Math 16A
Kouba
Related Rates Problems

1.) If the radius r of a circle is increasing at the rate of 5 $cm./min.$, at what rate is its
    a.) circumference changing when $r = 2\ cm.$?
    b.) area changing when $r = 2\ cm.$?

2.) The width x of a rectangle is increasing at the rate of 5 $in./min.$ and the length y is decreasing at the rate of 4 $in./min.$ At what rate is its
    a.) perimeter changing when $x = 3\ in.$ and $y = 2\ in.$?
    b.) area changing when $x = 3\ in.$ and $y = 2\ in.$?

3.) (See Diagram.) If the bottom of a 10 $ft.$ ladder is pushed toward the wall at the rate of 2 $ft./min.$, at what rate is the top of the ladder moving up the wall when the bottom of the ladder is
    a.) 6 $ft.$ from the wall ?
    b.) 1 $ft.$ from the wall ?
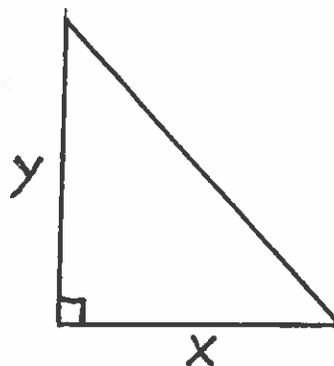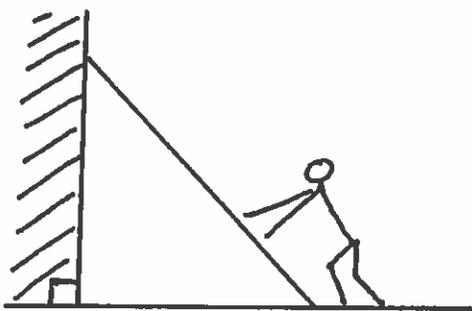
4.) (See Diagram.) Assume that y is increasing at the rate of 2 $in./min.$ and x is decreasing at the rate of 3 $in./min.$ in the given right triangle. At what rate is the triangle's
    a.) area changing when $x = 3\ in.$ and $y = 4\ in.$?
    b.) hypotenuse changing when $x = 3\ in.$ and $y = 4\ in.$?
    c.) perimeter changing when $x = 3\ in.$ and $y = 4\ in.$?

5.) Assume that the edge x of a cube is increasing at the rate of 4 $in./min.$ At what rate is the cube's
    a.) surface area changing when $x = 20\ in.$?
    b.) volume changing when $x = 20\ in.$?

6.) Assume that the radius r of a sphere is increasing at the rate of 5 $cm./hr.$ At what rate is the sphere's
    a.) diameter changing when $r = 10\ cm.$?
    b.) surface area ($S = 4\pi r^2$) changing when $r = 10\ cm.$?
    c.) volume ($V = (4/3)\pi r^3$) changing when $r = 10\ cm.$?

7.) A tank is in the shape of a right circular cylinder of height 20 $ft.$ and radius 5 $ft.$ Water fills the empty tank at the rate of 5π $ft.^3/min.$ How fast is the water level in the tank rising when the depth of water is 15 $ft.$?

8.) Assume that the surface area S of a sphere is increasing at the rate of 48π $cm.^2/hr.$ At what rate is the sphere's
    a.) radius changing when $r = 30$ $cm.$?
    b.) volume changing when $r = 30$ $cm.$?

9.) Assume that the volume V of a cube is decreasing at the rate of 60 $ft.^3/min.$ At what rate is the cube's surface area changing when the edge of the cube is 20 $ft.$?

10.) A tank is in the shape of a right circular cone $(V = (1/3)\pi r^2 h)$ of height 10 $ft.$ and base radius 5 $ft.$ Hot coffee fills the empty tank at the rate of 2π $ft.^3/hr.$ At what rate is the the depth h of coffee changing when
    a.) $h = 1$ $ft.$?
    b.) $h = 9$ $ft.$?

11.) A pile of sand is in the shape of a right circular cone $(V = (1/3)\pi r^2 h)$ of constant height 6 $m.$ If the volume of sand is increasing at the rate of 4π $m.^3/min.$ At what rate is the
    a.) radius of the circular base changing the volume of sand is $V = 200\pi$ $m.^3$?
    b.) area of the circular base changing the volume of sand is $V = 200\pi$ $m.^3$?

12.) A balloon floats 15 $ft.$ above the ground and moves horizontally away from a lamp pole which is 20 $ft.$ high at the rate of 2 $ft./sec.$ At what rate is the tip of the balloon's shadow moving away from the base of the pole when the balloon is 30 $ft.$ from the pole ?

13.) A balloon sits 10 $ft.$ away from the base of a lamp pole which is 20 $ft.$ high. The balloon begins rising vertically at the rate of 3 $ft./sec.$ At what rate is the tip of the balloon's shadow moving away from the base of the pole when the balloon is
    a.) 5 $ft.$ above the ground ?
    b.) 19 $ft.$ above the ground ?
    c.) 19.9 $ft.$ above the ground ?