Key

9.1 Practice (pg 480)

... relationship between the values in each table a direct variation, an inverse ...ariation, or neither? Write equations to model the direct and inverse variations.

7)

X	3	8	10	22
y	15	40	50	110

$\boxed{y = 5x}$ Direct variation

10)

X	0.1	3	6	24
y	3	0.1	0.05	0.0125

$\boxed{xy = .3}$ inverse variation

12)

X	10	12	20	23
y	2	$\frac{12}{5}$	4	$\frac{23}{5}$

$\boxed{y = \frac{x}{5} = \frac{1}{5}x}$ Direct variation

Describe the combined variation that is modeled by each formula.

16) $A = \pi r^2$

A varies directly with the square of r

19) $V = \frac{Bh}{3}$

V varies jointly with B and h

Write the function that models each relationship.

24) *z* varies directly with *x* and inversely with *y*. When *x=6* and *y=2*, *z=15*.

$z = \frac{kx}{y}$

$15 = \frac{k(6)}{2} = 3k$

$k = 5$

$\boxed{z = \frac{5x}{y}}$

25) *z* varies jointly with *x* and *y*. When *x=2* and *y=3*, *z=30*.

$z = kxy$

$30 = k(2)(3)$

$6k = 30$

$k = 5$

$\boxed{z = 5xy}$

26) *z* varies directly with the square of *x* and inversely with *y*. When *x=2* and *y=4*, *z=0.5*.

$z = \frac{kx^2}{y}$

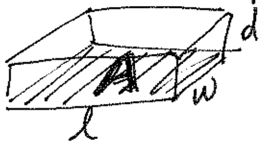
$.5 = \frac{k(2)^2}{4}$

$.5 = k$

$\boxed{z = \frac{.5x^2}{y} \text{ or } \frac{x^2}{2y}}$

52) **Construction** A concrete supplier sells premixed concrete in $300ft^3$ truckloads.

a. Write a model for the relationship between the area and the depth of a truckload of poured concrete.



$$300 = A \cdot d$$

$$l \cdot w = A$$

$$V = l \cdot w \cdot d = A \cdot d$$

$$\boxed{A = \frac{300}{d}}$$

b. What area will the concrete cover if it is poured to a depth of $0.5ft$?

$$A = \frac{300}{.5} = 600 \text{ ft.}^2$$

A depth of $1ft$?

$$A = \frac{300}{1} = 300 \text{ ft.}^2$$

A depth of $1.5ft$?

$$A = \frac{300}{1.5} = 200 \text{ ft.}^2$$

c. Write a model for the relationship between the depth and radius if the concrete is poured into a cylindrical shape.

$$V = \pi r^2 d \qquad 300 = \pi r^2 d \qquad \boxed{d = \frac{300}{\pi r^2}}$$

54) Suppose that t varies directly with s and inversely with the square of r. How is the value of t changing when the value of s is doubled? Is tripled?

$$t = \frac{ks}{r^2} \rightarrow \frac{k(2s)}{r^2} = 2\left(\frac{ks}{r^2}\right) = 2t \quad \Bigg| \quad \frac{k(3s)}{r^2} = 3\left(\frac{ks}{r^2}\right) = 3t$$

when s is doubled, t is doubled | when s is tripled, t is tripled

55) Suppose that x varies directly with the square of y and inversely with the square of z. How is the value of x changed if the value of y is halved? Is quartered?

$$x = \frac{ky^2}{z^2} \rightarrow \frac{k(\frac{1}{2}y)^2}{z^2} = \frac{k \cdot \frac{1}{4}y^2}{z^2} = \frac{1}{4}\left(\frac{ky^2}{z^2}\right) = \frac{1}{4}x \quad \Bigg| \quad \frac{k(\frac{1}{4}y)^2}{z^2} = \frac{k \cdot \frac{1}{16}y^2}{z^2} = \frac{1}{16}\left(\frac{ky^2}{z^2}\right) = \frac{1}{16}x$$

when y is halved, x is quartered | when y is quartered x is "sixteenthed"

58) **Open-Ended** The height h of a cylinder varies directly with its volume V and inversely with the square of its radius r. Find at least four ways to change the volume and radius of a cylinder so that its height is quadrupled.

$$\text{Volume of cylinder} = \pi r^2 h \rightarrow h = \frac{V}{\pi r^2} \rightarrow \left(k = \frac{1}{\pi}\right) \quad \text{Need } 4h \rightarrow 4\left(\frac{V}{\pi r^2}\right)$$

① Quadruple the volume

② Halve the radius

③ Double radius and multiply volume by 16

④ Quarter the radius and quarter the volume

... AND MANY MORE!

59) **Health** Health care professionals use the body mass index (BMI) to establish guidelines for determining any possible risk for their patients and for planning and useful prevention programs. The BMI varies directly with weight and inversely with the square of height. Use this portion of the BMI chart to determine the BMI formula.

Height	Range of Weight (pounds)			
	BMI 19-24.9	BMI 25-29.9	BMI 30-39.9	BMI $\geq$ 40
5'6"	118-154	155-185	186-246	$\geq$247
5'7"	121-158	159-190	191-254	$\geq$255
5'8"	125-163	164-196	197-261	$\geq$262
5'9"	128-168	169-202	203-269	$\geq$270
5'10"	132-173	174-208	209-277	$\geq$278
5'11"	136-178	179-214	215-285	$\geq$286
6'0"	140-183	184-220	221-293	$\geq$294

$$BMI = \frac{kW}{H^2} \longrightarrow k = \frac{(BMI)(H^2)}{W}$$

A few data points....

	H (feet)	BMI	W	k
5'6"	5.5	19	118	4.871
5'6"	5.5	29.9	185	4.889
5'9"	5.75	30	203	4.886
	6	30	221	4.887

$\Big\}\ k \approx 4.88$

$$BMI \approx \frac{4.88W}{H^2}$$ where W = weight in pounds, H = height in feet