WebAssign
3.9 Razones Relacionadas y Diferenciales (Homework)

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Diferencial, section B, Spring 2019
Instructor: Christiaan Ketelaar

Current Score : 36.5 / 31.5 **Due :** Friday, April 12, 2019 11:59 PM CST**Last Saved : n/a Saving... ()**

The due date for this assignment is past. Your work can be viewed below, but no changes can be made.

Important! Before you view the answer key, decide whether or not you plan to request an extension. Your Instructor may *not* grant you an extension if you have viewed the answer key. Automatic extensions are not granted if you have viewed the answer key.

Request Extension

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1. 2/2 points | Previous AnswersSCalcET8 3.9.002.

(a) If A is the area of a circle with radius r and the circle expands as time passes, find dA/dt in terms of dr/dt.

$\frac{dA}{dt} =$

$$2πr

✔ $\boxed{2\pi r}\ \frac{dr}{dt}$

(b) Suppose oil spills from a ruptured tanker and spreads in a circular pattern. If the radius of the oil spill increases at a constant rate of 1 m/s, how fast is the area of the spill increasing when the radius is 29 m?

$$58π

✔ $\boxed{58\pi}$ m^2/s

Solution or Explanation

(a) $A = \pi r^2 \quad \Rightarrow \quad \frac{dA}{dt} = \frac{dA}{dr}\frac{dr}{dt} = 2\pi r\frac{dr}{dt}$

(b) $\frac{dA}{dt} = 2\pi r\frac{dr}{dt} = 2\pi(29\text{ m})(1\text{ m/s}) = 58\pi\text{ m}^2\text{/s}$

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2. 1/1 points | Previous AnswersSCalcET8 3.9.004.MI.

The length of a rectangle is increasing at a rate of 7 cm/s and its width is increasing at a rate of 4 cm/s. When the length is 15 cm and the width is 6 cm, how fast is the area of the rectangle increasing?

$\boxed{102}$ ✔ $\boxed{102}$ cm^2/s

Solution or Explanation

Click to View Solution

3. 3/3 points | Previous AnswersSCalcET8 3.9.005.MI.SA.

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

A cylindrical tank with radius 6 m is being filled with water at a rate of 4 m^3/min. How fast is the height of the water increasing?

Step 1

If h is the water's height, the volume of the water is $V = \pi r^2 h$. We must find dV/dt. Differentiating both sides of the equation gives the following.

$$dhdt

$\frac{dV}{dt} = \pi r^2$ $\boxed{\frac{dh}{dt}}$

Step 2

Substituting for r, this becomes

$\frac{dV}{dt} =$

$$π·62

$\boxed{36\pi} \cdot \frac{dh}{dt}$.

Step 3

Substituting for $\frac{dV}{dt}$ and isolating $\frac{dh}{dt}$, we can conclude that the height of the water is increasing at the following rate.

$\frac{dh}{dt} =$

$$436π

$\boxed{\frac{1}{9\pi}}$ m/min.

You have now completed the Master It.

4. 1/1 points | Previous AnswersSCalcET8 3.9.015.

A street light is mounted at the top of a 15-ft-tall pole. A man 6 ft tall walks away from the pole with a speed of 4 ft/s along a straight path. How fast is the tip of his shadow moving when he is 30 ft from the pole?

20/3 20/3 ft/s

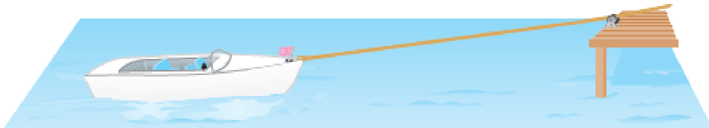
Solution or Explanation

Click to View Solution

5. 1/1 points | Previous AnswersSCalcET8 3.9.022.MI.

A boat is pulled into a dock by a rope attached to the bow of the boat and passing through a pulley on the dock that is 1 m higher than the bow of the boat. If the rope is pulled in at a rate of 1 m/s, how fast is the boat approaching the dock when it is 9 m from the dock? (Round your answer to two decimal places.)

-1.01 1.01 m/s



Solution or Explanation

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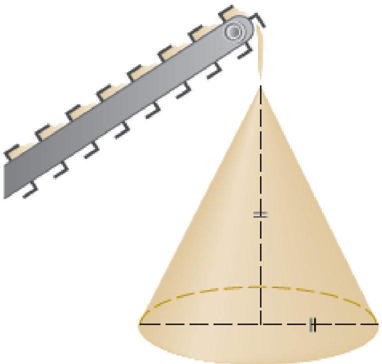
6. 1/1 points | Previous AnswersSCalcET8 3.9.029.

Gravel is being dumped from a conveyor belt at a rate of 15 ft^3/min, and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 9 ft high? (Round your answer to two decimal places.)

0.24 0.24 ft/min



Solution or Explanation

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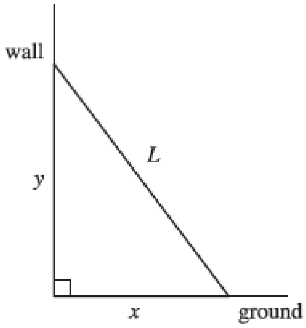
7. 1/1 points | Previous AnswersSCalcET8 3.9.033.

The top of a ladder slides down a vertical wall at a rate of 0.125 m/s. At the moment when the bottom of the ladder is 5 m from the wall, it slides away from the wall at a rate of 0.3 m/s. How long is the ladder?

13 ✓ 13 m

Solution or Explanation

From the figure and given information, we have $x^2 + y^2 = L^2$, $\frac{dy}{dt} = 0.125$ m/s, and $\frac{dx}{dt} = 0.3$ m/s when $x = 5$ m. Differentiating implicitly with respect to t, we get $x^2 + y^2 = L^2 \Rightarrow 2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0 \Rightarrow y\frac{dy}{dt} = -x\frac{dx}{dt}$. Substituting the given information gives us $y(-0.125) = -5(0.3) \Rightarrow y = 12$ m. Thus, $5^2 + 12^2 = L^2 \Rightarrow L^2 = 169 \Rightarrow L = 13$ m.



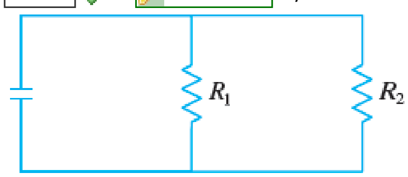
8. 1/1 points | Previous AnswersSCalcET8 3.9.039.

If two resistors with resistances R_1 and R_2 are connected in parallel, as in the figure below, then the total resistance R, measured in ohms (Ω), is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}.$$

If R_1 and R_2 are increasing at rates of 0.3 Ω/s and 0.2 Ω/s, respectively, how fast is R changing when $R_1 = 50$ Ω and $R_2 = 80$ Ω? (Round your answer to three decimal places.)

0.143 ✓ 0.143 Ω/s



Solution or Explanation

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9. 2/2 points | Previous AnswersSCalcET8 3.9.043.

A television camera is positioned 4000 ft from the base of a rocket launching pad. The angle of elevation of the camera has to change at the correct rate in order to keep the rocket in sight. Also, the mechanism for focusing the camera has to take into account the increasing distance from the camera to the rising rocket. Let's assume the rocket rises vertically and its speed is 700 ft/s when it has risen 3000 ft. (Round your answers to three decimal places.)

(a) How fast is the distance from the television camera to the rocket changing at that moment?

420 ✔ 420 ft/s

(b) If the television camera is always kept aimed at the rocket, how fast is the camera's angle of elevation changing at that same moment?

0.112 ✔ 0.112 rad/s

Solution or Explanation

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10. 1/1 points | Previous AnswersSCalcET8 3.9.045.

A plane flies horizontally at an altitude of 3 km and passes directly over a tracking telescope on the ground. When the angle of elevation is $\pi/6$, this angle is decreasing at a rate of $\pi/4$ rad/min. How fast is the plane traveling at that time?

$$3п

✔ 3π km/min

Solution or Explanation

Click to View Solution

11. 3.5/3.5 points | Previous Answers SCalcET8 3.9.018.MI.SA.

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

A spotlight on the ground shines on a wall 12 m away. If a man 2 m tall walks along the x-axis from the spotlight toward the building at a speed of 2.2 m/s, which is taken as the given *dx/dt*, how fast is the length of his shadow on the building decreasing when he is 4 m from the building?

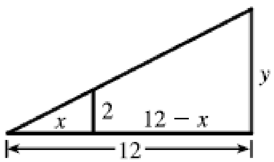
Step 1

Using the diagram below, find the relation between x and y.

$\frac{2}{x} =$

$$y12

$\frac{y}{12}$ ✓



Step 2

We must find dy/dt. The equation found in the previous step can be re-written as follows.

$y = \frac{24}{x}$ ✓ 24

$= 24x^{-1}$ ✓ -1

Step 3

Now find $\frac{dy}{dt}$.

$\frac{dy}{dt} =$

$$−24x−2

✓ $-24x^{-2} \cdot \frac{dx}{dt}$

Step 4

Substituting $x = 8$ gives us the following. (Round your answers to one decimal place.)

$\frac{dy}{dt} = \frac{(-24)(2.2)}{64}$ ✓ 2.2

$= -0.825$ ✓ -0.8

The shadow is decreasing at a rate of 0.825 ✓ 0.8 m/s.

You have now completed the Master It.

12. 3.5/3.5 points | Previous Answers SCalcET8 3.9.026.MI.SA.

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

A trough is 10 ft long and its ends have the shape of isosceles triangles that are 3 ft across at the top and have a height of 1 ft. If the trough is being filled with water at a rate of 14 ft^3/min, how fast is the water level rising when the water is 6 inches deep?

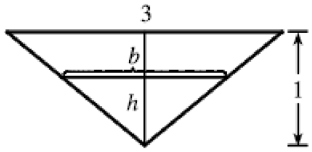
Step 1

Let h be the water's height and b be the distance across the top of the water. Using the diagram below, find the relation between b and h.

$\frac{3}{1} =$

$$bh

$\boxed{\frac{b}{h}}$



Step 2

The volume of the water is as follows.

$V = \frac{1}{2}bhl$

$= \frac{1}{2}bh(\boxed{10}$ 10 $)$

$= \boxed{5}$ 5 $(3h)(h)$

$$15h2

$= \boxed{15h^2}$

Step 3

We must find dh/dt. We have

14 $= \frac{dV}{dt} =$

$$30h

$\boxed{30h} \cdot \frac{dh}{dt}$.

Step 4

In feet, we know that

$h = \boxed{0.5}$ 1/2 ft.

Step 5

Consequently, we can conclude the following.

$\frac{dh}{dt} = \boxed{14/15}$ 14/15 ft/min

You have now completed the Master It.

13. 1/1 points | Previous Answers SCalcET8 3.10.003.

Find the linearization $L(x)$ of the function at a.

$$f(x) = \sqrt{x}, \quad a = 16$$

$L(x) =$
$$4+18(x−16)

$\boxed{\frac{x}{8}+2}$

Solution or Explanation

$f(x) = \sqrt{x} \quad \Rightarrow \quad f'(x) = \frac{1}{2}x^{-1/2} = \frac{1}{(2\sqrt{x})}$, so $f(16) = 4$ and $f'(16) = \frac{1}{8}$. Thus,

$L(x) = f(16) + f'(16)(x - 16) = 4 + \frac{1}{8}(x - 16) = 4 + \frac{1}{8}x - 2 = \frac{1}{8}x + 2.$

14.2/2 points | Previous AnswersSCalcET8 3.10.005.

Find the linear approximation of the function $f(x) = \sqrt{4 - x}$ at $a = 0$.

$L(x) =$
$$2−14(x−0)

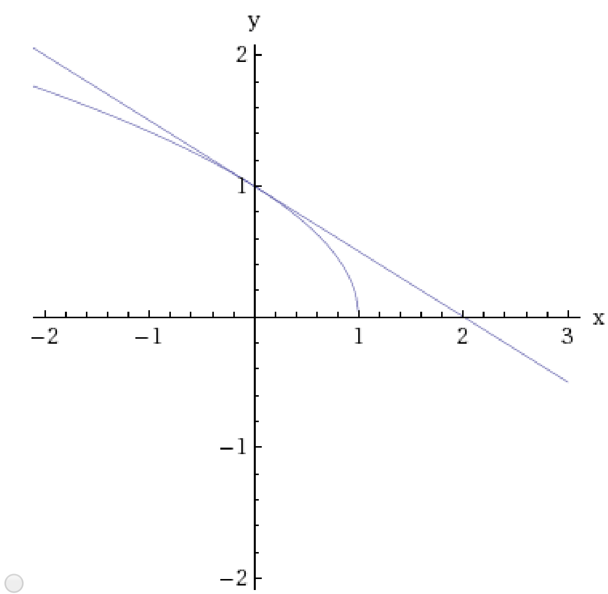
$2 - \frac{x}{4}$

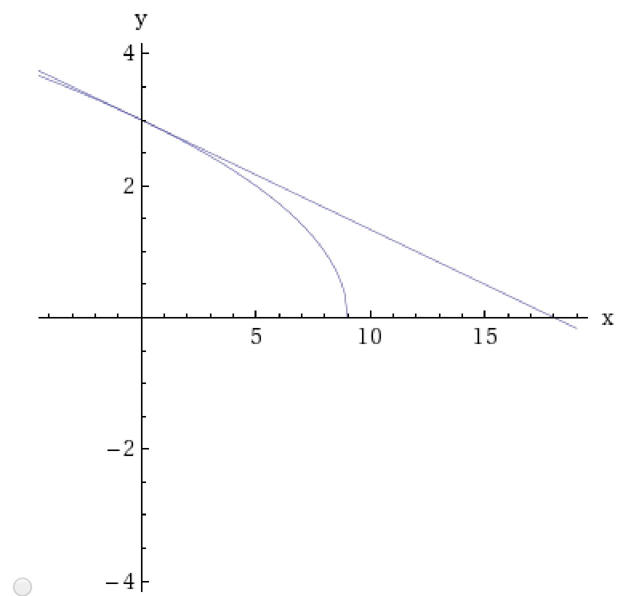
Use $L(x)$ to approximate the numbers $\sqrt{3.9}$ and $\sqrt{3.99}$. (Round your answers to four decimal places.)

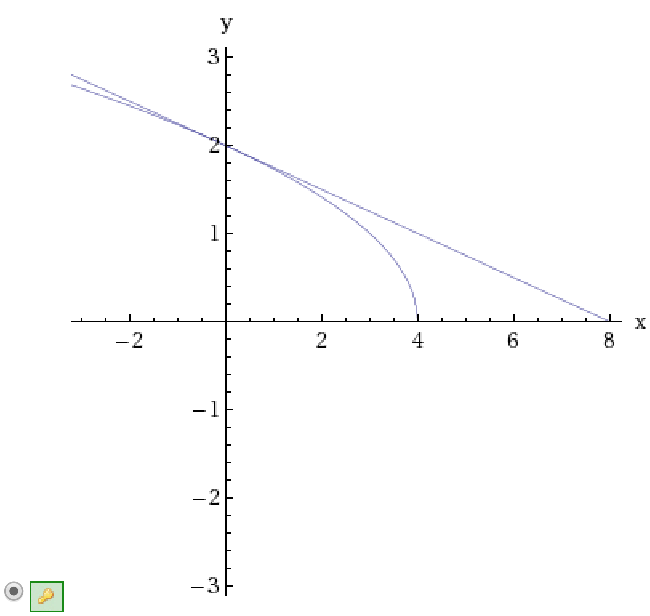
$\sqrt{3.9} \approx$ 1.9750 1.975

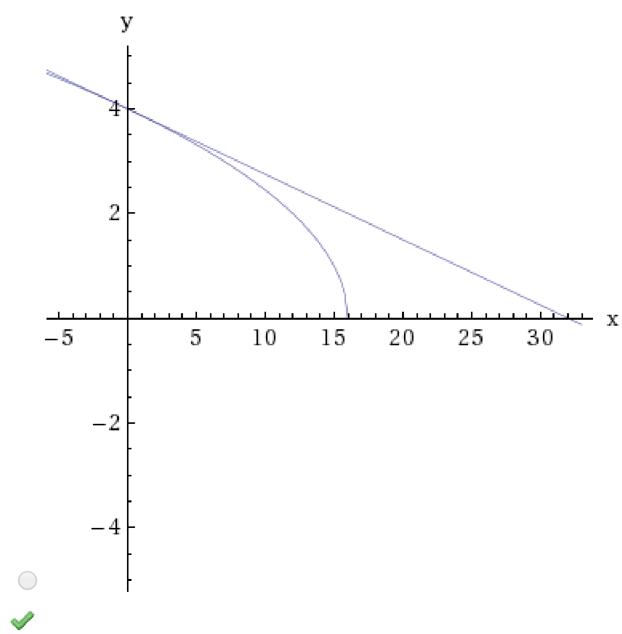
$\sqrt{3.99} \approx$ 1.9975 1.9975

Illustrate by graphing f and the tangent line.









Solution or Explanation

$f(x) = \sqrt{4 - x} \Rightarrow f'(x) = \dfrac{-1}{2\sqrt{4 - x}}$, so

$f(0) = 2$ and $f'(0) = -\dfrac{1}{4}$.

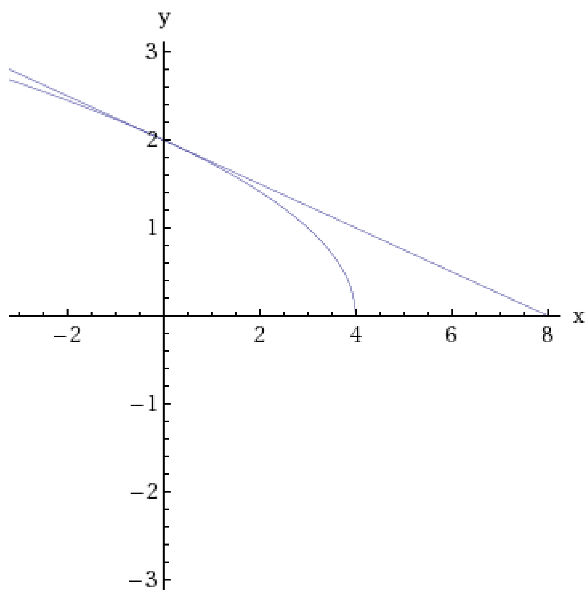
Therefore, $\sqrt{4 - x} = f(x) \approx f(0) + f'(0)(x - 0) = 2 + \left(-\dfrac{1}{4}\right)(x - 0) = 2 - \dfrac{1}{4}x$.

The linear approximation $2 - \dfrac{1}{4}x$ to f at $x = 0$ provides a good approximation to f for x near 0, so

$\sqrt{3.9} = \sqrt{4 - 0.1} \approx f - \dfrac{1}{4}(0.1) = 1.975$ and

$\sqrt{3.99} = \sqrt{4 - 0.01} \approx f - \dfrac{1}{4}(0.01) = 1.9975$.

Graphing f and the tangent line we have:



15. 2/2 points | Previous Answers SCalcET8 3.10.013.

Find the differential of each function.

(a) $y = \tan(\sqrt{5t})$

$dy =$
$$sec2(√5t)(12√5t)(5)dt

$\dfrac{5\sec^2(\sqrt{5t})}{2\sqrt{5t}}dt$

(b) $y = \dfrac{4 - v^2}{4 + v^2}$

$dy =$
$$[(−2v)(4+v2)−(4−v2)(2v)(4+v2)2]dv

$\dfrac{-16v}{(4+v^2)^2}dv$

Solution or Explanation

(a) For $y = f(t) = \tan(\sqrt{5t})$, $f'(t) = \sec^2(\sqrt{5t}) \cdot \frac{5}{2}(5t)^{-1/2} = \dfrac{5\sec^2(\sqrt{5t})}{2\sqrt{5t}}$, so $dy = \dfrac{5\sec^2(\sqrt{5t})}{2\sqrt{5t}}\,dt$.

(b) For $y = f(v) = \dfrac{4 - v^2}{4 + v^2}$,

$$f'(v) = \frac{(4 + v^2)(-2v) - (4 - v^2)(2v)}{(4 + v^2)^2} = \frac{-2v[(4 + v^2) + (4 - v^2)]}{(4 + v^2)^2} = \frac{-2v(8)}{(4 + v^2)^2} = \frac{-16v}{(4 + v^2)^2},$$

so $dy = \dfrac{-16v}{(4 + v^2)^2}\,dv$.

16. 2/2 points | Previous Answers SCalcET8 3.10.017.

(a) Find the differential dy.

$y = \sqrt{15 + x^2}$

$dy =$
$$[(12√15+x2)(2x)]dx

$\dfrac{x}{\sqrt{15+x^2}}dx$

(b) Evaluate dy for the given values of x and dx.

$x = 1$, $dx = -0.1$

$dy =$
$$−140

-0.025

Solution or Explanation

(a) $y = \sqrt{15 + x^2} \Rightarrow dy = \frac{1}{2}(15 + x^2)^{-1/2}(2x)\,dx = \dfrac{x}{\sqrt{15 + x^2}}\,dx$

(b) $x = 1$ and $dx = -0.1 \Rightarrow dy = \dfrac{1}{\sqrt{15 + 1^2}}(-0.1) = \frac{1}{4}(-0.1) = -0.025$.

17.1.5/1.5 points | Previous AnswersSCalcET8 3.10.034.

The radius of a circular disk is given as 23 cm with a maximum error in measurement of 0.2 cm.

(a) Use differentials to estimate the maximum error in the calculated area of the disk. (Round your answer to two decimal places.)

28.90 ✔ 28.90 cm^2

(b) What is the relative error? (Round your answer to four decimal places.)

0.0174 ✔ 0.0174

What is the percentage error? (Round your answer to two decimal places.)

1.74 ✔ 1.74 %

Solution or Explanation

Click to View Solution

18.2/2 points | Previous AnswersSCalcET8 3.10.517.XP.

(a) Find the differential *dy*.

$y = \tan(x)$

dy =

$$[*sec*2(*x*)]*dx*

✔ $\sec^2(x)dx$

(b) Evaluate *dy* for the given values of *x* and *dx*.

$x = \pi/3, \quad dx = -0.01$

dy = -0.04 ✔ -0.04

Solution or Explanation

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19.1/0 points | Previous AnswersSCalcET8 3.9.018.MI.

A spotlight on the ground shines on a wall 12 m away. If a man 2 m tall walks from the spotlight toward the building at a speed of 1.7 m/s, how fast is the length of his shadow on the building decreasing when he is 4 m from the building? (Round your answer to one decimal place.)

0.6 ✔ 0.6 m/s

Solution or Explanation

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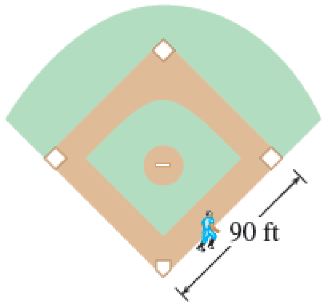
20. 1/0 points | Previous Answers SCalcET8 3.9.020.

A baseball diamond is a square with side 90 ft. A batter hits the ball and runs toward first base with a speed of 23 ft/s.



(a) At what rate is his distance from second base decreasing when he is halfway to first base? (Round your answer to one decimal place.)

10.3 ✔ 10.3 ft/s

(b) At what rate is his distance from third base increasing at the same moment? (Round your answer to one decimal place.)

10.3 ✔ 10.3 ft/s

Solution or Explanation

Click to View Solution

21. 1/0 points | Previous Answers SCalcET8 3.9.026.MI.

A trough is 8 ft long and its ends have the shape of isosceles triangles that are 2 ft across at the top and have a height of 1 ft. If the trough is being filled with water at a rate of 13 ft^3/min, how fast is the water level rising when the water is 6 inches deep?

1.625 ✔ 13/8 ft/min

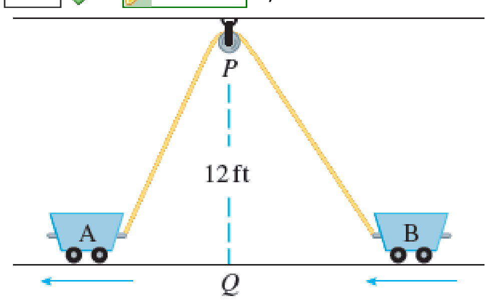
Solution or Explanation

Click to View Solution

22. 1/0 points | Previous Answers SCalcET8 3.9.042.

Two carts, A and B, are connected by a rope 39 ft long that passes over a pulley P (see the figure). The point Q is on the floor h = 12 ft directly beneath P and between the carts. Cart A is being pulled away from Q at a speed of 3.5 ft/s. How fast is cart B moving toward Q at the instant when cart A is 5 ft from Q? (Round your answer to two decimal places.)

1.52 ✔ 1.52 ft/s



Solution or Explanation

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23. 1/0 points | Previous Answers SCalcET8 3.9.050.

The minute hand on a watch is 9 mm long and the hour hand is 5 mm long. How fast is the distance between the tips of the hands changing at one o'clock? (Round your answer to one decimal place.)

-24.5 ✔ -24.5 mm/h

Solution or Explanation

Click to View Solution