Exercise 1.1

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 1E

$f(x)=x+\sqrt{2-x}$
$g(u)=u+\sqrt{2-u}$

Domain of both the functions is $(-\infty,2]$
For any value in the domain of the function
If
$x=u$

Then
$f(x)=g(u)$

So it is true that $f=g$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 2E

$f(x)=\dfrac{x^2-x}{x-1}$
$g(x)=x$

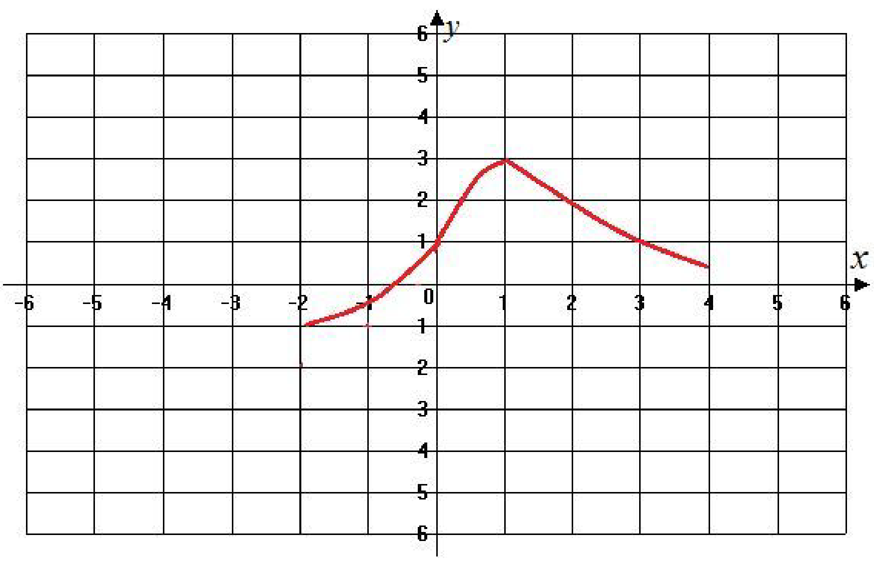
Domain of $f(x)=\dfrac{x^2-x}{x-1}$ is $(-\infty,1)\cup(1,\infty)$
Domain of $g(x)=x$ is $(-\infty,\infty)$

Function $f(x)=\dfrac{x^2-x}{x-1}$ is not defined at $x=1$, whereas $g(x)=x$ is defined all real values of x, so $f\neq g$

So it is not true that $f=g$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 3E

Consider the following graph:



a)

Need to determine the function value at *x* = 1.

Observe the above graph, the point on the graph at *x* = 1 is 3 units above the *x*-axis.

From the graph the point (1, 3) lies on the above graph, the value of *f* at 1 is 3.

Therefore *f*(1) = 3

b)

Need to determine the function value at *x* = -1.

Observe the above graph, the point on the graph at *x* = -1 is 0.25 below the *x*-axis.

From the graph, when $x = -0.25$, the graph lies about 0.25 unit below the *x*-axis, so the approximate value of $f(-1) = -0.25$

c)

Need to determine, for what values of *x* is $f(x) = 1$

From the graph, observe that the points (0, 1) and (3, 1) lie on it.

So, for the values $x = 0, 3$ the value of $f(x) = 1$

d)

Need to determine, for what values of *x* is $f(x) = 0$

From the graph, observe that the point $(-0.8, 0)$ lies on the above graph.

So, observe that at $x = -0.8$ the value of $f(x) = 0$.

e)

Observe that f(x) is defined when $-2 \le x \le 4$, so the domain of f is $[-2, 4]$

Also *f* takes on values from -1 to 3, so the range of *f* is $[-1, 3]$

Therefore, the domain and range is as follows:

Domain of the function f is $\boxed{[-2, 4]}$.

Range of the function f is $\boxed{[-1, 3]}$.

f)

Need to determine, on what interval is *f* increasing.

From the above graph, observe that, *f* rises from -2 to 1

Therefore, *f* is increasing on the interval $[-2, 1]$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 4E

(A) $f(-4) = -2$ and $g(3) = 4$

(B) $f(x) = g(x)$ when $x = -2$ *and* $x = 2$

(C) $f(x) = -1 \Rightarrow x = -3, 4$

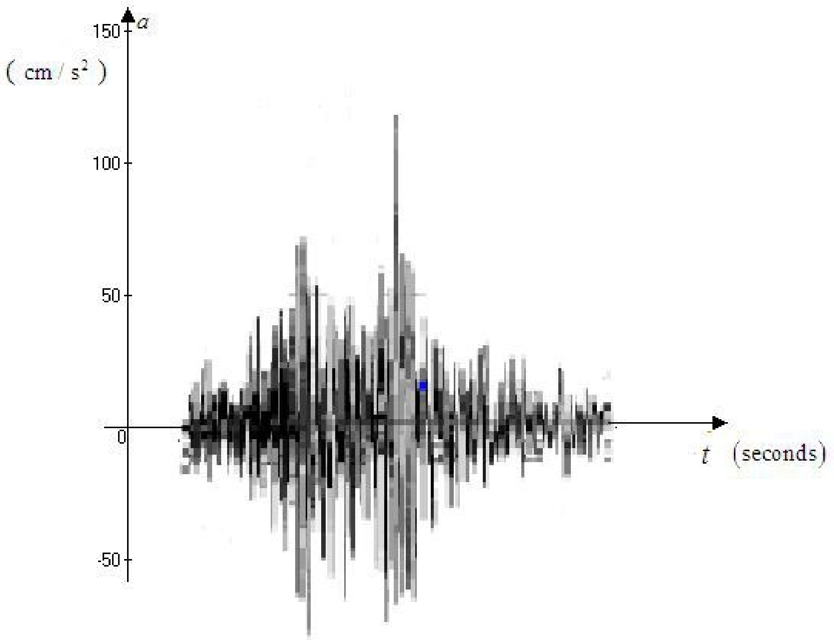
(D) f is decreasing on interval [0, 4]

(E) Domain of f is [-4, 4]
Range of f is [-2, 3]

(F) Domain of g is [-4, 3]
Range of g is [0.5, 4]

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 5E

Consider the following is the figure:



Use the above figure and estimate the range of the vertical ground acceleration function.

From the above figure, vertical ground acceleration function ranges from -85 to 115.

Therefore, the range of the function is, $\boxed{[-85, 115]}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 6E

(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 $y = x^3$

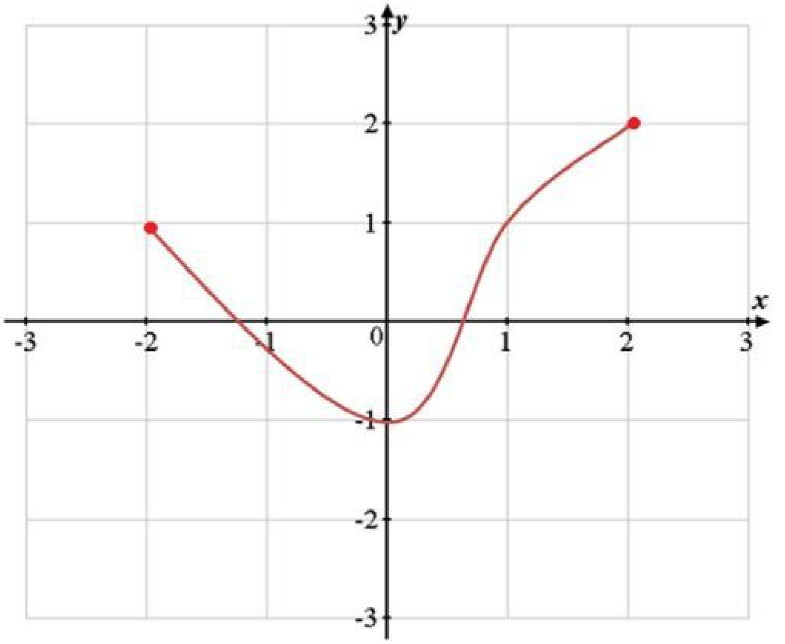
(D) $y = \sqrt[3]{x}$ is a root function and symmetric about origin so graph [g] is the graph of $y = \sqrt[3]{x}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 7E

It is $\boxed{\text{not}}$ the graph of function because it fails the vertical line test. For example, the line x = 0 (y-axis) intersects the graph at more than one points.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 8E

Consider the following graph:



The objective is to determine whether a graph represents a function. If so find the domain and range.

To determine whether a graph represents a function, we have to use the vertical line test.

The vertical line test says that a graph is a function if **no** vertical line intersects the graph more than once.

From the above graph, we see that no vertical line would intersect the graph more than once. This is enough to confirm that the graph is $\boxed{\text{a function}}$.

The domain of the function consists of all of the *x* values which can be found on the graph.

Here the graph exists for $-2 \le x \le 2$ with no breaks in the graph.

So the domain is the closed interval $\boxed{[-2,2]}$.

The range of the function consists of all of the *y* values which can be found on the graph. The lowest point has a *y*-value of -1 and the highest point has a *y*-value of 2.

Since there are no breaks in the graph, the range consists of all *y*-values in the closed interval $\boxed{[-1,2]}$.

Therefore the range of f is $\boxed{\{y \mid -1 \le y \le 2\} \text{ or } [-1,2]}$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 9E

The given curve is the graph of a function since vertical line touches the graph in at most one point

The domain of the function is $\boxed{[-3, 2]}$ and the range of the function is

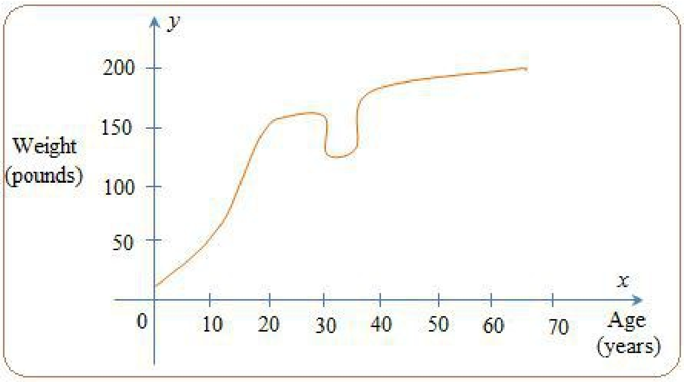
$\boxed{[-3,-2) \cup [-1,3]}$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 10E

The given curve is $\boxed{\text{not}}$ the graph of a function. Since any vertical line through integral values of x touches the graph at more than one point.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 11E

Sketch a graph that gives the person's weight as a function of age.



From the graph, observe that the person's weight is taken along the y – axis, and age is taken on the x – axis.

The graph shows that the person's weight rises between the age group 0-20; the increase in weight is like an uphill.

From 20-30, the weight of the person slightly increases about 160 pounds.

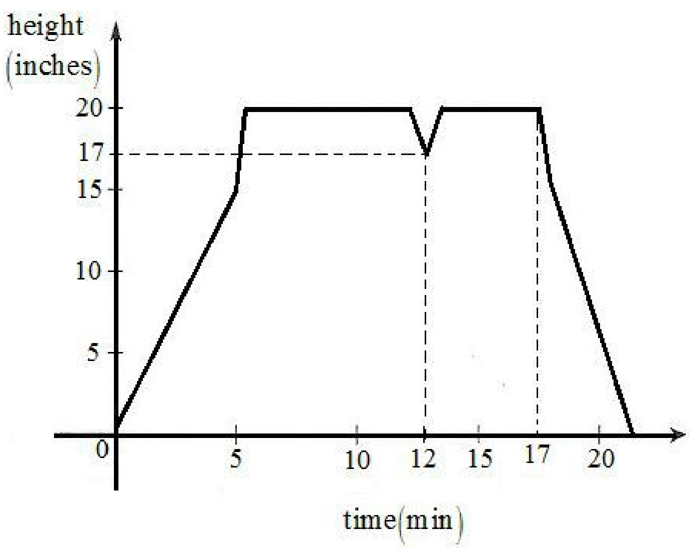
At the start of 30's, his weight dropped quickly to around 120 pounds. Then at age 35, the weight increased rapidly to about 170 pounds.

For the next 30 years, the person's weight gradually increased to about 190 pounds.

Therefore, the possible reasons for the loss of weight at the age of 30 are "he must be in the diet" or "in the exercise" or "maybe ill health".

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 12E

Below graph shows the height of the water in a bathtub as a function of time.



Verbal description of the graph is as follows:

Initially the bathtub was empty. When the water was flowing in the bathtub, the height of the water was increasing.

In first 5 minutes the height of the water increased up to 15 inches uniformly.

After that it took very less time to increase the height from 15 inches to 20 inches.

Then for next 7 minutes height of water in the bathtub didn't change, it remained 20 inches.

After that some water was taken out then the height of water reduced by 3 inches. Again water was filled in the bathtub and the height of water in bathtub again increased up to 20 inches.

For next 4 minutes the height remained 20 inches. Then again water was taken out and it took approximately 4 minutes to empty the bathtub.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 13E

Consider that some ice cubes are put in a glass which is filled with cold water.

On the graph, let y be the value of the temperature and x be the value of the time.

Notice that the temperature of the water in the glass starts cooling and then cools down further to almost freezing point as the ice melts.

This means that as time increases, temperature decreases.

So, this section of the graph would decrease to show the temperature falling.

Next, the water remains quite cold for some time while ice continues to melt.

So, the temperature remains constant, as the time increases.

This section of the graph would remain mostly horizontal to show no change in the temperature.

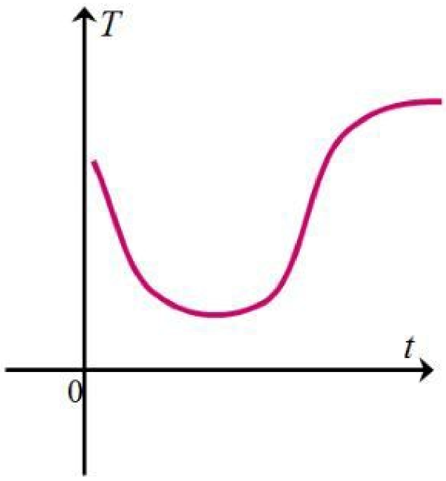
After the ice melts, the water temperature slowly rises to approach room temperature.

This section of the graph would increases to show the temperature rising.

The final temperature would presumably be higher than the original temperature of the water, since it was mentioned that the glass had cold water.

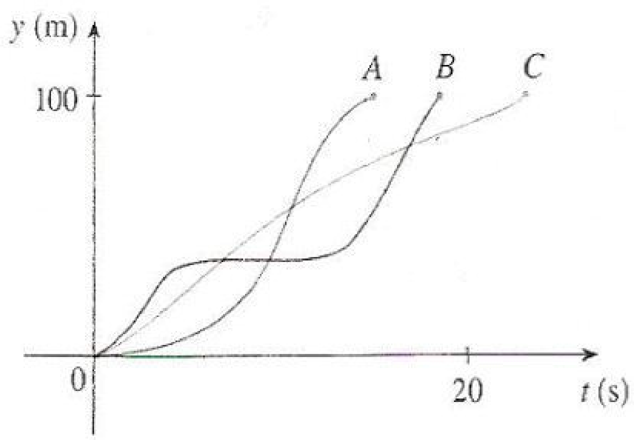
The above analysis can be graphically represented as shown below:

Temperature and time cannot be negative, so the graph will lie in first quadrant.



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 14E

Given graph shows the distance run as a function of time for each runner.



Verbal description of the given graph is as follows:

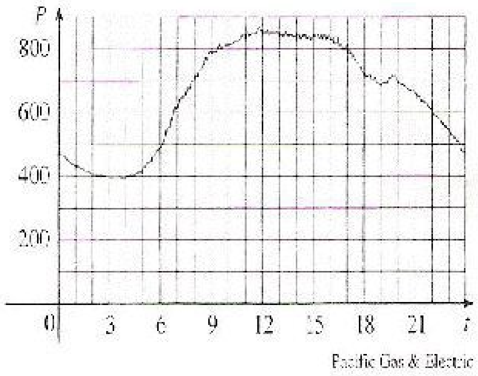
In the beginning B was leading the race. A was slow in the beginning but completed the race in the least time. B took more time than A and less than C. C took maximum time to finish the race.

A won the race.

Yes, each runner finished the race.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 15E

Given graph shows the power consumption in a day in September in San Francisco.



(a) At 6 AM the power consumption was approximately 500 megawatts.
At 6PM the power consumption was approximately 730 megawatts.

(b) The power consumption was lowest at 4AM.
The power consumption was highest at 12 NOON.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 16E

In general, at the beginning of the year, the hour of daylight is at its lowest point because of the winter season.

Then the daylight hours will increases steadily through the end of winter, and at the beginning of the spring.

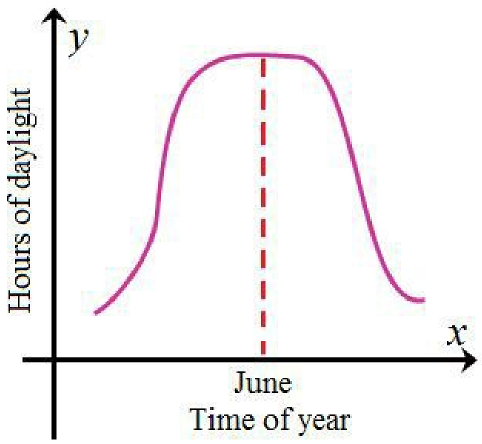
After that, as the summer season approaches, the daylight hours will increases rapidly. In this season daylight hours attains a maximum value and remains constant up to June.

Again, the daylight hours will decreases more quickly, and then decreases slowly at the beginning of the winter season (that is, around December).

The above analysis can be graphically represented as shown below:

Hours and time of year cannot be negative, so, the graph will lie in the first quadrant.

On the graph, let y be the value of the daylight hours and x be the time of the year:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 17E

To sketch the outdoor temperature as a function of time on spring day, take the time on the day from midnight to midnight.

At midnight the outdoor temperature is typically cool.

Normally, the outdoor temperature decreases slowly to an overnight and before the sunrise.

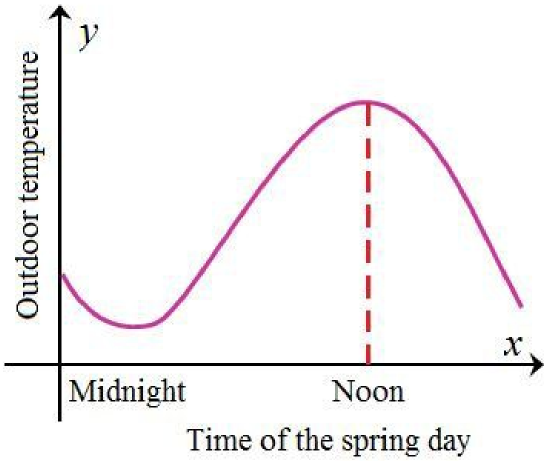
After that, as the sunrise, the outdoor temperature will increases rapidly, and attains a maximum value in the early afternoon. Then level offs for a while.

Again, the outdoor temperature will decreases slowly for the rest of the day.

The above analysis can be graphically represented as shown below:

Temperature and time of day cannot be negative, so, the graph will lie in the first quadrant.

On the graph, let *y* be the value of the outdoor temperature and *x* be the time of the typically spring day:



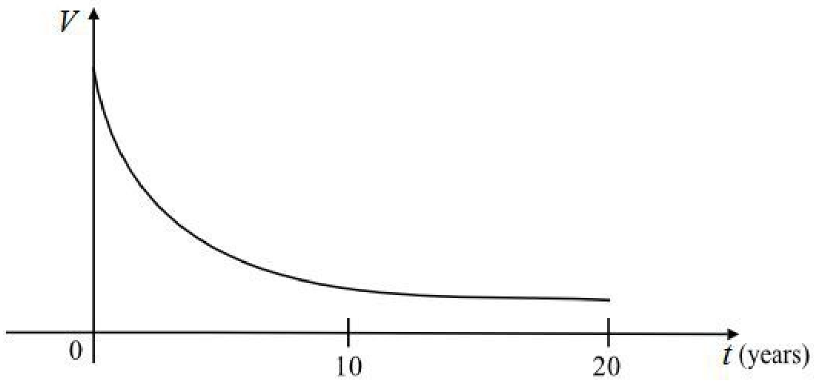
Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 18E

On the graph, we would represent the value of the car as the V value and the year since the car was purchased as the t value. Initially, the car's value will be at its highest because it is new.

Over time the value of the car will continue to decrease. The car's value will decrease more rapidly during the first few years, and then decrease less rapidly for the remaining time.

The decrease in value is shown on the graph by the graph going downhill from left to right. Initially the graph will be more steeply downhill because the car's value is dropping more rapidly during its first few years.

Here is a rough graph of the value, V, as a function of time, t, in years :



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 19E

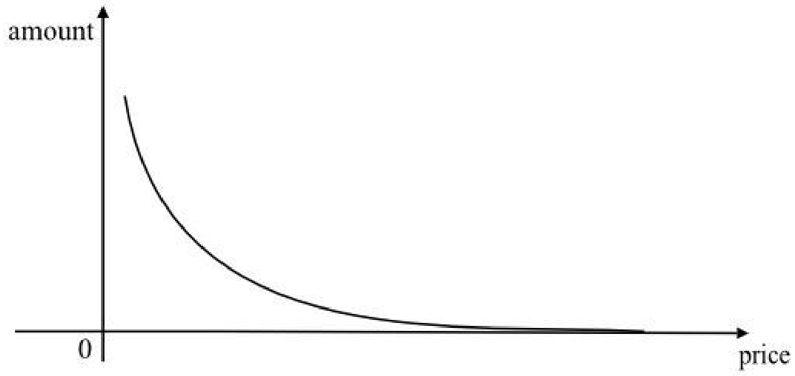
On the graph, represent the amount of coffee sold as the y value and the price of the coffee as the x value. Now, expect that for a lower price, the store could expect to sell more coffee.

Hence, the graph will start with a high y value, representing a large amount of coffee sold if the price, x, is low. The graph will start with some positive x value because we expect that the store would not want to give the coffee away for free.

As the price, x, increases, the store would sell less coffee. So the amount of coffee sold, y, would decrease. Hence, the graph would go downhill as the graph moves to the right.

As the price, x, continues to increase, the store would continue to sell less coffee until the coffee is so expensive that no one will buy any. Hence the graph will decrease until the amount sold, y, is 0.

A rough graph of the amount of coffee sold as a function of price is as follows:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 20E

Here, the initial temperature of a frozen pie is very cool.

Next, place the frozen pie in the oven for an hour.

During this section, the temperature of the pie will increase rapidly.

After one hour, take out the frozen pie from the oven.

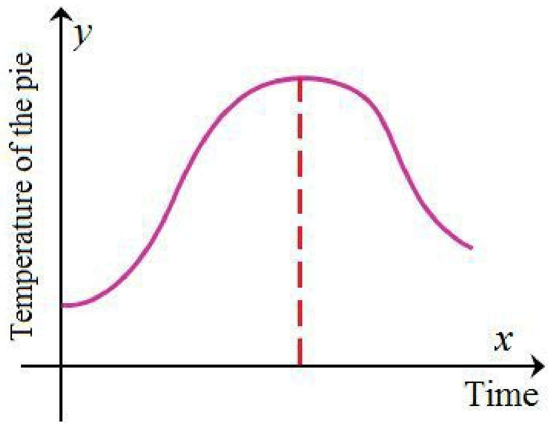
At this stage, the pie is as hot as the oven. So, the temperature of the pie will reach its maximum value and remains constant for a moment.

Finally, the temperature of the pie will decrease gradually,.

The above analysis can be graphically represented as shown below:

Temperature and time cannot be negative, so, the graph will lie in the first quadrant.

On the graph, let y be the value of the temperature of the pie and x be the time:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 21E

Consider that every Wednesday afternoon a homeowner cuts the grass.

So, the initial height of the grass would be low on the first week of Wednesday.

During the period from Wednesday to Wednesday, the height of the grass will increase gradually.

Then on the second week of Wednesday, again the grass gets cut.

So, the height of the grass would instantly become shorter.

This change would show on the graph as a gap between a higher y value and a lower y value.

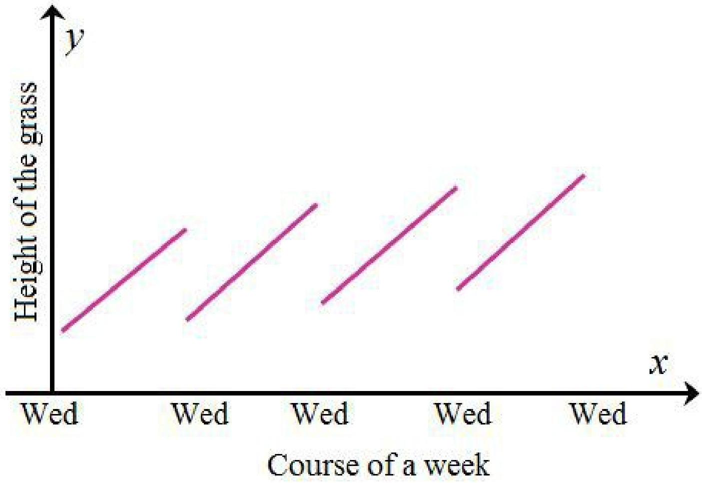
The same pattern would repeat three more times.

Each week, the grass would gradually increase in height, and then instantly become shorter each Wednesday.

The above analysis can be graphically represented as shown below:

Height and day of a week cannot be negative, so, the graph will lie in the first quadrant.

On the graph, let *y* be the height of the grass and *x* be the course of the weeks:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 22E

(a)

Over the course of the flight, the distance travelled would continually increase from 0 to 400 miles.

For this, the graph will be uphill from left to right.

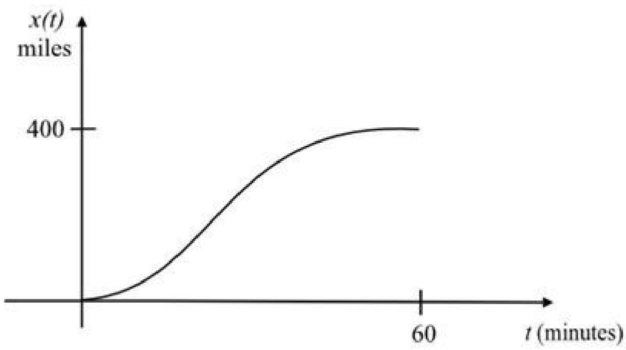
After that, the graph will be steepest in the middle because, the plane is traveling fastest.

This means, its distance travelled is increasing fastest, during the middle of the flight.

On the graph, let $x(t)$ be the horizontal distance travelled, and *t* be the time over the course of the flight.

For this graph, the *t* axis would be horizontal, and the *x* axis would be vertical.

Here is a rough graph of the horizontal distance in miles, $x(t)$, as a function of time in minutes, *t*:



(b)

For the beginning of the flight, the altitude would increase from 0 to approximately 35,000 ft.

For this portion, the graph will be going uphill from left to right.

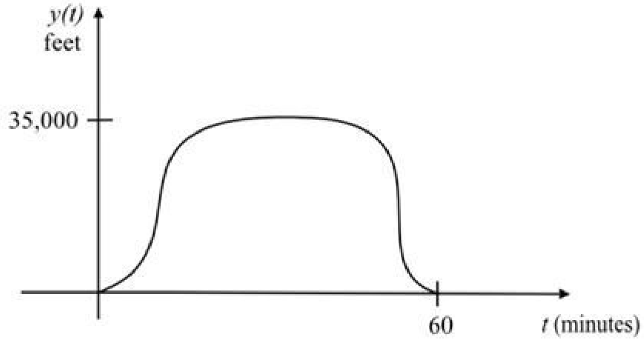
Next, the plane would level off at cruising altitude. So, the graph will remain relatively flat for some time.

After that, the plane will descend to land at the end of 60 minutes. So, the graph will go downhill from 35,000 to 0 as the plane is landing.

On the graph, let $y(t)$ be the altitude of the plane as the *y* value, and *t* be the time over the course of the flight as the *t* value.

For this graph, the *t* axis would be horizontal and the *y* axis would be vertical.

Here is a rough graph of the altitude in feet, $y(t)$, as a function of time in minutes, t:



(c)

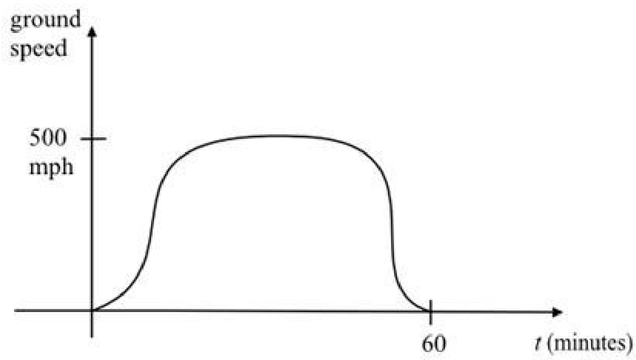
The ground speed is the measurement of speed from the reference of someone on the ground.

The plane travels 400 miles in 1 hour, so its average ground speed is 400 miles per hour. However, over the course of the flight, the plane would start from 0 mph and increase to its top speed, then slow down as it comes in for a landing.

On the graph of the ground speed, let *y* be the speed, and *t* be the time over the course of the flight. For this graph, the *t* axis would be horizontal and the ground speed axis would be vertical.

The graph would show this by going uphill until reaching the highest ground speed, and then it would level out as the plane flies steadily at its maximum speed, then the graph would go downhill as the plane's speed lessens while it comes in for a landing.

Here is a rough graph of the ground speed in mph as a function of time in minutes, t:



(d)

On the graph of the vertical velocity, we would represent the velocity as the *y* value and the time over the course of the flight as the *t* value. For this graph, the *t* axis would be horizontal and the vertical velocity axis would be vertical.

The vertical velocity is the measurement of speed and direction as the plane rises and falls. While the plane is ascending, the vertical velocity is positive. While the plane is descending, the vertical velocity is negative.

Initially, the plane starts on the ground where its vertical velocity is 0 mph. As the plane ascends, it increases its vertical velocity because it is climbing at a fast rate. The graph would show this change in vertical velocity by going uphill from left to right on this interval.

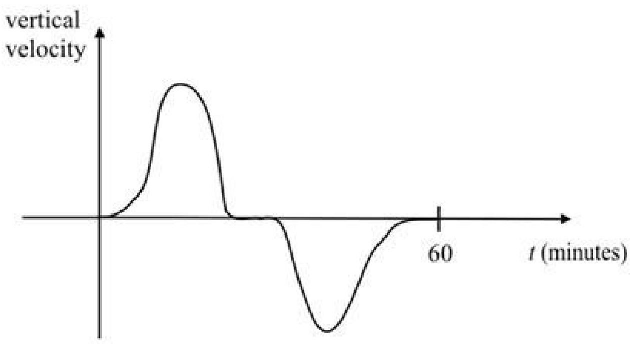
Eventually, the plane would approach its cruising altitude so its vertical velocity would decrease. The graph shows this decrease by going downhill. When it is cruising, the plane's height does not change much, so its vertical velocity would be around 0. For this interval of time, the graph would be flat.

After some time, the plane will start to descend which is a negative vertical velocity. As the plane descends faster, the vertical velocity becomes more negative. The graph shows this by going downhill from 0 into the negative.

As the plane comes in for a landing, it will start to descend less rapidly. Hence its vertical velocity will become less negative until the plane lands. The graph will show this by gradually going uphill and approaching 0. The vertical change is 0, when the plane land.

So the graph will end on the horizontal axis.

Here is a rough graph of the vertical velocity in mph as a function of time in minutes, t:

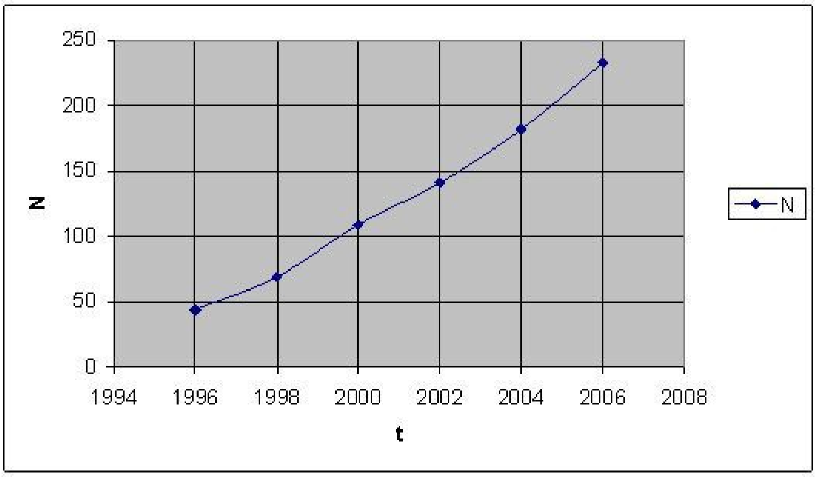


Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 23E

The number N (in millions) of US cellular phone subscribers is shown in the table.

t	1996	1998	2000	2002	2004	2006
N	44	69	109	141	182	233

(a) Graph of N as a function of t :



(b) From the graph we estimate that the number of cell-phone subscribers at midyear in 2001 is 125 millions.

From the graph we estimate that the number of cell-phone subscribers at midyear in 2005 is 207 millions.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 24E

Temperature readings T (in $°F$) were recorded every two hours from midnight to 2:00PM in Phoenix on September 10, 2008. The time t was measured in hours from midnight.

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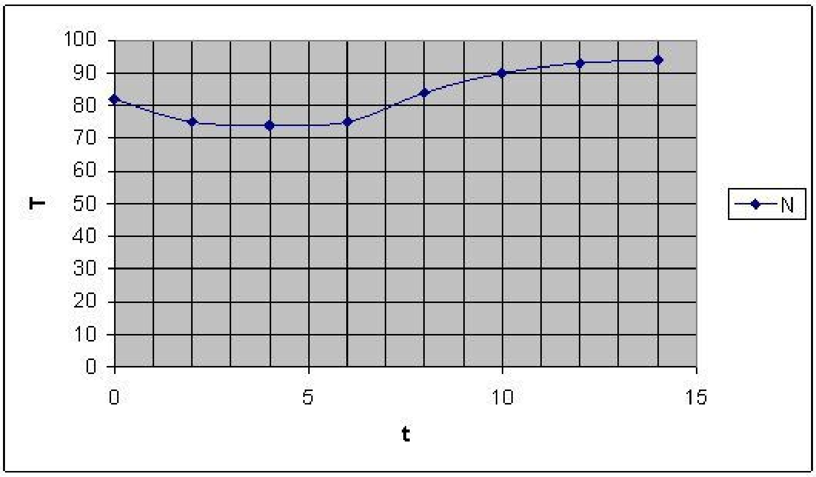
t	0	2	4	6	8	10	12	14
T	82	75	74	75	84	90	93	94

(a) Graph of T as a function of t :



(b) From the graph we estimate that the temperature at 9:00AM is 87 °F

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 25E

We have $f(x)=3x^2-x+2$

Now, $f(2)=3(2)^2-2+2=12$

$f(-2)=3(-2)^2-(-2)+2=16$

$f(a)=3a^2-a+2$

$$\begin{aligned} f(-a) &= 3(-a)^2-(-a)+2 \\ &= 3a^2+a+2 \end{aligned}$$

$$\begin{aligned} f(a+1) &= 3(a+1)^2-(a+1)+2 \\ &= 3(a^2+1+2a)-a+1 \\ &= 3a^2+5a+4 \end{aligned}$$

$$\begin{aligned} 2f(a) &= 2(3a^2-a+2) \\ &= 6a^2-2a+4 \end{aligned}$$

$$\begin{aligned} f(2a) &= 3(2a)^2-2a+2 \\ &= 12a^2-2a+2 \end{aligned}$$

$$\begin{aligned} f(a^2) &= 3(a^2)^2-a^2+2 \\ &= 3a^4-a^2+2 \end{aligned}$$

$$\begin{aligned} f(a+1) &= 3(a+1)^2-(a+1)+2 \\ &= 3(a^2+1+2a)-a+1 \\ &= 3a^2+5a+4 \end{aligned}$$

$$\begin{aligned} 2f(a) &= 2(3a^2-a+2) \\ &= 6a^2-2a+4 \end{aligned}$$

$$\begin{aligned} f(2a) &= 3(2a)^2-2a+2 \\ &= 12a^2-2a+2 \end{aligned}$$

$$\begin{aligned} f(a^2) &= 3(a^2)^2-a^2+2 \\ &= 3a^4-a^2+2 \end{aligned}$$

$$\begin{aligned} [f(a)]^2 &= (3a^2-a+2)^2 \\ &= 9a^4+a^2+4-6a^3-4a+12a^2 \\ &= 9a^4-6a^3+13a^2-4a+4. \end{aligned}$$

$$\begin{aligned} f(a+h) &= 3(a+h)^2-(a+h)+2 \\ &= 3a^2+3h^2+6ah-a-h+2 \end{aligned}$$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 26E

Let $F(r)$ denotes the amount of air required to inflate the balloon from a radius of r inches to a radius of $(r+1)$ inches

Then

$$F(r)=V(r+1)-V(r)$$
$$=\frac{4}{3}\pi(r+1)^3-\frac{4}{3}\pi r^3$$
$$=\frac{4}{3}\pi\left[(r+1)^3-r^3\right]$$
$$=\frac{4}{3}\pi\left[3r^2+3r+1\right]$$
$$\boxed{F(r)=4\pi\left[r^2+r+\frac{1}{3}\right]}$$

This is the required function

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 27E

Consider the function

$$f(x)=4+3x-x^2$$

Now, we need to evaluate the difference quotient

$$\frac{f(3+h)-f(3)}{h}$$

for the given function.

The difference quotient can be calculated as follows.

Replace x by $3+h$ and 3 in $f(x)$, we get

$$\frac{f(3+h)-f(3)}{h}=\frac{\left[4+3(3+h)-(3+h)^2\right]-\left[4+3(3)-3^2\right]}{h}$$
$$=\frac{\left[4+3(3+h)-(3^2+h^2+2\cdot3\cdot h)\right]-\left[4+3(3)-3^2\right]}{h}$$
$$=\frac{\left[4+9+3h-(9+h^2+6h)\right]-\left[4+9-9\right]}{h}$$
$$=\frac{4+9+3h-9-h^2-6h-4}{h}$$
$$=\frac{3h-h^2-6h}{h}$$
$$=\frac{-3h-h^2}{h}$$
$$=-3-h$$

Thus $\frac{f(3+h)-f(3)}{h}=\boxed{-3-h}$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 28E

Consider the function $f(x)=x^3$.

Find the difference quotient $\frac{f(a+h)-f(a)}{h}$.

The difference quotient can be calculated as follows:

Find $f(a+h)$, replace x by $a+h$ in $f(x)=x^3$.

$$f(a+h)=(a+h)^3$$
$$=(a+h)(a+h)(a+h)$$
$$=(a^2+2ah+h^2)(a+h)$$
$$=a^3+3a^2h+3ah^2+h^3$$

Find $f(a)$, replace x by a in $f(x)=x^3$.

$$f(a)=a^3.$$

Now substitute $f(a+h)$ and $f(a)$ in $\frac{f(a+h)-f(a)}{h}$.

$$\frac{f(a+h)-f(a)}{h}=\frac{a^3+3a^2h+3ah^2+h^3-a^3}{h}$$
$$=\frac{3a^2h+3ah^2+h^3}{h}.$$
$$=\frac{h(3a^2+3ah+h^2)}{h}$$
$$=3a^2+3ah+h^2.$$

Therefore, the difference quotient $\frac{f(a+h)-f(a)}{h}$ is $\boxed{3a^2+3ah+h^2}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 29E

Consider the function $f(x)=\frac{1}{x}$.

First find $f(a)$.

Substitute $x=a$ in the function $f(x)=\frac{1}{x}$.

$$f(a)=\frac{1}{a}.$$

Find $f(x)-f(a)$.

$$f(x)-f(a)=\frac{1}{x}-\frac{1}{a}$$
$$=\frac{a-x}{ax}$$ Simplify.

Evaluate $\frac{f(x)-f(a)}{x-a}$.

$$\frac{f(x)-f(a)}{x-a}=\frac{\frac{a-x}{ax}}{x-a}$$ Since $f(x)-f(a)=\frac{a-x}{ax}$.
$$=\frac{a-x}{ax}\cdot\frac{1}{x-a}$$ Simplify.
$$=\frac{a-x}{ax}\cdot\frac{1}{-(a-x)}$$
$$=-\frac{1}{ax}$$

Therefore, the simplified form of the given expression $\frac{f(x)-f(a)}{x-a}$ is $\boxed{-\frac{1}{ax}}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 30E

Consider the function

$$f(x)=\frac{x+3}{x+1}$$

Now, we need to evaluate the difference quotient

$$\frac{f(x)-f(1)}{x-1}$$

for the given function.

The difference quotient can be calculated as follows.

Replace x by 1 in $f(x)$, we get

$$\frac{f(x)-f(1)}{x-1}=\frac{\frac{x+3}{x+1}-\frac{1+3}{1+1}}{x-1}$$

$$=\frac{\frac{x+3}{x+1}-\frac{4}{2}}{x-1}$$

$$=\frac{\frac{x+3}{x+1}-\frac{2}{1}}{x-1}$$

Thus

$$\frac{f(x)-f(1)}{x-1}=\frac{\frac{x+3}{x+1}-\frac{2}{1}}{x-1} \quad \text{...... (1)}$$

We wish to simplify this.

On the top of the right hand side of (1), we get a common denominator of $x+1$ to add the fractions. We get

$$\frac{x+3}{x+1}-\frac{2}{1}=\frac{x+3}{x+1}-\frac{2(x+1)}{x+1}$$

$$=\frac{x+3}{x+1}-\frac{2x+2}{x+1}$$

$$=\frac{x+3-2x-2}{x+1}$$

$$=\frac{-x+1}{x+1}$$

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

Thus

$$\frac{x+3}{x+1}-\frac{2}{1}=\frac{-(x-1)}{x+1} \quad \text{...... (2)}$$

From equations (1) and (2), it can be seen that

$$\frac{f(x)-f(1)}{x-1}=\frac{\frac{-(x-1)}{x+1}}{x-1}$$

$$=-\frac{x-1}{x+1}\cdot\frac{1}{x-1}$$

$$=\frac{-1}{x+1}$$

Therefore $\frac{f(x)-f(1)}{x-1}=\boxed{\frac{-1}{x+1}}$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 31E

$$f(x)=\frac{x+4}{x^2-9}$$

The given function is not defined for the values of x where the denominator is zero.
i.e.,
$x^2-9=0$
So we get
$x^2-3^2=0$
$(x+3)(x-3)=0$
$x=3, x=-3$

So the function is not defined at $x=3, x=-3$.
So the domain of the function is all real values of x except $x=3, x=-3$
i.e., $(-\infty,-3)\cup(-3,3)\cup(3,\infty)$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 32E

$$f(x)=\frac{2x^3-5}{x^2+x-6}$$

The given function is not defined for the values of x where the denominator is zero.
i.e.,
$x^2+x-6=0$
So we get
$x^2+3x-2x-6=0$
$x(x+3)-2(x+3)=0$
$(x+3)(x-2)=0$
$x=-3, x=2$

So the function is not defined at $x=-3, x=2$.
So the domain of the function is all real values of x except $x=-3, x=2$
i.e., $(-\infty,-3)\cup(-3,2)\cup(2,\infty)$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 33E

$$f(t)=\sqrt[3]{2t-1}$$

The given function is defined for the values of t.

So the domain of the function is the set of all real numbers i.e., $(-\infty,\infty)$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 34E

Consider the function.

$$g(t)=\sqrt{3-t}-\sqrt{2+t}$$

Find the domain of the function.

To find the domain of the function, recall the fact that one cannot take the square root of a negative and get a real number.

So, anything under a square root must be greater than or equal to zero.

Now, because of the $\sqrt{3-t}$ in the function, write as follows:

$$3-t\geq 0$$
$$t\leq 3$$

And

$$2+t\geq 0$$
$$t\geq -2$$

So, the domain of the function is the set of all real numbers, which satisfy both the conditions.

That is, $-2 \le t \le 3$

Or in interval notation, write it as, $[-2,3]$.

Therefore,

The domain of the function is, $\boxed{-2 \le t \le 3 \text{ or } [-2,3]}$.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 35E

$$h(x) = \frac{1}{\sqrt[4]{x^2 - 5x}}$$

$$h(x) = \frac{1}{(x^2-5x)^{\frac{1}{4}}} \times \frac{(x^2-5x)^{\frac{1}{4}}}{(x^2-5x)^{\frac{1}{4}}} \times \frac{(x^2-5x)^{\frac{1}{2}}}{(x^2-5x)^{\frac{1}{2}}}$$

$$h(x) = \frac{(x^2-5x)^{\frac{1}{4}}\sqrt{(x^2-5x)}}{(x^2-5x)}$$

$h(x)$ is not defined when $(x-5)x = 0$ and $x^2 - 5x < 0$ (because the square root of a negative number is not defined (as a real number)).

So the domain of h(x) consists of all values of x such that $x^2 - 5x > 0$.

Now $x^2 - 5x > 0$

$\Rightarrow x(x-5) > 0$

This happens in

$x(x-5) > 0$ When x is greater than the value of 5.

$x(x-5) > 0$ When x is less than the value of 0.

Hence domain of h is $(-\infty, 0) \cup (5, \infty)$.

Domain is $\boxed{(-\infty, 0) \cup (5, \infty)}$

$$h(x) = \frac{1}{\sqrt[4]{x^2 - 5x}}$$

$h(x)$ is not defined when $x^2 - 5x \le 0$

Now $x^2 - 5x > 0$

$\Rightarrow x(x-5) > 0$

This happens in two cases:

Case1. $x > 0$ And $x - 5 > 0$

$\Rightarrow x > 0$ And $x > 5 \quad \Rightarrow x > 5$

Case2. $x < 0$ And $x - 5 < 0$

$\Rightarrow x < 0$ And $x < 5 \quad \Rightarrow x < 0$

Hence domain of h is $\boxed{(-\infty, 0) \cup (5, \infty)}$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 36E

$$f(u) = \frac{u+1}{1 + \frac{1}{u+1}}$$

The given function is defined for the values of u, where

$1 + \frac{1}{u+1} \ne 0$

$u + 1 + 1 \ne 0$

$u + 2 \ne 0$

$u \ne -2$

and

$u + 1 \ne 0$

$u \ne -1$

So the domain of the function is the set of all real numbers, except $u = -1$ and $u = -2$

i.e.,

$(-\infty, -2) \cup (-2, -1) \cup (-1, \infty)$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 37E

$f(p)=\sqrt{2-\sqrt{p}}$

The given function is defined for the values of x, where

$p \geq 0$

and

$2-\sqrt{p} \geq 0$

$\sqrt{p} \leq 2$

$0 \leq p \leq 4$

So the domain of the function is the set of all real numbers, where

$0 \leq p \leq 4$

or

$[0,4]$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 38E

Consider the function $h(x)=\sqrt{4-x^2}$.

The objective is to find the domain and range of the above function.

The function $h(x)$ is defined only when $4-x^2 \geq 0$ since the square root of a negative number is not defined (it is an imaginary number).

The domain of *h* consists of all value of *x* such that $4-x^2 \geq 0$.

$$\begin{aligned} 4-x^2 &\geq 0 \\ x^2 &\leq 4 \\ |x| &\leq 2 \end{aligned}$$

This means that $x \geq -2$ and $x \leq 2$.

Therefore, the domain of the function $h(x)=\sqrt{4-x^2}$ is, $-2 \leq x \leq 2$. That is, the domain is the interval $[-2,2]$.

Hence, the domain is $[-2,2]$.

Find the range of the function as follows:

Substitute the values of the domain interval in $h(x)=\sqrt{4-x^2}$ and find the minimum and maximum value.

$$\begin{aligned} h(-2) &= \sqrt{4-(-2)^2} \\ &= \sqrt{4-4} \\ &= 0 \end{aligned}$$

$$\begin{aligned} h(0) &= \sqrt{4-(0)^2} \\ &= \sqrt{4-0} \\ &= 2 \end{aligned}$$

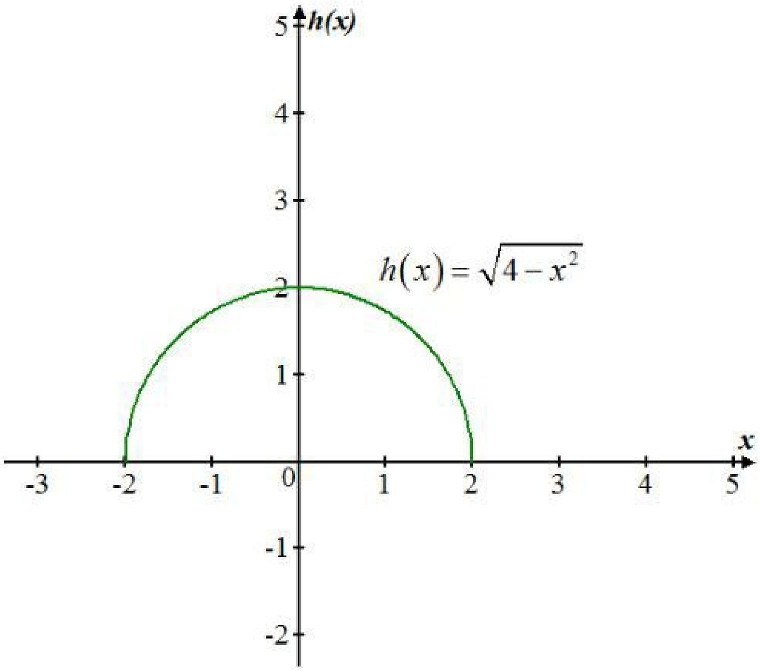
$$\begin{aligned} h(2) &= \sqrt{4-(2)^2} \\ &= \sqrt{4-4} \\ &= 0 \end{aligned}$$

The minimum value of $h(x)$ is 0 and the maximum value of $h(x)$ is 2.

Therefore, the range of the function $h(x)=\sqrt{4-x^2}$ is, $0 \leq h(x) \leq 2$. That is, the range is the interval $[0,2]$.

Hence, the range is $[0,2]$.

The graph of the function $h(x)=\sqrt{4-x^2}$ is as follows:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 39E

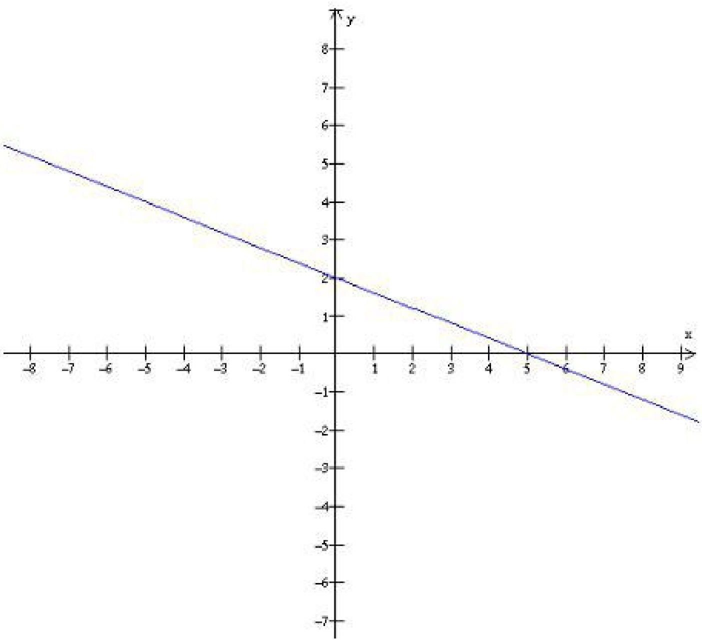
$f(x)=2-0.4x$

The given function is defined for all values of x.

So the domain of the function is the set of all real numbers.

$(-\infty,\infty)$

Graph of the given function



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 40E

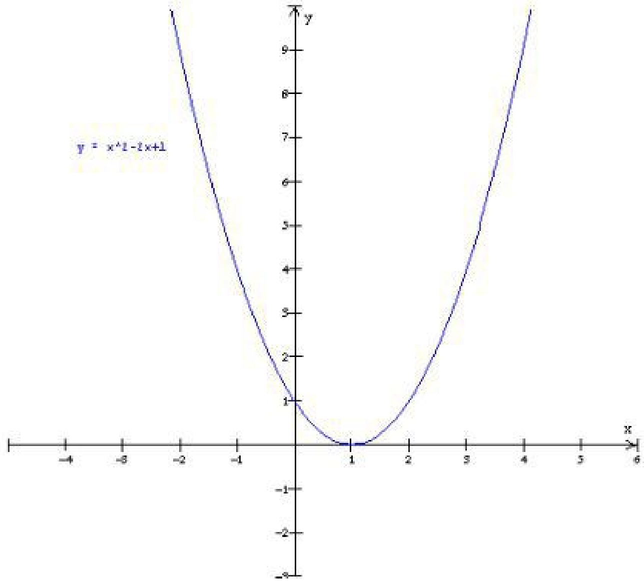
$F(x)=x^2-2x+1$

The given function is defined for all values of x.

So the domain of the function is the set of all real numbers.

$(-\infty,\infty)$

Graph of the given function



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 41E

Consider the following function:

$$f(t)=2t+t^2$$

The objective is to find the domain and sketch the graph of the function.

Since the function is a second degree polynomial.

We know that the polynomial is defined for all values of t

Hence the given function is defined for all t

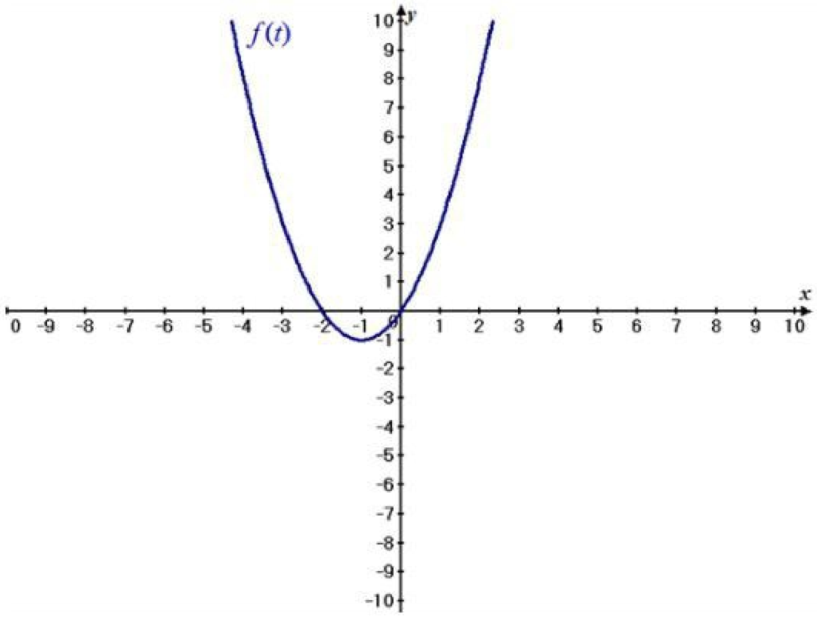
Therefore the domain of the given function is all real numbers

In interval notation, the domain is $\boxed{(-\infty,\infty)}$

Clearly the given function cuts the $x-$axis at $t=0, t=-2$

And $y-$intercept of $y=2t+t^2$ is $y=0$

Therefore, the graph of $f(t)=2t+t^2$ looks like as follows:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 42E

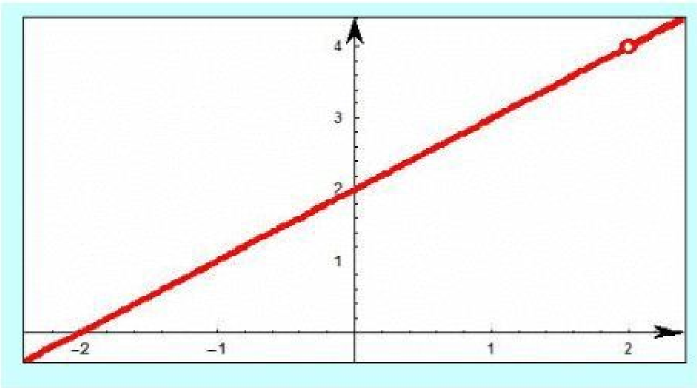
$H(t)=\frac{4-t^2}{2-t}$

Given function are defined at all real values except at 2.

Hence domain of the function is $R-\{2\}$

The domain of $H(t)$ is $\boxed{(-\infty,2)\cup(2,\infty)}$

The graph of $H(t)$ is



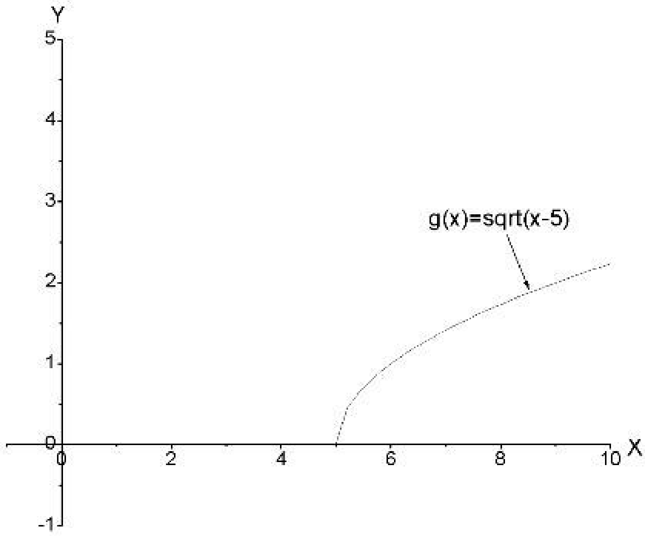
Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 43E

Here $g(x)=\sqrt{x-5}$

$g(x)$ is defined whenever $x-5\geq 0$ *or* $x\geq 5$

Hence $\boxed{\text{domain of g is } [5,\infty)}$

The graph of $g(x)$ is part of the parabola as shown below

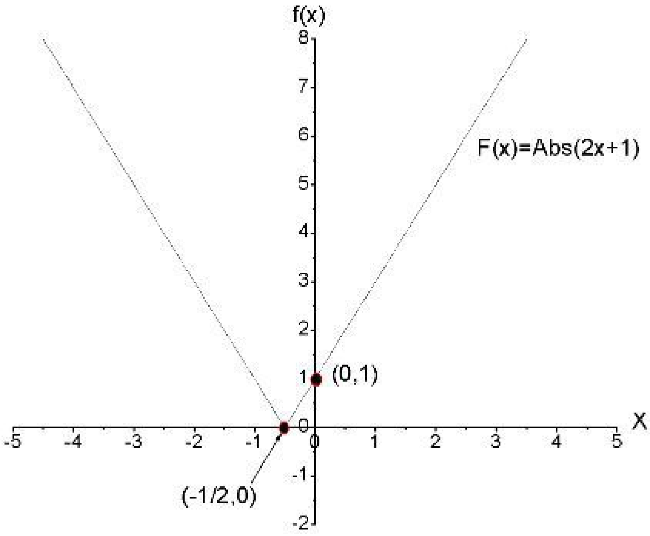


Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 44E

Here $F(x)=|2x+1|$

$F(x)$ is defined for all values of x, hence the $\boxed{\text{domain of F is } \mathbb{R}}$, the set of all real numbers.

The graph of $F(x)$ is as shown below



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 45E

Consider the function $G(x)$.

$$G(x)=\frac{3x+|x|}{x}$$

Rewrite the function as follows:

$$G(x)=3+\frac{|x|}{x}$$

Clearly, the denominator cannot be equal to zero, hence $x \neq 0$.

Therefore, the domain of $G(x)$ is $\boxed{(-\infty,0)\cup(0,\infty)}$.

The graph of $G(x)$ is obtained as follows:

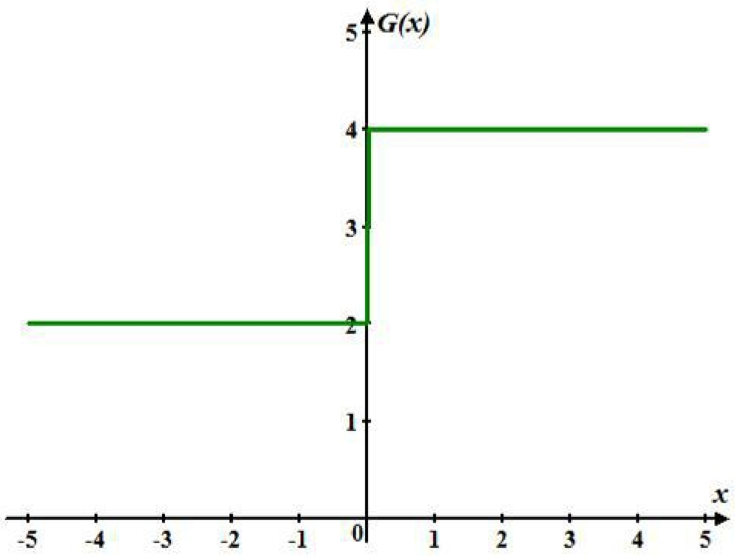
If $x>0$, then $|x|=x$.

$$\begin{aligned} G(x)&=3+\frac{x}{x} \\ &=4 \end{aligned}$$

If $x<0$, then $|x|=-x$.

$$\begin{aligned} G(x)&=3-\frac{x}{x} \\ &=2 \end{aligned}$$

Sketch the graph of the function $G(x)=\frac{3x+|x|}{x}$.



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 46E

$g(x) = |x| - x$

When $x > 0$ then
$g(x) = x - x$
$= 0$

When $x = 0$ then
$g(0) = 0 - 0$
$= 0$

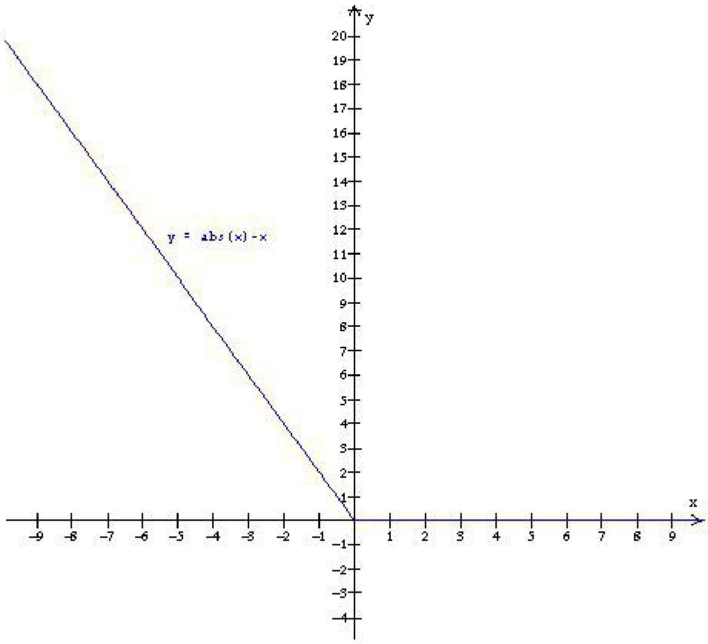
When $x < 0$ then
$g(x)$
$= -x - x$
$= -2x$

The given function is defined for all values of x

So the domain of the function is the set of all real numbers.

$(-\infty, \infty)$

Graph of the given function



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 47E

Consider the following function:

$$f(x) = \begin{cases} x+2 & \text{if } x < 0, \\ 1-x & \text{if } x \geq 0. \end{cases}$$

The function $f(x)$ is defined for all real numbers.

Hence, the domain of $f(x)$ is a set of all real numbers.

In the interval notation, the domain of $f(x)$ is $\boxed{(-\infty, \infty)}$.

The objective is to sketch the graph of $f(x)$.

Look at the value of the input x. If $x<0$, then the value of $f(x)$ is $x+2$.

On the other hand, if $x \ge 0$, then the value of $f(x)$ is $1-x$.

As $-1<0$,

$$f(-1) = -1+2 \quad \text{take } f(x) = x+2$$
$$= 1$$

As $0=0$,

$$f(0) = 1-0 \quad \text{take } f(x) = 1-x$$
$$= 1$$

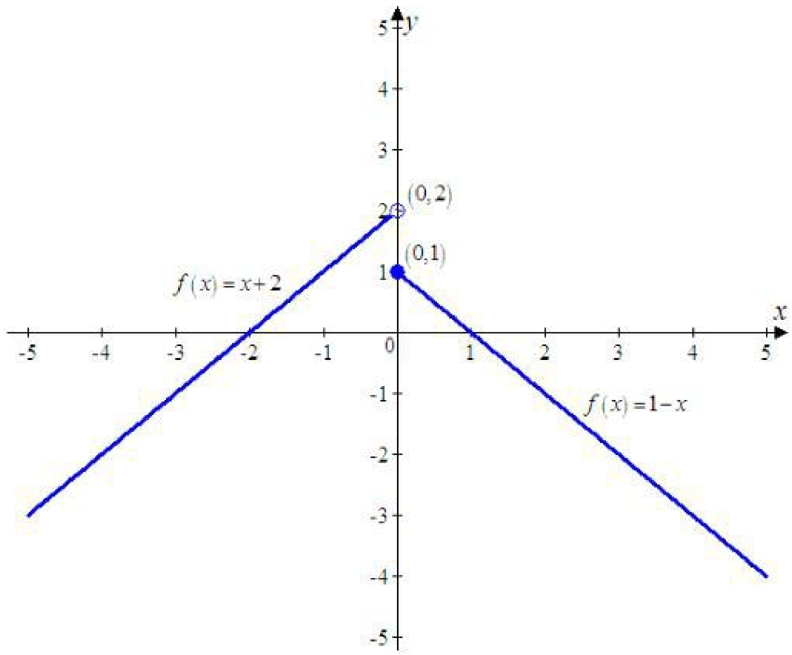
As $1>0$,

$$f(1) = 1-1 \quad \text{take } f(x) = 1-x$$
$$= 0$$

Observe that if $x<0$, then $f(x)=x+2$, so the part of the graph of f that lies to the left of the vertical line $x=0$ must coincide with the line $y=x+2$, which has the slope 1 and $y-$ intercept 2.

If $x \ge 0$, then $f(x)=1-x$, so the part of the graph of f that lies to the right of the line $x=0$ must coincide with the line $y=1-x$, which has slope -1 and $y-$intercept 1

Sketch the graph of the function $f(x)$.



From the graph, observe that the open dot indicates the point $(0,2)$ is excluded from the graph; the solid dot indicates that the point $(0,1)$ is included on the graph.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 48E

Consider the following function.

$$f(x) = \begin{cases} 3 - \frac{1}{2}x & \text{if } x \le 2 \\ 2x-5 & \text{if } x > 2 \end{cases} \quad \text{...... (1)}$$

Determine the domain and sketch the graph of the function.

The domain of a function $f(x)$ is defined as the set of those values of x for which the function $f(x)$ is defined.

The function is defined as follows:

$$f(x)=\begin{cases} 3-\frac{1}{2}x & \text{if } x\le 2 \\ 2x-5 & \text{if } x>2 \end{cases}$$

When $x\le 2$, the value of $f(x)$ is $3-\frac{1}{2}x$. On the other hand, if $x>2$, then the value of $f(x)$ is $2x-5$.

This implies that, the function $f(x)$ is defined for all real numbers.

Hence, the domain of $f(x)$ is the set of all real numbers.

In the interval notation, the domain of $f(x)$ is $\boxed{(-\infty,\infty)}$.

Sketch the graph of $f(x)$ as follows:

The function $f(x)$ is defined as follows:

$$f(x)=\begin{cases} 3-\frac{1}{2}x & \text{if } x\le 2 \\ 2x-5 & \text{if } x>2 \end{cases}$$

Since, $1\le 2$, the function assumes the following value.

$f(1)=3-\frac{1}{2}(1)$ if $x\le 2$, $f(x)=3-\frac{1}{2}x$

$=\frac{5}{2}$

Since, $2\le 2$, the function assumes the following value.

$f(2)=3-\frac{1}{2}(2)$ if $x\le 2$, $f(x)=3-\frac{1}{2}x$

$=2$

Since $3>2$, the function assumes the following value.

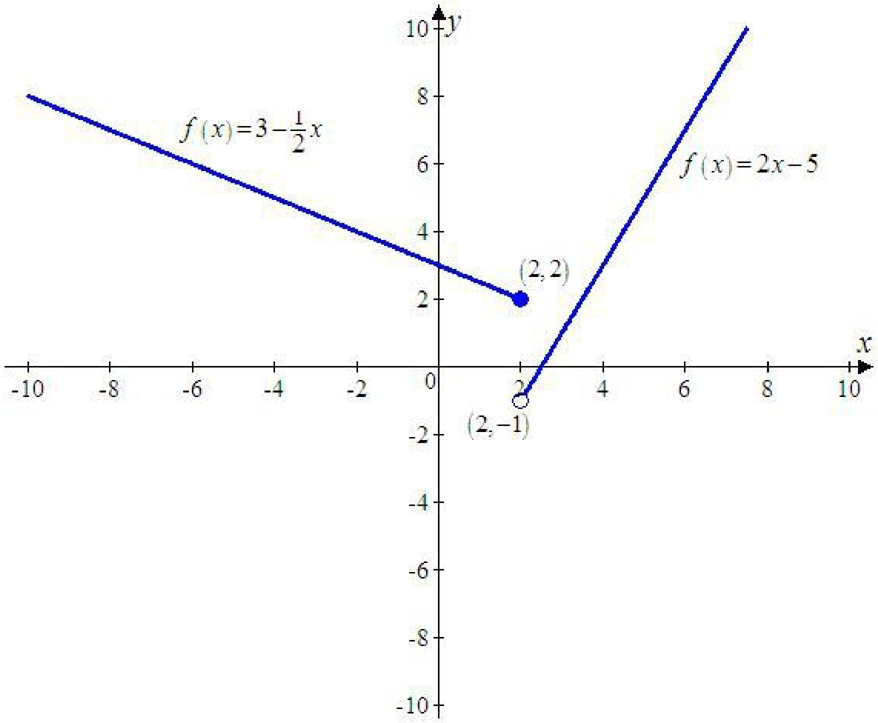
$f(3)=2(3)-5$ if $x>2$, $f(x)=2x-5$

$=1$

From (1), observe that if $x \le 2$, then $f(x) = 3 - \frac{1}{2}x$, so the part of the graph of f that lies to the left of the vertical line $x = 2$ must coincide with the line $y = 3 - \frac{1}{2}x$, which has the slope $-\frac{1}{2}$ and $y-$intercept as 3.

If $x > 2$, then $f(x) = 2x - 5$. So, the part of the graph of f that lies to the right of the line $x = 2$ must coincide with the line $y = 2x - 5$, which has slope 2 and $y-$intercept as -5.

From the above information graph of the function $f(x)$ is as follows:



In the above graph, the solid dot indicates the point $(2,2)$, this is included in the graph; the open dot indicates that the point $(2,-1)$ is excluded from the graph.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 49E

Consider the function,

$$f(x) = \begin{cases} x+2, & \text{if } x \le -1 \\ x^2, & \text{if } x > -1 \end{cases}$$

Observe that if $x \le -1$, then $f(x) = x + 2$, so the part of the graph of f that lies to the left of the vertical line $x = -1$ must coincide with the line $y = x + 2$, which has a slope 1 and $y-$intercept 2.

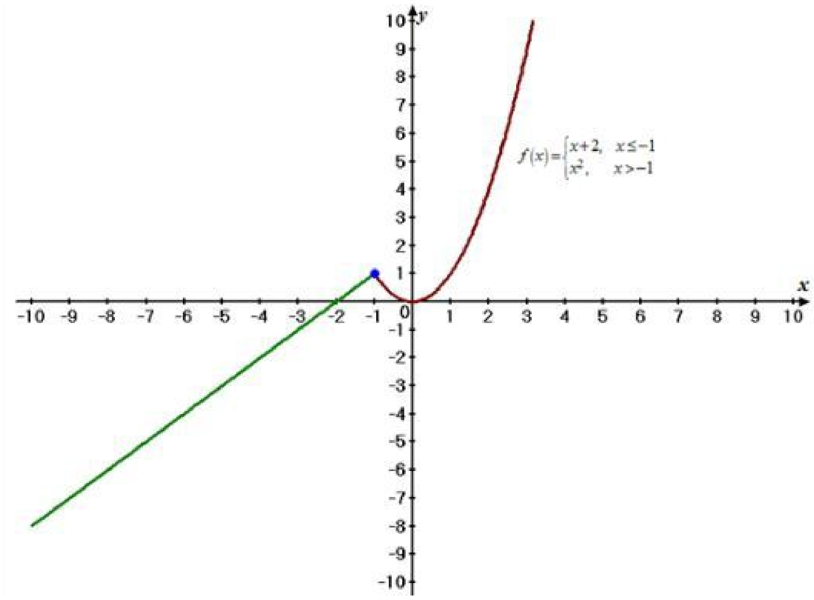
If $x > -1$, then $f(x) = x^2$.

So the part of the graph of f that lies to the right of the vertical line $x = -1$ must coincide with the curve $y = x^2$, which is a parabola.

Therefore, the domain of the function is,

$\boxed{(-\infty, \infty)}$.

The graph of $f(x)=\begin{cases} x+2, \text{ if } x \le -1 \\ x^2, \text{ if } x > -1 \end{cases}$ is shown below:



From the graph, observe that the point $(-1,1)$ is included on the graph.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 50E

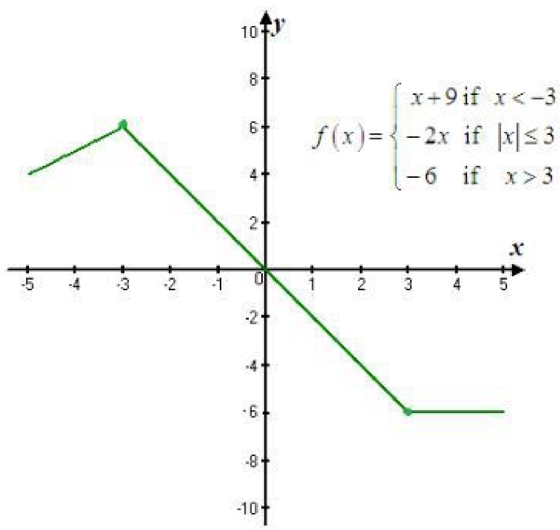
Consider the function:

$$f(x)=\begin{cases} x+9 \text{ if } x<-3 \\ -2x \text{ if } |x| \le 3 \\ -6 \text{ if } x>3 \end{cases}$$

The function defined when $x<-3$, $|x| \le 3$, $x>3$.

Therefore, the domain of the function is, $\boxed{(-\infty,\infty)}$.

The following is the graph of $f(x)=\begin{cases} x+9 \text{ if } x<-3 \\ -2x \text{ if } |x| \le 3 \\ -6 \text{ if } x>3 \end{cases}$:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 51E

Consider the line segment joining the points $(1,-3)$ and $(5,7)$.

Find an expression for the function that represents the line segment joining the points $(1,-3)$ and $(5,7)$.

Sketch the graph.

Let $(x_1,y_1)=(1,-3)$ and $(x_2,y_2)=(5,7)$.

The slope of the line segment that contains the points $(x_1,y_1),(x_2,y_2)$ is represented as follows:

$$m=\frac{y_2-y_1}{x_2-x_1}.$$

Therefore, the slope of the line segment contains the points $(1,-3),(5,7)$ is as follows:

$$\begin{aligned} m &= \frac{7-(-3)}{5-1} \\ &= \frac{7+3}{4} \\ &= \frac{10}{4} \\ &= \frac{5}{2} \quad \text{Simplify} \end{aligned}$$

The equation of the line passes through the point (x_1,y_1) with the slope m is mathematically expressed as follows:

$$(y-y_1)=m(x-x_1)$$

Substitute for (x_1,y_1) either the points $(1,-3)$ or $(5,7)$ and $m=\frac{5}{2}$ in the equation.

$$(y-y_1)=m(x-x_1).$$

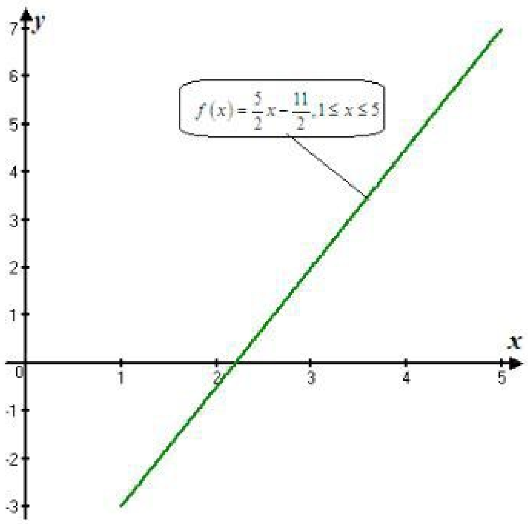
Thus, the equation of the line passes through $(1,-3)$ and $m=\frac{5}{2}$ is calculated as follows:

$$\begin{aligned} (y-(-3)) &= \frac{5}{2}(x-1) \\ 2(y+3) &= 5(x-1) \quad \text{Multiply both sides by 2} \\ 2y+6 &= 5x-5 \\ 2y &= 5x-5-6 \quad \text{Subtract both sides by 6} \\ 2y &= 5x-11 \quad \text{Simplify} \\ y &= \frac{5}{2}x-\frac{11}{2} \end{aligned}$$

Therefore, the function that represents the line segment joining the points $(1,-3)$ and $(5,7)$ is, $f(x)=\frac{5}{2}x-\frac{11}{2}$.

The line segment is from $x_1=1$ to $x_2=5$.

Sketch the graph of $f(x)=\frac{5}{2}x-\frac{11}{2}, 1\le x\le 5$.



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 52E

Consider the line segment joining the points $(-5,10)$ and $(7,-10)$.

Find an expression for the function that represents the line segment joining the points $(-5,10)$ and $(7,-10)$.

Sketch the graph.

Let $(x_1,y_1)=(-5,10)$ and $(x_2,y_2)=(7,-10)$.

The slope of the line segment contains the points $(x_1,y_1),(x_2,y_2)$ is,

$$m=\frac{y_2-y_1}{x_2-x_1}.$$

Therefore, the slope of the line segment contains the points $(-5,10),(7,-10)$ is,

$$\begin{aligned} m&=\frac{-10-10}{7-(-5)}\\ &=\frac{-20}{7+5}\\ &=\frac{-20}{12}\\ &=-\frac{5}{3} \quad \text{Simplify} \end{aligned}$$

The equation of the line passes through the point (x_1,y_1) with the slope m is,

$$(y-y_1)=m(x-x_1)$$

Now substitute for (x_1,y_1) either the points $(-5,10)$ or $(7,-10)$ and $m=-\frac{5}{3}$ in $(y-y_1)=m(x-x_1)$.

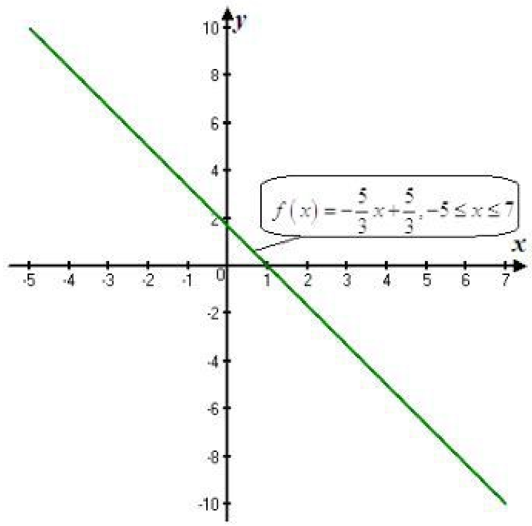
Thus, the equation of the line passes through $(-5,10)$ and $m=-\frac{5}{3}$ is,

$$\begin{aligned} (y-10)&=-\frac{5}{3}(x-(-5))\\ 3(y-10)&=-5(x+5) \quad \text{Multiply both sides by 3}\\ 3y-30&=-5x-25\\ 3y&=-5x-25+30 \quad \text{Add both sides by 30}\\ 3y&=-5x+5 \quad \text{Simplify}\\ y&=-\frac{5}{3}x+\frac{5}{3} \end{aligned}$$

Therefore, the function that represents the line segment joining the points $(-5,10)$ and $(7,-10)$ is, $f(x)=-\frac{5}{3}x+\frac{5}{3}$.

The line segment is from $x_1=-5$ to $x_2=7$.

Now sketch the graph of $f(x)=-\frac{5}{3}x+\frac{5}{3}, -5\le x\le 7$.



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 53E

Consider the following parabola:

$x+(y-1)^2=0$

This equation can be written as follows:

$(y-1)^2=-x$

$y-1=\pm\sqrt{-x}$

$y=1\pm\sqrt{-x}$

The bottom half of this parabola is given by the following expression:

$y=1-\sqrt{-x}$

Thus, the function which represents the bottom half of the parabola is $\boxed{f(x)=1-\sqrt{-x}}$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 54E

Consider the circle:

$x^2+(y-1)^2=4$.

The circle has radius 2 and center $(0,1)$.

Find an expression for the function for the top half of the circle.

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

$(y-1)^2=4-x^2$ Subtract both sides by x^2

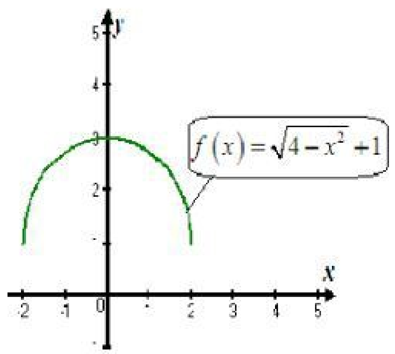
$y-1=\sqrt{4-x^2}$ Take square roots on both sides

$y=\sqrt{4-x^2}+1$ Add 1 on both sides

Therefore, the expression for the function for the top half of the circle is,

$\boxed{f(x)=\sqrt{4-x^2}+1,-2\le x\le 2}$

The following is the graph of $f(x)=\sqrt{4-x^2}+1,-2\le x\le 2$:



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 55E

In this case the graph is of a piecewise function defined on two pieces of x-axis:

(i) On [0, 3] the graph is a line segment joining the points (0,3) and (3,0)

Therefore it is part of the line given by

$y-3=\frac{3-0}{0-3}(x-0)$ (Using two point form)

$\Rightarrow y-3=-x$

$\Rightarrow y=-x+3$

(ii) On (3, 5], the graph of f is a line segment joining the points (3, 0) and (5,4). Its equation is

$y-0=\frac{4-0}{5-3}(x-3)$ [Two point form]

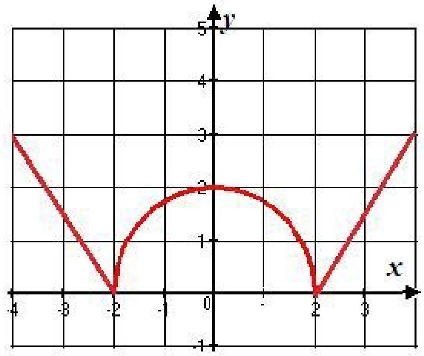
$\Rightarrow y=2x-6$

Hence, the required function is

$$f(x)=\begin{cases}-x+3 & if\ 0\le x\le 3\\ 2x-6 & if\ 3<x\le 5\end{cases}$$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 56E

Consider the figure as follows:



From the above figure, find an expression for the function that represents the line that passes through the points $(-4,3)$ and $(-2,0)$.

Let $(x_1, y_1) = (-4,3)$ and $(x_2, y_2) = (-2,0)$.

The slope of the line segment that contains the points $(x_1, y_1),(x_2, y_2)$ is mathematically expressed as follows:

$$m = \frac{y_2 - y_1}{x_2 - x_1}.$$

Therefore, the slope of the line contains the points $(-4,3),(-2,0)$ is calculated as follows:

$$\begin{aligned} m &= \frac{0-3}{-2-(-4)} \\ &= \frac{-3}{-2+4} \\ &= -\frac{3}{2} \quad \text{Simplify} \end{aligned}$$

The equation of the line passes through the point (x_1, y_1) with the slope m is expressed as follows:

$$(y - y_1) = m(x - x_1).$$

Substitute for (x_1, y_1) either the points $(-4,3)$ or $(-2,0)$ and $m = -\frac{3}{2}$ in the following equation.

$$(y - y_1) = m(x - x_1).$$

Thus, the equation of the line passes through $(-4,3)$ and $m = -\frac{3}{2}$ is calculated as follows:

$$\begin{aligned} (y-3) &= -\frac{3}{2}(x-(-4)) \\ 2(y-3) &= -3(x+4) \quad \text{Multiply both sides by 2} \\ 2y-6 &= -3x-12 \\ 2y &= -3x-12+6 \quad \text{Add both sides by 6} \\ 2y &= -3x-6 \\ y &= -\frac{3}{2}x - \frac{6}{2} \\ y &= -\frac{3}{2}x - 3 \end{aligned}$$

Therefore, the function that represents the line segment joining the points $(-4,3)$ and $(-2,0)$ is as follows:

$$f(x) = -\frac{3}{2}x - 3, x < -2.$$

Find an expression for the function that represents the upper half circle which is shown in the above figure.

The circle has radius 2 and has center at $(0,0)$.

Therefore, the equation of the circle is, $x^2+y^2=4$

Rearrange the equation as follows:

$$y^2=4-x^2$$
$$y=\sqrt{4-x^2}$$

Therefore, the function that represents the upper half circle is as follows:

$$f(x)=\sqrt{4-x^2}, -2\le x\le 2.$$

Find an expression for the function that represents the line that passes through the points $(2,0)$ and $(4,3)$.

Let $(x_1,y_1)=(2,0)$ and $(x_2,y_2)=(4,3)$.

The slope of the line segment that contains the points $(x_1,y_1),(x_2,y_2)$ is as follows:

$$m=\frac{y_2-y_1}{x_2-x_1}.$$

Therefore, the slope of the line contains the points $(2,0),(4,3)$ is calculated as follows:

$$m=\frac{3-0}{4-2}$$
$$=\frac{3}{2} \quad \text{Simplify}$$

The equation of the line passes through the point (x_1,y_1) with the slope m is as follows:

$$(y-y_1)=m(x-x_1)$$

Now substitute for (x_1,y_1) either the points $(2,0)$ or $(4,3)$ and $m=\frac{3}{2}$ in the following equation.

$$(y-y_1)=m(x-x_1).$$

Thus, the equation of the line passes through $(4,3)$ and $m=\frac{3}{2}$ is calculated as follows

$$(y-3)=\frac{3}{2}(x-4)$$
$$2(y-3)=3(x-4) \quad \text{Multiply both sides by 2}$$
$$2y-6=3x-12$$
$$2y=3x-12+6 \quad \text{Add both sides by 6}$$
$$2y=3x-6$$
$$y=\frac{3}{2}x-\frac{6}{2}$$
$$y=\frac{3}{2}x-3$$

Therefore, the function that represents the line segment joining the points $(2,0)$ and $(4,3)$ is as follows:

$$f(x)=\frac{3}{2}x-3, x>2.$$

Put the above expressions together, three-piece formula for f is as follows:

$$f(x)=\begin{cases} -\frac{3}{2}x-3 & \text{if } x<-2 \\ \sqrt{4-x^2} & \text{if } |x|\le 2 \\ \frac{3}{2}x-3 & \text{if } x>2 \end{cases}$$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 57E

Let the length and width of the rectangle be x meters and y meters respectively.

Then we know perimeter $= 2(x+y)$

$$\Rightarrow 2(x+y) = 20$$
$$\Rightarrow y = 10 - x$$

Now area of the function is given by

$A =$ length $\times$ Breath

$$\Rightarrow A = x \times y$$
$$= x \times (10 - x)$$
$$= 10x - x^2$$

$\therefore$ $\boxed{A(x) = 10x - x^2}$ is the required function,

Clearly x has to be greater then zero and less then 10, (otherwise this other side would be of negative length)

Here domain of $A(x)$ is $0 < x < 10$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 58E

Let the sides of the rectangle be x and y meters then

Area = length $\times$ breadth

$$\Rightarrow 16 = xy$$
$$\Rightarrow y = \frac{16}{x}$$

Now Perimeter (P) is given by

$$P = 2(x+y)$$
$$\Rightarrow P = 2(x + \frac{16}{x}) = 2x + \frac{32}{x}$$

Hence the required function is

$$\boxed{P(x) = 2x + \frac{32}{x}}$$

Now $\boxed{\text{The domain of this function is } x > 0}$

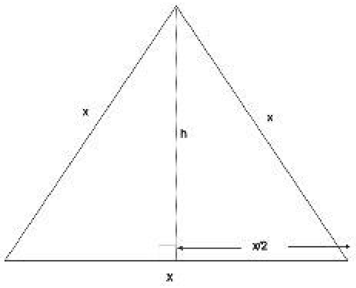
(since the lengths must be positive quantities)

If we take x>y, then the domain would be x > 4.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 59E

Let the side of the equilateral triangle be x units and its height be h units.

The altitude meets the opposite side (base) at its mid point creating a right angled triangle of sides $h, \frac{x}{2}$, and x units



By Pythagorean Theorem, we have

$$h^2 + \left(\frac{x}{2}\right)^2 = x^2$$
$$\Rightarrow h^2 = x^2 - \frac{x^2}{4}$$
$$= \frac{3x^2}{4}$$
$$\Rightarrow h = \frac{\sqrt{3}x}{2}$$

Let $A(x)$ represent the area of this triangle, then

$$A(x)=\frac{1}{2}\times\text{base}\times\text{height}$$
$$=\frac{1}{2}\times x\times h$$
$$=\frac{1}{2}x\left(\frac{\sqrt{3}}{2}x\right)$$

$$\boxed{A(x)=\frac{\sqrt{3}x^2}{4}}$$

This is the required function

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 60E

Let the edge of the cube be a units then its surface area S is given by

$S=6a^2$

and its volume is given by

$$V=a^3$$
$$\Rightarrow a=\sqrt[3]{V}$$
$$\therefore S=6\left(\sqrt[3]{V}\right)^2$$
$$\Rightarrow \boxed{S=6V^{2/3}}$$

This is the required function

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 61E

Let the height of the box be h meters and the side of its square edge be 'a' meters.
Then volume (V) of the box is

$$V=a^2h$$
$$\Rightarrow 2=a^2h$$
$$\Rightarrow h=\frac{2}{a^2}$$

Now, the total surface area of the open box is,

$S=4ah+a^2$ (4 walls + bottom)

Substituting the value of h, we get

$$S=4a\times\frac{2}{a^2}+a^2$$
$$\Rightarrow S=\frac{8}{a}+a^2 \qquad , a>0$$

This is the required function

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 62E

Let the height of the rectangular portion of the window be h ft. The perimeter of the window is

$$P=x+2h+\frac{\pi x}{2} \qquad \text{(Radius of semi-circle is } \frac{x}{2}\text{)}$$
$$\Rightarrow 30=x+2h+\frac{\pi x}{2}$$
$$\Rightarrow h=\frac{1}{2}\left(30-x-\frac{\pi x}{2}\right) \qquad \text{--- (1)}$$

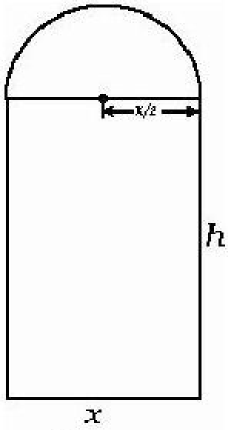


Fig. 1

Now area of the window is

A = area of rectangular region + area of semicircular region

$$A = h \times x + \frac{1}{2}\pi\left(\frac{x}{2}\right)^2$$

$$\Rightarrow A = hx + \frac{\pi x^2}{8}$$

Substituting value of h from (1) we get

$$A = \frac{x}{2}\left(30 - x - \frac{\pi x}{2}\right) + \frac{\pi x^2}{8}$$

$$= 15x - \frac{x^2}{2} - \frac{\pi x^2}{4} + \frac{\pi x^2}{8}$$

$$= 15x - \frac{x^2}{2} - \frac{\pi}{8}x^2$$

Or $\boxed{A = 15x - x^2\left(\frac{1}{2} + \frac{\pi}{8}\right)}$

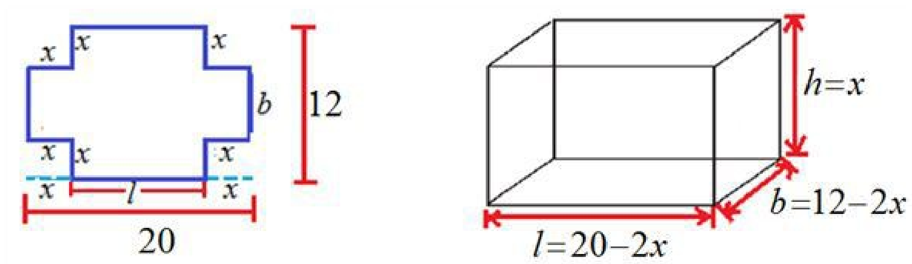
$$\therefore A = 15x - \frac{x^2}{8}(4 + \pi)$$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 63E

The length of the cardboard is 20 in and width is 12 in.

Now cut out equal squares of side x at each corner of the cardboard to construct a box with an open top as shown in the below figure.

The box with open top is shown below:



Let l, b, h are length, width and height of the open box.

Find the length of the box using the first figure.

$$x + l + x = 20$$
$$2x + l = 20$$
$$l = 20 - 2x$$

Find the width of the box.

$$x + b + x = 12$$
$$2x + b = 12$$
$$b = 12 - 2x$$

And height $h = x.$

Volume of the box is,

$$\begin{aligned} V(x) &= lbh \\ &= (\text{length})(\text{widht})(\text{height}) \\ &= (20 - 2x)(12 - 2x)x \\ &= (20 - 2x)(12x - 2x^2) \end{aligned}$$

$$= 4x^3 - 64x^2 + 240x$$

Therefore, the volume of the box in terms of x is $V(x) = 4x^3 - 64x^2 + 240x.$

Now find the range of the variable $x.$

The dimensions of the box are always greater than zero.

So the height $h = x > 0.$ ...... (1)

In the same way the width $b > 0.$

$$b > 0$$
$$12 - 2x > 0$$
$$-2x > -12 \quad \text{...... (2)}$$
$$-x > -6$$
$$x < 6$$

Also solve the inequality $l > 0.$

$$20 - 2x > 0$$
$$-2x > -20 \quad \text{...... (3)}$$
$$-x > -10$$
$$x < 10$$

Now take the intersection part of all the three inequalities (1), (2) and (3) because the x must satisfy all these three inequalities.

So, by considering (1), (2) and (3) conclude that the range of the variable x is $0 < x < 6.$

Hence, the required volume of the box in terms of x is

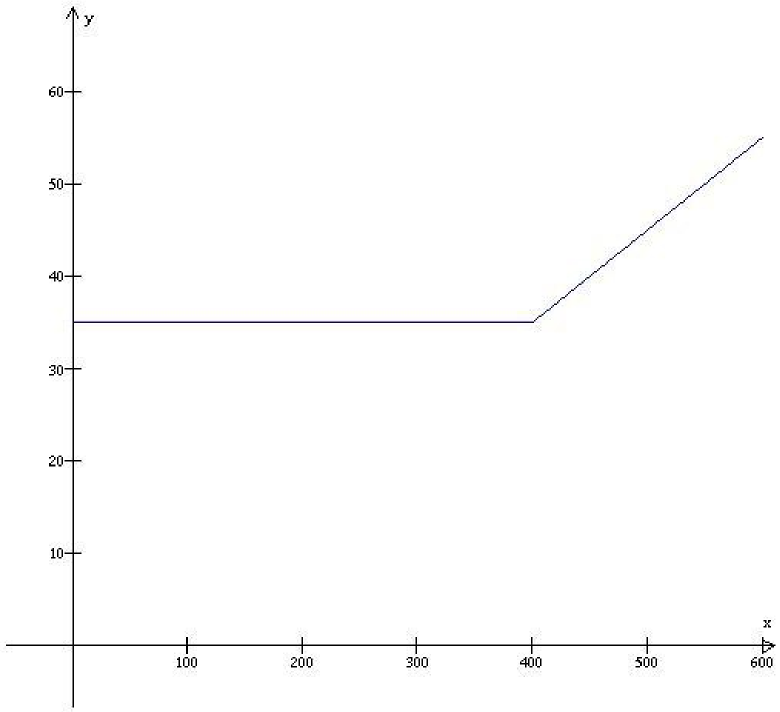
$$V(x) = \boxed{4x^3 - 64x^2 + 240x,\ 0 < x < 6}.$$

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 64E

Basic monthly charge \$35
Number of free minutes = 400
Charges for each additional minute of usage = 10 cents
The monthly cost in dollars is represented by C
The total number of calls is x
The cost function is

$$C(x) = \begin{cases} 35 & , x \le 400 \\ 35 + \frac{1}{10}(x - 400) & , x > 400 \end{cases}$$

The graph of the function C(x) as a function of x



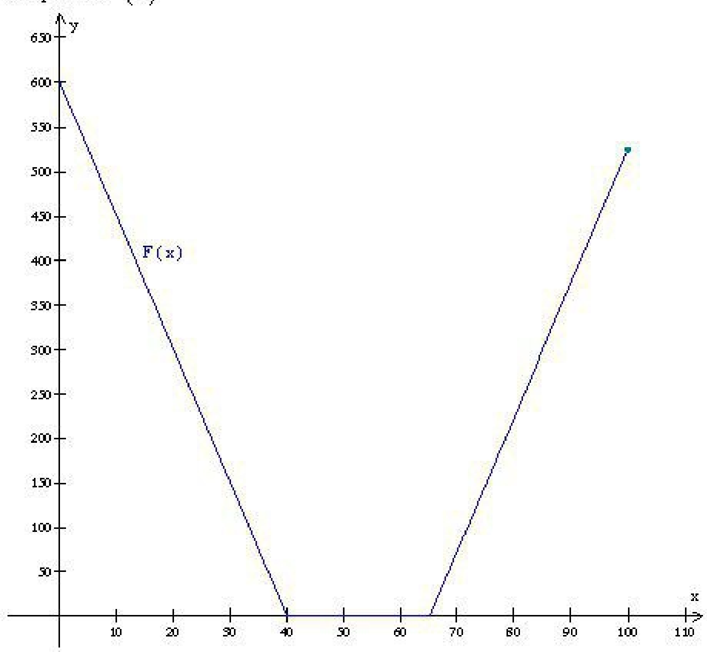
Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 65E

Maximum speed permitted on freeways = 65 mi / h
Minimum speed permitted on freeways = 40 mi / h
Fine for violating these limits is $15 for every mile per hour above maximum speed or below minimum speed.

Amount of fine as function F is

$$F(x)=\begin{cases}15(40-x) & \text{if} \quad 0\le x<40\\ 0 & \text{if} \quad 40\le x\le 65\\ 15(x-65) & \text{if} \quad x>65\end{cases}$$

Graph of $F(x)$

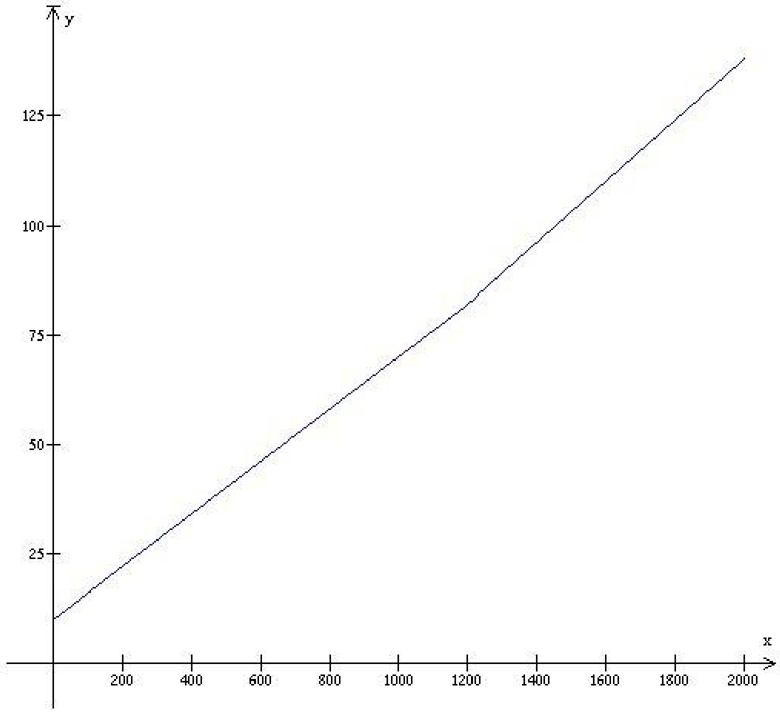


Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 66E

Basic monthly charge $10
Cost added per kWh for first 1200 kWh = 6 cents
Cost added per kWh for above 1200 kWh = 7 cents
The monthly cost in dollars is represented by E
The total amount of electricity consumed is x
The cost function is

$$E(x) = \begin{cases} 10 + \frac{6}{100}x & , x \le 1200 \\ 82 + \frac{7}{100}(x - 1200) & , x > 1200 \end{cases}$$

The graph of the function E(x) as a function of x



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 67E

(A) Let R be the rate of tax and I be the income, so R is the function of I.
Now we have been given that, there is no tax income up to $10000
So $R(I) = 0$ for $I \le \$10000$
If the income I is in the interval $\$10000 < I \le \$20000$, then the tax rate is 10%
So R(I)=10 (%) for $\$10000 < I \le \$20000$
If income is more than $20000 then the tax rate is 15%
Then R(I)=15 (%) for $I > \$20000$
Now we can write the tax rate R as a function of I as follows

$$R(I) = \begin{cases} 0 \ (\%) & \text{for } I \le \$10000 \\ 10 \ (\%) & \text{for } \$10000 < I \le \$20000 \\ 15 \ (\%) & \text{for } I > \$20000 \end{cases}$$

Now we can draw the graph of R (I) as follows

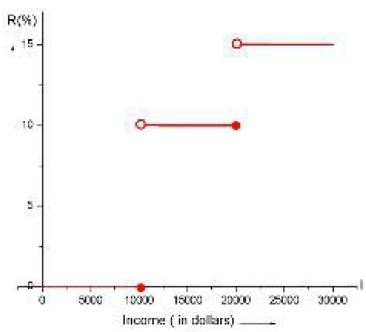


Fig.1

(B) We have to calculate tax on income of \$ 14000

Since there is no tax if income $I \le \$10000$
So non-taxable income is = \$ 10000
Then taxable income is = $14000 - 10000$ dollars
= \$ 4000
Since the total income is in the interval $(10000, 20000]$
So the income tax = 10% of 4000

$$= 4000 \times \frac{10}{100} = \$400$$

Thus $\boxed{\text{tax on income of } \$14000 = \$400}$

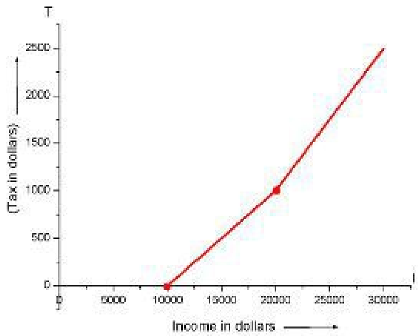
Now we have to calculate the tax on income of \$ 26000
First we breakup this income as follows
\$ 26000 = \$ 10000 + \$ 10000 + \$ 6000
Tax on first \$ 10000 = 0
Tax on second \$ 10000 = 10% of \$ 10000
Tax on last \$ 6000 = 15% of \$ 6000
Then total tax on income of \$ 26000

$$= 10000 \times 0 + 10000 \times 0.1 + 6000 \times 0.15 \text{ dollars}$$
$$= \$\ 1900$$

So the $\boxed{\text{tax on income of } \$26000 = \$\ 1900}$

(C) Since there is no tax if income $I \le \$10000$, so graph of tax T(I) will start from the point (10000, 0)
If the income $I > \$10000$ and $I \le \$\ 20000$, then tax rate is 10%
Maximum taxable income in this interval is = \$ 20000 - \$ 10000 = \$ 10000
Then maximum tax in this interval = $10000 \times 0.1 = \$\ 1000$
Therefore curve passes through the point (20000, 1000)
Since in this interval the tax rate is constant 10% then curve will be a straight line joining the points (10000, 0) and (20000, 1000)
Now if income tax $I > \$20000$, then the tax rate is 15 %
So tax $T(I) = (I - 20000) \times 0.15 + 1000$ dollars
Or $T(I) = 0.15I - 2000$ dollars

Therefore the graph of tax T (I) is as follows



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 68E

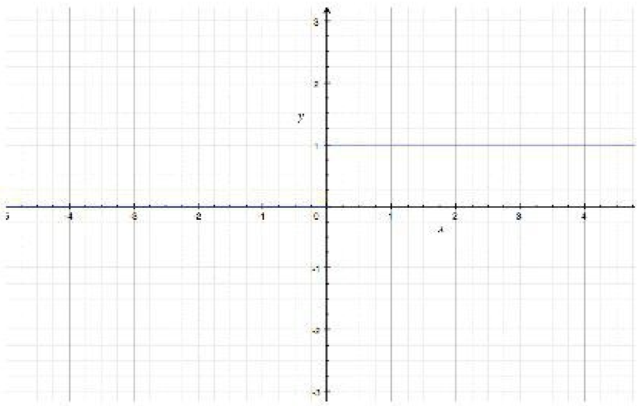
We have to give two examples of step functions that arise in everyday life uses
There are many role-playing games handle experience and leveling.
For example, a certain game could establish that 1 to100 corresponds to level 1, and 101 to 200 to level 2.

This could be modeled by a step function because there is a range of values that are defined by one level. We could then express "level" as a function of "experience" (exp):

$$\text{Level(exp)} = \begin{cases} 1 & 0 \le \text{exp} \le 100 \\ 2 & 101 \le \text{exp} \le 200 \end{cases}$$

Another common usage of step functions is on/off processes where things immediately change their state. For the sake of argument, we could say that a light bulb turning on is a step function. Say we set the time that the switch is flicked at $t = 0$.

Then it follows that we have a step function where for $t < 0$, the light emitted by the bulb is 0, but for $t > 0$ it is 1 (where 1 represents the "on" state).
The graph this example:



From the graph we can observe that, there is a step between 0 and 1, hence we call it as step function

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 69E

$f(x)$ is an odd function because its graph is symmetric about the origin.
$g(x)$ is an even function because its graph is symmetric about the y-axis.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 70E

$f(x)$ is neither even nor odd function because its graph is neither symmetric about the origin nor the y-axis.
$g(x)$ is an even function because its graph is symmetric about the y-axis.

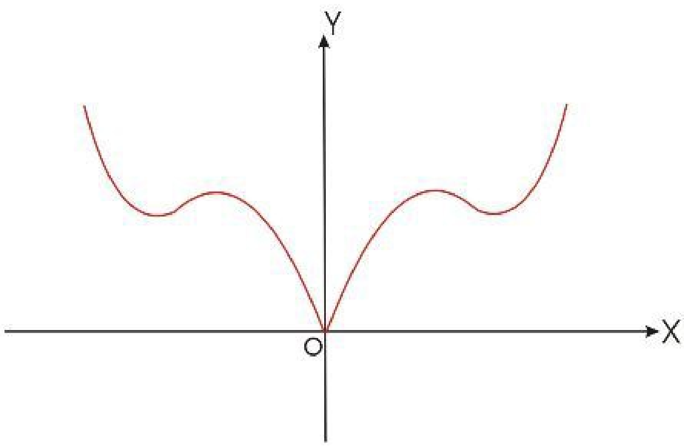
Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 71E

(A)
Since the graph is of an even function there it is symmetric about the y-axis. Hence y (5, 3) has on the graph there (-5, 3) must also be on the graph.

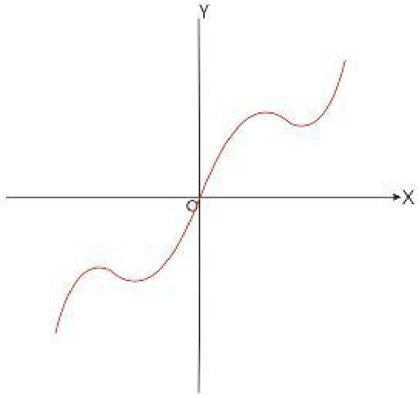
(B) Since the graph is of an odd function it is symmetric about the origin. Hence if (5, 3) lies on the graph, then (-5, -3) must also be on the graph.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 72E

(A) If f is an even function the completed graph will be symmetric about the Y-axis
Hence the required graph is



(B) If f is an odd function, the completed graph will be symmetric about the origin.
Hence the required graph is



Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 73E

Consider the following function:

$$f(x)=\frac{x}{x^2+1}.$$

To determine the function is even or odd, use **even and odd function** definitions.

If a function f satisfies $f(-x)=f(x)$ for every number x in its domain, then f is called an even function.

If a function f satisfies $f(-x)=-f(x)$ for every number x in its domain, then f is called an odd function.

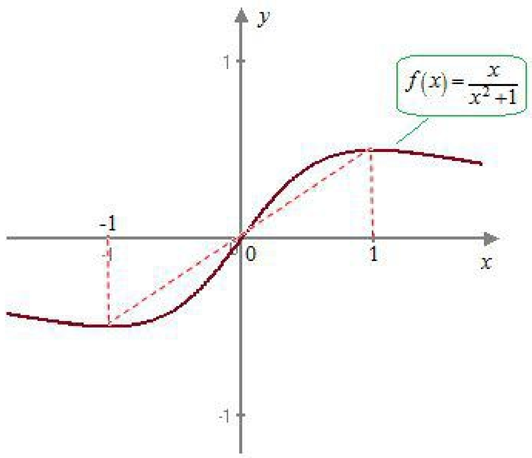
Replace x with $-x$, in $f(x)=\frac{x}{x^2+1}$.

$$\begin{aligned} f(-x) &= \frac{(-x)}{(-x)^2+1} \\ &= -\frac{x}{x^2+1} \\ &= -f(x) \end{aligned}$$

Therefore, the function $f(x)=\frac{x}{x^2+1}$ is an $\boxed{\text{odd function}}$.

Check the solution using graphing utility.

Sketch the graph of $f(x)$.



Observe that, graph of the function $f(x)=\frac{x}{x^2+1}$ is symmetric, about the origin.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 74E

Consider the following function:

$$f(x)=\frac{x^2}{x^4+1}.$$

To determine the function is even or odd, use **even and odd function** definitions.

If a function f satisfies $f(-x)=f(x)$ for every number x in its domain, then f is called an even function.

If a function f satisfies $f(-x)=-f(x)$ for every number x in its domain, then f is called an odd function.

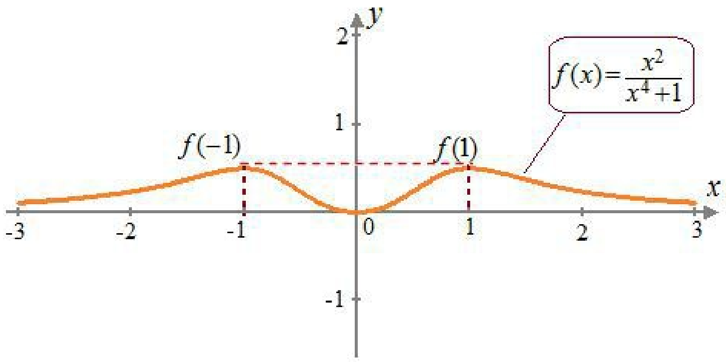
Replace x with $-x$, in $f(x)$.

$$\begin{aligned} f(-x) &= \frac{(-x)^2}{(-x)^4+1} \\ &= \frac{x^2}{x^4+1} \\ &= f(x) \end{aligned}$$

Therefore, the function $f(x)=\frac{x^2}{x^4+1}$ is an $\boxed{\text{even function}}$.

Check the solution using graphing utility.

Sketch the graph of $f(x)$.



Observe that, graph of the function $f(x)=\frac{x^2}{x^4+1}$ is symmetric, about the $y-$axis.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 75E

Consider the following function:

$$f(x)=\frac{x}{x+1}.$$

To determine the function is even or odd, use **even and odd function** definitions.

If a function f satisfies $f(-x)=f(x)$ for every number x in its domain, then f is called an even function.

If a function f satisfies $f(-x)=-f(x)$ for every number x in its domain, then f is called an odd function.

Replace x with $-x$, in $f(x)$.

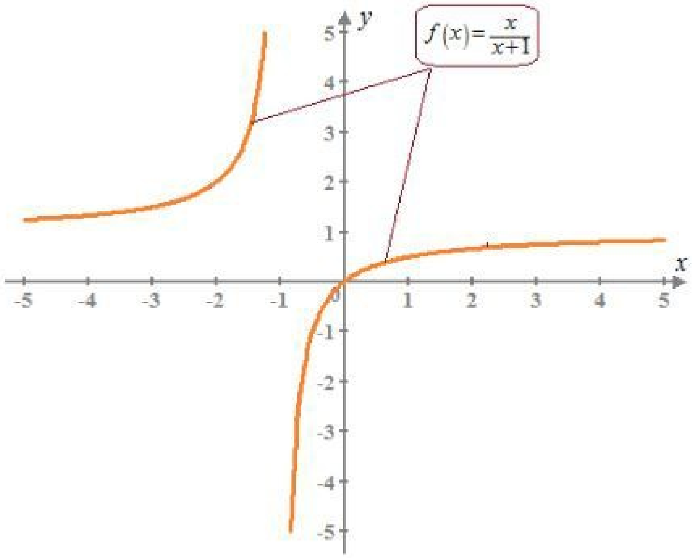
$$\begin{aligned} f(-x) &= \frac{(-x)}{(-x)+1} \\ &= \frac{-x}{1-x} \end{aligned}$$

The function $f(-x)\neq f(x)$ and $f(-x)\neq -f(x)$, so conclude that f is neither even nor odd.

Therefore, the function $f(x)=\frac{x}{x+1}$ is $\boxed{\text{neither even nor odd}}$.

Use graphing utility to check the solution.

Sketch the graph of $f(x)$.



From the graph, observe that the function $f(x)=\frac{x}{x+1}$ is symmetric, neither about the $y-$ axis nor about the origin.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 76E

Consider the following function:

$f(x)=x|x|$.

To determine the function is even or odd, use **even and odd function** definitions.

If a function f satisfies $f(-x)=f(x)$ for every number x in its domain, then f is called an even function.

If a function f satisfies $f(-x)=-f(x)$ for every number x in its domain, then f is called an odd function.

Replace x with $-x$, in $f(x)$.

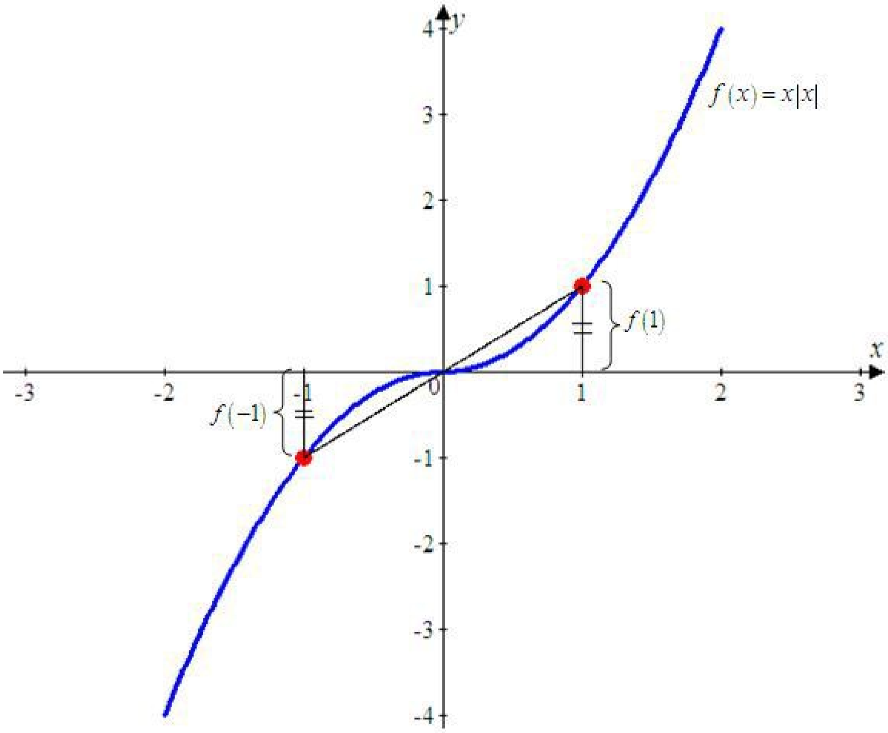
$$\begin{aligned} f(-x) &= (-x)|-x| \\ &= -x|x| \\ &= -(x|x|) \\ &= -f(x) \end{aligned}$$

The function $f(-x)=-f(x)$, so conclude that f is an odd function.

Therefore, the function $f(x)=x|x|$ is $\boxed{\text{an odd function}}$.

Use graphing utility to check the solution.

Sketch the graph of $f(x)$.



From the graph, observe that the function $f(x)=x|x|$ is symmetric, about the origin.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 77E

Consider the following function:

$$f(x)=1+3x^2-x^4.$$

To determine the function is even or odd, use **even and odd function** definitions.

If a function f satisfies $f(-x)=f(x)$ for every number x in its domain, then f is called an even function.

If a function f satisfies $f(-x)=-f(x)$ for every number x in its domain, then f is called an odd function.

Replace x with $-x$, in $f(x)$.

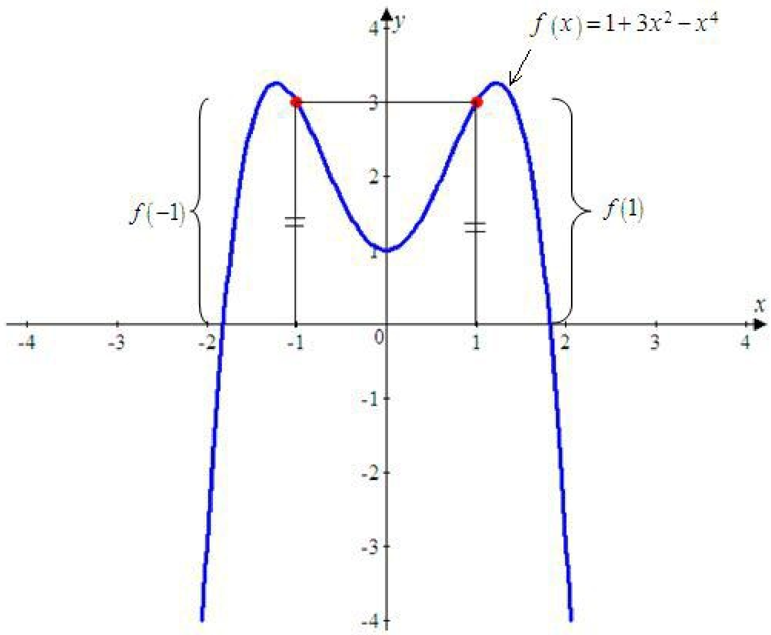
$$\begin{aligned} f(-x) &= 1+3(-x)^2-(-x)^4 \\ &= 1+3x^2-x^4 \\ &= f(x) \end{aligned}$$

The function $f(-x)=f(x)$, so conclude that f is an even function.

Therefore, the function $f(x)=1+3x^2-x^4$ is $\boxed{\text{an even function}}$.

Use graphing utility to check the solution.

Sketch the graph of $f(x)$.



From the graph, observe that the function $f(x)=1+3x^2-x^4$ is symmetric, about the $y-$ axis.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 78E

Consider the following function:

$f(x)=1+3x^3-x^5.$

To determine the function is even or odd, use **even and odd function** definitions.

If a function f satisfies $f(-x)=f(x)$ for every number x in its domain, then f is called an even function.

If a function f satisfies $f(-x)=-f(x)$ for every number x in its domain, then f is called an odd function.

Replace x with $-x$, in $f(x)$.

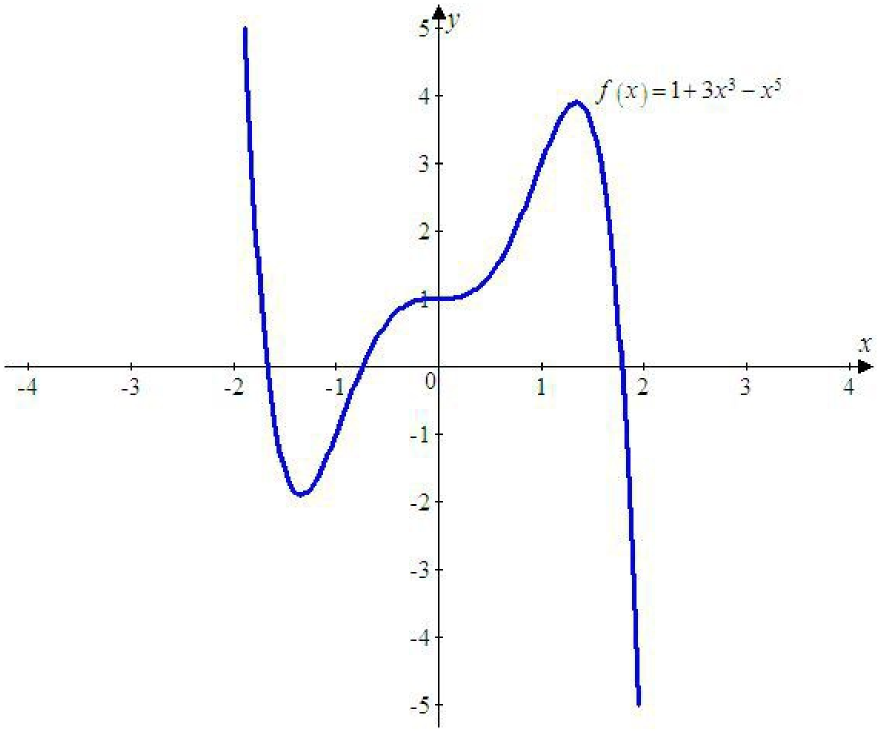
$$\begin{aligned} f(-x) &= 1+3(-x)^3-(-x)^5 \\ &= 1-3x^3+x^5 \end{aligned}$$

The function $f(-x)\neq f(x)$ and $f(-x)\neq -f(x)$, so conclude that f is neither even nor odd.

Therefore, the function $f(x)=1+3x^3-x^5$ is $\boxed{\text{neither even nor odd}}$.

Use graphing utility to check the solution.

Sketch the graph of $f(x)$.



From the graph, observe that the function $f(x)=1+3x^3-x^5$ is symmetric, neither about the $y-$axis nor about the origin.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 79E

If f and g are both even function

$f(-x)=f(x)$

$g(-x)=g(x)$

Now

$(f+g)(-x)$

$=f(-x)+g(-x)$

$=f(x)+g(x)$

$=(f+g)(x)$

Hence, $f+g$ is an even function.

If f and g are both odd function

$f(-x)=-f(x)$

$g(-x)=-g(x)$

Now

$(f+g)(-x)$

$=f(-x)+g(-x)$

$=-f(x)-g(x)$

$=-[f(x)+g(x)]$

$=-(f+g)(x)$

Hence, $f+g$ is an odd function.

If f is even and g is odd function

$f(-x)=f(x)$

$g(-x)=-g(x)$

Now

$(f+g)(-x)$

$=f(-x)+g(-x)$

$=f(x)-g(x)$

Therefore,

$(f+g)(-x)\neq(f+g)(x)$

$(f+g)(-x)\neq-(f+g)(x)$

So, $f+g$ is neither even nor odd function.

Stewart Calculus 7e Solutions Chapter 1 Functions and Limits Exercise 1.1 80E

If f and g are both even function

$f(-x)=f(x)$

$g(-x)=g(x)$

Now

$(fg)(-x)$

$=f(-x)g(-x)$

$=f(x)g(x)$

$=(fg)(x)$

Hence, fg is an even function.

If f and g are both odd function

$f(-x)=-f(x)$

$g(-x)=-g(x)$

Now

$(fg)(-x)$

$=f(-x)g(-x)$

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

$=f(x)g(x)$

$=(fg)(x)$

Hence, fg is an even function.

If f is even and g is odd function

$f(-x)=f(x)$

$g(-x)=-g(x)$

Now

$(fg)(-x)$

$=f(-x)g(-x)$

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

$=-f(x)g(x)$

$=-fg(x)$

Therefore,

So, fg is an odd function.