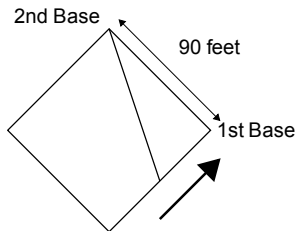


Worksheet 5 (Corrected October 19, 2009)

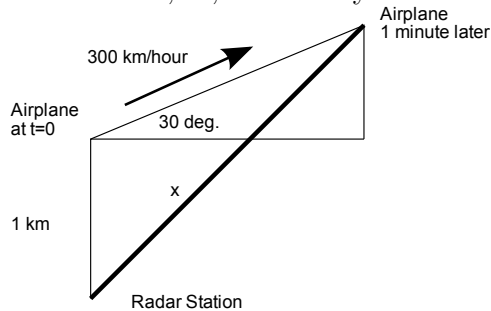
Make sure to specify the correct units on all solutions.

- Suppose a ball is thrown vertically upward with a speed of 80 feet/second and that its height after t seconds is given by $h(t) = 80t - 16t^2$. Find (a) the maximum height of the ball; (b) the speed when the ball is going up at a height of 96 feet; (c) the speed when the ball is going down at a height of 96 feet; (d) the speed when the ball hits the ground.

- A baseball diamond is a square with sides 90 feet. A batter hits the ball and runs toward first base with a speed of 24 feet/second. At what rate is his distance from second base decreasing when he is halfway to first base?



- A plane flying with a constant speed of 300 km/hour passes over a ground radar station at an altitude of 1 km and climbs at an angle of 30 degrees. At what rate is the distance from the plane to the radar station increasing one minute later. Hint: The law of cosines for a triangle with sides A , B , and C says $A^2 = B^2 + C^2 - 2BC \cos \theta$ where θ is the angle opposite side A .



4. To resistors connected in parallel have an effective total resistance R where $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$. If resistors R_1 and R_2 are increasing at rates of 0.3 Ohms/second and 0.2 Ohms/second, respectively, how fast is R changing when $R_1 = 80$ Ohms and $R_2 = 100$ Ohms? (The Ohm is the unit of resistance).

5. Find a linear approximation to $f(x) = \frac{1}{\sqrt{2+x}}$ near $x = 0$.

6. Use differentials to approximate $\sqrt{99.8}$.

7. Use differentials to estimate the amount of paint (in liters) to apply a coat of paint 0.05 cm thick to a hemispherical dome with diameter 50 meters (1 meter = 100 cm, 1 liter = $10 \times 10 \times 10 = 1000$ cm³). (A hemisphere is half of a sphere.)