

1. The Whizzo Confectionery Company is planning to market a new candy called the Dental Delight. It consists of a (spherical) steel ball with radius 5 mm, covered with a milk chocolate coating $\frac{1}{4}$ mm thick.

Use differentials to approximate the volume of milk chocolate in each Dental Delight. Be sure to include units in your answer.

(The volume V of a sphere of radius r is given by $V = \frac{4}{3}\pi r^3$.)

2. A circular table top is measured to be 6 ft in diameter, using an old measuring tape whose markings could be off by as much as $\frac{1}{2}$ inch. Suppose this measurement is used to calculate the area of the table. Use differentials to estimate the largest possible error in the determination of the area.
3. Find the local linearization $L(x)$ for the function $f(x) = \frac{1}{1+x^2}$ at $a = 3$.
4. Find the linear function $L(n)$ that best approximates $\tan((45+n)^\circ)$ when n is close to 0.
5. In a computer model of bacterial growth, the function $P(t)$ represents the population of a certain bacterium at time t . It is known that $P(10) = 5000$ and that, in general, the rate of growth in the population follows the rule

$$P'(t) = 0.02P(t).$$

Use a linear approximation to estimate $P(10.5)$.

6. A water balloon is dropped from a hovering United Nations helicopter. The balloon's velocity v (measured in feet per second, in the downward direction) obeys the equation

$$v'(t) = 32 - 0.2v(t).$$

At $t = 4$ seconds, the balloon's velocity is 88 feet per second. Use differentials or a linear approximation to approximate the balloon's velocity at $t = 4.5$ seconds.