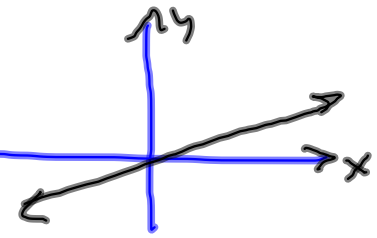
§6.7 Direct Variation

y varies directly with x → proportional to.

$y = kx$

for some Konstant k.



If $y = 4$ when $x = 20$

Find k & the variation equation.

$y = kx$

$4 = 20k$

$k = \frac{1}{5} = \frac{4}{20} = k$

$y = \frac{1}{5}x$

If y is directly proportional to the square of x.

$y = kx^2$

Falling bodies, constant acceleration.

If $y = 7$ when $x = 3$. Find y when $x = 5$.

$y = kx^2$

$7 = (3^2)k$

$7 = 9k$

$\frac{7}{9} = k$

$y = \frac{7}{9}x^2$

when $x = 5$,

$y = \frac{7}{9}(5)^2$

$= \frac{(7)(25)}{9}$

$= \frac{175}{9} = y$

Find

$\left(\frac{7}{9}\right)(25)$

$= \left(\frac{7}{9}\right)\left(\frac{25}{1}\right)$

$= \frac{(7)(25)}{9}$

Joint Variation

If y varies jointly with x and z.

$$y = Kxz$$

If $y = 7$, when $x = 9, z = 2$

what's y when $x = 3, z = 8$?

Find K

$$7 = (9)(2)K$$

$$\frac{7}{18} = K$$

Use K

$$y = \frac{7}{18}xz$$

If $x = 3, z = 8 \Rightarrow$

$$y = \frac{7}{18}(3)(8) = \frac{(\cancel{24}^{12})(7)}{\cancel{18}_{9}} = \frac{84}{9} = y$$

Inverse Variation

If y varies inversely with x.

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

y is proportional to the reciprocal of x

$$y = K\left(\frac{1}{x}\right) = \frac{K}{x}$$

Surface area of a ball is proportional to the square of its radius.

Suppose the surface area is 36π in^2 when the radius is 3 inches. What is the surface area when radius is 5 inches?

Let S = surface area (in in^2)
r = radius (in inches)

$$S = kr^2$$

$$36\pi = (3)^2 k = 9k$$

$$k = \frac{36\pi}{9} = k =$$

$$k = 4\pi$$

$$S = 4\pi r^2$$

when $r = 5$

$$S = (4\pi)(5^2) = 100\pi \text{ square inches}$$

Perfect

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The force of attraction (gravitational) between two bodies varies jointly with the mass of the two bodies and inversely with the square of the distance between them.

$$F = \frac{K m_1 m_2}{r^2}$$

F = force
m_1 = mass of 1st body
m_2 = " " 2nd "
r = distance between them

Solve:

$$\frac{4x^2-24x}{3x^2-x-2} + \frac{3}{3x+2} = \frac{-4}{x-1}$$

LCD $= (3x+2)(x-1)$

$\mathcal{D} = \{x \mid x \neq 1 \text{ and } x \neq -\frac{2}{3}\}$

$(3x+2)(x-1) = 3x^2-3x+2x-2$

$= 3x^2 - x - 2$ Cool

$$\frac{4x^2-24x}{(3x+2)(x-1)} + \left(\frac{3}{3x+2}\right)\left(\frac{x-1}{x-1}\right) = \left(\frac{-4}{x-1}\right)\left(\frac{3x+2}{3x+2}\right)$$

$4x^2-24x+3(x-1) = -4(3x+2)$

$4x^2-24x+3x-3 = -12x-8$

$+12x+8 = +12x+8$

$4x^2-24x+15x+5 = 0$

} Forgot to collect like terms.

$4x^2-9x+5 = 0$ ← Collected like terms.

Find #s whose product is $(4)(5) = 20$ & which add up to -9

$-4-5 = -9$

$(-4)(-5) = +20$

$4x^2 - 5x - 4x + 5$

$x(4x-5) - 1(4x-5)$

$(4x-5)\left(\frac{x(4x-5)}{(4x-5)} - \frac{1(4x-5)}{(4x-5)}\right)$

$(4x-5)(x-1) = 0$

$4x-5 = 0$ or $x-1 = 0$

$4x = 5$

$x = \frac{5}{4}$

$x = 1$

$\notin D$

Final Answer: $\left\{\frac{5}{4}\right\}$

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