FST 2-7 Notes
Topic: Inverse Variation Models
GOAL:
Review inverse variation functions as models in a variety of situations.

SPUR Objectives

E Describe properties of inverse variation functions.

Vocabulary

varies inversely as, is inversely proportional to
constant of variation, constant of proportionality
inverse-square relationship
varies inversely as the square of, is inversely proportional to the square of
power function

Inverse Variation
Suppose you have 6 pounds of ground meat to make hamburger patties of equal weight. The more patties you make, the less each patty will weigh. The weight per patty *varies inversely as* (or is inversely proportional to) the number of patties.
W = weight of patties and N = number of patties

$$W = \frac{6}{N}$$

Warm-Up

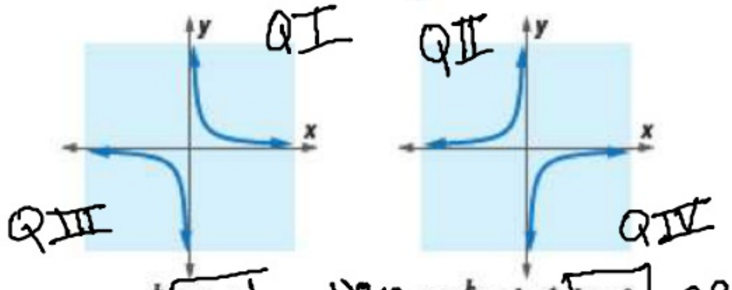
K is constant of variation

1. If A and B are inversely proportional and $A = 10$ when $B = 5$, then what is the value of B when $A = 50$?

$A = \frac{K}{B}$ $\quad 10 = \frac{K}{5}$ $\quad (10)(5) = K$ $\quad 50 = K$

$50 = \frac{50}{B}$ $\quad B = 1$

Inverse Variation Models $\quad y = \dfrac{k}{x}$



$y = \frac{k}{x}, \boxed{k > 0}$ positive $\quad y = \frac{k}{x} = kx^{-1}, \boxed{k < 0}$ negative

Properties

- Graph is a hyperbola
- k is the constant of variation
- Domain: $\{x \mid x \neq 0\}$
- vertical asymptote at x = 0 (y-axis)
- Range: $\{y \mid y \neq 0\}$
- Horizontal asymptote at y = 0 (x-axis)

$n = \frac{K}{S}$

$n \cdot S = K$

1. The average song size (in MB) and approximate number of songs for a sample of 32 GB MP3 players are listed in the table below.

L1 x Average song size (MB) S	L2 y Approximate number of songs on 32GB MP3 player n	K
3.6	8000	28800
4.7	7000	32900
4.5	7200	32400
4.2	7600	31920
4.1	7800	31980
5.8	5500	31900
4.9	6500	31850
5.1	6300	32130

Average K

$\frac{253,880}{8} = 31735$

a. Find a formula that gives the average number n of songs that will fit on an MP3 player as a function of the average song size s.

b. Graph both the data and the model on a single set of axes.

c. Use residuals to assess the quality of your model.

d. About 10,000 songs would correspond to what average song size?

STAT #1

a) $n \cdot S = K$

$6500(4.9) = K$

$31,850 = K$

$n = \frac{31850}{S}$

$y = \frac{31850}{x}$

b) STAT #1
enter data L1, L2
2nd Y= STAT PLOT #1
Choose Scatterplot
Zoom 9
GO TO Y=
enter equation
$y = \frac{31850}{x}$
GRAPH

c) move cursor L3
enter
(L3 = predicted)
$L3 = 31850 \div L1$
(L4 = Residual)
Res = obs − Pred
$L4 = L2 - L3$
STAT → Calc #1
1 Var STATS L4
$\Sigma x^2 = 787,004.9$

Better model?
$K = 31735$
$y = \frac{31735}{x}$

$\Sigma x^2 = 760,826.5$

d) $n \cdot S = 31735$

$\frac{10000S}{10000} = \frac{31735}{10000}$

$\boxed{S = 3.2 \text{ MB}}$

L

2. The intensity of light from a point source is inversely proportional to the square of the distance from the light source. Suppose that at a distance of 5 cm, the light intensity is rated at 600 lux. What will the intensity be at a distance of 10 cm? At 23 cm?

d

$$L = \frac{K}{d^2}$$

$$600 = \frac{K}{5^2}$$

$$(600)(5^2) = K$$

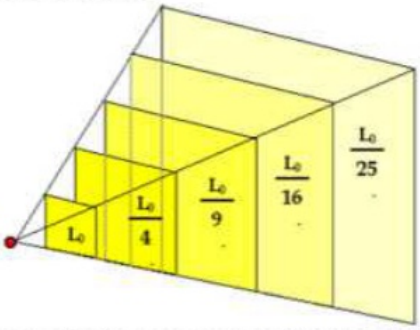
$$15000 = K$$

$$L = \frac{15{,}000}{10^2}$$

$$L = 150 \text{ lux}$$

$$L = \frac{15{,}000}{23^2}$$

$$L = 28.36 \text{ lux}$$



An example of the "one over r squared" relationship for light

[illegible]

Illuminance is a measure of how much luminous flux is spread over a given area. One can think of luminous flux (measured in lumens) as a measure of the total "amount" of visible light present, and the illuminance as a measure of the intensity of illumination on a surface. A given amount of light will illuminate a surface more dimly if it is spread over a larger area, so illuminance is inversely proportional to area.

http://en.wikipedia.org/wiki/Lux