

## 3.9 Hmwk - Related Rates (Homework)

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Past Due **Due Date: SAT, FEB 28, 2026 11:59 PM CST**

**Current Score: - / 20 POINTS | 0.0 %**

Due date has passed. No changes can be made without an approved extension request.  
**You may not be granted an extension if you have already viewed the answer key.**

 [VIEW ANSWER KEY](#)

### Scoring and Assignment Information ^

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
POINTS	-/1	-/1	-/1	-/1	-/3	-/1	-/1	-/2	-/1	-/1	-/1	-/1	-/3	-/1	-/1

#### Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

#### Assignment Scoring

Your best submission for each question part is used for your score.

1. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.002.

- (a) If  $A$  is the area of a circle with radius  $r$  and the circle expands as time passes, find  $\frac{dA}{dt}$  in terms of  $\frac{dr}{dt}$ .

$$\frac{dA}{dt} = \left( \text{(No Response)} \right) \frac{dr}{dt}$$

- (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 2 m/s, exactly how fast (in  $\text{m}^2/\text{s}$ ) is the area of the spill increasing when the radius is 29 m?

$$\text{(No Response)} \text{ m}^2/\text{s}$$

### Resources

[Read It](#)

2. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.049.

A plane flying with a constant speed of 300 km/h passes over a ground radar station at an altitude of 1 km and climbs at an angle of  $30^\circ$ . At what rate (in km/h) is the distance from the plane to the radar station increasing a minute later? (Round your answer to the nearest whole number.)

$$\text{(No Response)} \text{ km/h}$$

### Resources

[Read It Watch It](#)

3. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.040.

When air expands adiabatically (without gaining or losing heat), its pressure  $P$  and volume  $V$  are related by the equation  $PV^{1.4} = C$ , where  $C$  is a constant. Suppose that at a certain instant the volume is  $650 \text{ cm}^3$  and the pressure is  $80 \text{ kPa}$  and is decreasing at a rate of  $10 \text{ kPa/min}$ . At what rate (in  $\text{cm}^3/\text{min}$ ) is the volume increasing at this instant? (Round your answer to the nearest whole number.)

(No Response)  $\text{cm}^3/\text{min}$

### Resources

[Read It](#)

4. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.016.

At noon, ship A is  $180 \text{ km}$  west of ship B. Ship A is sailing east at  $40 \text{ km/h}$  and ship B is sailing north at  $35 \text{ km/h}$ . How fast (in  $\text{km/hr}$ ) is the distance between the ships changing at  $4:00 \text{ p.m.}$ ? (Round your answer to three decimal places.)

(No Response)  $\text{km/h}$

### Resources

[Read It](#)

5. [- / 3 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

SCalcET9 3.9.022.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.

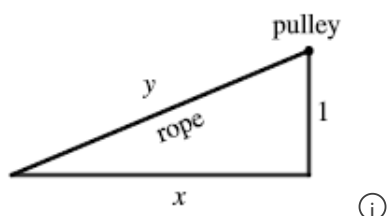
**Tutorial Exercise**

A 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 (in m/s) is the boat approaching the dock when it is 6 m from the dock?

**Step 1**

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

(No Response)  $= x^2 + 1$

**Resources**[Read It](#)

6. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

SCalcET9 3.9.013.

A plane flying horizontally at an altitude of 1 mile and a speed of 490 mi/h passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when it has a total distance of 5 miles away from the station. (Round your answer to the nearest whole number.)

(No Response) mi/h

**Resources**[Read It Watch It](#)

7. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

SCalcET9 3.9.009.

Suppose  $4x^2 + 16y^2 = 100$ , where  $x$  and  $y$  are functions of  $t$ .

- (a) If  $\frac{dy}{dt} = \frac{1}{4}$ , find  $\frac{dx}{dt}$  when  $x = 3$  and  $y = 2$ .

$$\frac{dx}{dt} = \boxed{\text{(No Response)}}$$

- (b) If  $\frac{dx}{dt} = 4$ , find  $\frac{dy}{dt}$  when  $x = -3$  and  $y = 2$ .

$$\frac{dy}{dt} = \boxed{\text{(No Response)}}$$

### Resources

[Read It](#)

8. [- / 2 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

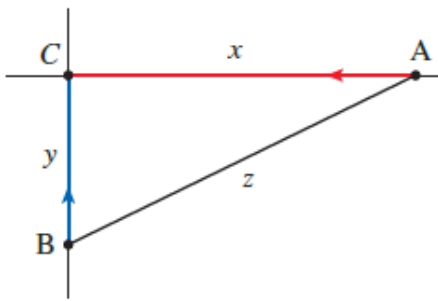
SCalcET9 3.9.AE.004.

**Example 4**[Video Example](#) 

Car A is traveling west at 60 mi/h and car B is traveling north at 70 mi/h. Both are headed for the intersection of the two roads. At what rate are the cars approaching each other when car A is 0.4 mi and car B is 0.3 mi from the intersection?

**Solution**

We draw the figure below, where  $C$  is the intersection of the roads.



ⓘ

At a given time  $t$ , let  $x$  be the distance from car A to  $C$ , let  $y$  be the distance from car B to  $C$ , and let  $z$  be the distance between the cars, where  $x$ ,  $y$ , and  $z$  are measured in miles.

We are given that  $\frac{dx}{dt} = -60$  mi/h and  $\frac{dy}{dt} = -70$  mi/h. (The derivatives are negative because  $x$  and  $y$  are decreasing.) We are asked to find  $\frac{dz}{dt}$ . The equation that relates  $x$ ,  $y$ , and  $z$  is given by the Pythagorean Theorem.

$$z^2 = x^2 + y^2$$

Differentiating each side with respect to  $t$ , we have

$$2z \frac{dz}{dt} = 2x \frac{dx}{dt} + 2y \frac{dy}{dt}$$

$$\frac{dz}{dt} = \frac{1}{z} \left( x \frac{dx}{dt} + y \frac{dy}{dt} \right).$$

When  $x = 0.4$  mi and  $y = 0.3$  mi, the Pythagorean Theorem gives  $z = 0.5$  mi, so

$$\begin{aligned} \frac{dz}{dt} &= \frac{1}{\boxed{\text{No Response}}} \left[ \left( \boxed{\text{No Response}} \right) (-60) + \left( \boxed{\text{No Response}} \right) (-70) \right] \\ &= \boxed{\text{No Response}} \text{ mi/h.} \end{aligned}$$

The cars are approaching each other at a rate of  $\boxed{\text{No Response}}$  mi/h.

**Resources**

[Read It](#)

9. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

SCalcET9 3.9.014.

If a snowball melts so that its surface area decreases at a rate of  $6 \text{ cm}^2/\text{min}$ , find the rate (in  $\text{cm}/\text{min}$ ) at which the diameter decreases when the diameter is 8 cm. (Round your answer to three decimal places.)

(No Response)  $\text{cm}/\text{min}$

### Resources

[Read It](#)

10. [- / 1 Points]

DETAILS

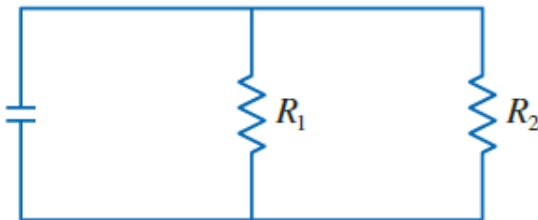
MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

SCalcET9 3.9.039.

If two resistors with resistances  $R_1$  and  $R_2$  are connected in parallel, as shown in the figure, then the total resistance  $R$ , measured in ohms ( $\Omega$ ), 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  $0.3 \text{ } \Omega/\text{s}$  and  $0.2 \text{ } \Omega/\text{s}$ , respectively, how fast (in  $\Omega/\text{s}$ ) is  $R$  changing when  $R_1 = 50 \text{ } \Omega$  and  $R_2 = 80 \text{ } \Omega$ ? (Round your answer to three decimal places.)

(No Response)  $\Omega/\text{s}$

### Resources

[Read It Watch It](#)

11. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.004.EP.

Let  $V$  represent the volume of a sphere with radius  $r$  mm. Write an equation for  $V$  (in  $\text{mm}^3$ ) in terms of  $r$ .

$$V(r) = \boxed{\text{(No Response)}} \text{ mm}^3$$

Find the radius of a sphere (in mm) when its diameter is 40 mm.

$$r = \boxed{\text{(No Response)}} \text{ mm}$$

The radius of a sphere is increasing at a rate of 5 mm/s. How fast is the volume increasing (in  $\text{mm}^3/\text{s}$ ) when the diameter is 40 mm? (Round your answer to two decimal places.)

$$\boxed{\text{(No Response)}} \text{ mm}^3/\text{s}$$

### Resources

[Read It](#)

12. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.007.MI.

A cylindrical tank with radius 3 m is being filled with water at a rate of  $4 \text{ m}^3/\text{min}$ . How fast is the height of the water increasing (in m/min)?

$$\boxed{\text{(No Response)}} \text{ m/min}$$

### Resources

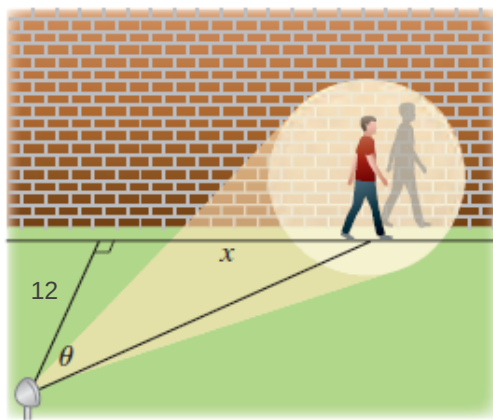
[Read It Watch It Tutorial](#)

**Example 5**[Video Example](#) 

A man walks along a straight path at a speed of 3 ft/s. A searchlight is located on the ground 12 ft from the path and is kept focused on the man. At what rate is the searchlight rotating when the man is 5 ft from the point on the path closest to the searchlight?

**Solution**

We draw the figure below and let  $x$  be the distance from the man to the point on the path closest to the searchlight. We let  $\theta$  be the angle between the beam of the searchlight and the perpendicular to the path.



We are given that  $\frac{dx}{dt} = 3$  ft/s and are asked to find  $\frac{d\theta}{dt}$  when  $x = 5$ . The equation that relates  $x$  and  $\theta$  can be written from the figure.

$$\frac{x}{(\text{No Response})} = \tan(\theta) \quad x = \left( (\text{No Response}) \right) \tan(\theta).$$

Differentiating each side with respect to  $t$ , we get

$$\frac{dx}{dt} = \left( (\text{No Response}) \right) \frac{d\theta}{dt}.$$

so

$$\frac{d\theta}{dt} = \left( (\text{No Response}) \right) \frac{dx}{dt}$$

$$= \left( (\text{No Response}) \right) (3)$$

$$= (\text{No Response}).$$

When  $x = 5$ , the length of the beam is 13, so  $\cos(\theta) = \frac{12}{13}$  and

$$\frac{d\theta}{dt} = \left( (\text{No Response}) \right) \left( \frac{12}{13} \right)^2 = (\text{No Response}).$$

The searchlight is rotating at a rate of  rad/s.

### Resources

[Read It](#)

14. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.005.

The radius of a spherical ball is increasing at a rate of 2 cm/min. At exactly what rate (in  $\text{cm}^2/\text{min}$ ) is the surface area of the ball increasing when the radius is 5 cm?

$\text{cm}^2/\text{min}$

### Resources

[Read It](#)

15. [- / 1 Points]

DETAILS

MY NOTES

ASK YOUR TEACHER

PRACTICE ANOTHER

S<sub>Calc</sub>ET9 3.9.006.MI.

The length of a rectangle is increasing at a rate of 7 cm/s and its width is increasing at a rate of 6 cm/s. When the length is 15 cm and the width is 8 cm, how fast is the area of the rectangle increasing (in  $\text{cm}^2/\text{s}$ )?

$\text{cm}^2/\text{s}$

### Resources

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