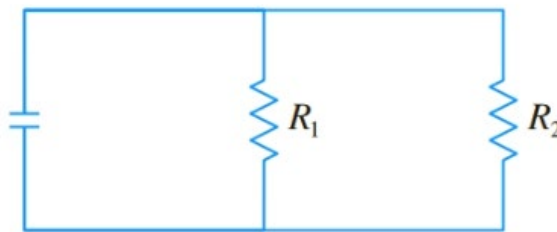2.8 – Related Rates
2.9 – Linear Approximations and Differentials

1. (10 pts) If two resistors with resistances R_1 and R_2 are connected in parallel, as in the figure on the right, then the total resistance R, measured in ohms (Ω), is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}.$$

If R_1 and R_2 are increasing at rates of 0.4 Ω/s and 0.1 Ω/s, respectively, how fast is R changing when $R_1 = 90\ \Omega$ and $R_2 = 70\ \Omega$?

2. (10 pts) A Ferris wheel with a radius of 11 m is rotating at a rate of one revolution every 2 minutes. How fast is a rider rising when his seat is 16 m above ground level? Give an *exact* answer and then approximate the answer to one decimal place.

3. Let $f(x) = \sqrt{x+2}$.

    a. (5 pts) Find an equation of the tangent line to f at the point $(7,3)$.

    b. (5 pts) Sketch the graph of f and the graph of the tangent line on the same set of coordinate axes.

4. (5 pts) Painters want to paint the sides and top of the outside of a cylindrical water tank that has a radius of 5 feet and a height of 10 feet. Calculate the amount of paint needed for a 6-mil (6 thousandths of an inch) coat of paint in two ways:

    a. (5 pts) Direct calculation.

    b. (5 pts) Using a a differential.

5. (5 pts) Estimate $\sin\left(33^0\right)$, using the tangent line or differentials.