

Salahaddin University-Erbil
College of Engineering
Department of Architectural Engineering
First Year Students
2nd Semester



Mathematics I

Application of Derivative

(Ch.3)

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3.1. Related Rate of Change:

Example (changing dimensions in a rectangle)

The length l of a rectangle is decreasing at the rate of 2 cm/sec while the width w is increasing at the rate of 2 cm/sec.

when $l=12$ cm and $w=5$ cm.

Find the rates of change of :

(a) the area

(b) the perimeter

(c) the lengths of the diagonals of the rectangle.

3.1. Related Rate of Change:

Example a sliding ladder

A 13-ft ladder is leaning against a house when its base starts to slide away. By the time the base is 12 ft from the house, the base is moving at the rate of 5 ft/sec.

- How fast is the top of the ladder sliding down the wall then?
- At what rate is the area of the triangle formed by the ladder, wall, and ground changing then?
- At what rate is the angle θ between the ladder and the ground changing then?

3.1. Related Rate of Change:

Example a growing sand pile

Sand falls from a conveyor belt at the rate of $10\text{m}^3/\text{min}$ onto the top of a conical pile. The height of the pile is always three-eighths of the base diameter.

How fast are the height and radius changing when the pile is 4m high?

Example a building's shadow

On a morning of a day when the sun will pass directly overhead, the shadow of an 80-ft building on level ground is 60 ft long. At the moment in question, the angle θ the sun makes with the ground is increasing at the rate of $0.27^\circ/\text{min}$. At what rate is the shadow decreasing? (Remember to use radians)

Activity

Example

A and B are walking on straight streets that meet at right angles. A approaches the intersection at 2 m/sec; B moves away from the intersection 1 m/sec. at what rate is the angle θ changing when A is 10 m from the intersection and B is 20 m from the intersection? Express your answer in degrees per second to the nearest degree.

