

AP Calculus AB
2.12 – Related Rates II

1. Given the cone below, answer the following questions.

A. Determine the relationship between h (height of water) and r (radius of the top of water).

B. Write a formula for the volume, V , of water:

i) as a function of h alone.

ii) as a function of r alone.

C. For each of the expressions for V obtained in B(i) and B(ii), determine $\frac{dV}{dt}$. [Note: both h and r are functions of t]

D. Translate each of the following phrases into mathematical statements, using derivatives.

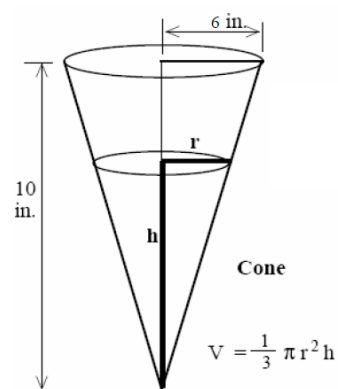
i) "the height of the water is increasing 7 inches per minute." _____

ii) "the radius of the surface of the water is decreasing 2 inches per minute." _____

iii) "water is pouring into the cone at a steady rate of $5 \text{ in}^3/\text{min}$." _____

E. When there are 6 inches of water in the cone, the height of the cone is increasing at 7 inches per minute. How fast is the water in the cone increasing?

F. Water is pouring into the cone at a rate of $5 \text{ in}^3/\text{min}$. How fast is the radius changing when the cone of water reaches a height of 4 inches? How does the answer tell you if the radius is increasing or decreasing?



2. Water is pouring into a conical tank at a rate of $15 \text{ ft}^3/\text{min}$. The tank has a height of 15 ft and radius 6 ft . How fast is the water level rising at the instant when it is 5 ft high?

3. A spotlight on the ground is shining on a wall 10m away. A man, 2m tall, walks from the spotlight toward the wall at a speed of 1.2m/s. Determine the rate of change of the height of the shadow at the instant when the man is 3m from the wall.

4. Water is pouring into a swimming pool that is 5m long and has a cross-section as shown in the diagram below. If water is being poured in at a rate of $25\text{m}^3/\text{min}$, calculate how fast the water level is rising at the deep end of the pool at the instant when the water level is 2m high.

