

# RELATED RATES

Math 130 - Essentials of Calculus

1 November 2019

## BASIC EXAMPLES - VOLUME AND AREA FORMULAS

## EXAMPLE

*Air is being pumped into a spherical balloon so that its volume increases at a rate of  $100\text{cm}^3/\text{s}$ . How fast is the radius of the balloon increasing when the diameter is  $50\text{cm}$ ?*

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*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  $1\text{m}/\text{s}$ , how fast is the area of the spill increasing when the radius is  $30\text{m}$ ?*

# PYTHAGOREAN THEOREM

## EXAMPLE

*A ladder 10ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 1 ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 6ft from the wall?*

## DEMAND

## EXAMPLE

*The demand equation for a company's memory chips is  $(q^2 + 80)p = 10000$ , where  $p$  is the price of each chip and  $q$  is the number of chips, in thousands, that will be sold monthly. When the chips are priced at \$49.95, the company expects to sell 11,000 units monthly, but the price is decreasing at a rate of \$1.50 per month. Find the rate at which the demand for the memory chips is changing with respect to time.*

# MORE THAN ONE DYNAMIC QUANTITY

## EXAMPLE

*Two cars start moving from the same point. One travels south at  $60\text{mi/hr}$  and the other travels west at  $25\text{mi/hr}$ . At what rate is the distance between the cars increasing two hours later?*

# MULTIPLE RELATIONS

Gravel is being dumped from a conveyor belt at a rate of  $30\text{ft}^3/\text{min}$ , 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  $10\text{ft}$  high?