

Related Rates

Reading

- Sections 3.9

Practice problems

- Section 3.9 5, 7, 9, 13, 15, 25, 29
- In class: 3.9 6, 17
- To turn in: 3.9 14, 16

Notes

Related Rates

Related rates is a collection of problems that deal with rates of change of physical quantities and their relation. A typical example would be a ladder sliding along a wall, and the rates at which the height of the position of the ladder and the distance of the base of the ladder from the wall relate. Almost universally, these quantities are function of the elapsed time t .

Example 1: A 10ft ladder leans against a wall, and its base slides away at a rate of 0.5ft/sec. When the ladder is 3ft from the wall, at what rate is its tip sliding downwards?

Typical steps in solving such problems:

- Read the problem carefully, identify known quantities and unknown quantities.
- Identify which quantities are truly constant, and which quantities vary.
- Draw a picture depicting the relation between these quantities.
- Turn the geometry of the picture into an algebraic relation between the quantities.
- Treat these quantities as functions of t , and differentiate the relation to obtain a relation between the derivatives (rates of change) of the quantities.

Example 2: Water pours into a rectangular tank with base 2m by 3m, at a rate of $2\text{m}^3/\text{sec}$. How fast is the water rising?

Example 3: A conical tank with circular top with height 4m and radius at the top of 3m is filled with water. The volume of that water increases at a rate of $1\text{m}^3/\text{sec}$. How fast is the water rising in the tank.

Example 4: A rocket launches from the ground, at a distance of 2km from our location, and moving at a speed of 50km/sec. We are fixing our look at the bottom of the rocket with a telescope. When the rocket has traveled for 3 seconds, what is the rate at which the angle of our view changes.