

WORKSHEET: RELATED RATES

Names and student IDs: _____

A spherical balloon is being inflated. At a particular time, the volume was 400 m^3 and the inflation rate was $20 \text{ m}^3/\text{sec}$. At that time, was its radius increasing or decreasing? At what rate? (Be sure to include the correct units.) (The numbers will not work out nicely.)

Steps:

- (1) Understand the problem!
- (2) Draw a picture if possible. Name every quantity that varies with a **letter** (a function of time). Do **not** use a separate letter for any velocity, rate of change, etc. These are derivatives of quantities you should have already named with letters.
- (3) State the information given, and what is to be found.
- (4) Relate the variables, giving a relation that is valid for all values of time, not just the time for which the information in the problem is given. Choose a form of the relation that is easy to differentiate.
- (5) Differentiate the relation in step (4) **with respect to time**, getting an equation involving quantities from step (2) and their derivatives. **Be sure to use the chain rule!** In this problem, if there are less than two derivatives in the result, you made a mistake.
- (6) Now, and only now, restrict to the particular time given in the problem. (In many solutions, this will be “put $t = t_0$ ”, “put $t = 0$ ”, or similar.) Put the known values in the equation above, and solve for the quantity asked for. (In this problem, you will need to find the radius at the time given from the volume at that time.)

You will need the volume V of a sphere of radius r . It is $V = \frac{4}{3}\pi r^3$. (You will need to know this formula.)

1. Do steps (1) and (2) above.

2. Do step (3) above.

3. Do step (4) above.

4. Do step (5) above.

5. Do step (6) above.