1. Bacteria are growing in a circular colony one bacterium thick. The bacteria are growing at a constant rate, thus making the area of the colony increase at a constant rate of 12 mm^2/hr.

   (a) Draw a picture of the situation.

   (b) Find an equation expressing the rate of change of area as a function of the radius, r, of the colony.

   (c) How fast is r changing when r equals 3 mm?

   (d) Describe the way dr/dt changes as r increases.

2. Joe blows up a spherical balloon. He recalls that the volume is $(4/3)\pi r^3$. Find dV/dt as a function of r and dr/dt. In order for the radius to increase at 2 cm/sec, how fast must Joe blow air into the balloon when $r = 3$? When $r = 6$?

3. You recall that the area of an ellipse is $A = \pi ab$, where a and b are the lengths of the semiaxes (like radii but for an ellipse). Suppose that an ellipse is changing size but always keeps the same proportions, $a = 2b$. At what rate is the length a of the major axis changing when $b = 12$ cm and the area is decreasing at 144 cm^2/sec?

4. Chris hits a line drive to center field. As he rounds second base, he heads directly for third, running at 20 ft/sec. Assume that the baseball diamond is square and the length between any two bases is 90 ft.

   (a) Draw a picture of the situation.

   (b) Write an equation expressing the rate of change of his distance from home plate as a function of his displacement from third base.

   (c) How fast is his distance from home plate changing when he is halfway to third? At third? Is the latter answer reasonable? Explain.