

# Guided Practice

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Class: Calculus I

Date assigned: July 23, 2018

Date due: July 30, 2018

Time estimate to complete this assignment: 30-50 minutes

## Overview

Solving related rates problems

## Learning Objectives

### *Basic Objectives*

1. Recall common math formulas and equations from geometry
2. Recall implicit differentiation and adapt to related rates problems
3. Recognize the steps needed to solve related rates problems and study an example of solving a related rate problem

### *Advanced Objectives*

1. Analyze and solve more complicated related rates problem

## Watch:

1. Watch the video: Common math formulas and equations (23:07)  
<https://www.youtube.com/watch?v=gW3V6yvUR90>
2. Watch the video on solving a basic related rates problem (7:42)  
<https://www.khanacademy.org/math/ap-calculus-ab/ab-diff-contextual-applications-new/ab-4-4/v/rates-of-change-between-radius-and-area-of-circle>

And then complete a practice problem:

<https://www.khanacademy.org/math/ap-calculus-ab/ab-diff-contextual-applications-new/ab-4-5/e/related-rates>

**Read:** Download and read the following handouts from Canvas

1. "Guideline for Solving Related Rates Problem"
2. "Implicit Differentiation for Related Rates Problem"

**Homework:** Our textbook Briggs Sec 3.11 #5-29 odd

# Lesson Plan

**Lesson:** Related Rates

**Timeframe:** Pre-class: 50 min  
In-class: 1 hour  
Post-class: 120 min

**Materials needed:**

1. Non-graphing calculator
2. Chalk/markers (for in-class activity work on black/whiteboard)

**Objectives:**

***Basic:***

1. Recall common math formulas and equations from geometry
2. Recall implicit differentiation and adapt to related rates problems
3. Recognize the steps needed to solve related rates problems and study an example of solving a related rate problem

***Advanced:***

1. Analyze and solve more complicated related rates problem

**Background to the Lesson:**

There is a main challenge that students will face in this lesson. This challenge is that word problems have traditionally been students' weakness because often times they have difficulty setting up the problem using symbols and equations. Hopefully, by exposing the students to a detailed step-by-step related rates problem solving guideline and with some solved-problem examples during pre-class activity, students are more ready to handle the in-class activity.

**Introduction to Lesson:**

Before class students will watch some videos and read handouts about basics of related rates problems. After getting some ideas they work in groups in class to solve more complicated problems. Homework assignment will be given at the end of the lesson so the student can practice solving the problems on their own.

## Procedure

### *Pre-Class Individual Space Activities and Resources:*

Steps	Purpose	Estimated Time	Learning Objective
<b>Step 1:</b> Watch a video on common math formulas and equations (such as Pythagorean theorem and volume of sphere) at <a href="https://www.youtube.com/watch?v=gW3V6yvUR90">https://www.youtube.com/watch?v=gW3V6yvUR90</a>	Review math formulas	15 min	Basic #1
<b>Step 2:</b> Download and read handout "Implicit Differentiation for Related Rates Problem"	Know how rates are resulted from implicit differentiation	10 min	Basic #2
<b>Step 3:</b> Download and read handout "Guideline for Solving Related Rates Problem"	Know the steps involved in setting up and solving related rates problem (used with step 4)	5 min	Basic #3
<b>Step 4:</b> Watch a video on solving a basic/simple related rates problem and complete a similar practice problem on khan academy	Familiarize with basic setup of a related rates problem (with the use of knowledge from step 3)	20 min	Basic #3

***In-Class Group Space Activities and Resources.***

<b>Steps</b>	<b>Purpose</b>	<b>Estimated Time</b>	<b>Learning Objective</b>
<b>Step 1:</b> TAPPS. Students form pairs. Problem solver and listener take turn solving two related rates problems with similar difficulty on the black/whiteboard.	Engage in solving related rates problems	50 min	Advanced #1
<b>Step 2:</b> Reflection: students ask each other if there is any comment/thought about the entire process of solving the problem. Discuss any difficulty experience.	Help each other improve skill for solving related rates problem	10 min	Advanced #1

***Post-Class Individual Space Activities and Resources.***

<b>Steps</b>	<b>Purpose</b>	<b>Estimated Time</b>	<b>Learning Objective</b>
<b>Step 1:</b> Complete homework assignment on solving related rates problems	Practice solving related rates problems	120 min	All objectives

**Evaluation:*****Analysis.***

I am certain that the lesson will be a positive experience for the students. When doing word problem alone, student may feel frustrated. But by learning together as pairs or groups during In-class activity, they are helping each other or reinforcing each others' knowledge or skill in solving related problems. Also, though this lesson, students learn about how derivatives can be applied to solving real world problems.

In terms of implementation, the only thing that I wonder is whether the students can finish more than two problems, for more experience/practice.

***Connections to Future Lessons.***

This lesson, related rates, may not directly connect to the next topic in sequence but it certainly connects to another topic in the near future: optimization, which is also word-problem in nature. The experience they gain in this lesson should help them in setting up initial plan for solving optimization problems.