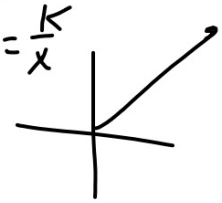
Trig 3.8

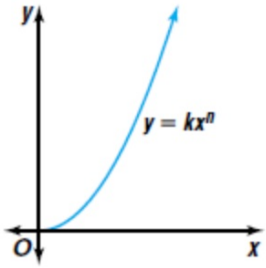
Solve problems involving direct*, inverse**, joint** variation

* Alg 1 Ch. 5
**Alg 2 Ch. 9

- direct variation ↑ ↑ or ↓ ↓ $y = kx$
- inverse variation ↑ ↓ or ↓ ↑ $y = \frac{k}{x}$



- constant of variation
- directly proportional
- inversely proportional
- joint variation (combination)



activity: whiteboards (if time)

k= constant $y = k \cdot x$ $(6, 27)$

1 Suppose y varies directly as x and $y = 27$ when $x = 6$.

a. Find the constant of variation and write an equation of the form $y = kx^n$.

b. Use the equation to find the value of y when $x = 10$.

$\frac{27}{6} = \frac{k \cdot 6}{6}$

(a) $\frac{9}{2} = k$

(a) $y = \frac{9}{2}x$

(b) $y = \frac{9}{2} \cdot 10$

$= 45$

$y = kx^3$

3 If y varies directly as the cube of x and $y = -67.5$ when $x = 3$, find x when $y = -540$.

$-67.5 = k \cdot 3^3$

$-67.5 = 27k$

$-2.5 = k$

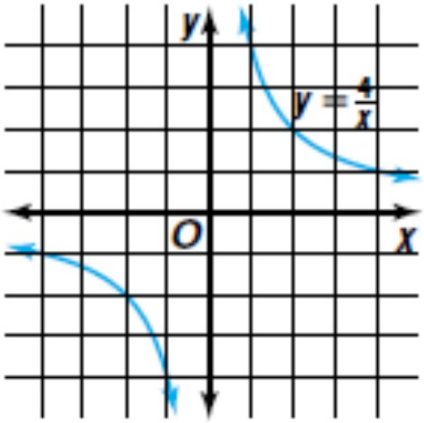
$-\frac{5}{2} = k$

$y = -\frac{5}{2}x^3$

$-\frac{2}{5} \cdot -540 = \left(-\frac{5}{2}\right)x^3\left(-\frac{2}{5}\right)$

$216^{\left(\frac{1}{3}\right)}$ $\quad \sqrt[3]{x^3}$

$x = 6$



inverse variation
driving
leftovers
homework

$y = \frac{4}{x}$

4 If y varies inversely as x and $y = 21$ when $x = 15$, find x when $y = 12$.

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

$21 = \frac{k}{15}$

$k = 315$

$y = \frac{315}{x} + 1$

$y = \frac{315}{x} + \frac{x}{x}$

$12 = \frac{315}{x}$

$12x = 315$

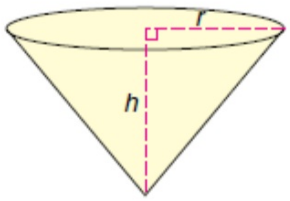
$x = 26.25$

$$y = k\frac{x^n}{y^n}$$

Joint Variation

y varies jointly as x^n and z^n if there is some nonzero constant k such that $y = kx^nz^n$, where $x \neq 0$, $z \neq 0$, and $n > 0$.

Example 5 **GEOMETRY** The volume V of a cone varies jointly as the height h and the square of the radius r of the base. Find the equation for the volume of a cone with height 6 centimeters and base diameter 10 centimeters that has a volume of 50π cubic centimeters.



$V = k \cdot hr^2$

$\frac{50\pi}{150} = \frac{k \cdot 6 \cdot 25}{150}$

$\frac{1}{3}\pi = k$

$V = \frac{1}{3}\pi hr^2$

$V = \frac{1}{3}\pi r^2 h$

whiteboards

Find the constant of variation for each relation and use it to write an equation f each statement. Then solve the equation.

5. If y varies inversely as x and $y = 3$ when $x = 4$, find y when $x = 15$.

6. If y varies directly as the square of x and $y = -54$ when $x = 9$, find y when $x = 6$.

7. If y varies jointly as x and the cube of z and $y = 16$ when $x = 4$ and $z = 2$, find y when $x = -8$ and $z = -3$.

3.8

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