4.6 Related Rates

How Calculus Saved My Job (and my future)

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3. The volume of a right circular cylinder is $V = \pi r^2 h$, so find

(a) $\frac{dV}{dt}$ if r is constant, and (b) $\frac{dV}{dt}$ if h is constant, and (c) $\frac{dV}{dt}$ if neither r nor h are constant

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12. A trough is 15 feet long and 4 feet across the top. Its ends are isosceles triangles with height 3 feet. Water runs into the trough at the rate of $2.5 \frac{\text{feet}^3}{\text{minute}}$. How fast is the water level rising when it is 2 feet deep?

21. A dinghy (small boat) is pulled toward a dock by a rope from the bow through a ring on the dock 6 feet above the bow. The rope is hauled in at the rate of $2 \frac{\text{feet}}{\text{second}}$. (a) How fast is the boat approaching the dock when 10 feet of rope are out? (b) At what rate is angle θ changing at that moment?

24. Coffee is draining from a conical filter into a cylindrical coffeepot at the rate of $10 \frac{\text{inches}^3}{\text{minute}}$. (a) How fast is the level in the pot rising when the coffee in the cone is 5 inches deep? (b) How fast is the level in the cone falling at that moment?

30. A light shines from the top of a pole 50 feet high. A ball is dropped from the same height from a point 30 feet away from the light. How fast is the shadow of the ball moving along the ground 0.5 seconds later (assume that the ball falls a distance $s = 16t^2$ feet in t seconds) ?