

## ALGEBRA FRACTIONS - Simplify Expressions and Solve Equations

Page	Description
1	Simplify expressions involving adds, takes, times and divides
2	Simplify expressions by factorising the numerator and denominator and then cancelling
3	Solve equations by multiplying to get rid of the denominators. Just numbers in the denominators
4	Solve more complicated equations by multiplying to get rid of the denominators. Just numbers in the denominators
5	Solve equations by multiplying to get rid of the denominators. Numbers and algebra in the denominators

# Algebraic Fractions - Simplify these fractions

Follow the standard rules of fractions for add, take, times and divide

Adds and takes, cross multiply  $\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm cb}{bd}$

Multiply  $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

Divide  $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

$$1) \quad \frac{1}{x} + \frac{1}{y}$$

$$= \frac{1 \times y + 1 \times x}{xy}$$

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

$$2) \quad \frac{a}{x} + \frac{b}{y}$$

$$= \frac{a \times y + b \times x}{x \times y}$$

$$= \frac{ay + bx}{xy}$$

$$3) \quad \frac{2}{x} - \frac{3}{y}$$

$$= \frac{2 \times y - 3 \times x}{xy}$$

$$= \frac{2y - 3x}{xy}$$

$$4) \quad \frac{a}{x} \times \frac{b}{y}$$

$$= \frac{ab}{xy}$$

$$5) \quad \frac{3}{x} \div \frac{2}{y}$$

$$= \frac{3}{x} \times \frac{y}{2} = \frac{3y}{2x}$$

$$6) \quad \frac{1}{x+1} + \frac{1}{x+2}$$

$$= \frac{1 \times (x+2) + 1 \times (x+1)}{(x+1)(x+2)}$$

$$= \frac{x+2+x+1}{(x+1)(x+2)} = \frac{2x+3}{(x+1)(x+2)}$$

$$7) \quad \frac{2}{x+1} + \frac{3}{x-2}$$

$$= \frac{2(x-2) + 3(x+1)}{(x+1)(x-2)}$$

$$= \frac{2x-4+3x+3}{(x+1)(x-2)}$$

$$= \frac{5x-1}{(x+1)(x-2)}$$

$$8) \quad \frac{x-1}{x+1} - \frac{x+1}{x+2}$$

$$= \frac{(x-1)(x+2) - (x+1)(x+1)}{(x+1)(x+2)}$$

$$= \frac{x^2+2x-x-2 - (x^2+2x+1)}{(x+1)(x+2)}$$

$$= \frac{x^2+x-2-x^2-2x-1}{(x+1)(x+2)}$$

$$= \frac{-x-3}{(x+1)(x+2)}$$

$$9) \quad \frac{1}{x+1} \times \frac{1}{x+2}$$

$$\rightarrow = \frac{1}{(x+1)(x+2)}$$

$$10) \quad \frac{1}{x+1} \div \frac{1}{x+2} = \frac{1}{x+1} \times \frac{x+2}{1} = \frac{x+2}{x+1}$$

$$1) 6x^2 + 5x + 1 = (3x + 1)(2x + 1)$$

$$5) 6x^2 - 5x + 1 = (3x - 1)(2x - 1)$$

$$9) 9x^2 - 4 = (3x - 2)(3x + 2)$$

$$2) 2x^2 + 11x + 12 = (x + 4)(2x + 3)$$

$$6) 4x^2 - 8x + 3 = (2x - 3)(2x - 1)$$

$$10) 9a^2 - b^2 = (3a - b)(3a + b)$$

$$3) 2x^2 - x - 6 = (2x + 3)(x - 2)$$

$$7) x^2 - 16 = (x - 4)(x + 4)$$

$$4) 4x^2 - 7x - 2 = (4x + 1)(x - 2)$$

$$8) x^2 - 4 = (x - 2)(x + 2)$$

Simplify these fractions by factorising the quadratics in the numerators and denominators and then cancelling. The quadratics are all factorised above.

$$\text{Qu. 1} \quad \frac{2x^2 + 11x + 12}{2x^2 - x - 6} = \frac{(x+4)\cancel{(2x+3)}}{\cancel{(2x+3)}(x-2)} = \frac{x+4}{x-2}$$

$$\text{Qu. 4} \quad \frac{2x^2 + 11x + 12}{x^2 - 16} = \frac{\cancel{(x+4)}(2x+3)}{(x-4)\cancel{(x+4)}} = \frac{2x+3}{x-4}$$

$$\text{Qu. 2} \quad \frac{2x^2 - x - 6}{4x^2 - 7x - 2} = \frac{(2x+3)\cancel{(x-2)}}{(4x+1)\cancel{(x-2)}} = \frac{2x+3}{4x+1}$$

$$\text{Qu. 5} \quad \frac{2x^2 - x - 6}{x^2 - 4} = \frac{(2x+3)\cancel{(x-2)}}{\cancel{(x-2)}(x+2)} = \frac{2x+3}{x+2}$$

$$\text{Qu. 3} \quad \frac{6x^2 - 5x + 1}{4x^2 - 8x + 3} = \frac{(3x-1)\cancel{(2x-1)}}{\cancel{(2x-3)}\cancel{(2x-1)}} = \frac{3x-1}{2x-3}$$

$$\text{Qu. 6} \quad \frac{9x^2 - 4}{4x^2 - 8x + 3} = \frac{(3x-2)(3x+2)}{(2x-3)(2x-1)} \quad \text{no cancelling}$$

Multiply each term by the lowest common multiple of all the denominators, then cancel, simplify and solve

$$1) \quad \frac{2}{3}y + \frac{1}{2}y = 7$$

The lowest common multiple of 2 and 3 is 6

Multiply each term by 6

$$\boxed{6 \times} \frac{2y}{3} + \boxed{6 \times} \frac{1y}{2} = \boxed{6 \times} 7$$

Cancel the denominators

$$2 \times 2y + 3 \times y = 42$$

$$4y + 3y = 42$$

$$7y = 42$$

$$y = 6$$

$$2) \quad \frac{1}{4}y + \frac{1}{2}y = 6$$

$$\boxed{4 \times} \frac{1y}{4} + \boxed{4 \times} \frac{1y}{2} = \boxed{4 \times} 6$$

L.C.M of 2 and 4 is 4

$$y + 2y = 24$$

$$3y = 24$$

$$y = 8$$

$$3) \quad \frac{y+1}{3} = \frac{y-1}{4}$$

$$\boxed{12 \times} \frac{(y+1)}{3} = \boxed{12 \times} \frac{(y-1)}{4}$$

LCM of 3 and 4 is 12

$$4(y+1) = 3(y-1)$$

$$4y + 4 = 3y - 3$$

$$y = -7$$

$$4) \quad \frac{2y-1}{3} = \frac{y}{2}$$

$$\boxed{6 \times} \frac{(2y-1)}{3} = \boxed{6 \times} \frac{y}{2}$$

$$2(2y-1) = 3y$$

$$4y - 2 = 3y$$

$$y = 2$$

③

$$5) \quad \frac{2y-1}{6} + \frac{y+3}{3} = \frac{5}{2}$$

$$\boxed{6 \times} \frac{(2y-1)}{6} + \boxed{6 \times} \frac{(y+3)}{3} = \boxed{6 \times} \frac{5}{2}$$

$$(2y-1) + 2(y+3) = 3 \times 5$$

$$2y - 1 + 2y + 6 = 15$$

$$4y + 5 = 15$$

$$4y = 10$$

$$y = \frac{10}{4} = 2.5$$

$$6) \quad \frac{y-2}{3} + \frac{y+6}{4} = 16$$

$$\boxed{12 \times} \frac{(y-2)}{3} + \boxed{12 \times} \frac{(y+6)}{4} = \boxed{12 \times} 16$$

$$4(y-2) + 3(y+6) = 192$$

$$4y - 8 + 3y + 18 = 192$$

$$7y + 10 = 192$$

$$7y = 182$$

$$y = 26$$

## Solving Equations with fractions

Watch out for sign errors on questions 3,4,5,6,8,9,10

$$A) 6x \frac{x}{2} + 6x \frac{x}{3} = 6x \cdot 10$$

$$3x + 2x = 60$$

$$5x = 60 \quad x = 12$$

$$B) 12x \frac{2x}{3} + 12x \frac{x}{4} = 12x \cdot 11$$

$$4 \times 2x + 3 \times x = 132$$

$$8x + 3x = 132$$

$$11x = 132 \quad x = 12$$

$$1) 6 \frac{(x+3)}{2} + 6 \frac{(x+4)}{3} = 2 \times 6$$

$$3(x+3) + 2(x+4) = 12$$

$$3x + 9 + 2x + 8 = 12$$

$$5x + 17 = 12$$

$$5x = -5$$

$$x = -1$$

$$2) 6 \frac{(y+5)}{6} + 6 \frac{(y-1)}{2} = 10 \times 6$$

$$y + 5 + 3(y-1) = 60$$

$$y + 5 + 3y - 3 = 60$$

$$4y + 2 = 60$$

$$4y = 58$$

$$y = 14.5$$

$$3) 4x \frac{(x+1)}{2} - 4 \frac{(x-1)}{4} = 4 \times 4$$

$$2(x+1) - (x-1) = 16$$

$$2x + 2 - x + 1 = 16$$

$$x + 3 = 16$$

$$x = 13$$

$$4) 30 \frac{(a-4)}{5} - 30 \frac{(a-2)}{6} = 0 \times 30$$

$$6(a-4) - 5(a-2) = 0$$

$$6a - 24 - 5a + 10 = 0$$

$$a - 14 = 0$$

$$a = 14$$

$$5) 12x \frac{(3b+5)}{4} - 12 \frac{(5b-13)}{3} = 1 \times 12$$

$$3(3b+5) - 4(5b-13) = 12$$

$$9b + 15 - 20b + 52 = 12$$

$$-11b + 67 = 12$$

$$-11b = -55$$

$$b = 5$$

(4)

$$6) 14 \frac{(c-2)}{7} - 14 \frac{(3-c)}{14} = 1 \times 14$$

$$2(c-2) - (3-c) = 14$$

$$2c - 4 - 3 + c = 14$$

$$3c - 7 = 14$$

$$3c = 21$$

$$c = 7$$

$$7) 6 \frac{(d+12)}{3} + 6 \frac{(d+3)}{6} = 6 \frac{(3d+11)}{2}$$

$$2(d+12) + (d+3) = 3(3d+11)$$

$$2d + 24 + d + 3 = 9d + 33$$

$$3d + 27 = 9d + 33$$

$$-6 = 6d$$

$$d = -1$$

$$8) 6 \frac{(2e+1)}{6} - 6 \frac{(e-1)}{3} = 6 \frac{(e-3)}{2}$$

$$(2e+1) - 2(e-1) = 3(e-3)$$

$$2e + 1 - 2e + 2 = 3e - 9$$

$$3 = 3e - 9$$

$$3e = 12$$

$$e = 4$$

$$9) 30 \frac{(p-1)}{3} - 30 \frac{(p+2)}{6} = 30 \frac{p}{10}$$

$$10(p-1) - 5(p+2) = 3p$$

$$10p - 10 - 5p - 10 = 3p$$

$$5p - 20 = 3p$$

$$2p = 20$$

$$p = 10$$

$$10) 12 \frac{(2x-5)}{3} - 12 \frac{(2x-3)}{4} = 12 \frac{(x-6)}{12}$$

$$4(2x-5) - 3(2x-3) = x-6$$

$$8x - 20 - 6x + 9 = x - 6$$

$$2x - 11 = x - 6$$

$$x = 5$$

## Equations with Fractions

$$1) 2x \frac{x}{2} = 4 \times 2$$

$$x = 8$$

$$2) 3x \frac{2x}{3} = 8 \times 3$$

$$2x = 24$$

$$x = 12$$

$$3) 2 \frac{(x+1)}{2} = 4 \times 2$$

$$x+1 = 8$$

$$x = 7$$

$$4) 2x \frac{x}{2} + 1^2 = 4 \times 2$$

$$x + 2 = 8$$

$$x = 6$$

$$5) 6x \frac{x}{2} + \frac{x \times 6}{3} = 5 \times 6$$

$$3x + 2x = 30$$

$$5x = 30$$

$$x = 6$$

$$6) 6 \frac{(x+2)}{2} + \frac{(x-2)6}{3} = 7 \times 6$$

$$3(x+2) + 2(x-2) = 42$$

$$3x + 6 + 2x - 4 = 42$$

$$5x + 2 = 42$$

$$5x = 40$$

$$x = 40/5 = 8$$

$$7) 8 \frac{(2x-4)}{4} + \frac{(3x+2)8}{8} = 8 \times 8$$

$$2(2x-4) + (3x+2) = 64$$

$$4x - 8 + 3x + 2 = 64$$

$$7x - 6 = 64$$

$$7x = 70$$

$$x = 10$$

$$8) 4x \frac{(2x+1)}{2} = \frac{(2x+4) \times 4}{4}$$

$$2(2x+1) = 2x+4$$

$$4x+2 = 2x+4$$

$$2x = 2$$

$$x = 1$$

$$9) x \frac{x^8}{x} = 4 \times x$$

$$8 = 4x$$

$$x = 2$$

$$10) \frac{(x+2) \times 8}{x+2} = 2 \times (x+2)$$

$$8 = 2(x+2)$$

$$8 = 2x+4$$

$$2x = 4$$

$$x = 2$$

$$11) \frac{8}{x+2} = \frac{6}{x}$$

$$x(x+2) \times \frac{8}{x+2} = \frac{x(x+2) \times 6}{x}$$

$$8x = 6(x+2) \quad 2x = 12$$

$$8x = 6x + 12 \quad x = 6$$

$$12) \frac{12}{x+1} = \frac{20}{3x-1}$$

$$\cancel{(x+1)}(3x-1) \times \frac{12}{x+1} = \cancel{(x+1)}(3x-1) \frac{20}{3x-1}$$

$$12(3x-1) = 20(x+1)$$

$$36x - 12 = 20x + 20$$

$$16x = 32 \quad x = 2$$

$$13) \frac{24}{2x-1} = \frac{16}{3x-4}$$

$$\cancel{(2x-1)}(3x-4) \times \frac{24}{2x-1} = \cancel{(2x-1)}(3x-4) \frac{16}{3x-4}$$

$$24(3x-4) = 16(2x-1)$$

$$72x - 96 = 32x - 16$$

$$40x = 80$$

$$x = 2$$

⑤