

## Fractions

### Multiply

$$\frac{a}{c} \cdot \frac{b}{d} = \frac{a \cdot b}{c \cdot d}$$

### Divide

$$\frac{a}{c} : \frac{b}{d} = \frac{a}{c} \cdot \frac{d}{b} = \frac{a \cdot d}{c \cdot b}$$

### Add

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\frac{a}{c} + \frac{b}{d} = \frac{a}{c} \cdot \frac{d}{d} + \frac{b}{d} \cdot \frac{c}{c} = \frac{ad}{cd} + \frac{bc}{cd} = \frac{ad+bc}{cd}$$

$$\frac{5}{7} + \frac{3}{7} - \frac{2}{7} = \frac{6}{7}$$

$$\frac{1}{8ab} + \frac{1}{8b(a-2)} + \frac{1}{b(a^2-4)} = \frac{(a-2)(a+2) + a(a+2) + 8a}{8ab(a-2)(a+2)}$$

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

## Simple equations

- add the same number
- subtract —
- multiply by a number  $\neq 0$
- divide by a number  $\neq 0$

$$\begin{aligned} 3x + 10 &= x + 4 & / - 10 \\ 3x &= x - 6 & / - x \\ 2x &= -6 & / : 2 \\ \boxed{x} &= \boxed{-3} \end{aligned}$$

$$\begin{aligned} x & \quad 48 \text{ hours} \\ & \text{over 38 hours your wage doubles} \\ & \$812 \end{aligned} \quad \begin{aligned} 38x + 2 \cdot 10 \cdot x &= 812 \\ 58x &= 812 & / : 58 \\ \boxed{x} &= \boxed{14} \end{aligned}$$

$$\begin{aligned} 6p - \frac{1}{2}(2p-3) &= 3(1-p) - \frac{7}{6}(p+2) \\ 6p - p + 1.5 &= 3 - 3p - \frac{7}{6}p - \frac{14}{6} \\ 5p + 1.5 &= -\frac{25}{6}p + \frac{4}{6} & / + \frac{25}{6}p \\ \frac{18}{6}p + \frac{18}{6} &= \frac{4}{6} \\ 5p + \frac{25}{6}p + 1.5 &= \frac{4}{6} & / - 1.5 \\ 5p + \frac{25}{6}p &= \frac{4}{6} - 1.5 & / \cdot 6 \\ 30p + 25p &= 4 - 9 \\ 55p &= -5 & / : 55 \\ p &= -\frac{5}{55} = -\frac{1}{11} \end{aligned}$$

$$\frac{x+2}{x-2} - \frac{8}{x(x-2)} = \frac{2}{x} \quad \boxed{x \neq 2} \quad \boxed{x \neq 0} \quad / (x-2) \cdot x$$

$$\begin{aligned} x(x+2) - 8 &= 2(x-2) \\ x^2 + 2x - 8 &= 2x - 4 & / - 2x + 4 \\ x^2 - 4 &= 0 \\ (x-2)(x+2) &= 0 \\ \begin{aligned} x-2 &= 0 & \Rightarrow & x+2 &= 0 \\ \boxed{x} &= \boxed{2} & & \boxed{x} &= \boxed{-2} \end{aligned} \end{aligned}$$

## Quadratic equations

$$ax^2 + bx + c = 0 \quad a, b, c \in \mathbb{R}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\begin{aligned} 15x - x^2 &= 0 & x^2 - 9 &= 0 \\ x(15-x) &= 0 & (x+3)(x-3) &= 0 \\ \begin{aligned} x &= 0 \\ x &= 15 \end{aligned} & & \begin{aligned} x &= 3 \\ x &= -3 \end{aligned} \end{aligned}$$

$$\begin{aligned} x^2 - 5x + 6 &= 0 \\ (x-2)(x-3) &= 0 \\ \begin{aligned} x &= 2 \\ x &= 3 \end{aligned} \end{aligned}$$

## Systems of linear equations:

- Substitution
- Elimination

$$\begin{aligned} \text{Elimination} & \quad \text{Substitution} \\ \begin{aligned} (1) \quad 3x + 4.5y &= 27 \\ (2) \quad 3x - 4y &= -7 \\ (2) - (1) & \quad \underline{3x - 4y - 3x - 4.5y = -7 - 27} \\ & \quad \underline{-8.5y = -34} \\ & \quad \boxed{y = 4} \\ 3x - 4y &= -7 \\ 3x - 16 &= -7 \\ 3x &= 9 \\ \boxed{x} &= \boxed{3} \end{aligned} & \quad \begin{aligned} -1.5(1) \quad 2x + 3y &= 18 \\ (2) \quad 3x - 4y &= -7 \\ \begin{aligned} 3(9 - 1.5y) - 4y &= -7 \\ 27 - 4.5y - 4y &= -7 \\ -8.5y &= -34 \\ \boxed{y} &= \boxed{4} \end{aligned} & \quad \begin{aligned} 2x &= 18 - 3y \\ \boxed{x} &= 9 - 1.5y \\ x &= 9 - 1.5 \cdot 4 \\ \boxed{x} &= \boxed{3} \end{aligned} \end{aligned} \end{aligned}$$

$$\begin{aligned} (1) \quad x - y &= 5 \\ (2) \quad x + 3y &= 11 \\ (2) - (1) & \quad \underline{4y = 6} \\ & \quad y = 1.5 \\ x - 1.5 &= 5 \\ x &= 6.5 \end{aligned} \quad \begin{aligned} (1) \quad 3x + 4y &= 2.1 \rightarrow 3x = 2.1 - 4y \\ (2) \quad 5x - 6y &= 7.3 \quad \boxed{x} = 0.7 - \frac{4}{3}y \\ 5(0.7 - \frac{4}{3}y) - 6y &= 7.3 & x = 0.7 - \frac{4}{3}(-0.3) \\ 3.5 - \frac{20}{3}y - 6y &= 7.3 & \boxed{x} = \boxed{1.1} \\ -\frac{38}{3}y &= 3.8 & \boxed{y} = \boxed{-0.3} \end{aligned}$$

$$5\% \quad \$10,000 \quad \$676$$

$$7.2\%$$

$$\begin{aligned} x + y &= 10000 \rightarrow y = 10000 - x \\ 0.05x + 0.072y &= 676 \\ 0.05x + 0.072(10000 - x) &= 676 \\ 0.05x + 720 - 0.072x &= 676 \\ -0.022x &= -44 \\ \boxed{x} &= \boxed{2000} \\ \boxed{y} &= \boxed{8000} \end{aligned}$$