AP Calculus AB: Problem Set #5

For each of the following problems, be sure to draw and label a diagram when applicable, write what's given, write an equation, then solve the problem and answer the question. Show all work!!

1. If a snowball melts so that its surface area decreases at a rate of 1 cm^2/min, find the rate at which the diameter decreases when the diameter is 10 cm.

2. At noon, ship A is 150 km west of ship B. Ship A is sailing east at 35 km/h and ship B is sailing north at 25 km/h. How fast is the distance between the ships changing at 4:00 P.M.?

3. The altitude of a triangle is increasing at a rate of 1 cm/min while the area of the triangle is increasing at a rate of 2 cm^2/min. At what rate is the base of the triangle changing when the altitude is 10 cm and the area is 100 cm^2?

4. Gravel is being dumped from a conveyor belt at a rate of $30\ {ft^3}/{\min}$, and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always the same. How fast is the height of the pile increasing when the pile is 10 ft high?

5. Two sides of a triangle are 4 m and 5 m in length and the angle between them is increasing at a rate of $0.06\ {rad}/{s}$. Find the rate at which the area of the triangle is increasing when the angle between the sides of fixed length is $\frac{\pi}{3}$. (Hint: $Area = \frac{1}{2}ab\sin C$)

6. Boyle's Law states that when a sample of gas is compressed at a constant temperature, the pressure P and volume V satisfy the equation $PV = C$, where C is a constant. Suppose that at a certain instant the volume is 600 cm^3, the pressure is 150 kPa, and the pressure is increasing at a rate of $20\ {kPa}/{\min}$. At what rate is the volume decreasing at this instant?