

## Modeling Using Variation

### *A Review*

A *variation* problem essentially describes how one quantity (variable) changes in relation to other quantities (variables). This relation often involves a value called the *constant of variation*, and is usually identified by the letter  $k$ .

There are two typical types of basic variation – *direct* and *inverse* – with a third – *joint* – being a combination of the first two. The table below illustrates the wording of the variation and how the formula is written.

Variation Type	Wording in Application	General Formula
Direct	“y varies directly as $x$ ” “y is proportional to $x$ ”	$y = kx$
Inverse	“y varies inversely as $x$ ” “y is inversely proportional to $x$ ”	$y = \frac{k}{x}$
Joint	“z varies directly as $x$ and $y$ and inversely as $w$ ” “z is proportional to $x$ and $y$ and inversely proportional to $w$ ”	$z = \frac{kxy}{w}$

Most variation problems can be answered through the following process:

1. Write the general variation formula from the given written text.
2. Use given information to find the constant of variation,  $k$ .
3. Write the specific variation formula (basically, rewrite Step 1 with the value of  $k$  found in Step 2).
4. Substitute the rest of the given information into the specific formula (from Step 3) to find the desired quantity (the remaining unknown variable).

Note that not all problems require all 4 steps. In many cases, for example, you only care to find the specific variation formula, so you only need to go to Step 3.

Also note that some quantities can be described in ways other than a single variable. For example, “A varies directly as the square root of  $B$ ” would give the formula  $A = k\sqrt{B}$ .

Today, we are going to focus on the basic variation formula computation, then later move to more realistic applications. For starters, look at Examples 3, 4, 5, and 6 in Section 3.7 – focus on how the formulas are set up – then try page 363: #1-29 (odd).

If you have any questions, feel free to step next door to Mr. Deck’s class during the last 15 minutes.