Teaching Notes for Algebra I
Homework #8

Overview: In this lesson, students will learn how to set up and solve equations of variations.

Preparation: Watch video on "equations of variation." This is a rare exception where I will print and hand out the word problems covered in class. The exact wording is important and it takes up too much to make sure it's correct verbally. Be sure to print the "class handout" PDF prior to class.

Classroom Examples:

1) L varies directly as the square of M and inversely as the square root of C. If L = -32 when M = 4 and C = 36, find the constant of variation, K, and write the equation of variation.

2) Anna's grade on this test, G, varies directly as the square root of the amount of hours she studies, S, and inversely as the cube of the amount of time she spends playing video games, V. Find the equation of variation if Anna spends 36 hours studying, 1 hour playing video games, and she gets an 81 on the test. If Anna actually spends 64 hours studying and 3 hours playing video games, what grade will Anna earn on this test?

3) T varies jointly as the cube root of D and the square of R and inversely as the square root of J. If T = 20 when D = 27, R = 2, and J = 16, find the equation of variation. If D = 8, while R = 6 and J = 9, find T.

$$T = \frac{K\sqrt[3]{D}R^2}{\sqrt{J}}$$

$$20 = \frac{K\sqrt[3]{27}(2)^2}{\sqrt{16}}$$

$$20 = \frac{K\sqrt[3]{27}(2)^2}{\sqrt{16}}$$

$$20 = \frac{K(3)(4)}{4}$$

$$20 = 3K$$

$$\frac{20}{3} = K \qquad T = \frac{20\sqrt[3]{D}R^2}{3\sqrt{J}}$$

$$T = \frac{20\sqrt[3]{8}(6)^2}{3\sqrt{9}}$$

$$T = \frac{20(2)(36)}{3(3)}$$

$$T = 160$$

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4) The force it takes to stretch a spring, F, varies directly as the distance, X, it is stretched. Find the equation of variation if it takes 48 pounds of force to stretch a spring 9 inches. If the spring is stretched to 30 inches, how much force will it take?

$F = KX$

$48 = K9$

$\frac{48}{9} = K$

$F = \frac{48X}{9}$

$F = \frac{48(30)}{9}$

$F = 160$

5) F varies directly as the cube of H, inversely as the cube root of A, and inversely as the square of L. If F = 27 when H = 2, A = 64 and L = 3, find the constant of variation, K, and write the equation of variation.

$F = \frac{KH^3}{\sqrt[3]{A}L^2}$

$27 = \frac{K(2)^3}{\sqrt[3]{64}(3)^2}$

$27 = \frac{K8}{4(9)}$

$\frac{27(9)(4)}{8} = K$

$\frac{243}{2} = K$

$F = \frac{243H^3}{2\sqrt[3]{A}L^2}$

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6) A study concludes that the amount of hours you sleep at night varies directly as the square of the distance you walk during the day and inversely as the square root of the amount of sugar you consume during that day. Find the equation of variation if, when you walk 4 miles and consume 36 grams of sugar, you get 12 hours of sleep. If you walk 2 miles and consume 81 grams of sugar, how many hours of sleep would you get?

S = sleep
W=distance walked
C=sugar consumed

$$S = \frac{KW^2}{\sqrt{C}}$$

$$12 = \frac{K(4)^2}{\sqrt{36}}$$

$$12 = \frac{K(16)}{36}$$

$$\frac{12(36)}{16} = K$$

$$27 = K$$

$$S = \frac{27W^2}{\sqrt{C}}$$

$$S = \frac{27W^2}{\sqrt{C}}$$

$$S = \frac{27(2)^2}{\sqrt{81}}$$

$$S = \frac{27(4)}{9}$$

$$S = 12$$