Literal Equations

Literal Equations

Equations that involve several pronumerals. The solution will be expressed in terms of the other pronumerals, or parameters. All the normal processes for solving equations are still valid for literal equations. Remember that for equations involving algebraic fractions, you can only use the reciprocal of both sides if there is only one fraction expression with all terms for that side on both sides.

Example

$$\frac{1}{x+a}+\frac{1}{x+2a}=\frac{2}{x+3a}$$

$$\frac{x+2a}{(x+a)(x+2a)}+\frac{x+a}{(x+a)(x+2a)}=\frac{2}{x+3a}$$

$$\frac{2x+3a}{(x+a)(x+2a)}=\frac{2}{x+3a}$$

$$(2x+3a)(x+3a)=2(x+a)(x+2a)$$

$$2x^2+6ax+3ax+9a^2=2x^2+4ax+2ax+4a^2$$

$$9ax-6ax=4a^2-9a^2$$

$$3ax=-5a^2$$

$$x=\frac{-5a}{3}$$

Simultaneous Literal Equations

Simultaneous equations that involve several pronumerals. Solved using the normal methods of substitution and elimination. To solve for n of the pronumerals, you will need n equations.

Example

$ax+by=p$ and $bx-ay=q$

$$a^2x+aby=ap$$
$$b^2x-aby=bq$$

$$\left(a^2+b^2\right)x=ap+bq$$

$$x=\frac{ap+bq}{a^2+b^2}$$

$$abx+b^2y=bp$$
$$-abx+a^2y=-aq$$

$$\left(a^2+b^2\right)y=bp-aq$$

$$y=\frac{bp-aq}{a^2+b^2}$$

General Solution of Equations Involving a Single Parameter

Equations that involve two variables can be solved in terms of a parameter. That is the solution of the equation will depend on the value of the parameter.

Example

$$6x-5t=30$$

$$6x=5t+30$$

$$x=\frac{5}{6}t+5$$

Example

$$x^2+3tx-27=0$$

$$x=\frac{-3t\pm\sqrt{(3t)^2-4(1)(-27)}}{2(1)}$$

$$x=\frac{-3t\pm\sqrt{9t^2+108}}{2}$$

$$x=\frac{-3\pm 3\sqrt{t^2+12}}{2}$$