Exercise 1.2

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 1E

(a) $f(x) = \log_2 x$

Given function is a logarithmic function

(b) $g(x) = \sqrt[4]{x}$

Given function is a root function

(c) $h(x) = \frac{2x^3}{1-x^2}$

Given function is a rational function.

(d) $u(t) = 1 - 1.1t + 2.45t^2$

Given function is a polynomial function.

The degree of this polynomial function is 2.

(e) $v(t) = 5^t$

Given function is an exponential function.

(f) $w(\theta) = \sin\theta\cos^2\theta$

Given function is a Trigonometric function.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 2E

(a) $y = \pi^x$

Given function is a exponential function

(b) $y = x^\pi$

Given function is a power function

(c) $y = x^2(2 - x^3)$

Given function is a polynomial function.

$y = x^2(2 - x^3)$

$\Rightarrow y = 2x^2 - x^5$

So, the degree of the polynomial is 5.

(d) $y = \tan t - \cos t$

Given function is a trigonometric function.

(e) $y = \frac{s}{1+s}$

Given function is a rational function.

(f) $y = \frac{\sqrt{x^3 - 1}}{1 + \sqrt[3]{x}}$

Given function is an algebraic function.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 3E

(A)

$y = x^2$ and $y = x^8$ are even function so both of the graph will be symmetric about y-axis .For $-1 < x < 0$ and $0 < x < 1$, $y = x^2 >$ $y = x^8$ .the graph of $y = x^2$ should have more curvature than $y = x^8$. So graph [h] is the graph of $y = x^2$.

(B)

$y = x^5$ is an odd function so graph o $y = x^5$ will be symmetric about the origin. The graph [f] is the graph of $y = x^5$

(C) Remaining graph [g] is the graph of $y = x^8$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 4E

(A) $y = 3x$ is a straight line so graph [G] is the graph of $y = 3x$

(B) $y = 3^x$ is an exponential function so graph [f] is the graph of $y = 3^x$

(C) $y = x^3$ is a power function and symmetric about origin so graph [F] is the graph of $y = x^3$

(D) $y = \sqrt[3]{x}$ is a root function and symmetric about origin so graph [g] is the graph of $y = \sqrt[3]{x}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 5E

(a)

The objective is to find an equation for the family of linear function with slope 2.

Consider the linear function of the form, $y = mx + b$.

Here, *m* is the slope and *b* is *y*-intercept.

Substitute the slope $m = 2$ in the above linear function.

$$y = mx + b$$
$$y = 2x + b$$

Therefore, the equation for the family of the linear function with slope 2 is $\boxed{y = 2x + b}$.

Find the members of the family of the linear function by substituting any real numbers in place of *b*.

Substitute $b = 0$ in $y = 2x + b$.

$$y = 2x + 0$$
$$y = 2x$$

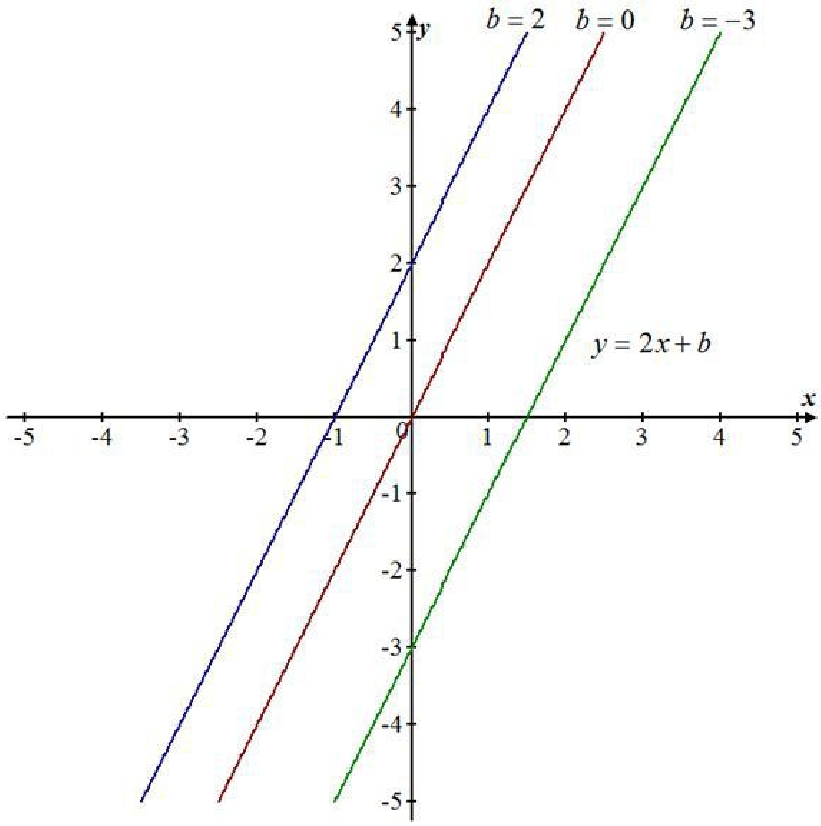
Substitute $b = 2$ in $y = 2x + b$.

$$y = 2x + 2$$

Substitute $b = -3$ in $y = 2x + b$.

$$y = 2x - 3$$

Now, sketch graph of the members of the family of $y=2x+b$ as follows:



(b)

The objective is to find an equation for the family of linear functions such that $f(2)=1$.

The linear function passes through the point $(2,1)$, since $f(2)=1$.

Substitute the point in the point slope form, $y-y_1=m(x-x_1)$.

$$
\begin{aligned}
y-1&=m(x-2)\\
y&=mx-2m+1
\end{aligned}
$$

Therefore, the equation for the family of linear function which passes through the point $(2,1)$ is, $\boxed{y=mx-2m+1}$.

Find the members of the family of the linear function by substituting any real numbers in place of *m*.

Substitute $m=-1$ in $y=mx-2m+1$.

$$
\begin{aligned}
y&=mx-2m+1\\
&=(-1)x-2(-1)+1\\
&=-x+3
\end{aligned}
$$

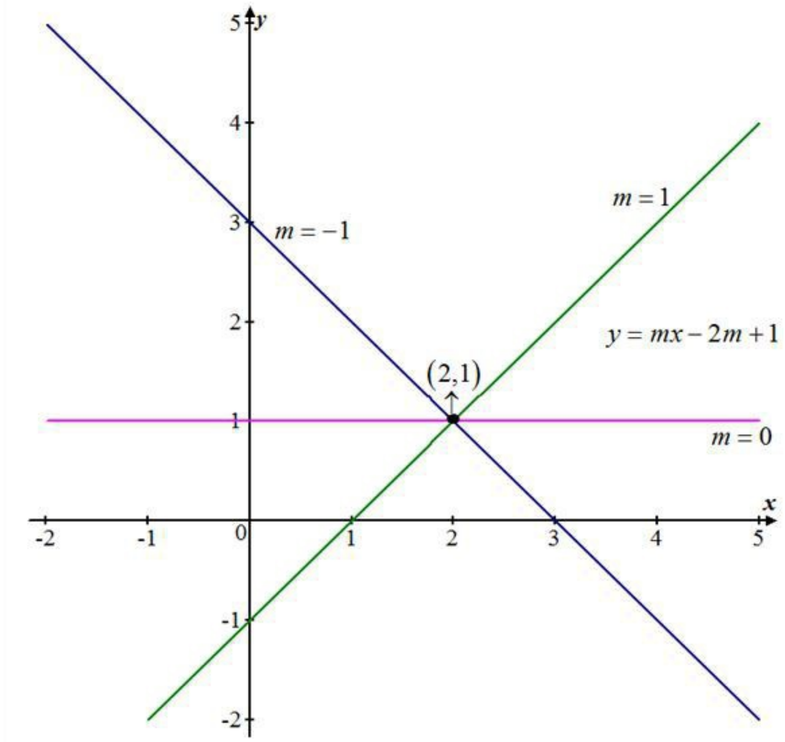
Substitute $m=0$ in $y=mx-2m+1$.

$$
\begin{aligned}
y&=mx-2m+1\\
&=(0)x-2(0)+1\\
&=1
\end{aligned}
$$

Substitute $m=1$ in $y=mx-2m+1$.

$$
\begin{aligned}
y&=mx-2m+1\\
&=(1)x-2(1)+1\\
&=x-1
\end{aligned}
$$

Now sketch the graph of the members of the family of $y = mx - 2m + 1$ as follows:



(c)

The objective is to find the function which belongs to both the families in part (a) and part (b).

To belong to both the families the slope of the function should be 2 and it should pass through the point $(2,1)$.

Substitute $m = 2$ and the point $(2,1)$ in the slope intercept form, $y - y_1 = m(x - x_1)$.

$$y - 1 = 2(x - 2)$$
$$y - 1 = 2x - 4$$
$$y = 2x - 4 + 1$$
$$y = 2x - 3$$

Therefore, the function that belongs to both the families is, $\boxed{y = 2x - 3}$.

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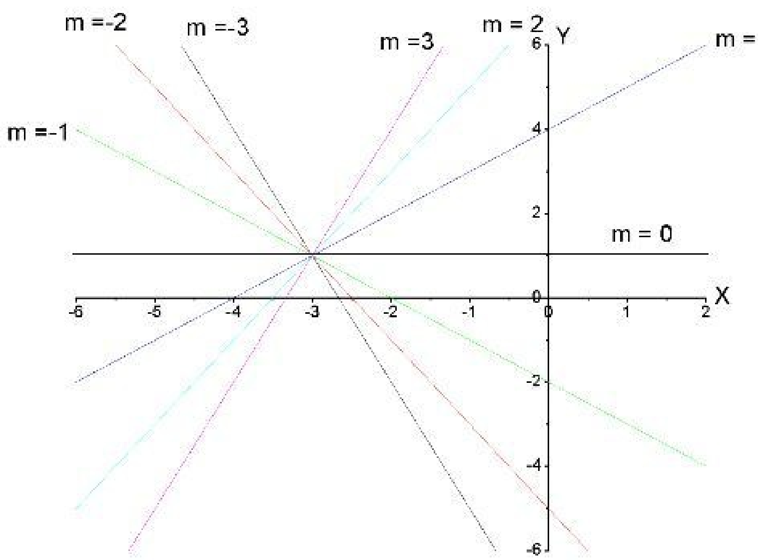


All members of family of the linear functions $f(x) = 1 + m(x + 3)$ pass through the point (-3, 1)

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 7E

All members of family of the linear functions $f(x) = c - x$ are the straight lines.

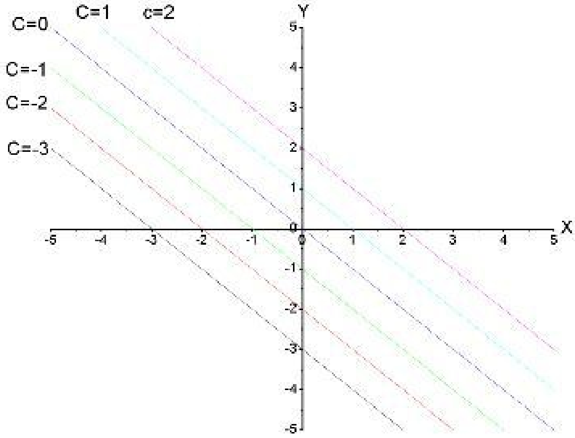
$f(x) = c - x$

$f(x) = (-1)x + c$

it is in the form $f(x) = mx + b$, slope $= m$, and y-intecept $= b$.

Therefore slope (-1) and have y-intercept $= c$.

Here they have common slope.



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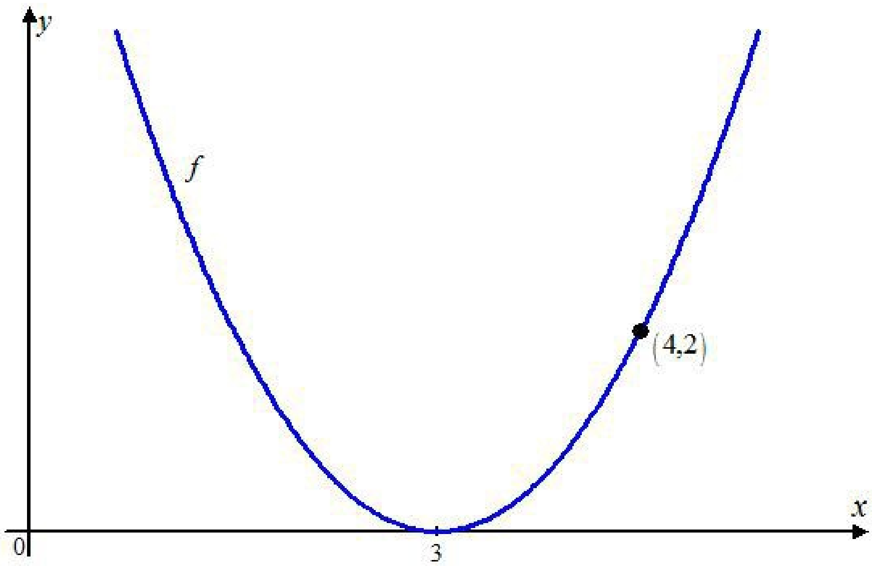
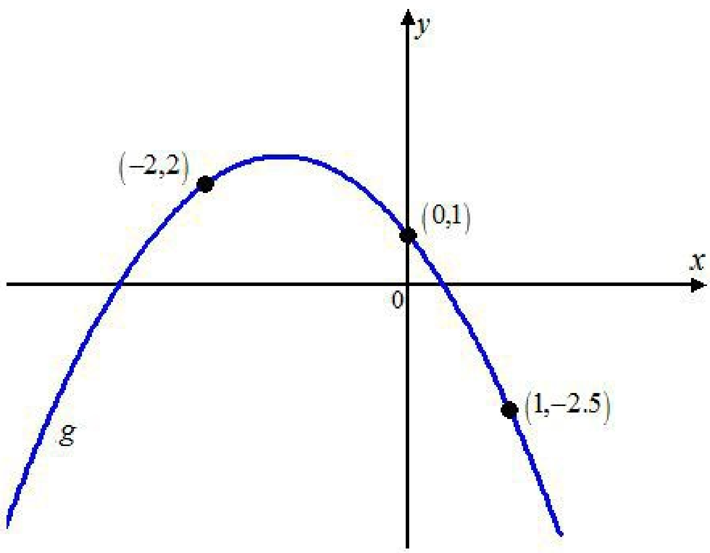
Consider the graphs as shown





Graph-1 Graph-2

Its need to find the quadratic functions corresponding to given graphs

To find quadratic functions corresponding to **Graph-1**:

Observe that, **Graph-1** represents a parabola.

All quadratic function graphs are transformations of the parabola $y = ax^2$.

From the given graph of the function f, we see that the parabola $y = ax^2$ has been shifted 3 units to the right.

To shift the graph of any function $y = f(x)$ to the right by c units, we replace the input x with the quantity $x - c$.

Since the given graph is a shift of $y = ax^2$ by 3 units to the right, we replace x with $x - 3$:

$y = ax^2$

$y = a(x-3)^2$ (Replace x with $x-3$)

Hence, an equation of the **Graph-1** is $y = a(x-3)^2$ where a is an unknown constant.

We need to solve for a.

From the **Graph-1**, we see that the ordered pair $(4,2)$ must be a solution to the equation, since the point $(4,2)$ lies on the graph.

Therefore, substitute 4 for x and 2 for y into the equation $y = a(x-3)^2$ to solve for a:

$2 = a(4-3)^2$ (Replace x with 4 and y with 2)

$2 = a(1)^2$ (Subtract)

$2 = a(1)$ (Exponent)

$2 = a$ (Multiply)

Therefore, the equation $y = a(x-3)^2$ represents Graph-1 if we replace a with 2.

$y = a(x-3)^2$

$y = 2(x-3)^2$ (Replace a with 2)

To express the equation as a function, we replace y with the notation $f(x)$.

Therefore, an equation for the **Graph-1** is $\boxed{f(x) = 2(x-3)^2}$.

To find quadratic functions corresponding to **Graph-2**:

A quadratic function is a polynomial of degree 2 which can be written in the form:

$p(x) = ax^2 + bx + c$

where a, b and c are constants.

From the **Graph-2**, we are shown that the y intercept is $(0,1)$.

Hence the ordered pair $(0,1)$ must be a solution to the equation $y = ax^2 + bx + c$.

Therefore, substitute 0 for x and 1 for y into the equation $y = ax^2 + bx + c$:

$1 = a(0)^2 + b(0) + c$ (Replace x with 0 and y with 1 in $y = ax^2 + bx + c$)

$1 = c$

So, an equation of the given graph is $y = ax^2 + bx + 1$ because $c = 1$.

Since the point $(-2,2)$ is on the **Graph-2**, the equation $y = ax^2 + bx + 1$ is satisfied by the ordered pair $(-2,2)$.

Substitute -2 for x and 2 for y in $y = ax^2 + bx + 1$ and then simplify:

$2 = a(-2)^2 + b(-2) + 1$

$2 = 4a - 2b + 1$ $\left((-2)^2 = 4\right)$

$1 = 4a - 2b$ (Subtract 1 from both sides)

Similarly, since the point $(1,-2.5)$ is on the graph, the equation $y = ax^2 + bx + 1$ is satisfied by the ordered pair $(1,-2.5)$.

Substitute 1 for x and -2.5 for y in $y = ax^2 + bx + 1$ and then simplify:

$-2.5 = a(1)^2 + b(1) + 1$

$-2.5 = a + b + 1$

$-3.5 = a + b$ (Subtract 1 from both sides)

The two resulting equations, $1 = 4a - 2b$ and $-3.5 = a + b$, from the previous steps form a system of equations which we can solve for a and b. The system is:

$$\begin{aligned} 1 &= 4a - 2b \\ -3.5 &= a + b \end{aligned}$$

We will use the elimination method to solve the system.

Multiply the second equation by 2 and then add the equations together:

$$\begin{aligned} &1 = 4a - 2b && 1 = 4a - 2b \\ &2(-3.5) = 2(a+b) && \Rightarrow \quad -7 = 2a + 2b \quad (\text{multiply equation 2 by 2}) \end{aligned}$$

Adding the equations together, we get:

$$\begin{array}{r} 1 = 4a - 2b \\ +(-7 = 2a + 2b) \\ \hline -6 = 6a \end{array} \quad \left(\begin{array}{r} 1 - 7 = -6 \\ 4a + 2a = 6a \\ -2b + 2b = 0 \end{array} \right)$$

By dividing both sides by -6, we see that $a = -1$.

To solve for b, we substitute -1 for a in either equation from the system.

$-3.5 = a + b$

$-3.5 = -1 + b$ (Replace a with -1)

$-2.5 = b$ (Add 1 to both sides)

So, the system is solved if $a = -1$ and $b = -2.5$.

Substitute the values for a and b into the graph's equation $y = ax^2 + bx + 1$

$y = -1x^2 - 2.5x + 1$ (Replace a with -1 and b with -2.5)

To express the equation as a function, we replace y with the notation $g(x)$.

Therefore, an equation for the **Graph-2** is $\boxed{g(x) = -x^2 - 2.5x + 1}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 9E

The objective is to find an expression for the cubic function f if the following statement holds:

" $f(1) = 6$ and $f(-1) = f(0) = f(2) = 0$"

A cubic function is a polynomial of degree 3 which can be written in the following form:

$f(x) = ax^3 + bx^2 + cx + d$

Here, a, b, c and d are constants.

It is given that $f(-1) = f(0) = f(2) = 0$, which implies that if x equals $-1, 0$ or 2, then the output is 0. Hence the graph of f would have three $x-$intercepts, or zeros.

The factored form of a cubic equation with three zeros is as follows:

$f(x)=m(x-s)(x-t)(x-u)$

Here, m is the greatest common factor, or GCF, of the terms in the cubic function, and s, t and u are the zeros of the function. Since, three zeros of the given function are known, substitute these values into the equation $f(x)=m(x-s)(x-t)(x-u)$.

$f(x)=m(x-(-1))(x-0)(x-2)$ (replace s with -1, t with 0 and u with 2)

$f(x)=m(x+1)(x)(x-2)$ $(-(-1)=1)$

Therefore, the equation of the cubic function is $f(x)=m(x+1)(x)(x-2)$. Here, m is an unknown constant. Solve for m as follows:

It is known that $f(1)=6$. Therefore, replace x with 1 in the equation $f(x)=m(x+1)(x)(x-2)$ and then replace $f(1)$ with 6 to solve for m as follows:

$f(x)=m(x+1)(x)(x-2)$

$f(1)=m(1+1)(1)(1-2)$ (Replace each x with 1)

$6=m(1+1)(1)(1-2)$ (Replace $f(1)$ with 6)

$6=m(2)(1)(-1)$ (Add)

$6=-2m$ (Multiply)

$-3=m$ (Divide both sides by -2)

Hence, replace m with -3 in the equation $f(x)=m(x+1)(x)(x-2)$ as follows:

$f(x)=-3(x+1)(x)(x-2)$

Therefore, the equation for the cubic function is $\boxed{f(x)=-3x(x+1)(x-2)}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 10E

The recent studies indicate that the average surface temperature of the earth has been rising steadily.

Consider some scientists have modeled the temperature by the linear function,

$T=0.02t+8.50$,

Where T is the temperature in $°C$ and t represents years since 1900.

(a)

The equation of linear form is $y=mx+c$, m is the slope and c is *y*-intercept.

Now compare $T=0.02t+8.50$ with $y=mx+c$.

Therefore, slope of the linear equation is $\boxed{0.02}$ and the *y*-intercept is $\boxed{8.50}$.

(b)

Use the equation $T=0.02t+8.50$ predict the average global surface temperature in 2100.

Since 2100 is after 200 years from 1900, substitute $t=200$ in $T=0.02t+8.50$.

$$
\begin{aligned}
T &= 0.02(200)+8.50 \\
&= 4+8.5 \\
&= 12.5
\end{aligned}
$$

Therefore, the temperature in 2100 years is $\boxed{12.5°C}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 11E

Suppose that, to approximate the appropriate dosage c for a child of age a, pharmacists use the equation

$c=0.0417D(a+1)$

Here D represents the recommended adult dosage for a drug in mg.

Suppose the dosage for an adult is 200 mg. that is $D=200$ mg

(a)

Its need to determine the slope of the graph of c

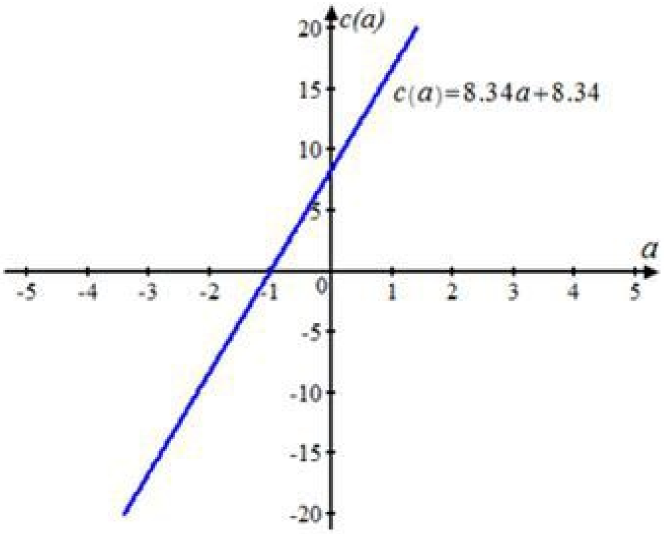
$c = 0.0417D(a+1)$ Original equation

$c = 0.0417(200)(a+1)$ Replace D with 200

$c = 8.34(a+1)$

$c = 8.34(a) + 8.34$

Below figure shows the graph of the linear function $c(a) = 8.34a + 8.34$ and a table of sample values.



a	$c(a) = 8.34a + 8.34$
0	8.34
1	16.68
2	25.02
3	33.36
4	41.7

Notice that whenever a increases by 1, the value of $c(a)$ increases by 8.34

So, $c(a)$ increases by 8.34 as fast as a

Thus the slope of the graph $c(a) = 8.34a + 8.34$, namely 8.34, can be interpreted as the rate of change of $c(a)$ with respect to a that this represents the increase in dosage, in mg, per year of age.

(b)

For a newborn, we use $a = 0$, and calculate c

$c = 8.34(a) + 8.34$ Original equation

$c = 8.34(0) + 8.34$ Replace a with 0

$= 8.34$

So, the dosage for a newborn is $\boxed{8.34}$ mg.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 12E

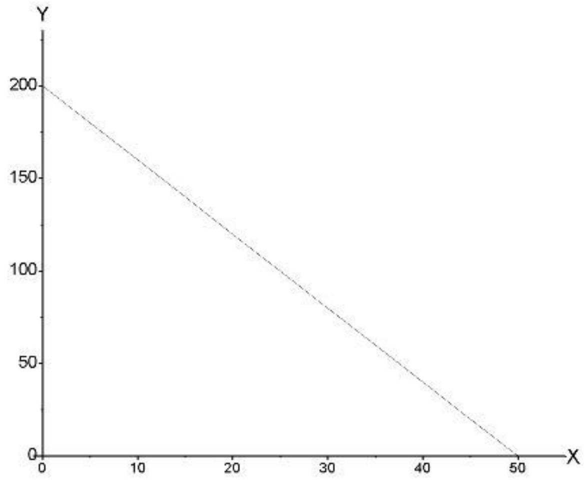
(A)

Since $x > 0$ so we take values of x from 0 onwards and since $y > 0$ so

$200 - 4x > 0$

$4x < 200 \Rightarrow x < 50$

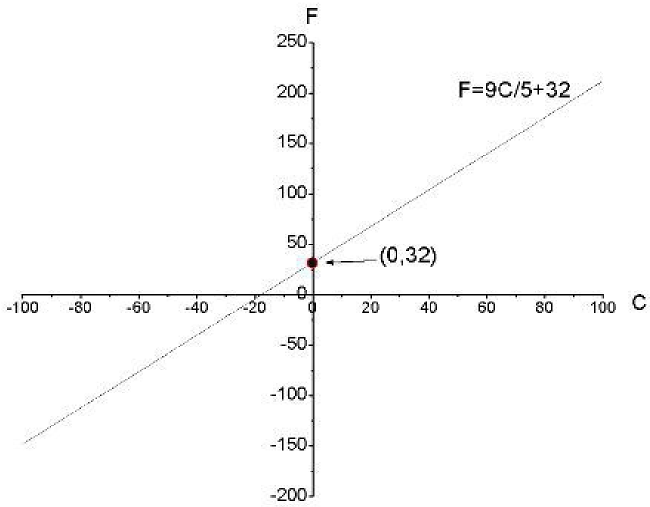
So we graph the function on the interval [0, 50]



(B)

Slope of the graph is -4, which means that for each increase of 1 dollar for rental space, the number of spaces rented decreases by 4.
The y-intercept is 200. Which is the number of spaces when no charge for each space.
X- Intercept is 50. This is the smallest rental charge that results in no spaces rented.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 13E



(A)

(B)

Slope of the graph is 9/5, which means that for each increase of 1 degree for C, F increases 9/5 degrees.
The F-intercept is 32. Which is the Fahrenheit temperature corresponds to a Celsius temperature of 0 degree C.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 14E

(A) Let d be the distance traveled (in miles) and t be the time (hours)
When t = 0, d = 0
Person starts at 2.00 pm and passes the distance 40 mile at 2.50 pm

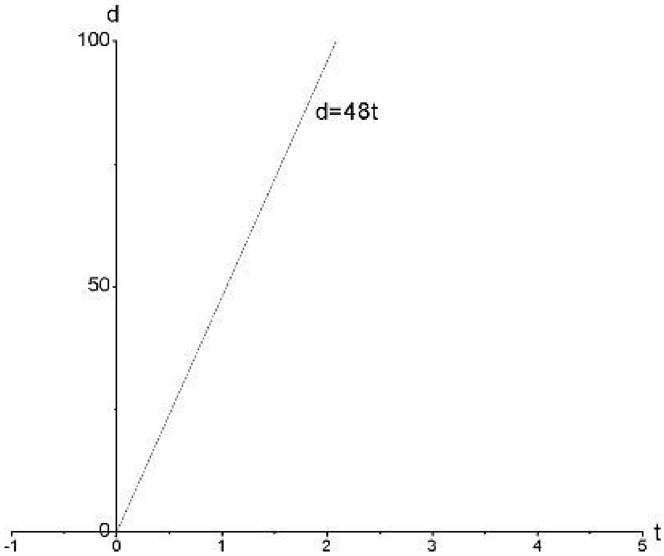
So time $t = \frac{50}{60} = \frac{5}{6}h$ and d = 40 miles

So we have two points (0, 0) and $\left(\frac{5}{6}, 40\right)$

So slope $m = \frac{40-0}{\frac{5}{6}-0} = \frac{240}{5} = 48$ miles / h^2

So equation of the distance function be $\boxed{d = 48t}$

(B)



(C) The slope of the line is 48 which represent the car's speed in miles/h

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 15E

(A) An insect produces 113 chirps per minute at $70°F$ and 173 chirps per minute at $80°F$

So slope of the linear function $= \dfrac{80-70}{173-113} = \dfrac{10}{60} = 1/6$

Then the equation of the linear function be

$$T-80 = \frac{1}{6}(N-173)$$

$$\Rightarrow T = \frac{N}{6} - \frac{173}{6} + 80$$

$$\Rightarrow \boxed{T = \frac{N}{6} + \frac{307}{6}}$$

Where T is the temperature and N is a number of chirps per minute.

(B)

$$\boxed{T = \frac{N}{6} + \frac{307}{6}}$$

Here coefficient of N is $\frac{1}{6}$.

Slope of the graph is 1/6 which represents the temperature in (F) increases One-sixth as the number of cricket chirps per minute increases.

(C) When N = 150 chirps/ minute then $T(150) = \dfrac{150}{6} + \dfrac{307}{6} = 76.17°F \approx 76°F$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 16E

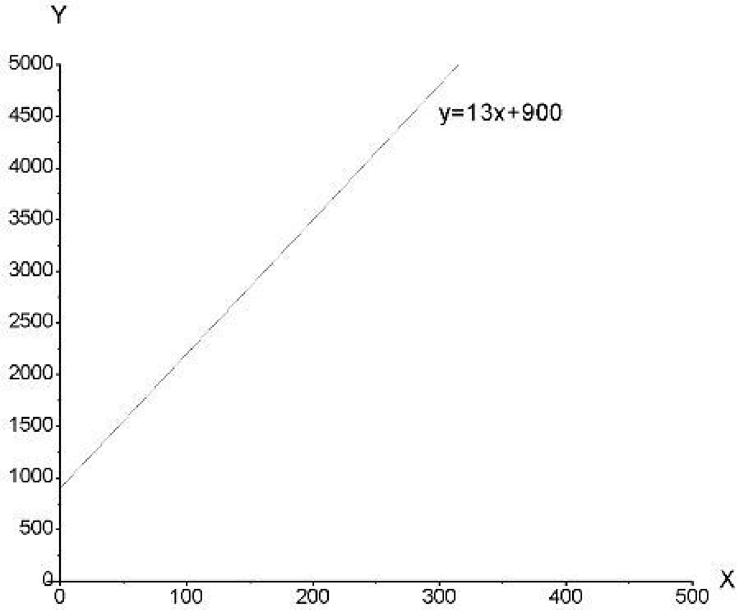
(A) Let x be the number of chairs produced in one day and y be the cost (in dollars)
We have been given when x = 100, y = 2200 and when x = 300, y = 4800
So we have two points on the graph of linear function (100, 2200) and (300, 4800)

Then the slope of the graph $= \dfrac{4800-2200}{300-100} = 13$

Then the equation of the linear function be

$$(y-2200) = 13(x-100)$$

$$\Rightarrow \boxed{y = 13x + 900}$$



(B)

Slope of the graph is 13, which represents the cost (in dollars) of producing each additional chair

(C) Y-intercept is 900 which is the fixed daily costs.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 17E

(A)

Let d be the depth and P be the pressure. We have, when $d=0$, $P=15$

So (0, 15) be the point on the graph of the function. Now pressure increases by

4.34 lb/in^2 for every 10ft .So pressure increases $\dfrac{4.34}{10}=0.434$ for every 1 ft.

So slope of the graph is 0.434 and y-intercept is 15 so equation of the linear function be $\boxed{P=0.434d+15}$

(B)

Now $P=100\ \text{lb/in}^2$

Then $100=0.434d+15$

$\Rightarrow 0.434=85$

$\Rightarrow d=\dfrac{85}{0.434}\approx \boxed{195.85}$ feet $\approx \boxed{196\text{ feet}}$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 18E

(A)

Let d be the distance traveled and c be the cost (in dollars)

So when $d=480$ miles $C=\$380$

And when $D=800$ miles $C=\$460$

So we have two points (480, 380) and (800, 460) on the graph of the linear function C. Then the slope of the graph is $=\dfrac{460-380}{800-480}=\dfrac{80}{320}=1/4$

So linear equation is

$$(C-380)=\frac{1}{4}(d-480)$$

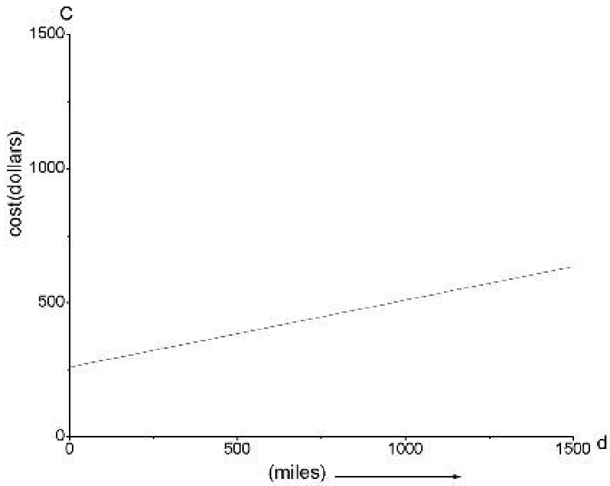
$$\Rightarrow C=\frac{d}{4}-120+380$$

$$\Rightarrow \boxed{C=\frac{d}{4}+260}$$

(B)

When $d=1500$ miles then cost $C=\dfrac{1500}{4}+260=\boxed{\$635}$

(C)



(D)

Y-intercept is $260 which represents the fixed cost.

(E)

Linear function gives a suitable model in this situation because we have fixed monthly costs (insurance, and car payments) and cost of fuel, tires, oil for each additional mile driven is a constant

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 19E

(A)

The given graph is a graph of periodic function. So a trigonometric function would be best model. Appropriate model is $\boxed{f(x) = a\cos(bx) + C}$

(B)

In this graph the data is decreasing in a linear form. So model $\boxed{f(x) = mx + b}$ will be the appropriate model with $m < 0$

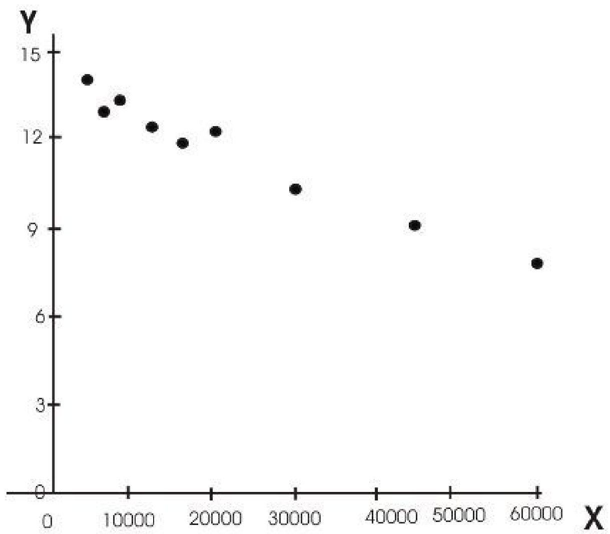
Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 20E

(A)

Data is increasing exponentially so a model $\boxed{f(x) = a.b^x}$ *or* $\boxed{f(x) = ab^x + C}$ is the appropriate model

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 21E

(A)



A linear model is appropriate because data is decreasing linearly approximately

(B)

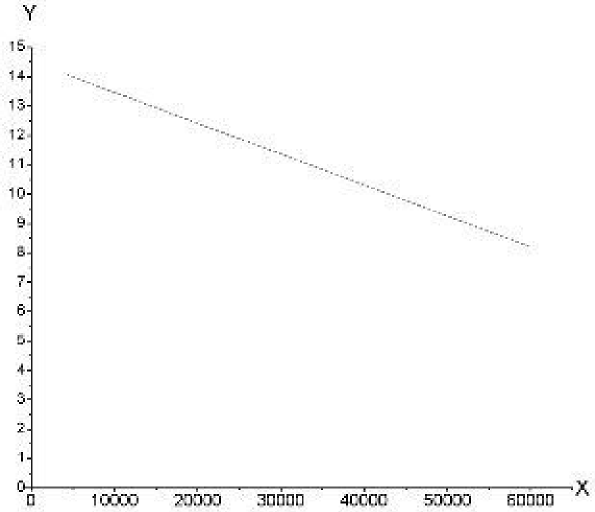
Using (4000, 14.1) and (60000, 8.2)

$$\text{Slope} = \frac{8.2 - 14.1}{60000 - 4000} \approx -0.000105357$$

Then equation

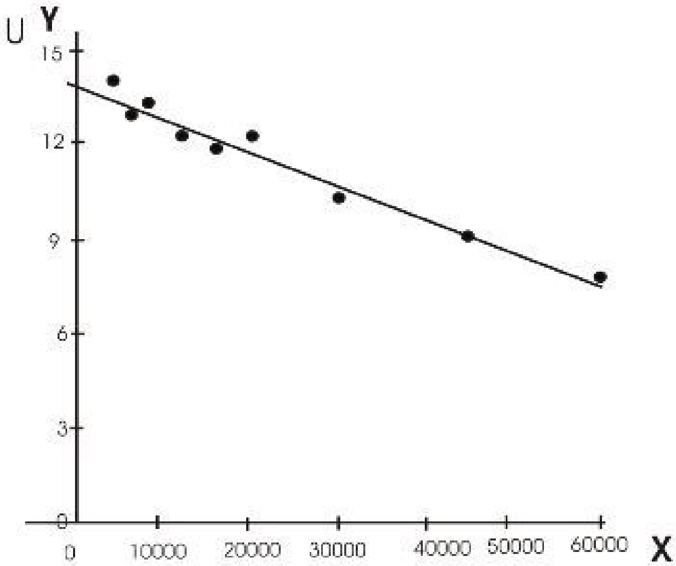
$$y - 14.1 \approx -0.000105357(x - 4000)$$

$$\Rightarrow \boxed{y \approx -0.000105357x + 14.521429}$$



(C) With the help of computer we get the least squares regression line

$$y = -0.0000997855x + 13.950764$$



(D)

When $x = \$25000$

Then $y \approx -0.0000997855 \times 2500 + 13.950764$

≈ 11.456 or $\boxed{11.5}$ per 100 population

(E)

When $x = 80000$, $y \approx 5.968$ or about 6% chance

(F)

When $x = 200000, y$ is negative, so model can not be applied.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 22E

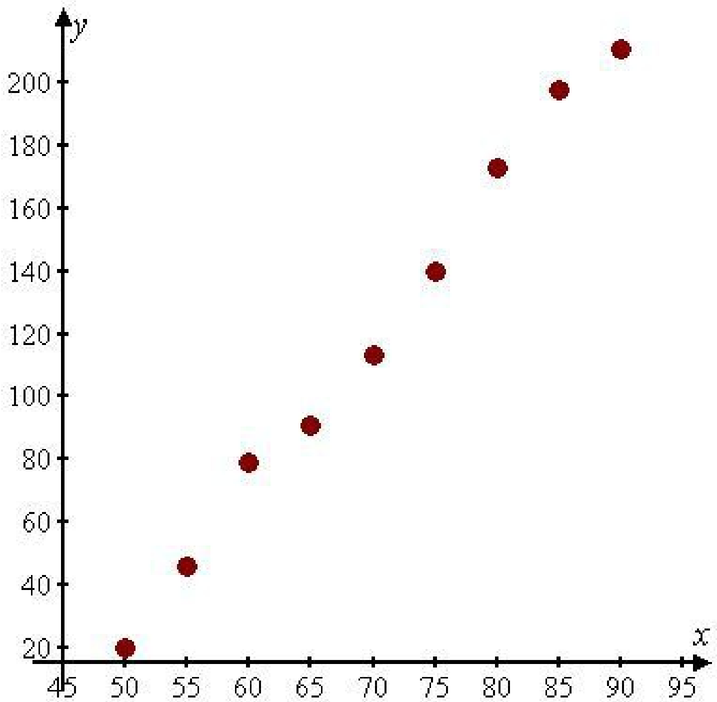
The following table shows the chirping rates for various temperatures.

Temperature (oF)	Chirping rate (chirps/min)
50	20
55	46
60	79
65	91
70	113
75	140
80	173
85	198
90	211

>

(a) **Make a scatter plot of the above tabular data.**

Take the temperature on *x*-axis and chirping rate on *y*-axis, and then the scattered plot for the given tabular data will be as shown in the following diagram.



(b) From the above figure it is observed that the points are one after the other, so the Linear model is fits the given data.

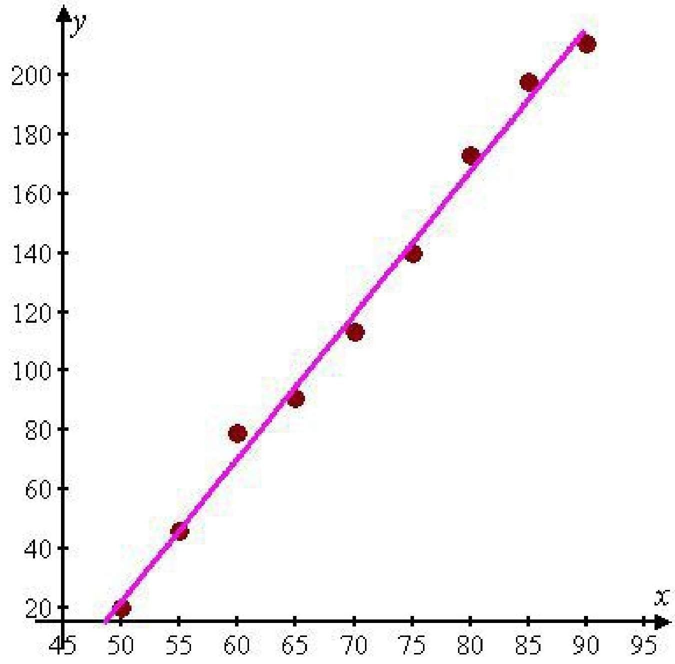
Use the graphing calculator or computer algebraic system (which uses Least squares method) to find the regression line ·

The linear model that fits the given tabular data is as follows.

$$\boxed{C = 4.86T - 221}$$

Where C represents the chirping rate and T represents the temperature.

The following diagram shows scatter plot and the regression line for the data.



(c) Estimate the chirping rate at 100oF.

Substitute 100 for T in $C = 4.86T - 221$ and simplify it.

$$\begin{aligned} C &= 4.86(100) - 221 \\ &= 486 - 221 \\ &= 265 \end{aligned}$$

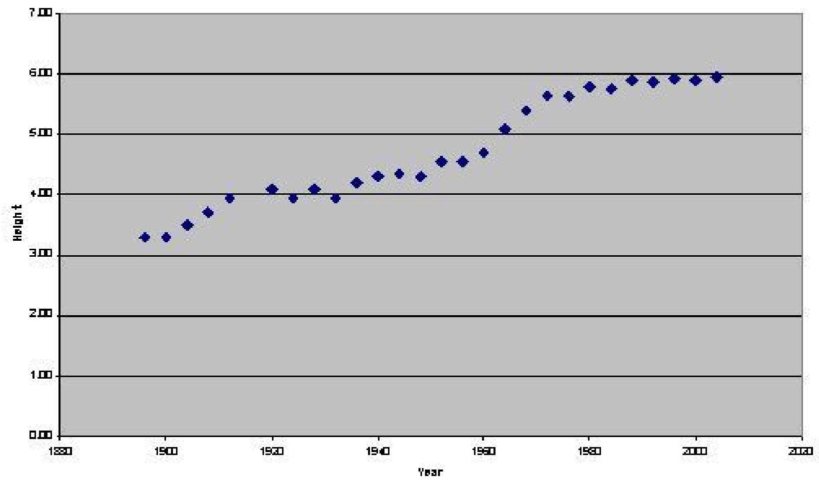
Hence the chirping rate at 100oF is $\boxed{\textbf{265 chirps / min}}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 23E

The table gives the winning heights for the men's Olympic pole vault competitions upto the year 2004.

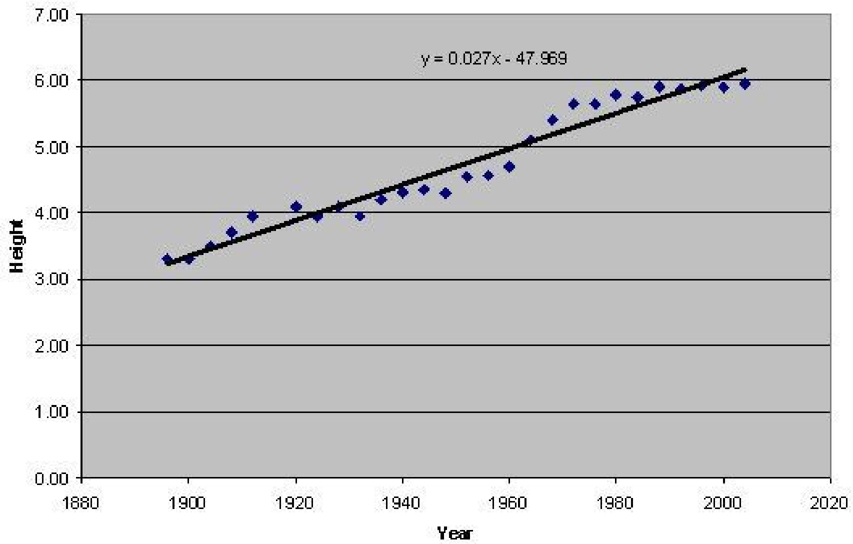
year	Height(m)	year	Height(m)
1896	3.3	1960	4.7
1900	3.3	1964	5.1
1904	3.5	1968	5.4
1908	3.71	1972	5.64
1912	3.95	1976	5.64
1920	4.09	1980	5.78
1924	3.95	1984	5.75
1928	4.09	1988	5.9
1932	3.95	1992	5.87
1936	4.2	1996	5.92
1940	4.31	2000	5.9
1944	4.35	2004	5.95
1948	4.3		
1952	4.55		
1956	4.56		

(a) Scatter plot of the given data (using MS Excel)
:



From the graph we observe that the linear model is appropriate.

(b) Using MS Excel, we get that the Equation of regression line is
$H = 0.027t - 47.969$
Scatter graph along with the regression line is shown below:



(c) Using the linear model, height of the height of the winning pole vault at the 2008 Olympics is

$H = 0.027t - 47.969$

$H = 0.027(2008) - 47.969$

$H = 6.247$

The actual winning height in was 5.96 meters.
So the prediction using the linear model is higher than the actual winning height.

(d) If we predict the winning height in 2100 using this linear model, we get

$H = 0.027t - 47.969$

$H = 0.027(2100) - 47.969$

$H = 8.731\text{m}$

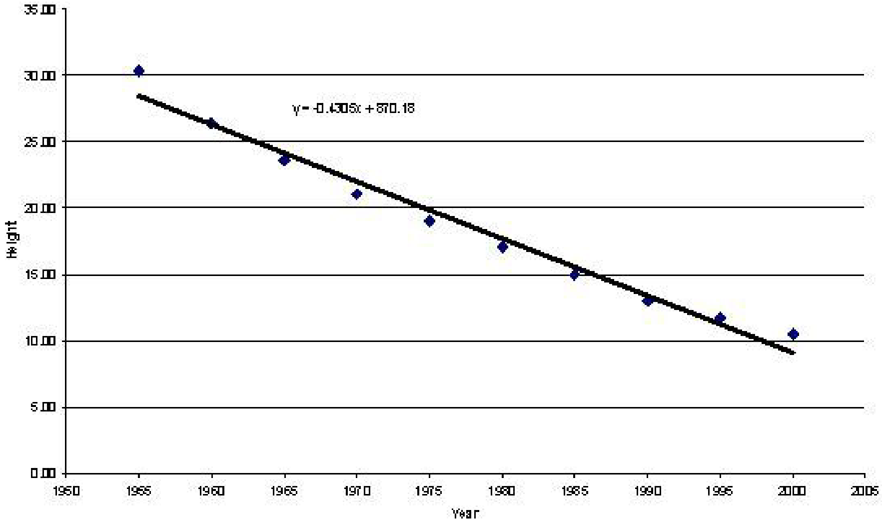
This is very much impossible. So, it is not reasonable to use the model to predict the winning height at the 2100 Olympics.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 24E

The table shows the percentage Argentina that has lived in rural areas from 1955 to 2000.

year	Height(m)	year	Height(m)
1955	30.4	1980	17.1
1960	26.4	1985	15.0
1965	23.6	1990	13.0
1970	21.1	1995	11.7
1975	19.0	2000	10.5

Scatter graph of the given data.



The regression line is also shown on the graph.

From the graphing utility (MS Excel) we get that the linear model for the data is

$$P = -0.4305t + 870.18$$

From this linear model:
Rural percentage in 1988 is

$$P = -0.4305(1988) + 870.18$$

$$P = -855.834 + 870.18$$

$$P = 14.346$$

Rural percentage in 1988 is 14.346%

Rural percentage in 2002 is

$$P = -0.4305(2002) + 870.18$$

$$P = -861.861 + 870.18$$

$$P = 8.319$$

Rural percentage in 2002 is 8.319%

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 25E

The illumination of an object by a light source is inversely proportional to the square of the distance from the source.
It can be written as a function of x the distance from the source

$$f(x) = kx^{-2}$$

If we move halfway to the lamp, then the illumination is

$$f(x) = k\left(\frac{x}{2}\right)^{-2}$$

$$\Rightarrow f(x) = k\frac{x^{-2}}{2^{-2}}$$

$$\Rightarrow f(x) = 4kx^{-2}$$

From this we get that the light is 4 times as brighter as it was at distance x.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 26E

The number of species S of bats living in a cave in central Mexico has been related to the surface area A of the caves by the equation

$$S = 0.7A^{0.3}$$

(a) Surface area of the cave called Mision Impossible near Puebla, Mexico is
$A = 60$ m2
The number of species of bats living in the cave is
$S = 0.7A^{0.3}$
$\Rightarrow S = 0.7(60)^{0.3}$
$\Rightarrow S = 0.7(3.41543)$
$\Rightarrow S = 2.390801$
$\Rightarrow S \approx 2$
Therefore the number of species of bats in the cave is 2.

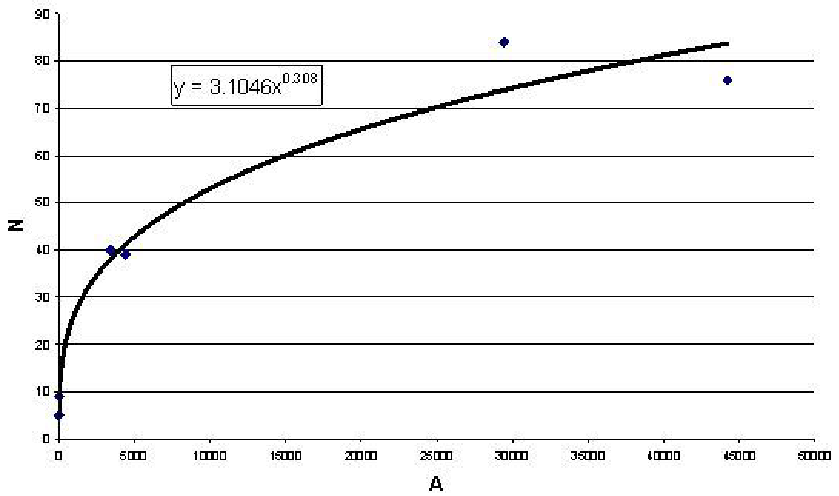
(b) If 4 species of bats live in the cave, then
$S = 0.7A^{0.3}$
$\Rightarrow 4 = 0.7A^{0.3}$
$\Rightarrow \frac{4}{0.7} = A^{0.3}$
$\Rightarrow \left(\frac{4}{0.7}\right)^{\frac{1}{0.3}} = A$
$\Rightarrow A = (5.7143)^{\frac{1}{0.3}}$
$\Rightarrow A = 333.58$
$\Rightarrow A \approx 334$ m2

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 27E

The table shows the number of reptiles and amphibians inhabiting Caribbean islands and the area of the island in square miles.

Island	A	N
Saba	4	5
Monserrat	40	9
Puerto Rico	3459	40
Jamaica	4411	39
Hispaniola	29418	84
Cuba	44218	76

(a) Let us first plot the scatter graph for the given data. (Using MS Excel). Using regression feature of Power Type we draw the trend line and we obtain the power function for the given data.



We get the following power function
$N = 3.1046A^{0.308}$

(b) The Caribbean island of Dominica has area 291 m^2
The number of reptiles and amphibians inhabiting Dominica is
$N = 3.1046A^{0.308}$
$\Rightarrow N = 3.1046(291)^{0.308}$
$\Rightarrow N = 3.1046(5.74)$
$\Rightarrow N = 17.82$
$\Rightarrow N \approx 18$
Therefore, the number of reptiles and amphibians inhabiting Dominica is 18

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.2 28E

Consider the data,

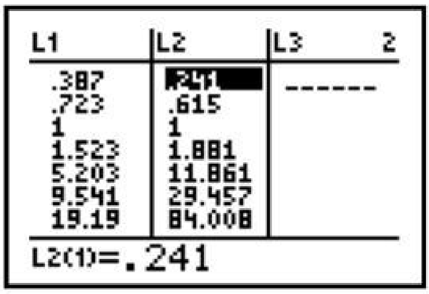
Planet	*d*(Mean distance)	*T* (Period of revolution)
Mercury	0.387	0.241
Venus	0.723	0.615
Earth	1.000	1.000
Mars	1.523	1.881
Jupiter	5.203	11.861
Saturn	9.541	29.457
Uranus	19.190	84.008
Neptune	30.086	164.784

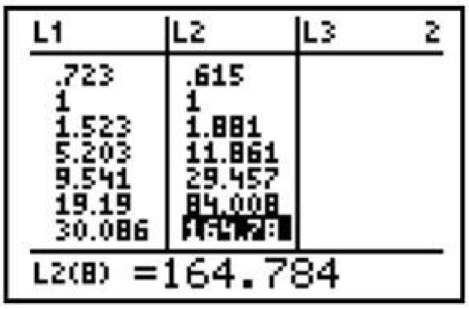
(a)

Find a power model for the above data:

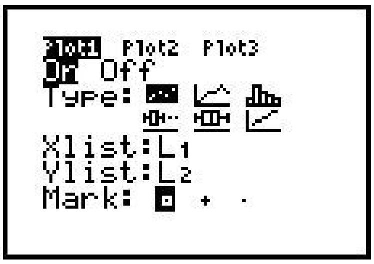
Step1: Press STAT 1 for the EDIT screen; enter values of years into L_1 and sales into L_2.

The display as shown below:

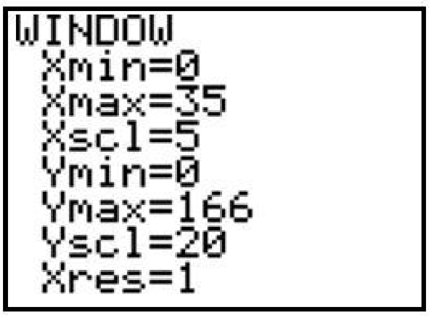




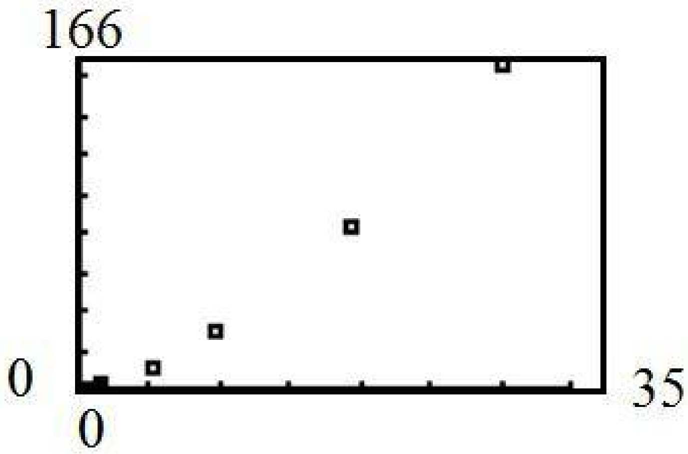
Step2: Press 2nd Y= and select Plot 1. Then set as follows



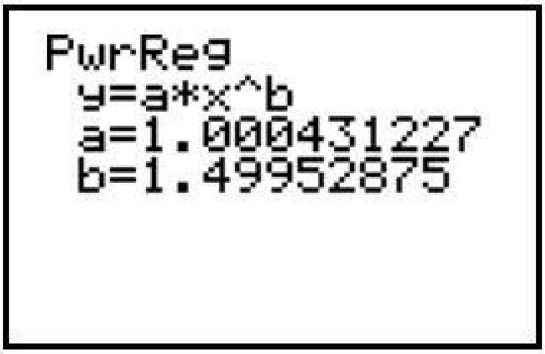
Step3: Press WINDOW key then set as follows



Step4: To view the scatter plot of the data, Press GRAPH key.



Step5: Press 2nd MODE then press STAT chooses CALC sub menu and press A then Press 2nd L_1 , 2nd L_2 and press ENTER key.



Therefore, the Power Model: $T = \boxed{1.004d^{1.499}}$

(b)

Kepler's Third Law of Planetary Motion states that "the square of the period of revolution of a planet is proportional to the cube of its mean distance from the sun."

So, there exist a constant *k* such that

$$T^2 = kd^3$$

Where *T* is the period of revolution of a planet and *d* is the mean distance from the sun.

Rewrite it as,

$$T^2 = kd^3$$
$$T = \sqrt{kd^3}$$
$$T = \sqrt{k}d^{1.5}$$

This is much closed to the power model in part (a) with $\sqrt{k} = 1.004$

Yes, the power model corroborates Kepler's Third Law.