



Calculus 1, Workshop 6: Related Rates

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References:

Smith, Robert T. and Minton, Roland B., Calculus, 2nd ed., 2001, McGraw Hill, Section 2.8, pages 220-226 and the Trigonometry Reference Page at the front of the book

Part I: Inverted Cone Filter

1. A filter in the shape of an inverted cone is 20 cm high and has a radius of 30 cm at its top. A solution is poured through the filter, and residue gathers in the filter at a rate of 5 cubic centimeters per minute. Find the rate at which the height of the residue is increasing when the height is 3 cm.

Part II: Volume of wood

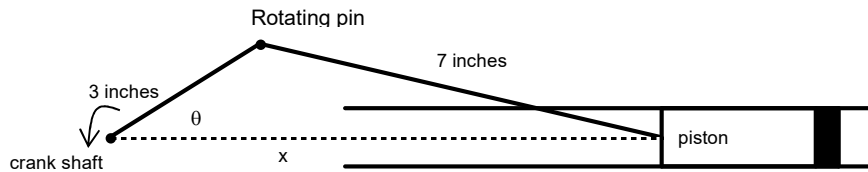
In forestry wood volume and its rate of growth are useful in determining when a tree should be harvested. A simple model of the useful volume of a tree's trunk involves considering the trunk to be a right circular cylinder.

1. Suppose that when the trunk is 40 feet high its diameter is 6 inches and its diameter is changing at $\frac{3}{16}$ inches/year and its height is changing at 1.5 feet/year. How fast is the volume of wood changing?

2. Suppose that when the trunk is 80 feet high its diameter is 24 inches and its diameter is changing at $\frac{1}{8}$ inches/year and its height is changing at 1 feet/year. How fast is the volume of wood changing?

Part III: Crankshaft

For the engine shown, a 7-inch connecting rod is fastened to a crank of radius 3 inches. The crankshaft rotates counter-clockwise at a constant rate of 200 revolutions per minute. Find the velocity of the piston when $\theta = \pi / 3$. (Hint: Begin by writing a relationship between x and θ .)



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