

1. The voltage V (in volts) across a circuit is given by $V = IR$ (Ohm's Law), where I is the current (in amps) flowing through the circuit and R is the resistance (in ohms). If we place two circuits, with resistance R_1 and R_2 , in parallel, then their combined resistance R is given by

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

Suppose the current is 2 amps and increasing at 10^{-2} amp/sec and R_1 is 3 ohms and increasing at 0.5 ohm/sec, while R_2 is 5 ohms and decreasing at 0.1 ohm/sec. Calculate the rate at which the voltage is changing.

2. The temperature of a gas in $^{\circ}F$ is given by $T = x^2 - 5xy + y^2z$, with x, y, z in feet.
- (a) What is the rate of change in the temperature at the point $(1, 2, 3)$ in the direction of $\vec{v} = 2\hat{i} + \hat{j} - 2\hat{k}$?
- (b) What is the direction of maximum rate of change of temperature at the point $(1, 2, 3)$?
- (c) What is the maximum rate of change of temperature at the point $(1, 2, 3)$?