Problem 1

If $f(x) = x + \sqrt{2-x}$ *and* $g(x) = u + \sqrt{2-u}$*, is it true that* $f = g$*?*

Solution

True

Problem 2

If

$$f(x) = \frac{x^2 - x}{x - 1} \quad \text{and} \quad g(x) = x$$

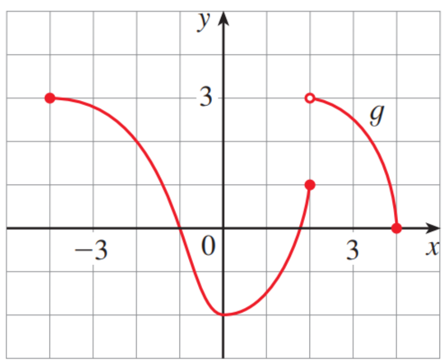
is it true that $f = g$*?*

Solution

False

Problem 3

The graph of a function g *is given:*



Source: James Stewart, Calculus: Early Transcendentals [9e]

1. *State the values of* $g(-2)$*,* $g(0)$*,* $g(2)$ *and* $g(3)$

   ### Solution

   $g(-2) = 2 \quad g(0) = -2 \quad g(2) = 1 \quad g(3) = 2.5$

2. *For what value(s) of* x *is* $g(x) = 3$*?*

   ### Solution

   $g(x) = 3 \Rightarrow x = -4$

3. *For what value(s) of* x *is* $g(x) \leq 3$*?*

Solution

$g(x) \leq 3 \Rightarrow x \in [-4, 4]$

4. *State the domain and range of g*

Solution

Domain : $[-4, 4]$ Range : $[-2, 3]$

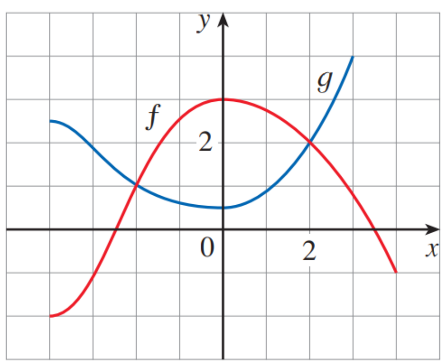
5. *On what interval(s) is g increasing?*

Solution

$[0, 2]$

Problem 4

The graph of f and g are given:



Source: James Stewart, Calculus: Early Transcendentals [9e]

1. *State the values of* $f(-4)$ *and* $g(3)$

Solution

$f(-4) = -2 \quad g(3) = 4$

2. *Which is larger,* $f(-3)$ *or* $g(-3)$*?*

Solution

$g(-3)$

3. *For what values of x is* $f(x) = g(x)$*?*

Solution

$x = \pm 2$

4. *On what interval(s) is $f(x) \leq g(x)$?*

Solution

$[-4, -2] \cup [2, 3]$

5. *State the solution of the equation $f(x) = -1$*

Solution

$f(x) = -1 \Rightarrow x = -3$

6. *On what interval(s) is g decreasing?*

Solution

$[-4, 0]$

7. *State the domain and range of f*

Solution

Domain : $[-4, 4]$ Range : $[-2, 3]$

8. *State the domain and range of g*

Solution

Domain : $[-4, 3]$ Range : $[0.5, 4]$

Problem 5

Figure 1 was recorded by an instrument operated by the California Department of Mines and Geology at the University Hospital of the University of Southern California in Los Angeles. Use it to estimate the range of the vertical ground acceleration function at USC during the North-ridge earthquake.

Solution

Problem 6

In this section we discussed examples of ordinary, everyday functions: population is a function of time, postage cost is a function of package weight, water temperature is a function of time. Give three other examples of function from everyday life that are described verbally. What can you say about the domain and range of each of your functions? If possible, sketch a rough graph of each function.

Solution

Problem 7

Determine whether the equation or table defines y as a function of x:

$$3x - 5y = 7$$

Solution

True

$$y = \frac{3x - 7}{5}$$

Problem 8

Determine whether the equation or table defines y as a function of x:

$$3x^2 - 2y = 5$$

Solution

True

$$y = \frac{3x^2 - 5}{2}$$

Problem 9

Determine whether the equation or table defines y as a function of x:

$$x^2 + (y - 3)^2 = 5$$

Solution

False

$$y = \pm(\sqrt{3x^2 - 5} + 3)$$

Problem 10

Determine whether the equation or table defines y as a function of x:

$$2xy + 5y^2 = 4$$

Solution

False

$$y = \frac{-x \pm \sqrt{x^2 + 20}}{5}$$

Problem 11

Determine whether the equation or table defines y as a function of x:

$$(y+3)^3 + 1 = 2x$$

Solution

True

$$y = \sqrt[3]{2x-1} - 3$$

Problem 12

Determine whether the equation or table defines y as a function of x:

$$2x - |y| = 0$$

Solution

False

$$y = \pm 2x$$

Problem 13

Determine whether the equation or table defines y as a function of x:

x Height (cm)	y Shoe size
180	12
150	8
150	7
160	9
175	10

Source: James Stewart, Calculus: Early Transcendentals [9e]

Solution

False

Problem 14

Determine whether the equation or table defines y as a function of x:

x Year	y Tuition cost (\$)
2016	10,900
2017	11,000
2018	11,200
2019	11,200
2020	11,300

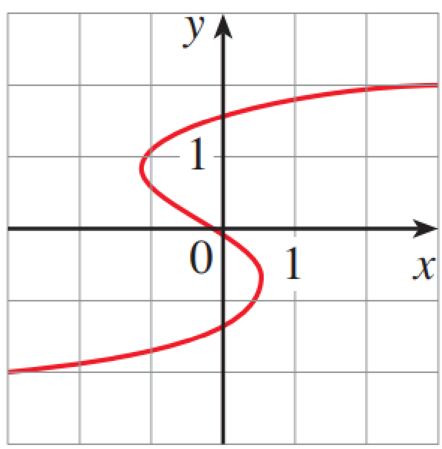
Source: James Stewart, Calculus: Early Transcendentals [9e]

Solution

True

Problem 15

Determine whether the curve is the graph of a function of x. If it is, state the domain and range of the function



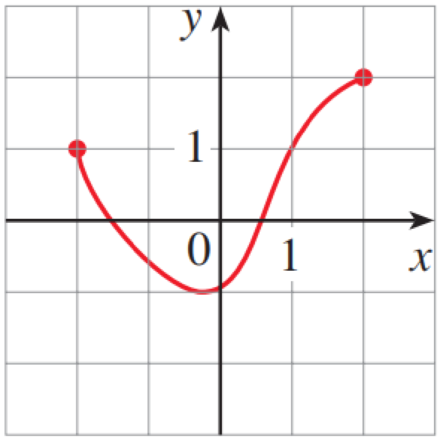
Source: James Stewart, Calculus: Early Transcendentals [9e]

Solution

False

Problem 16

Determine whether the curve is the graph of a function of x. If it is, state the domain and range of the function



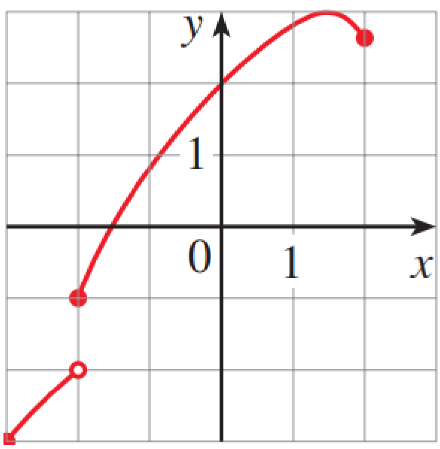
Source: James Stewart, Calculus: Early Transcendentals [9e]

Solution

Domain : $[-2, 2]$ Range : $[-1, 2]$

Problem 17

Determine whether the curve is the graph of a function of x. If it is, state the domain and range of the function



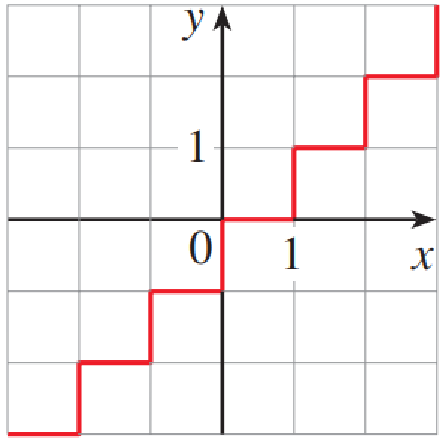
Source: James Stewart, Calculus: Early Transcendentals [9e]

Solution

Domain : $[-3, 2]$ Range : $[-3, 3]$

Problem 18

Determine whether the curve is the graph of a function of x. If it is, state the domain and range of the function



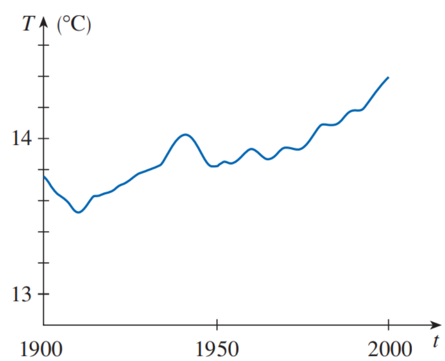
Source: James Stewart, Calculus: Early Transcendentals [9e]

Solution

False

Problem 19

Shown is a graph of the global average temperature T during the 20th century. Estimate the following:



Source: James Stewart, Calculus: Early Transcendentals [9e]

1. *The global average temperature in 1950*

   ### Solution

   ≈ 13.82

2. *The year when the average temperature was $14.2°C$*

   ### Solution

   ≈ 1992

3. *The years when the temperature was smallest and largest*

Solution

1910 and 2003

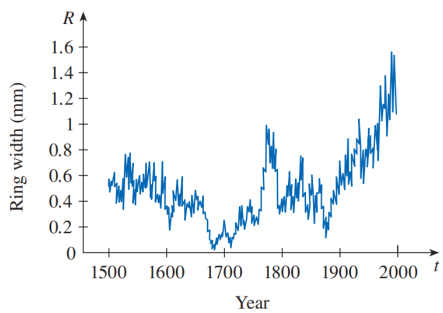
4. *The range of T*

Solution

$[13.5, 14.4]$

Problem 20

Trees grow faster and form wider rings in warm years and grow more slowly and form narrower rings in cooler years. The figure shows ring widths of a Siberian pine from 1500 to 2000.



Source: James Stewart, Calculus: Early Transcendentals [9e]

1. *What is the range of the ring width function?*

Solution

$[0.1, 1.6]$ (mm)

2. *What does the graph tend to say about the temperature of the earth? Does the graph reflect the volcanic eruptions of the mid-19th century?*

Solution

The graph tends to say that the temperature of the earth is increasing. And it also reflects the volcanic eruptions of the mid-19th century.

Problem 21

You put some ice cubes in a glass, fill the glass with cold water, and then let the glass sit on a table. Describe how the temperature of the water changes as time passes. Then sketch a rough graph of the temperature of the water as a function of the elapsed time.

Solution

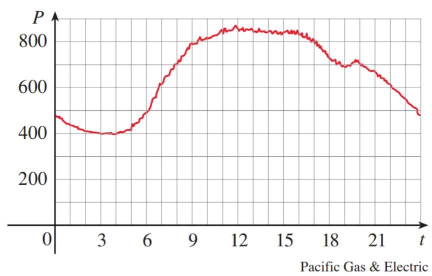
Problem 22

You place a frozen pie in an oven and bake it for an hour. Then you take it out and let it cool. Describe how the temperature of the pie changes as time passes. Then sketch a rough graph of the temperature of the pie as a function of time.

Solution

Problem 23

The graph shows the power consumption for a day in September in San Francisco. (P is measured in megawatts; t is measured in hours starting at midnight.)



Source: James Stewart, Calculus: Early Transcendentals [9e]

1. *What was the power consumption at 6 AM? At 6 PM?*

   Solution

   The power consumption at 6 AM is 500 (MW), and at 6 PM is 720 (MW).

2. *When was the power consumption the lowest? When was it the highest? Do these times seem reasonable?*

   Solution

   The power consumption is lowest at 3 AM and is highest at midday. And it is reasonable.

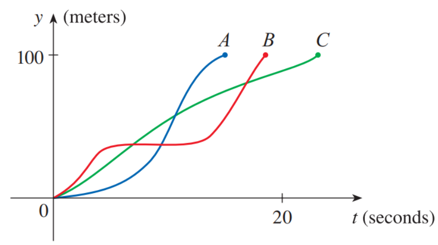
Problem 24

Three runners compete in a 100-meter race. The graph depicts the distance run as a function of time for each runner. Describe in words what the graph tells you about this race. Who won the race? Did each runner finish the race?

Solution

Problem 25

Sketch a rough graph of the outdoor temperature as a function of time during a typical spring day.



Source: James Stewart, Calculus: Early Transcendentals [9e]

Solution

Problem 26

Sketch a rough graph of the number of hours of daylight as a function of the time of year.

Solution

Problem 27

Sketch a rough graph of the amount of a particular brand of coffee sold by a store as a function of the price of the coffee.

Solution

Problem 28

Sketch a rough graph of the market value of a new car as a function of time for a period of 20 years. Assume the car is well maintained.

Solution

Problem 29

A homeowner mows the lawn every Wednesday afternoon. Sketch a rough graph of the height of the grass as a function of time over the course of a four-week period.

Solution

Problem 30

An airplane takes off from an airport and lands an hour later at another airport, 400 miles away. If t represents the time in minutes since the plane has left the terminal building, let $x(t)$ be the horizontal distance traveled and $y(t)$ be the altitude of the plane.

1. *Sketch a possible graph of $x(t)$*

   ### Solution

2. *Sketch a possible graph of $y(t)$*

Solution

3. *Sketch a possible graph of the ground speed*

Solution

4. *Sketch a possible graph of the vertical velocity*

Solution

Problem 31

Temperature readings T (in $^\circ F$) were recorded every two hours from midnight to 2:00 PM in Atlanta on a day in June. The time t was measured in hours from midnight.

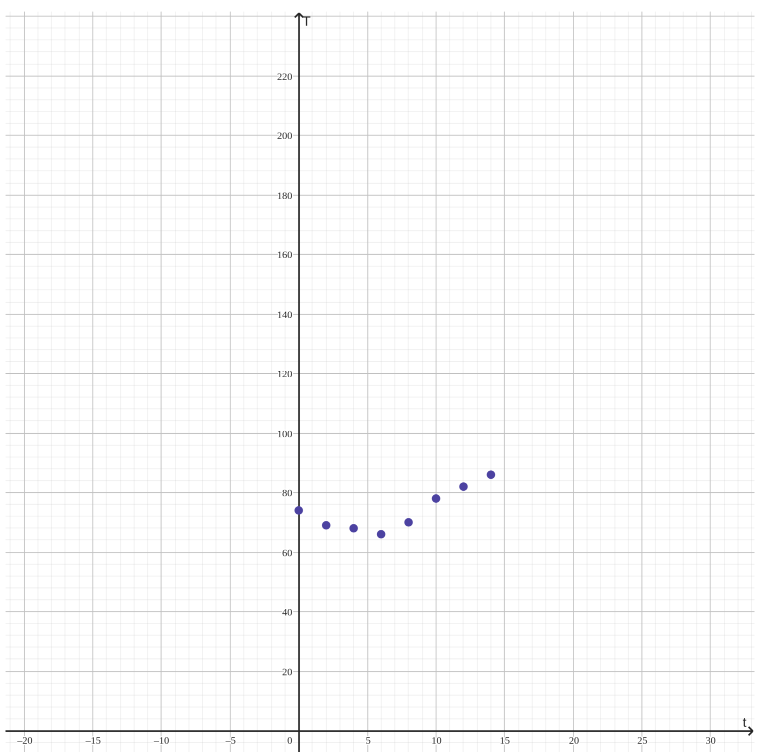
t	0	2	4	6	8	10	12	14
T	23	21	20	19	21	26	28	30

Source: James Stewart, Calculus: Early Transcendentals [9e]

1. *Use the readings to sketch a rough graph of T as a function of t*

Solution

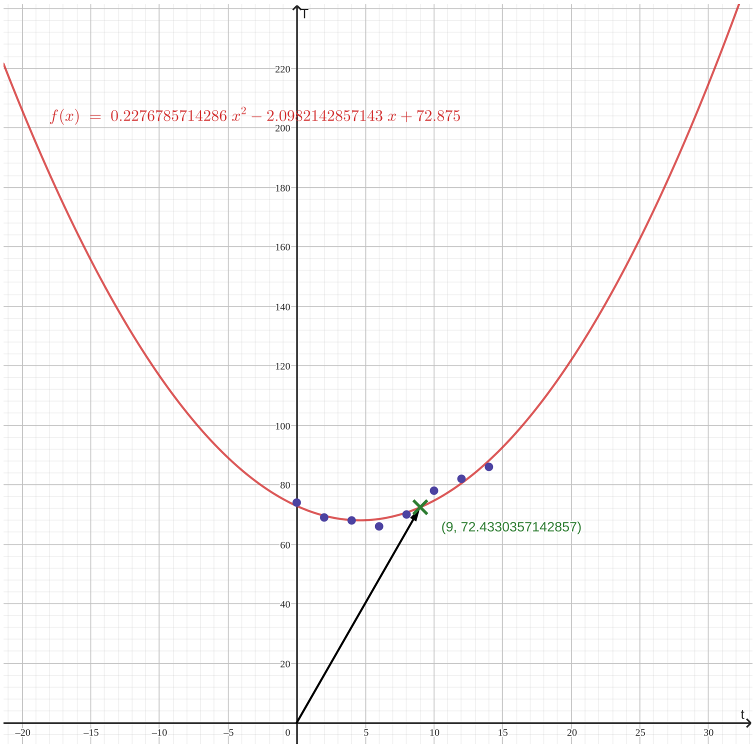
We can use a quadratic function to fit those points.



2. *Use your graph to estimate the temperature at 9:00 AM*

Solution

$\approx 72.4°F$



Problem 32

Researchers measured the blood alcohol concentration(BAC) of eight adult male subjects after rapid consumption 30 mL of ethanol (corresponding to two standard alcoholic drinks). The table shows the data they obtained by averaging the BAC (in g/dL) of the eight men.

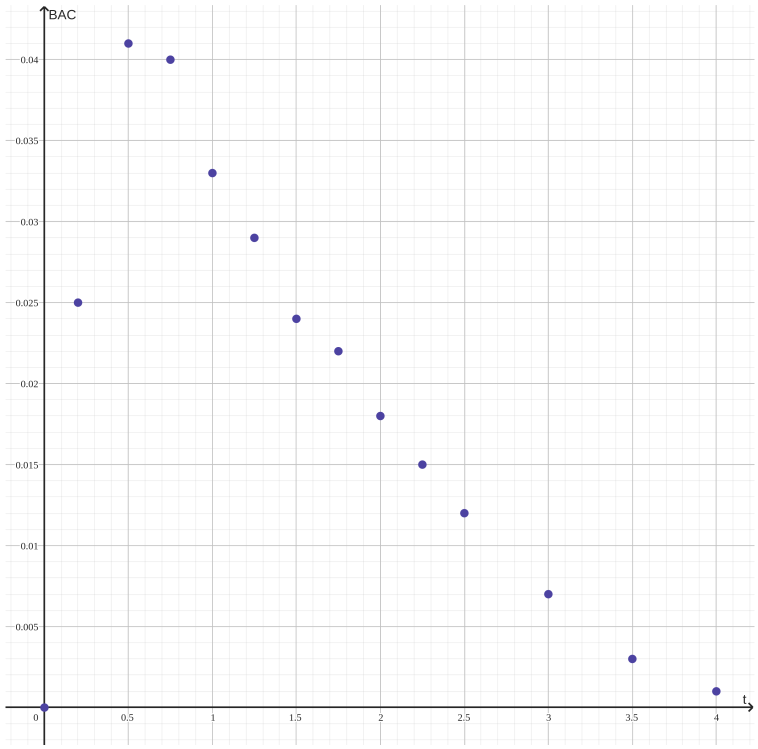
t (hours)	BAC	t (hours)	BAC
0	0	1.75	0.022
0.2	0.025	2.0	0.018
0.5	0.041	2.25	0.015
0.75	0.040	2.5	0.012
1.0	0.033	3.0	0.007
1.25	0.029	3.5	0.003
1.5	0.024	4.0	0.001

Source: James Stewart, Calculus: Early Transcendentals [9e]

1. *Use the readings to sketch a rough graph of BAC as a function of t*

Solution

2. *Use your graph to describe how the effect of alcohol varies with time*



Solution

The BAC value increases from 0 (g/dL) to the maximum of 0.041 (g/dL) before it decreases to 0.001 (g/dL) 4 hours after consuming 30 mL of ethanol.

Problem 33

If $f(x) = 3x^2 - x + 2$, *find* $f(2)$, $f(-2)$, $f(a)$, $f(-a)$, $f(a+1)$, $2f(a)$, $f(2a)$, $f(a^2)$, $[f(a)]^2$, *and* $f(a+h)$.

Solution

Problem 34

If $g(x) = \frac{x}{\sqrt{x+1}}$, *find* $g(0)$, $g(3)$, $5g(a)$, $\frac{1}{2}g(4a)$, $g(a^2)$, $[g(a)]^2$, $g(a+h)$, *and* $g(x-a)$.

Solution

Problem 35

Evaluate the difference quotient for the given function. Simplify your answer.

$$f(x) = 4 + 3x - x^2 \qquad \frac{f(3+h) - f(3)}{h}$$

Solution

Problem 36

Evaluate the difference quotient for the given function. Simplify your answer.

$$f(x) = x^3 \qquad \frac{f(a+h) - f(a)}{h}$$

Solution

Problem 37

Evaluate the difference quotient for the given function. Simplify your answer.

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

Solution

Problem 38

Evaluate the difference quotient for the given function. Simplify your answer.

$$f(x) = \sqrt{x+2} \qquad \frac{f(x) - f(1)}{x - 1}$$

Solution

Problem 39

Find the domain of the function

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

Solution

Problem 40

Find the domain of the function

$$f(x) = \frac{x^2 + 1}{x^2 + 4x - 21}$$

Solution

Problem 41

Find the domain of the function

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

Solution

Problem 42

Find the domain of the function

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

Solution

Problem 43

Find the domain of the function

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

Solution

Problem 44

Find the domain of the function

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

Solution

Problem 45

Find the domain of the function

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

Solution

Problem 46

Find the domain of the function

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

Solution