VARIATION

If <u>a</u> varies <u>directly</u> as <u>b</u>, then <u>a</u> = <u>k</u> \ge <u>b</u> for some constant k. In other words, a = kb.

If <u>a</u> varies <u>inversely</u> as <u>b</u>, then <u>a</u> = <u>k</u> \pm <u>b</u> for some constant k. In other words, $a = \frac{k}{b}$.

If <u>a</u> varies jointly as b and c, then <u>a</u> = <u>k</u> \ge <u>bc</u> for some constant k. In other words, a = kbc.

If <u>a</u> varies <u>directly</u> as <u>b</u> and <u>inversely</u> as <u>c</u>, then <u>a</u> = <u>k</u> \ge <u>b</u> \div <u>c</u> for some constant k. In other words, $a = \frac{kb}{c}$.

Examples:

[a]

At a fixed time of day, the length of a person's shadow varies directly as the person's height. If a 6 foot tall person casts a 4 foot long shadow, how tall is a person who casts a 3 foot long shadow ?

[b]

The number of songs you can store on an MP3 player varies inversely as the memory used by each song. If an MP3 player can store 650 songs that each require 90 kilobytes of memory, how many songs can it store if each song requires 75 kilobytes of memory ?

[c]

The cost to treat a painting with a protectant varies jointly as the length and width of the painting. If it costs \$160 to treat a 2 foot by 3 foot painting, what is the cost to treat a 7 foot by 9 foot painting ?

[d]

The cost per person for a pizza lunch varies directly as the number of pizzas purchased and inversely as the number of people. If 10 pizzas are bought for 25 people and the cost per person is \$7, what is the cost per person if 24 pizzas are bought for 60 people ?

Problems:

[1]

The pressure exerted by a gas varies inversely as the volume it occupies. If a gas occupying 12 cubic meters exerts a pressure of 3 atmospheres, find the pressure exerted if the gas is compressed to 4 cubic meters.

[2]

Suppose the value of a certain wine varies jointly as its age and its rating. If a 90 point wine from 2001 is valued at \$150, find the value of a 96 point wine from 1985.

[3]

Suppose the opening day box office of a horror film marketed by Mutant Guerrilla Marketing varies directly as the cost of the marketing campaign and inversely as the **total number** of films opening that day. \$4 million was spent on Hostel 8's marketing campaign; it opened the same day as 7 other films; and it grossed \$12 million on its opening day. The producers are planning to spend \$2 million on the marketing campaign of Alien vs Predator 5: In Space No One Can Hear You Yawn, and to open it on the same day as 2 other films. What should be the opening day box office ?

[4]

The bimbot of a blongle varies directly as its wickywack. If the blongle with a wickywack of 12 has a bimbot of 56, find the wickywack of a blongle with a bimbot of 21.