + 118.9}$.

(c)
We need to estimate $y$ when $x = 20$.
An approximation of the best-fitting line is $y = -1.86x + 118.9$.
By substituting 20 for $x$ in this equation, we have

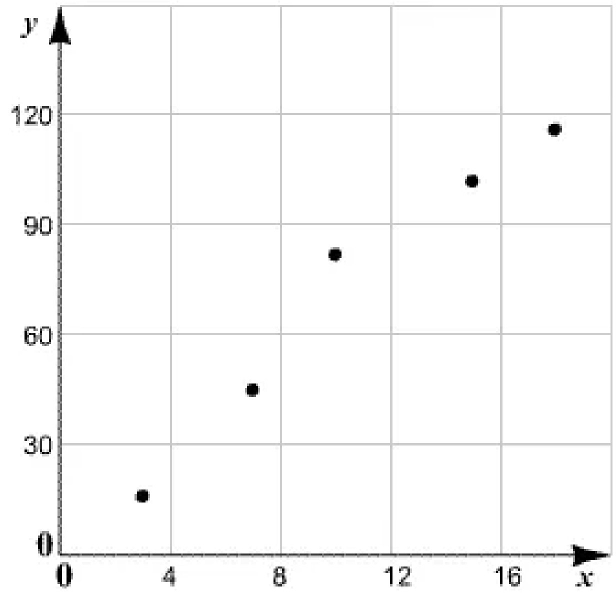
$$y = -1.86x + 118.9$$
$$= -1.86(20) + 118.9$$
$$= -37.2 + 118.9$$
$$= 81.7$$

Therefore the value of $y$ when $x = 20$ is $\boxed{81.7}$.

## Answer 13e.

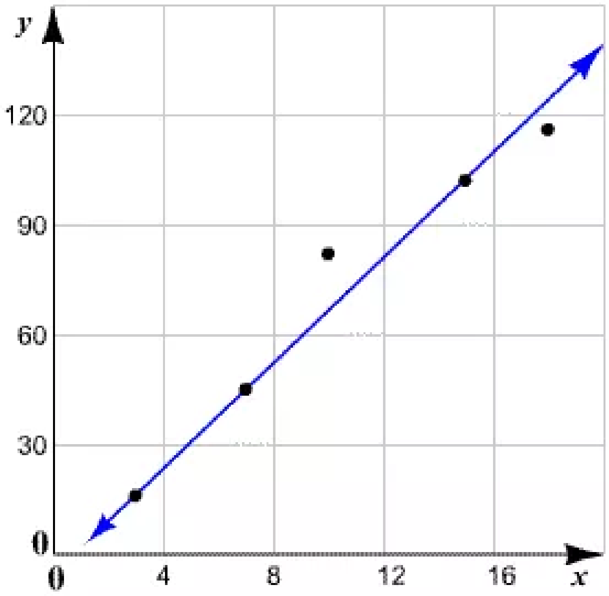
**(a)** The given data can be represented in the ordered pair form as (3, 16), (7, 45), (10, 82), (15, 102), and (18, 116).

Plot the above points on a graph to get the scatter plot.



**(b)** The line that closely follows the trends shown by the data points is called a best-fitting line.

First, sketch the line that best fits the data.




Now, choose two data points that appear to lie on the line. Let the points be (3, 16) and (15, 102).

Find the slope, $m$, using these points.

$$m = \frac{102 - 16}{15 - 3}$$

$$= \frac{86}{12}$$

$$\approx 7.2$$

The point slope form of an equation is $y - y_1 = m(x - x_1)$. Choose (3, 16) as the point $(x_1, y_1)$.

Substitute 6.7 for $m$, 3 for $x_1$, and 16 for $y_1$ in the above equation.

$y - 16 = 7.2(x - 3)$

Simplify.

$y - 16 = 7.2x - 21.6$

Add 16 to both sides of the equation.

$$y - 16 + 16 = 7.2x - 21.6 + 16$$
$$y = 7.2x - 5.6$$

Thus, an approximation of the best fitting line is $y = 7.2x - 5.6$.

**(c)** Substitute 20 for $x$ in $y = 7.2x - 5.6$ and simplify.

$$y = 7.2(20) - 5.6$$
$$= 144 - 5.6$$
$$= 138.4$$

Therefore, the value of $y$ is 138.4 when $x$ is 20.

## Answer 14e.

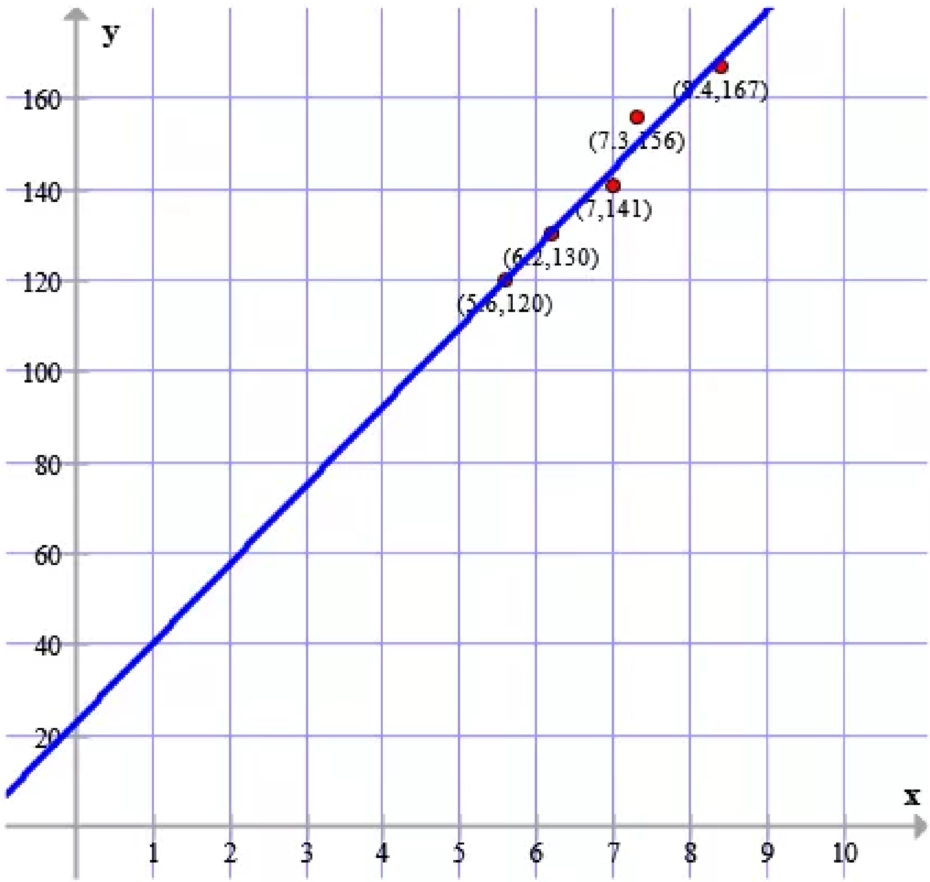
The given table of data is,

| $x$ | 5.6 | 6.2 | 7 | 7.3 | 8.4 |
|---|---|---|---|---|---|
| $y$ | 120 | 130 | 141 | 156 | 167 |

(a)

We have to draw a scatter plot of the data.

The scatter plot for the given data is drawn below:



(b)

We need to approximate the best-fitting line.

Now we choose two points that appear to lie on the line. The chosen points are, $(6.5, 135.5)$ which is not an original data point and $(5.6, 120)$ which is an original data point.

Now we have to write an equation of the line. For this we need to find the slope using the points $(6.5, 135.5)$ and $(5.6, 120)$.

$$\begin{aligned}\text{Slope}, m &= \frac{120-135.5}{5.6-6.5}\\ &= \frac{-15.5}{-0.9}\\ &= 17.22\end{aligned}$$

Now we use point-slope form to write the equation. We choose $(x_1, y_1) = (6.5, 135.5)$.

$$\begin{aligned} y - y_1 &= m(x - x_1) && \text{[point-slope form]}\\ y - 135.5 &= 17.22(x - 6.5) && \text{[Substitute for } m, x_1, y_1\text{]}\\ y - 135.5 &= 17.22x - 111.93 \\ y &\approx 17.22x + 23.07 && \text{[Simplify]}\end{aligned}$$

Therefore an approximation of the best-fitting line is $\boxed{y = 17.22x + 23.07}$.

(c)

We need to estimate $y$ when $x = 20$.

An approximation of the best-fitting line is $y = 17.22x + 23.07$.

By substituting 20 for $x$ in this equation, we have

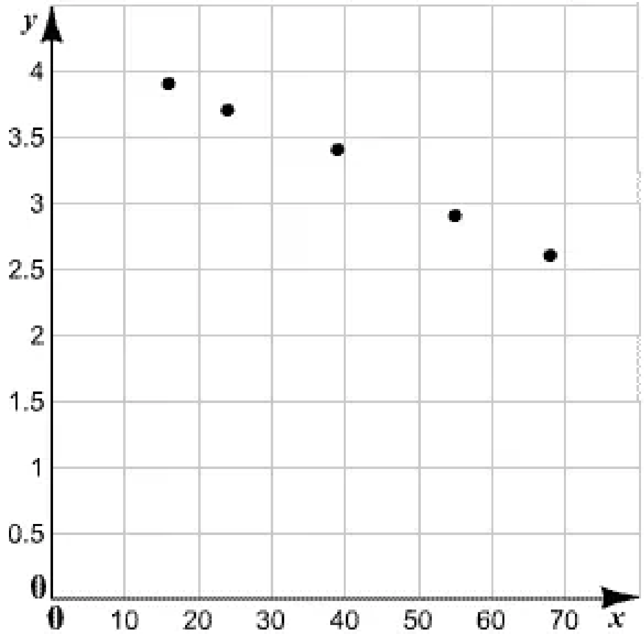
$$\begin{aligned} y &= 17.22x + 23.07\\ &= 17.22(20) + 23.07\\ &= 344.4 + 23.07\\ &= 367.47\end{aligned}$$

Therefore the value of $y$ when $x = 20$ is $\boxed{367.47}$.

**Answer 15e.**

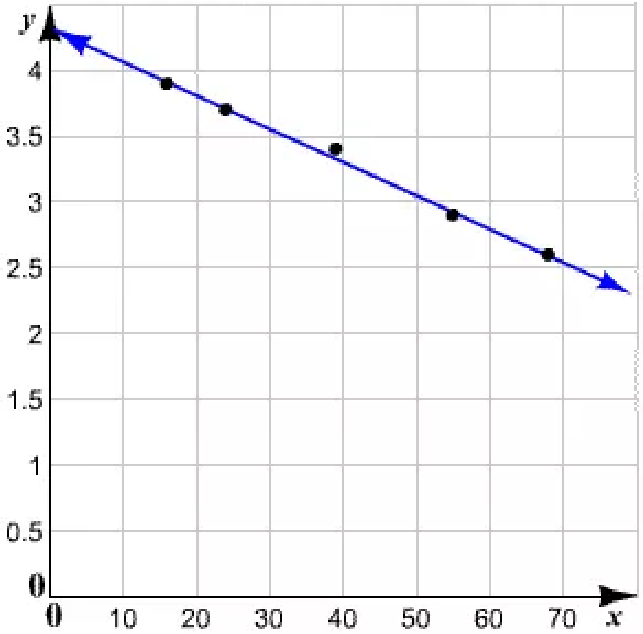
**(a)** The given data can be represented in the ordered pair form as (16, 3.9), (24, 3.7), (39, 3.4), (55, 2.9), and (68, 2.6).

Plot the above points on a graph to get the scatter plot.




**(b)** The line that closely follows the trends shown by the data points is called a best-fitting line.

First, sketch the line that best fits the data.



Now, choose two data points that appear to lie on the line. Let the points be (16, 3.9) and (68, 2.6).

Find the slope $m$ using these points.

$$\begin{aligned} m &= \frac{2.6 - 3.9}{68 - 16} \\ &= \frac{-1.3}{52} \\ &= -0.025 \end{aligned}$$

The point slope form of an equation is $y - y_1 = m(x - x_1)$. Choose (16, 3.9) as the point $(x_1, y_1)$.

Substitute $-0.025$ for $m$, 16 for $x_1$, and 3.9 for $y_1$ in the above equation.
$y - 3.9 = -0.025(x - 16)$

Simplify.
$y - 3.9 = -0.025x + 0.4$

Add 3.9 to both sides of the equation.

$$\begin{aligned} y - 3.9 + 3.9 &= -0.025x + 0.4 + 3.9 \\ y &= -0.025x + 4.3 \end{aligned}$$

Thus, an approximation of the best fitting line is $y = -0.025x + 4.3$.

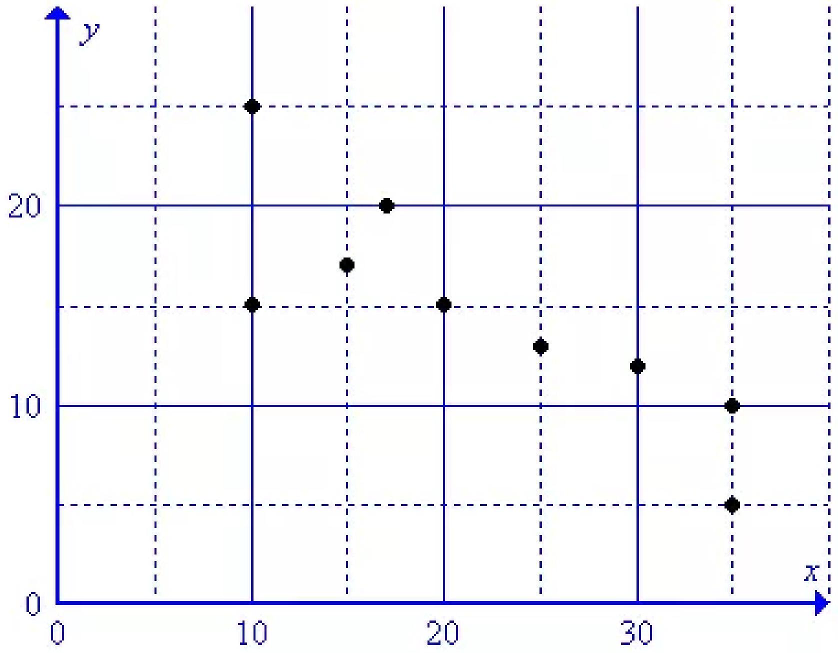
**(c)** Substitute 20 for $x$ in $y = -0.025x + 4.3$ and simplify.

$$\begin{aligned} y &= -0.025(20) + 4.3 \\ &= -0.5 + 4.3 \\ &= 3.8 \end{aligned}$$

Therefore, the value of $y$ is 3.8 when $x$ is 20.

**Answer 16e.**

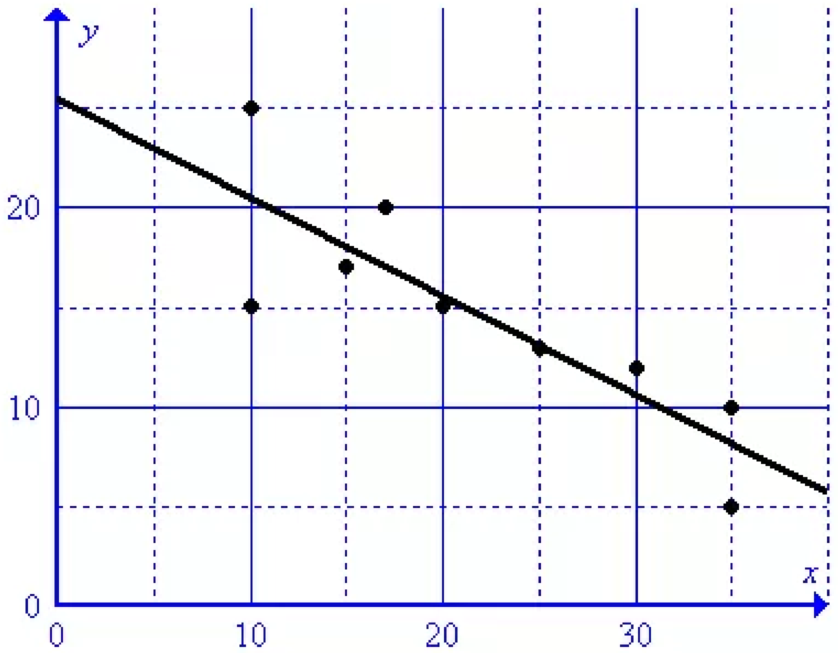
The given graph is




We need to find the equation best models the data in the scatter plot. The options for the answer are

(A) $y = 15$ (B) $y = -\frac{1}{2}x + 26$ (C) $y = -\frac{2}{5}x + 19$ (D) $y = -\frac{4}{5}x + 33$

Now we sketch the line that appears to best fit the data.




We choose two points that appear to lie on the line. For the above line we choose $(5, 23)$ which is not an original data point, and $(25, 13)$ which is an original data point.

We write an equation of the line by calculating the slope of the points $(5,23)$ and $(25,13)$.

Therefore

$$\begin{aligned} m &= \frac{13-23}{25-5} \\ &= \frac{-10}{20} \\ &= -\frac{1}{2} \end{aligned}$$

We use point-slope form to write the equation by choosing $(x_1, y_1) = (5,23)$.

$$y - y_1 = m(x - x_1) \qquad [\text{Point slope form}]$$

$$y - 23 = -\frac{1}{2}(x-5) \qquad [\text{By substituting } m, x_1 \text{ and } y_1]$$

$$y - 23 = -\frac{1}{2}x + \frac{5}{2}$$

$$y = -\frac{1}{2}x + 23 + \frac{5}{2}$$

$$y = -\frac{1}{2}x + 25.5 \qquad [\text{By simplifying}]$$

$$y \approx -\frac{1}{2}x + 26$$

Therefore an approximation of the best fitting line is $y = -\frac{1}{2}x + 26$. Hence the answer is option

$\boxed{(B)}$.

## Answer 18e.

A set of data has correlation coefficient *r*. We need to find the value of *r* for which the data points lie closest to a line. The options for the answer are

(A) $r = -0.96$ (B) $r = 0$ (C) $r = 0.38$ (D) $r = 0.5$

A correlation coefficient, denoted by $r$, is a number from $-1$ to 1 that measures how well a line fits a set of data pairs $(x, y)$. If $r$ is near 1, the points lie close to a line with positive slope. If $r$ is near $-1$, the points lie close to a line with negative slope. If $r$ is near 0, the points do not lie close to any line.

Among the given values for r the nearest value to $-1$ is $-0.96$. Therefore for the value $r=-0.96$, the data points lie closest to a line with negative slope.

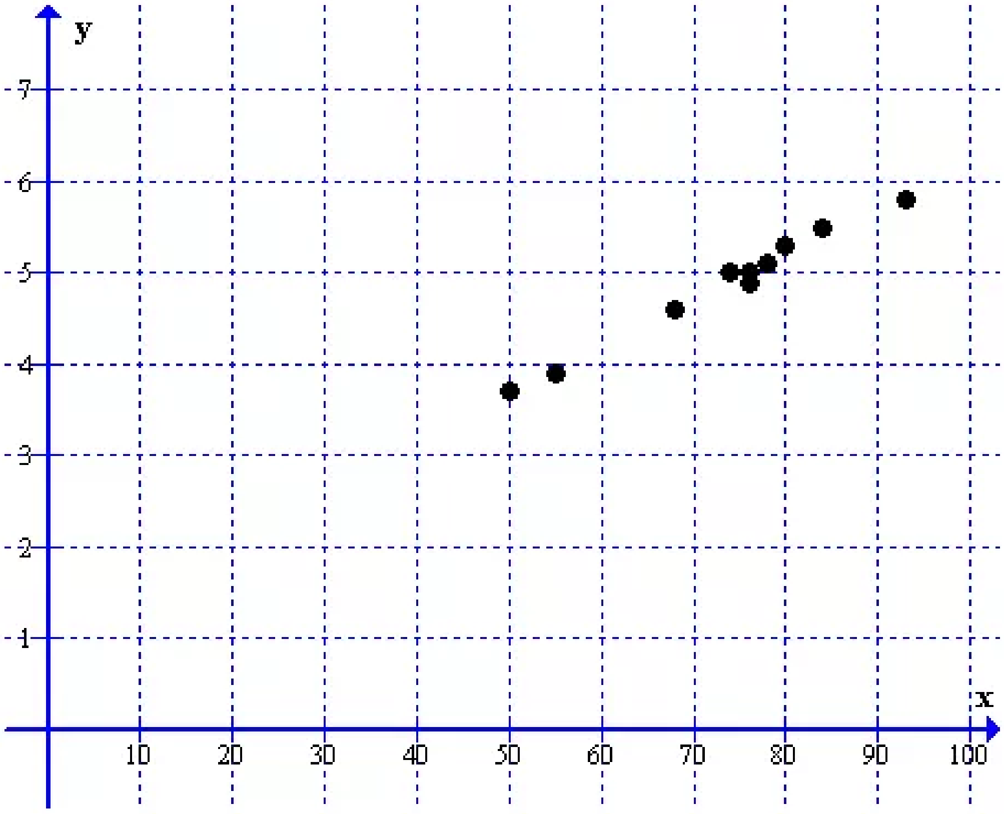
Thus the answer is option $\boxed{(A)}$.

## Answer 19e.

By using the graphing calculator we need to find and draw the graph of an equation of the best fitting line for the following data:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *x* | 78 | 74 | 68 | 76 | 80 | 84 | 50 | 76 | 55 | 93 |
| *y* | 5.1 | 5.0 | 4.6 | 4.9 | 5.3 | 5.5 | 3.7 | 5.0 | 3.9 | 5.8 |

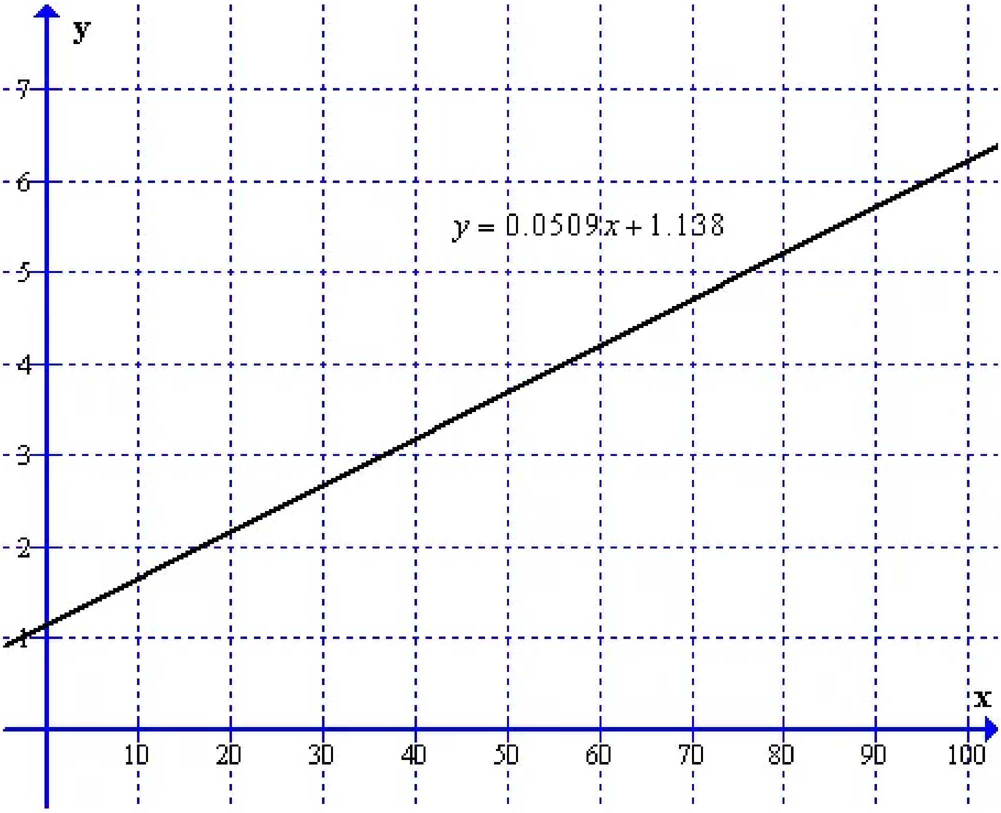
We have to draw a scatter plot of the data as shown below:




From the above graph we obtain the equation using the scatter plot as:

$\boxed{y=0.0509x+1.138}$

The graph of the equation is as follows:

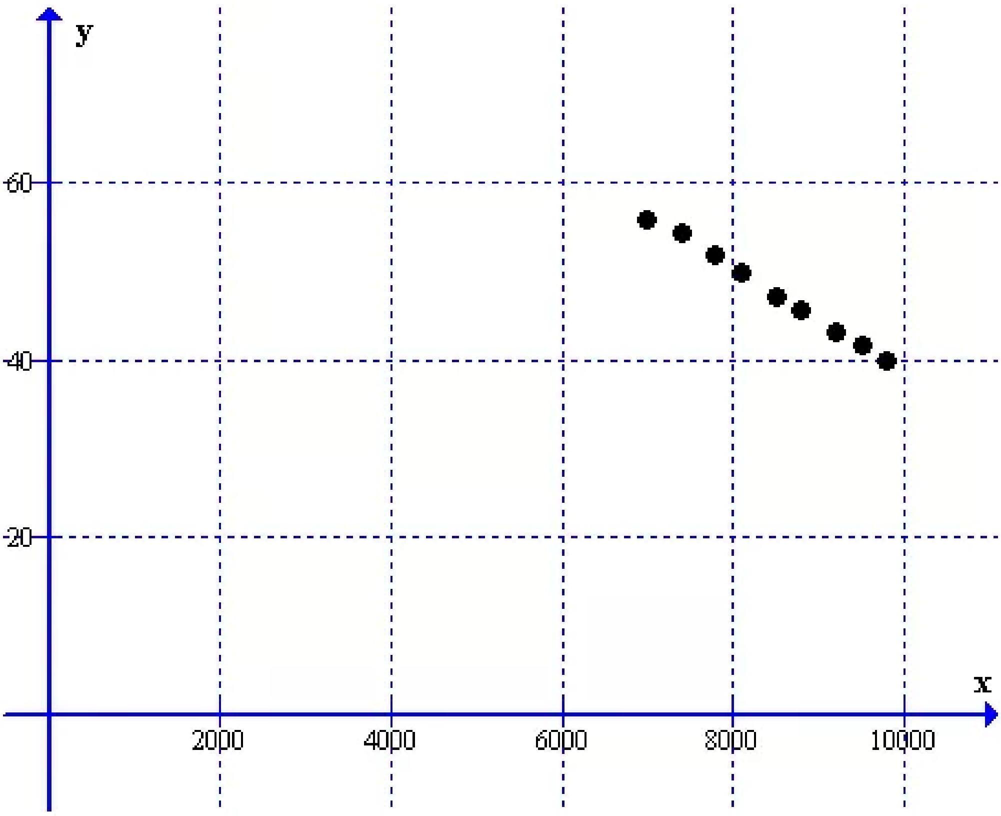



**Answer 20e.**

By using the graphing calculator we need to find and draw the graph of an equation of the best fitting line for the following data:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *x* | 7000 | 7400 | 7800 | 8100 | 8500 | 8800 | 9200 | 9500 | 9800 |
| *y* | 56.0 | 54.5 | 51.9 | 50.0 | 47.3 | 45.6 | 43.1 | 41.6 | 39.9 |

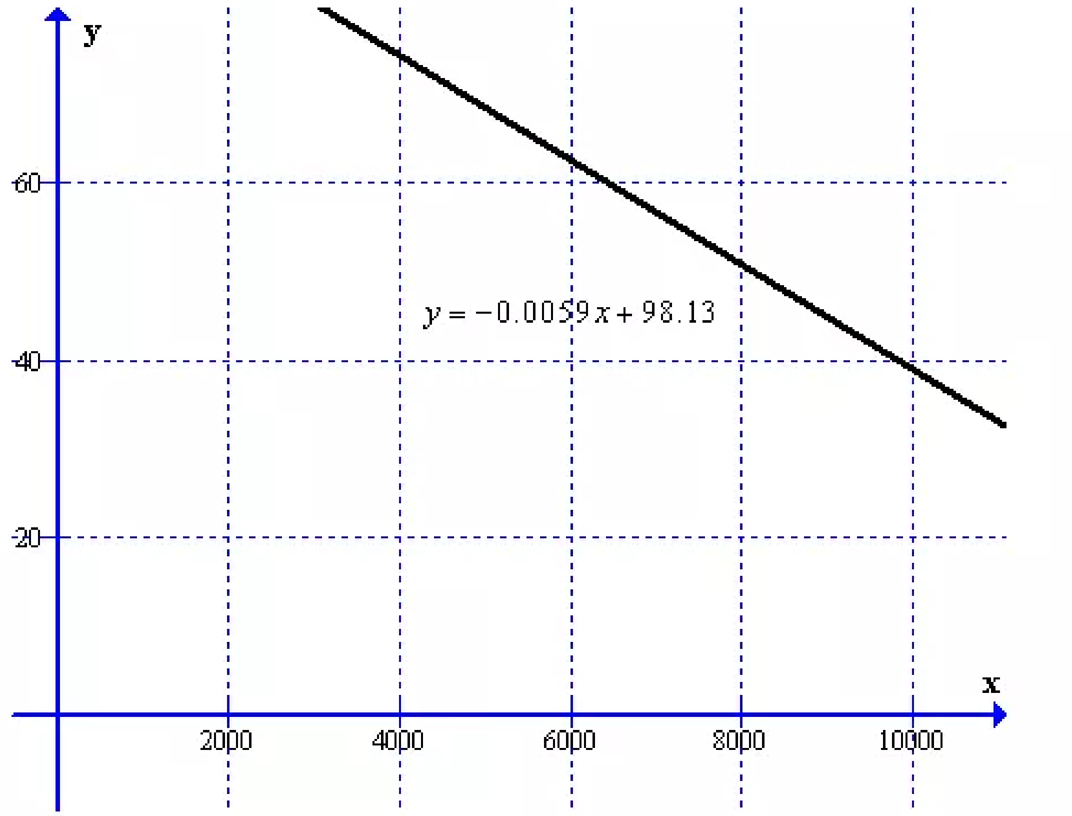
We have to draw a scatter plot of the data as shown below:



From the above graph we obtain the equation using the scatter plot as:

$$\boxed{y=-0.0059x+98.13}$$

The graph of the equation is as follows:




## Answer 22e.

A set of data pairs has correlation coefficient $r=0.1$. We need to explain that is it logical to use the best fitting line to make predictions from the data.

A correlation coefficient, denoted by $r$, is a number from $-1$ to 1 that measures how well a line fits a set of data pairs $(x,y)$. If $r$ is near 1, the points lie close to a line with positive slope. If $r$ is near $-1$, the points lie close to a line with negative slope. If $r$ is near 0, the points do not lie close to any line.

In the given problem we have the correlation coefficient, *r* as 0.1 and it is near 0. Therefore the data points do not lie close to any line.

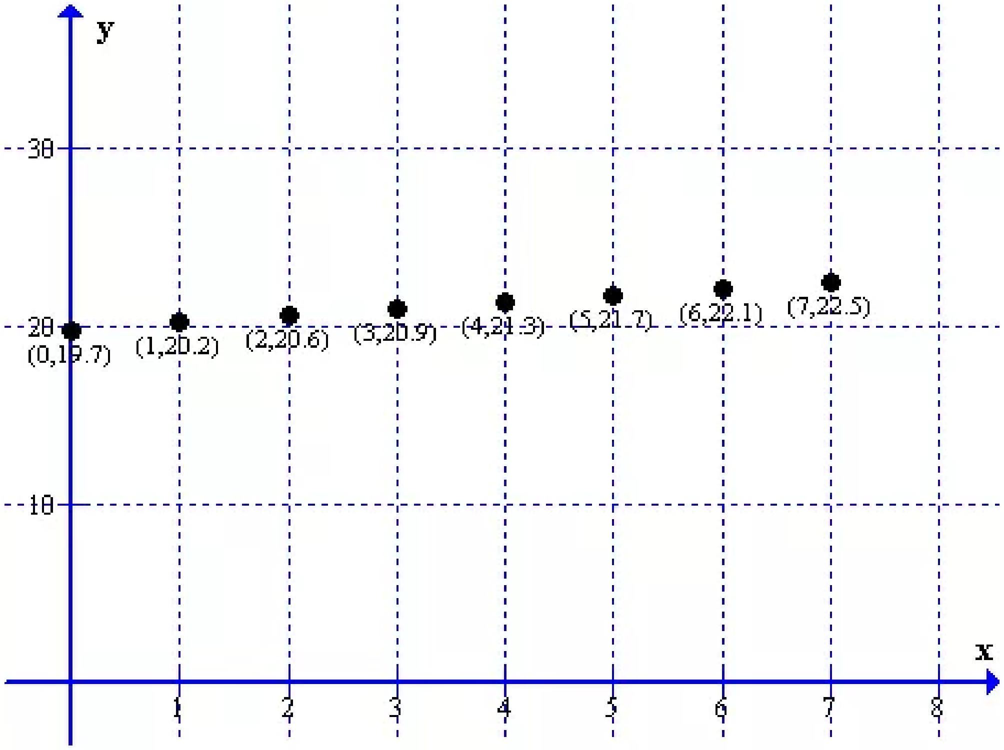
Hence it is $\boxed{\text{not logical}}$ to use the best fitting line to make predictions from the data.

**Answer 24e.**

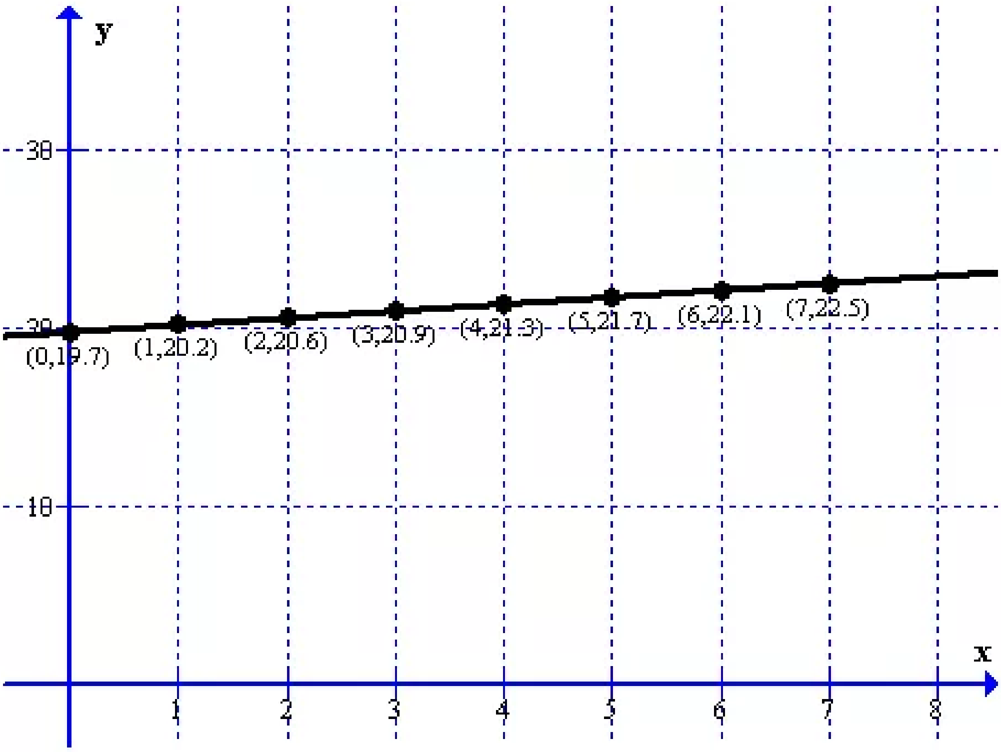
The data pairs $(x, y)$ give the population $y$ (in millions) of Texas x years after 1997. We need to approximate the best fitting line for the data below:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $x$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| $y$ | 19.7 | 20.2 | 20.6 | 20.9 | 21.3 | 21.7 | 22.1 | 22.5 |

We have to draw a scatter plot of the data. Therefore the scatter plot for the given data is drawn below:




We sketch the line that appears to best fit the data as below:



Now we choose two points that appear to lie on the line. The chosen points are, $(8,23)$ which is not an original data point and $(1,20.2)$ which is an original data point.

Now we have to write an equation of the line. For this we need to find the slope using the points $(8,23)$ and $(1,20.2)$.

$$\begin{aligned}\text{Slope}, m &= \frac{20.2-23}{1-8}\\ &= \frac{-2.8}{-7}\\ &= \frac{2}{5}\\ &= 0.4\end{aligned}$$

Now we use point-slope form to write the equation. We choose $(x_1, y_1) = (8,23)$.

$$\begin{aligned} y - y_1 &= m(x - x_1) && [\text{point-slope form}]\\ y - 23 &= 0.4(x-8) && [\text{Substitute for } m, x_1, y_1]\\ y - 23 &= 0.4x - 3.2 \\ y &= 0.4x - 3.2 + 23 \\ y &\approx 0.4x + 19.8 && [\text{Simplify}] \end{aligned}$$

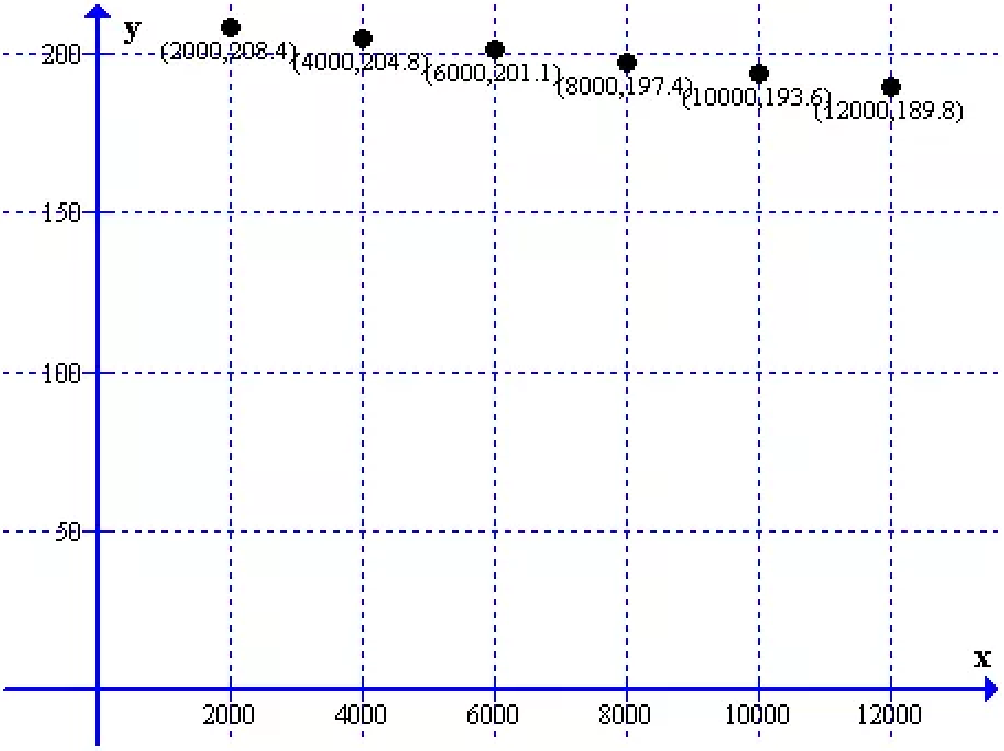
Therefore an approximation of the best-fitting line is $\boxed{y = 0.4x + 19.8}$.

## Answer 26e.

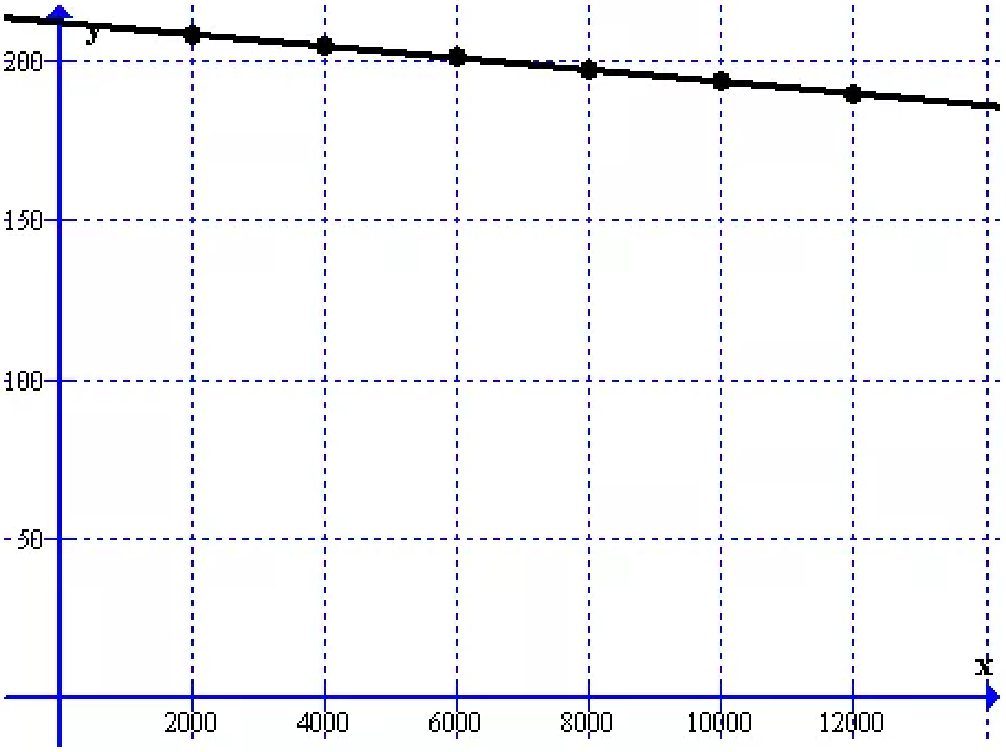
The data pairs $(x, y)$ give the boiling point *y* (in degrees Fahrenheit) where *x* represents the elevation (in feet). We need to approximate the best fitting line for the data below:

| | | | | | | |
|---|---|---|---|---|---|---|
| $x$ | 12000 | 10000 | 8000 | 6000 | 4000 | 2000 |
| $y$ | 189.8 | 193.6 | 197.4 | 201.1 | 204.8 | 208.4 |

We have to draw a scatter plot of the data. Therefore the scatter plot for the given data is drawn below:




We sketch the line that appears to best fit the data as below:



Now we choose two points that appear to lie on the line. The chosen points are, $(1000, 211)$ which is not an original data point and $(6000, 201.1)$ which is an original data point.

Now we have to write an equation of the line. For this we need to find the slope using the points $(1000, 211)$ and $(6000, 201.1)$.

$$\begin{aligned} \text{Slope}, m &= \frac{201.1 - 211}{6000 - 1000} \\ &= \frac{-9.9}{5000} \\ &= -0.0019 \end{aligned}$$

”>

Now we use point-slope form to write the equation. We choose $(x_1, y_1) = (1000, 211)$.

$$\begin{aligned} y - y_1 &= m(x - x_1) && [\text{point-slope form}] \\ y - 211 &= -0.0019(x - 1000) && [\text{Substitute for } m, x_1, y_1] \\ y - 211 &= -0.0019x + 1.9 \\ y &= -0.0019x + 1.9 + 211 \\ y &\approx -0.0019x + 212.9 && [\text{Simplify}] \end{aligned}$$

Therefore an approximation of the best-fitting line is $\boxed{y = -0.0019x + 212.9}$.

## Answer 28e.

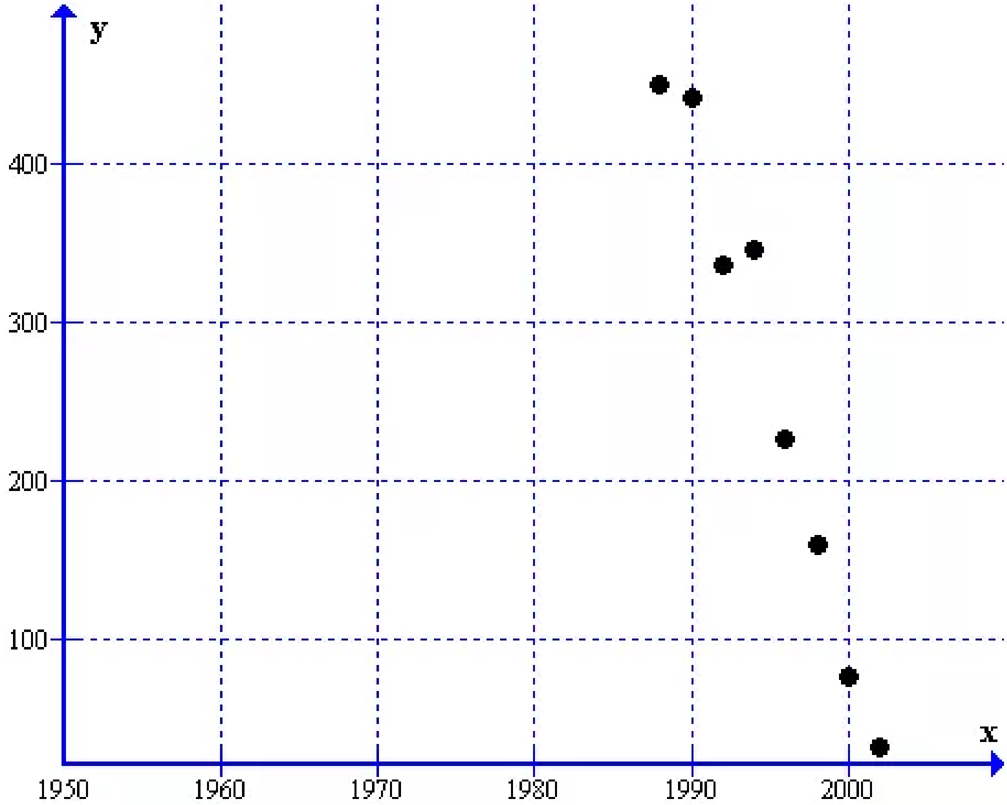
The manufacturers' shipments (in millions) of cassettes and CDs in the United States from 1988 to 2002 is shown in the table shown below:

| Year | 1988 | 1990 | 1992 | 1994 | 1996 | 1998 | 2000 | 2002 |
|---|---|---|---|---|---|---|---|---|
| Cassettes | 450.1 | 442.2 | 336.4 | 345.4 | 225.3 | 158.5 | 76.0 | 31.1 |
| CDs | 149.7 | 286.5 | 407.5 | 662.1 | 778.9 | 847.0 | 942.5 | 803.3 |

(a)

We need to draw a scatter plot of the data pairs $(\text{year}, \text{shipments of cassettes})$ and describe the correlation shown by the scatter plot.

The scatter plot for the given data pairs $(\text{year}, \text{shipments of cassettes})$ is drawn below:

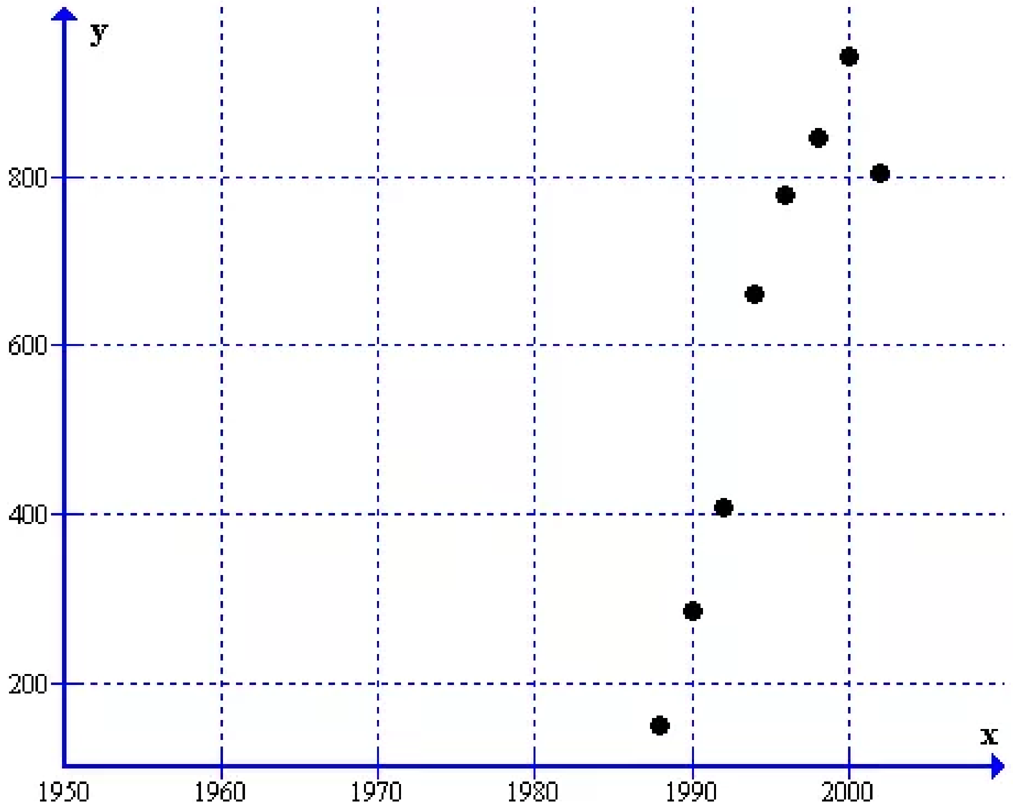



The scatter plot shows a negative correlation, because as the year increased, the shipments of cassettes tend to decrease.

(b)

We need to draw a scatter plot of the data pairs $(\text{year}, \text{shipments of CDs})$ and describe the correlation shown by the scatter plot.

The scatter plot for the given data pairs $(\text{year}, \text{shipments of CDs})$ is drawn below:




The scatter plot shows a positive correlation, because as the year increased, the shipments of CDs tend to increase.

The scatter plot shows a negative correlation, because as the shipments of CDs increased, the shipments of cassettes tend to decrease.

The real world factor related to this problem is:

As the time increasing the manufacturers' shipments of cassettes is decreasing and the manufacturers' shipments of CDs is increasing.

## Answer 29e.

Data from some countries in North America show a positive correlation between life expectancy and number of personal computers per capita in that country.

We need to make a conjecture about the reason for the positive correlation between life expectancy and number of personal computers per capita.

The scatter plot between life expectancy and number of personal computers per capita shows a positive correlation. That means as the life expectancy in that country increased, the number of personal computers per capita tend to increase.

Is it reasonable to conclude from the data that giving residents of a country more personal computers will lengthen their lives? We need to explain this statement.

With the given information in the problem we can say that when the life expectancy increases, personal computers per capita also tend to increase. We cannot find the length of their lives. Therefore it is not reasonable to conclude the given statement from the data.

## Answer 30e.

We need to solve the equation $2x - y = 10$ for *y* and find the value of *y* for $x = 8$.

Rewriting the given equation, we have

$$2x - y = 10 \quad [\text{Original equation}]$$
$$-y = 10 - 2x \quad [\text{Taking } 2x \text{ to the right side}]$$
$$y = -(10 - 2x) \quad [\text{Multiplying both sides by } -1]$$
$$y = -10 + 2x$$
$$y = 2x - 10 \quad [\text{Simplify}]$$

Therefore the solution for *y* is $\boxed{y = 2x - 10}$.

Now by putting $x=8$ in the equation $y=2x-10$, we have

$$\begin{aligned} y &= 2x-10 \\ &= 2(8)-10 && [\text{Since } x=8] \\ &= 16-10 && [\text{Since } 2\times 8 \text{ is equals to } 16] \\ &= 6 && [\text{By simplifying}] \end{aligned}$$

Therefore the value of *y* is $\boxed{6}$ for $x=8$.

## Answer 32e.

We need to solve the equation $x-4y=3$ for *y* and find the value of *y* for $x=-3$.

Rewriting the given equation, we have

$$\begin{aligned} x-4y &= 3 && [\text{Original equation}] \\ -4y &= 3-x && [\text{Taking } x \text{ to the right side}] \\ \frac{-4y}{-4} &= \frac{3-x}{-4} && [\text{Dividing both sides by } -4] \\ y &= -\frac{3}{4}+\frac{x}{4} && [\text{Simplify}] \\ y &= \frac{x}{4}-\frac{3}{4} \end{aligned}$$

Therefore the solution for *y* is $\boxed{y=\frac{x}{4}-\frac{3}{4}}$.

Now by putting $x=-3$ in the equation $y=\frac{x}{4}-\frac{3}{4}$, we have

$$\begin{aligned} y &= \frac{x}{4}-\frac{3}{4} \\ &= \frac{-3}{4}-\frac{3}{4} && [\text{Since } x=-3] \\ &= \frac{-3-3}{4} && [\text{By taking L.C.M.}] \\ &= \frac{-6}{4} \\ &= -\frac{3}{2} && [\text{By simplifying}] \end{aligned}$$

Therefore the value of *y* is $\boxed{-\frac{3}{2}}$ for $x=-3$.

## Answer 34e.

We need to solve the equation $-0.5y+0.25x=2$ for $y$ and find the value of $y$ for $x=4$.

Rewriting the given equation, we have

$$-0.5y+0.25x=2 \quad \text{[Original equation]}$$
$$-0.5y=2-0.25x \quad \text{[Taking } 0.25x \text{ to the right side]}$$
$$\frac{-0.5y}{-0.5}=\frac{2-0.25x}{-0.5} \quad \text{[Dividing both sides by } -0.5\text{]}$$
$$y=-\frac{2}{0.5}+\frac{0.25}{0.5}x$$
$$y=-4+\frac{1}{2}x \quad \text{[By simplifying]}$$

Therefore the solution for $y$ is $\boxed{y=-4+\frac{1}{2}x}$.

Now by putting $x=4$ in the equation $y=-4+\frac{1}{2}x$, we have

$$y=-4+\frac{1}{2}x$$
$$=-4+\frac{1}{2}(4) \quad \text{[Since } x=4\text{]}$$
$$=-4+2 \quad \left[\text{Since}\frac{4}{2}=2\right]$$
$$=-2 \quad \text{[By simplifying]}$$

Therefore the value of $y$ is $\boxed{-2}$ for $x=4$.

## Answer 36e.

We need to evaluate the function for the given value of $x=9$.

By rewriting the function, we have

$$f(x)=-x+7 \quad \text{[Original equation]}$$
$$f(9)=-9+7 \quad \text{[By putting } x=9\text{]}$$
$$=-2 \quad \text{[By simplifying]}$$

Therefore the value of $f(x)$ is $\boxed{-2}$ for $x=9$.

## Answer 38e.

We need to evaluate the function $f(x)=14-|x|$ for the given value of $x=-2$.

The absolute value of a real number *x* is defined as follows:

$$|x|=\begin{cases} x, \text{if } x \text{ is positive} \\ 0, \text{ if } x=0 \\ -x, \text{if } x \text{ is negative} \end{cases}$$

Here the value of *x* is negative, so $|x|=-x$. Therefore

$$\begin{aligned} f(x)&=14-|x| && \text{[Original equation]} \\ &=14-(-x) \\ &=14+x \\ f(-2)&=14+(-2) && \text{[By putting } x=-2\text{]} \\ &=14-2 && \text{[By simplifying]} \\ &=12 \end{aligned}$$

Therefore the value of $f(x)$ is $\boxed{12}$ for $x=-2$.

## Answer 40e.

We need to evaluate the function $f(x)=|-6-x|$ for the given value of $x=4$.

The absolute value of a real number *x* is defined as follows:

$$|x|=\begin{cases} x, \text{if } x \text{ is positive} \\ 0, \text{ if } x=0 \\ -x, \text{if } x \text{ is negative} \end{cases}$$

Here the value of *x* is positive, so $|-6-x|=-6-x$. Therefore

$$\begin{aligned} f(x)&=|-6-x| && \text{[Original equation]} \\ f(x)&=-6-x \\ f(4)&=-6-4 && \text{[By putting } x=4\text{]} \\ &=-10 && \text{[By simplifying]} \end{aligned}$$

Therefore the value of $f(x)$ is $\boxed{-10}$ for $x=4$.

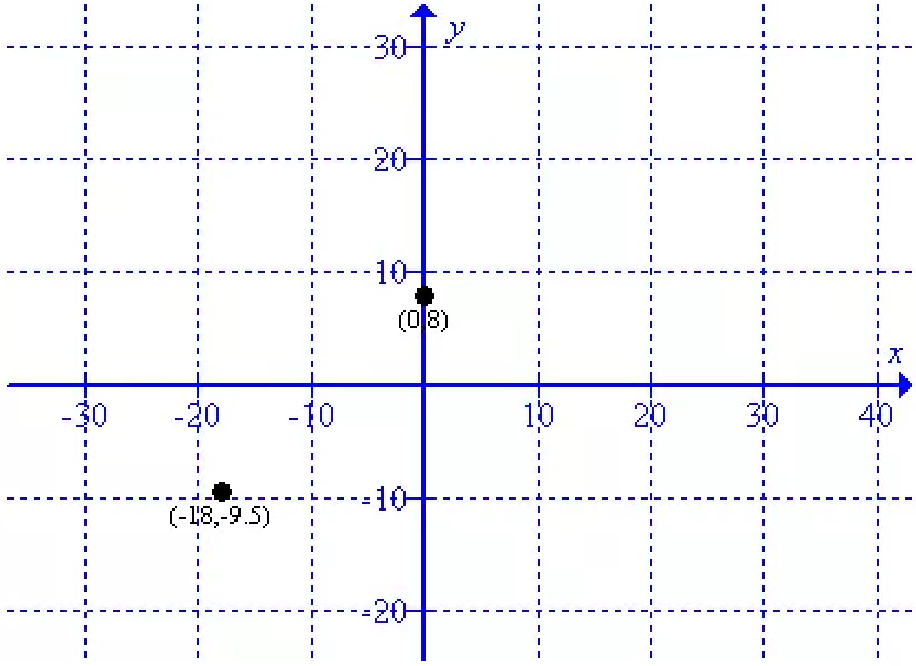
## Answer 42e.

We need to graph the equation $y = x + 8$.

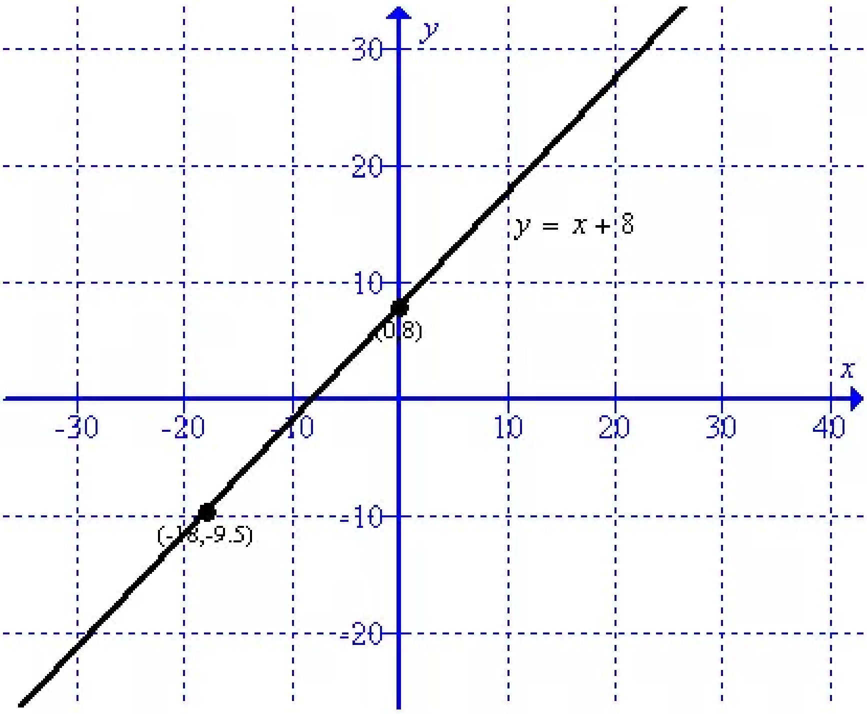
The equation is already in slope-intercept form.

We need to identify the *y*-intercept and it is 8, so we plot the point $(0,8)$ where the line crosses the *y*-axis.

We identify the slope. The slope is 1, so we plot a second point on the line by starting at $(0,8)$ and then moving down 18 units and left 18 units. The second point is $(-18,-9.5)$.




We draw a line through these two points as below:



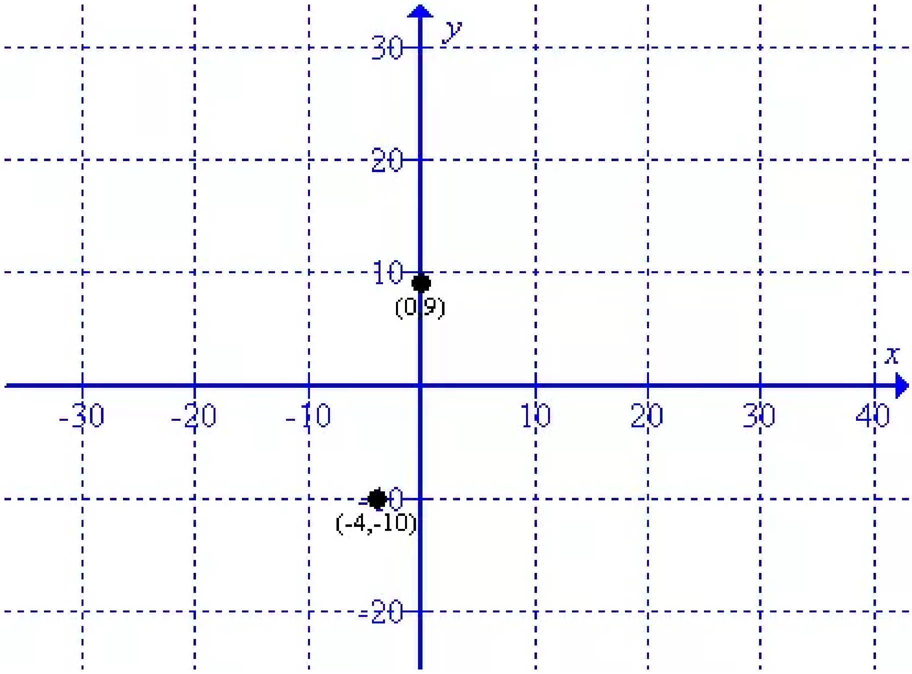
## Answer 44e.

We need to graph the equation $y = 5x + 9$.

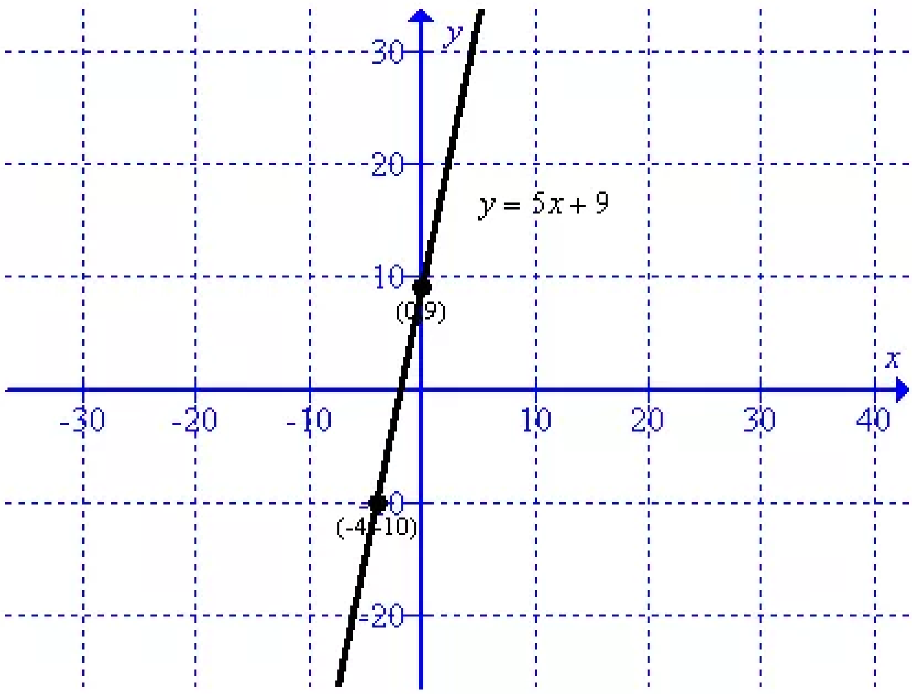
The equation is already in slope-intercept form.

We need to identify the *y*-intercept and it is 9, so we plot the point $(0,9)$ where the line crosses the *y*-axis.

We identify the slope. The slope is 5, so we plot a second point on the line by starting at $(0,9)$ and then moving down 19 units and left 4 units. The second point is $(-4,-10)$.




We draw a line through these two points as below:



## Answer 46e.

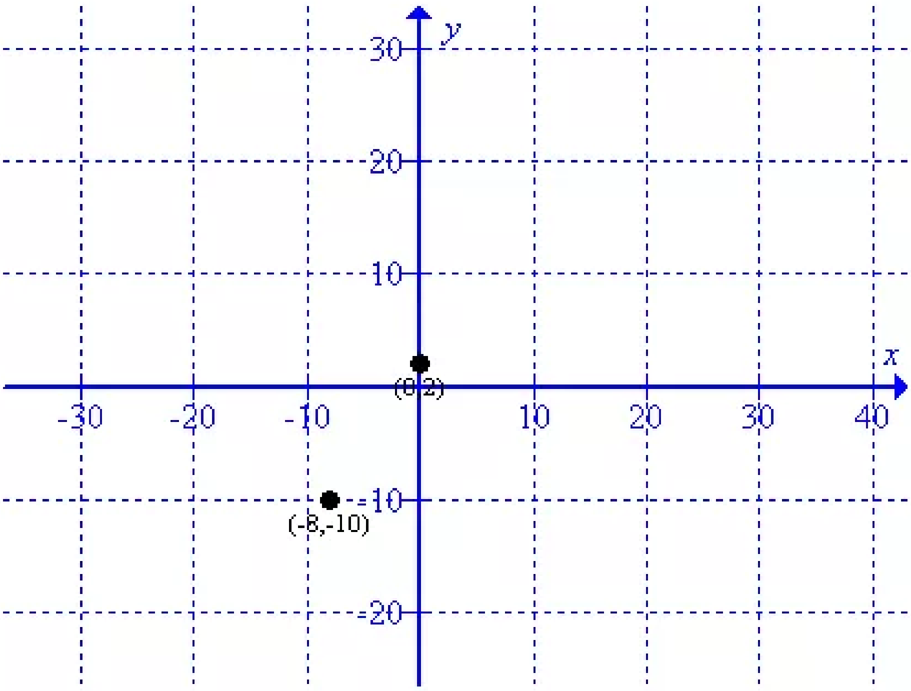
We need to graph the equation $3x-2y=-4$.

We convert the equation into slope-intercept form. Therefore

$$3x-2y=-4$$
$$-2y=-4-3x \quad \text{[Taking } 3x \text{ to the right side]}$$
$$y=2+\frac{3}{2}x \quad \text{[Dividing both sides by } -2\text{]}$$
$$y=\frac{3}{2}x+2$$

We need to identify the *y*-intercept and it is 2, so we plot the point $(0,2)$ where the line crosses the *y*-axis.

We identify the slope. The slope is $\frac{3}{2}$, so we plot a second point on the line by starting at $(0,2)$ and then moving down 12 units and left 8 units. The second point is $(-8,-10)$.



We draw a line through these two points as below: