

AP Calculus AB - Related Rates - Worksheet

Common Core AP CALC AB 4.4 · maths-pdf.fr/en/

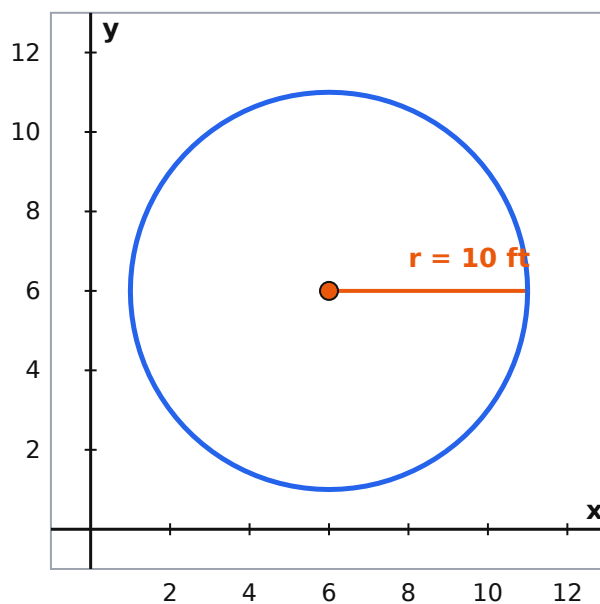
Name: _____ Class: _____ Date: ____/____/____

These 22 problems practice related rates problems with circles, spheres, cones, ladders, shadows and right triangles (AP Calculus AB, topics 4.4). The early problems build the basic skill, and each one uses a different function or situation so that no two feel alike.

Later problems use cones, shadows, angles and distance problems such as a kite, a boat and a baseball runner. Work in pencil, show every step, and check the answer key only after a full attempt.

AP Calculus AB · Common Core State Standards: **AP CALC AB 4.4**

Exercise 1 - Growing ripple



A circular ripple.

A ripple spreads so that its radius grows at 3 ft/s. How fast is the area increasing when the radius is 10 feet?

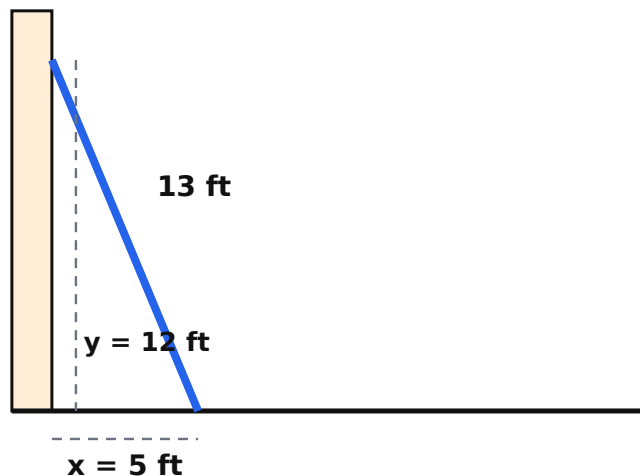
Exercise 2 - Melting ice cube

An ice cube melts so that its volume decreases at $6 \text{ cm}^3/\text{min}$ while it stays a cube. How fast is the edge shrinking when the edge is 3 cm? How fast is the surface area changing then?

Exercise 3 - Growing cube

The edge of a cube grows at 2 cm/s . Find how fast the volume and the surface area change when the edge is 3 cm.

Exercise 4 - Sliding ladder



A 13-foot ladder with its base 5 feet from the wall.

A 13-foot ladder leans against a wall. The base slides away from the wall at 2 ft/s . How fast is the top sliding down the wall when the base is 5 feet from the wall?

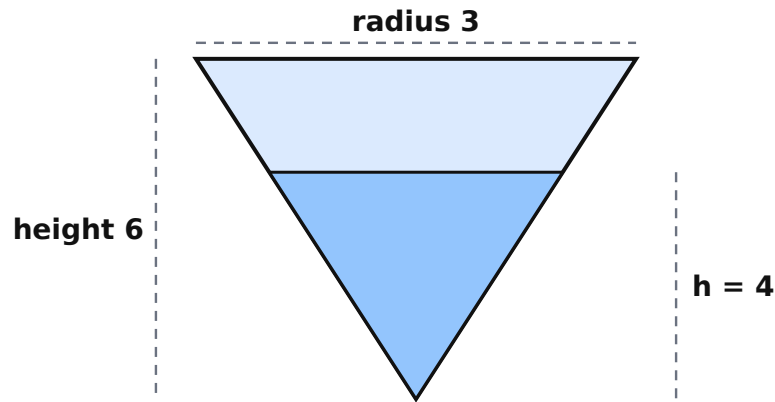
Exercise 5 - Rectangle

A rectangle's length grows at 3 in/s while its width shrinks at 2 in/s . Find the rates of change of the area and the perimeter when the length is 8 in and the width is 5 in.

Exercise 6 - Two cars

One car drives north at 60 mph and another drives east at 40 mph from the same intersection. How fast is the distance between them changing after half an hour?

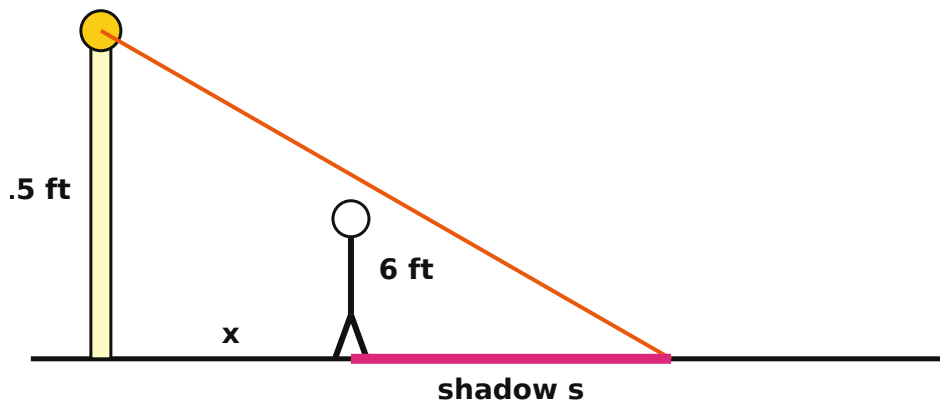
Exercise 7 - Cone-shaped cup



A cone-shaped cup: radius 3 in and height 6 in, with water depth $h = 4$ in.

Water pours into a cone-shaped cup (point down, radius 3 in, height 6 in) at $2 \text{ in}^3/\text{s}$. How fast is the water level rising when the depth is 4 in?

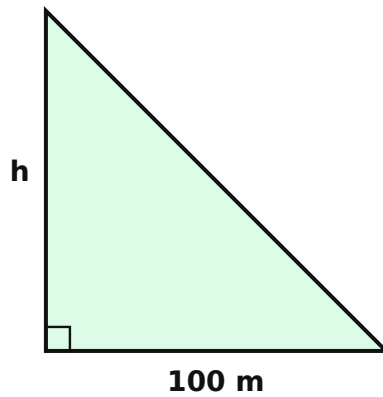
Exercise 8 - Shadow length



A 15-foot light and a 6-foot person.

Aisha is 6 ft tall and walks away from a 15-ft street light at 4 ft/s . How fast is the tip of her shadow moving, and how fast is her shadow lengthening?

Exercise 9 - Angle of elevation



Observer 100 m from the launch point.

A weather balloon rises at 5 m/s from a point 100 m from an observer. How fast is the angle of elevation changing when the balloon is 100 m high?

Exercise 10 - Sand pile

Sand falls at $10 \text{ ft}^3/\text{min}$ onto a conical pile whose height always equals its radius. How fast is the height rising when the pile is 5 ft high?

Exercise 11 - Melting sphere

A snowball melts so that its radius shrinks at $0.5 \text{ cm}/\text{min}$. How fast is its volume changing when the radius is 4 cm?

Exercise 12 - Circle with circumference

The circumference of a circle grows at $4 \text{ cm}/\text{s}$. How fast is its area growing at the moment the circumference is $20\pi \text{ cm}$?

Exercise 13 - Gas under pressure

A gas obeys $PV = 200$. The volume is decreasing at $3 \text{ cm}^3/\text{s}$. Find how fast the pressure is changing when $V = 10$.

Exercise 14 - Draining cylinder

Water drains from a cylindrical tank of radius 2 ft at $12 \text{ ft}^3/\text{min}$. How fast is the water level falling?

Exercise 15 - Kite

A kite is 80 ft high and the wind carries it horizontally at $5 \text{ ft}/\text{s}$. How fast is the string being let out when 100 ft of string is out?

Exercise 16 - Boat and dock

A rope runs from a dock 8 ft above the deck of a boat to the boat. The rope is pulled in at 1.5 ft/s. How fast is the boat moving toward the dock when 10 ft of rope is out?

Exercise 17 - Runner on a baseball diamond

A runner moves from first base to second base at 20 ft/s on a 90-ft square diamond. How fast is her distance from home plate changing when she is 30 ft past first base?

Exercise 18 - Approaching plane

A plane flies at 3 miles altitude toward a radar station at 480 mph. How fast is the distance to the station changing when the plane is 4 miles horizontally from the station?

Exercise 19 - Triangle with changing angle

Two sides of a triangle are 6 cm and 8 cm. The angle between them grows at 0.1 rad/s. How fast is the area changing when the angle is $\frac{\pi}{3}$?

Exercise 20 - Oil spill

An oil spill is circular, and its radius grows at 2 ft/min. How fast is the area growing when the radius is 50 ft?

Exercise 21 - Triangular trough

A horizontal trough 10 ft long has a triangular cross section 4 ft wide at the top and 2 ft deep. Water enters at 3 ft³/min. How fast is the water level rising when the water is 1 ft deep?

Exercise 22 - Volume and surface area

A balloon's radius grows at 0.4 cm/s. At $r = 6$ cm, find $\frac{dV}{dt}$ and $\frac{dS}{dt}$ and show that their ratio is $\frac{\pi}{2}$.