Combined Variation

Often in real-life situations, one variable varies as a combination of variables, may include any ***combination*** of all previously mentioned variations.

Example

The force needed to keep a car from skidding on a curve varies jointly with the weight of the car and the speed squared, and inversely with the radius of the curve. If 242 pounds of force would keep a 2000 pound car from skidding on a curve with a radius of 500 feet at 30 mph, what force would keep the same car from skidding on a curve with a radius of 750 feet going 50 mph?

$$f = \frac{kws^2}{r}$$

Continued: If $f = 242$ when $w = 2000$, $s = 30$, and $r = 500$, find f when $w = 2000$, $s = 50$, and $r = 750$.

Find the constant of proportionality:

$$f = \frac{kws^2}{r} \qquad 242 = \frac{k(2000)(30)^2}{500}$$

$$242 = \frac{k(4)(900)}{1}$$

$$\frac{242}{3600} = k$$

$$0.067\overline{2} = k$$

Continued: find f when $w = 2000$, $s = 50$, and $r = 750$.

Now find f:

$$f = \frac{kws^2}{r}$$

$$f = \frac{.067\overline{2}(2000)(50)^2}{750}$$

$$f = \frac{.067\overline{2}(8)(2500)}{3}$$

$$f = 448.1\ldots$$

The amount of force required to keep the car from skidding is approximately 448.1 pounds.