Study Guide

Inverse variation
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Inverse Variation

Variation equations are formulas that show how one quantity changes in relation to one or more other quantities. There are four types of variation: direct, inverse (or indirect), joint, and combined. This skill focuses on inverse variation.

Inverse (or indirect) variation formulas show that when one quantity increases, the other quantity decreases, and vice versa. For example, when the price of an item increases, the demand decreases. Indirect variation formulas are of the form $y = k/x$, where k is the constant of variation and needs to be determined.

Example 1: If p and q vary inversely and $p = 10$ when $q = 1.6$, find p when $q = 8$.

$$(1)\ p = \frac{k}{q} \rightarrow 10 = \frac{k}{1.6}$$

$$(2)\ 10(1.6) = \frac{k(1.6)}{1.6}$$

$$16 = k$$

$$(3)\ p = \frac{16}{8}$$

$$p = 2$$

Step 1: Set up the appropriate inverse variation formula. Since p varies inversely with q, that formula is $p = k/q$. Using the first set of values in the problem (because both p and q are known), substitute p and q into the formula so that the constant k can be determined.
Step 2: Solve for k by multiplying each side of the equation by 1.6 ($k = 16$).
Step 3: Now that the constant k has been determined, substitute the values into the formula that are known to determine the value of p when $q = 8$ and solve for p ($p = 2$).

Answer: $p = 2$ when $q = 8$

NOTE: A simpler way to solve inverse variation problems is to remember that the product of x and y is always the same. The values given for x and y may change, but the product of x and y remains the same. The following table is an example of a function in which x and y have an inverse relationship.

x	y	$x \times y$
2	4	8
-4	-2	8
-8	-1	8
1	8	8

As stated above, the values given for x and y change, but their products remain the same. For this table, the constant of variation, the product of x and y, is 8. Since y can always be found by dividing x into 8, y varies inversely with x.

Once the student is comfortable with the concept of inverse variation, he or she will be ready to solve problems in the context of real world situations.

Example 2: The amount of time it takes a seamstress to sew a wedding dress varies inversely with the number of years of sewing experience she has. If Veronica could sew a wedding dress in 8 days when she

had 3 years of sewing experience, how many days will it take her to sew a wedding dress now that she has 5.5 years of sewing experience? Round your answer to the nearest full day.

(1) $8 \times 3 = 24$
(2) $24 \div 5.5 = 4.\overline{36}$
(3) $4.\overline{36} \approx 4$

Step 1: Determine the constant of variation by multiplying the two terms that vary inversely (8 days and 3 years).
Step 2: Divide the constant of variation by Veronica's experience now (5.5) to determine the number of days that it will take Veronica to sew the dress (4.3636...).
Step 3: Round 4.36 to the nearest whole day (4).

Answer: It will take Veronica 4 days to make a wedding dress now that she has 5.5 years of sewing experience.

As a reinforcement activity, have the student think of situations where two things vary inversely, such as the number of years in college versus the average college student's savings account. Make up some numbers for the various situations and solve for one variable when the other is known.