

## Addition and Subtraction

$$2 + 3 + 5 + 7$$

$$12 + 25 + 28 + 35$$

$$1.25 + 0.5 + 0.2$$

$$12 - 25 + 41 - 35 + 28$$

$$10 - 7 - 4$$

$$105 + 93 + 95 + 1107$$

$$2 - (14 + 136) + 31 - (215 - 24)$$

## Multiplication and Division

$$3 \cdot 7$$

$$3 * 100$$

$$2 \times 15$$

$$0.5 \cdot 25$$

$$100 \div 20$$

$$4.5 : 1.5$$

$$2 \cdot 4 \cdot 5 \cdot 25$$

$$225 : 25 : 5$$

$$9 + (8 \cdot 7 - 6 + 5 \cdot 4) - 3 \cdot (2 + 1)$$

## Vertical operations

$$\begin{array}{r} 34 \\ + 123 \\ \hline \end{array}$$

$$\begin{array}{r} 1596 \\ + 2354 \\ \hline \end{array}$$

$$\begin{array}{r} 235 \\ - 98 \\ \hline \end{array}$$

$$\begin{array}{r} 2352 \\ - 1563 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 492 \\ \times 23 \\ \hline \end{array}$$

$$\underline{92 \times 5}$$

$$\underline{323 \times 58}$$

$$3 \overline{)69}$$

$$56 \overline{)3678}$$

$$24 \overline{)242}$$

$$31 \overline{)5698}$$

$$567 \overline{)5}$$

$$3924 \overline{)23}$$

## Fractions and Mixed numbers

$$\frac{1}{3} + \frac{3}{3} - \frac{5}{3} - \frac{2}{3}$$

$$\left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{4} - \frac{1}{5}\right)$$

$$2\frac{1}{2} + 3\frac{3}{4}$$

$$\frac{3}{2} + 5\frac{3}{4} + \frac{2}{5} - 1\frac{3}{4}$$

$$\left(\frac{3}{4} + \frac{5}{6} + \frac{2}{3}\right) \cdot \frac{8}{9}$$

$$\frac{11}{4} : 7 + \frac{2}{7} : \frac{8}{5} + 2 : \frac{14}{15}$$

## Comparing Fractions

$$\frac{3}{5} > \frac{1}{5}$$

$$\frac{12}{23} < \frac{11}{23}$$

$$\frac{1}{2} < \frac{1}{4}$$

$$\frac{3}{4} > \frac{7}{8}$$

$$\frac{3}{15} > \frac{5}{9}$$

$$\frac{17}{162} < \frac{27}{68}$$

## Comparing Mixed fractions (Comparing whole parts, Converting to Improper Fraction)

$$2\frac{3}{5} > 5\frac{1}{5}$$

$$12\frac{12}{23} < 11\frac{11}{23}$$

$$3\frac{1}{2} < 3\frac{1}{4}$$

$$7\frac{3}{15} > 7\frac{7}{14}$$

## Complex fractions

$$\frac{\frac{1}{2} - \frac{1}{3}}{\frac{1}{4} - \frac{1}{3}}$$

$$\frac{(1 - \frac{1}{12}) \cdot (1 - \frac{1}{11})}{(1 - \frac{17}{16}) \cdot (1 - \frac{5}{3})}$$

$$1 - \frac{1 + \frac{1}{1+2}}{2 + \frac{1}{1+3}}$$

$$\frac{\frac{4}{3} + (1 : \frac{2}{3})}{3 + \frac{1}{5} - \frac{1}{5} \cdot \frac{3}{2} \cdot 10}$$

## More complex arithmetic operations

$$-16 - (-4) + 23$$

$$-5 \times (-4) + 24 \div (-4)$$

$$\frac{5}{4} - (\frac{1}{2} - \frac{3}{4})$$

$$45 + 25 \div (-5) * 3 - 2 * 11$$

$$\frac{3}{2} * \frac{1}{2} + \frac{1}{2} \div \frac{1}{4}$$

$$(\frac{9}{4} - \frac{13}{8}) - (\frac{1}{4} - \frac{1}{2})$$

$$31 - [11 - (-4 - 5 + 10) - 4]$$

$$-3.15 \cdot 2.04 + (-18.6) \times 0.35 + 49 * 2.02$$

$$-7.35 + 4.54 - 4.86 + 3.46$$

$$0.47 - 2.6 \cdot (5.17 - 0.3707 \div 0.044)$$

$$\left(3\frac{1}{4} \cdot 5\frac{3}{13} - 7\frac{1}{3} \cdot 2\frac{2}{11}\right) - 3.375 \cdot 1\frac{1}{9} - 3 : \frac{1}{4}$$

$$\frac{\frac{0.21}{0.75-0.6} - \frac{7}{6} : \left(\frac{1}{15} + \frac{3}{8} + \frac{29}{40}\right)}{\frac{28}{65} \cdot \left(\frac{9}{2} - \frac{25}{7}\right)}$$

## Absolute values

$$|-4| + |5| - |-3|$$

$$||4 - 2| - 4| + 2|$$

## Factorization and Algebraic fractions

$$a^2 - b^2$$

$$4x^2 - 9$$

$$4x^2 - 12xy + 9y^2$$

$$p^3 - q^3$$

$$8 + 36y + 54y^2 + 27y^3$$

$$x^4 - 2x^3 + 2x - 1$$

$$\frac{a^2 - 4}{2a - 4}$$

$$\frac{a^2 + ab}{ab + b^2}$$

$$\frac{a^2 + 4a + 4}{a^2 - 4}$$

$$\frac{3x^2 + 11x + 6}{x + 3}$$

$$\frac{(a - b)^2}{a^2 - b^2}$$

$$\frac{2x}{x + 2} \cdot \frac{x^2 + 2x}{x + 1}$$

$$\frac{a^3 - ab^2}{a^3b - a^2b^2}$$

$$\frac{a^2 - 4}{4a^2} \div \frac{a + 2}{2a + 4}$$

$$\frac{a^3 - 1}{1 + \frac{1}{a - \frac{a}{a+1}}}$$

$$\frac{x^2 + 4x + 4}{x - 3} \cdot \frac{5}{3x + 6}$$

$$\left( \frac{x}{x^2 - 36} - \frac{x - 6}{x^2 + 6x} \right) \div \frac{2x - 6}{x^2 + 6x} + \frac{x}{6 - x}$$

## Exponentiation and Roots

$$(-7)^2$$

$$(5abc)^3$$

$$\sqrt{16} + 3$$

$$(-5)^3$$

$$10^3 \cdot 10^2$$

$$5^5 : 5^2 : 5$$

$$\sqrt{\frac{4}{25}}$$

$$\left(\frac{2}{3}\right)^2$$

$$3^{13} \cdot \left(\frac{1}{3}\right)^{13}$$

$$\sqrt{15} \cdot \sqrt{3}$$

$$\frac{1}{\sqrt{2}}$$

$$3^7 \cdot \left(\frac{1}{12}\right)^7 \cdot 2^7$$

$$\sqrt{28} : \sqrt{2}$$

$$\frac{7^0 - \frac{1}{4} \cdot \left(\frac{2}{3}\right)^{-3}}{\sqrt[4]{4} - 1}$$

$$\frac{\left(\frac{2}{3}\right)^{-3} \cdot (2.5)^0 + 2^{-4}}{(-0.4)^{-2} - \left(\frac{4}{5}\right)^{-1}}$$

$$\sqrt{\frac{2}{5}} \sqrt{\frac{5}{27}} \cdot \sqrt{\frac{3}{2}}$$

$$\sqrt{x^2 - 4} \cdot \sqrt{\frac{x - 2}{x + 2}}$$

$$\sqrt{a - 3} \cdot \sqrt{a + 3} \cdot \sqrt{a^2 - 9}$$

## Linear equations

$$\frac{2x}{3} = \frac{x}{4}$$

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

$$\frac{x - 2}{4} - \frac{x - 3}{5} = \frac{x - 4}{5}$$

$$\frac{t - 5}{2} = 3$$

$$(x - 3) : 5 = 2 : 8$$

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

$$3.72x + 3.48 \cdot 7 = 3.65(x + 7)$$

$$2x + 4 \cdot (14 - x) + 20 = 60$$

## Linear equations with restrictions

$$\frac{x+3}{x+2} - 1 = 0$$

$$\frac{1}{x-1} + \frac{1}{x+1} = \frac{1}{-x+1}$$

$$\frac{x-5}{x-2} : \frac{x+2}{x+3} = 1$$

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

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

## Linear equations with parameters

Choose for which variable you want to solve the equation

$$3a + 5x = 2$$

$$-4y = 7 - 2x$$

$$-2x = \frac{1}{6}p$$

$$\frac{11}{3}x + 5 = 2\left(p - \frac{x}{5}\right)$$

## Linear equations with absolute values

$$|x| + 3 = 5$$

$$|x - 4| = 9$$

$$|x + 2| = -7$$

$$|x + 1| = 0$$

$$|3x - 5| = |2x + 1|$$

$$|x + 1| + |x + 2| = 5$$

$$||x - 1| - 2| = 1$$

$$||2x + 3| - 4| = 1$$



## Quadratic equations (methods: Square root method, Quadratic formula, Factor method, PQ formula)

$$x^2 - 4 = 0$$

$$(x - 2)^2 = 25$$

$$5x^2 + 48x = 0$$

$$x^2 - 3x - 4 = 0$$

$$(x + 1)(x - 3) = 0$$

$$x^2 + x - 30 = 0$$

$$16x^2 + 40x + 25 = 400$$

$$x^4 + 3x^2 + 2 = 0$$

$$(k - 7)^4 - 13(k - 7)^2 + 36 = 0$$

## Exponential and logarithmic equations

$$\log_4 x = -2$$

$$\frac{100}{1+e^{-x}} = 0.5$$

$$3^{3x-4} = 9^{2x-3}$$

$$25^{x-1} \cdot 2^{2x+1} - 8 = 0$$

$$\log_3(3^x - 8) = 2 - x$$

$$\frac{e^x}{e^x - 4} = 3$$

$$9^x - 3^{x+1} = 4$$

$$2^{x^2+4x+5} = 2$$

## Trigonometric equations

$$\sin(x) = \cos(x)$$

$$\sin^2(x) - 3\sin(x) + 2 = 0$$

$$\cos(3x - \pi) \cdot \tan\left(3x - \frac{\pi}{4}\right) = 0$$

$$\sin(2(x + 45^\circ)) = 1$$

$$\tan(x) = \frac{\sqrt{3}}{3}$$

$$\tan(x) * \sin\left(\frac{\pi}{2} - x\right) = 0$$

$$\sin x - \sqrt{3} \cos x = 0$$

$$2 \tan^3(x) = \tan(x)$$

$$\sin(x) \cos(2x) + \cos(x) \sin(2x) = \frac{\sqrt{3}}{2}$$

## Irrational equations

$$\sqrt{x} = 9$$

$$\sqrt{3x - 1} = \sqrt{2x + 4}$$

$$\sqrt{\frac{x - 2}{3 + x}} = 5$$

$$\sqrt{2x + \sqrt{3x + 1}} = 2$$

$$\frac{\sqrt{x} - 1}{x - 1} = 1 - \frac{1}{\sqrt{x} + 1}$$

$$\sqrt{11x + 3} - \sqrt{2 - x} = \sqrt{9x + 7} - \sqrt{x - 2}$$

$$\sqrt{3x - 1} - \sqrt{x + 1} = \sqrt{2x + 1} - \sqrt{2x - 1}$$

## Systems of linear equations

$$\begin{cases} y = 2x + 1 \\ y = 4x - 2 \end{cases}$$

$$\begin{cases} 3x = 12 \\ 4x - 5y = 6 \end{cases}$$

$$\begin{cases} 3x - y = 21 \\ 2x + y = 4 \end{cases}$$

$$\begin{cases} 2x - 3y = 14 \\ 4x + 5y = 18 \end{cases}$$

$$\begin{cases} x + y + z = 6 \\ 2x + y - z = 1 \\ 3x - y + z = 4 \end{cases}$$

$$\begin{cases} x^2 + 2xy + y^2 - 1 = 0 \\ 2x - y + 5 = 0 \end{cases}$$

## Complex systems of equations

$$\begin{cases} x^2 + y^2 - 16x + 39 = 0 \\ x^2 - y^2 - 9 = 0 \end{cases}$$

$$\begin{cases} y = |x + 1| \\ y = x - 2 \end{cases}$$

$$\begin{cases} x^2 + y^2 = 5 \\ xy = 2 \end{cases}$$

$$\begin{cases} \log_{10}(x) + \log_{10}(y) = 3 \\ \log_{10}(x) - \log_{10}(y) = 1 \end{cases}$$

$$\begin{cases} \frac{4}{x} + \frac{6}{y} = 0 \\ \frac{3}{x} - \frac{4}{y} = -2\frac{5}{6} \end{cases}$$

$$\begin{cases} \log_2(x) + \log_4(y) = 4 \\ 3^{(x^2)} = 9 \cdot 3^{(15y+2)} \end{cases}$$

$$\begin{cases} 1 - 4^{(x-y)} = 0 \\ x^2 + 2x + 1 = 0 \end{cases}$$

## Inequalities

$$x + 3 < 0$$

$$2x + 5 > 7x - 3 + 5$$

$$\frac{2}{x+3} > 0$$

$$\frac{2x-1}{3} - \frac{3x+1}{4} < 1 - \frac{x}{12}$$

$$\frac{7x+1}{4x-3} \geq 2$$

$$\frac{x+5}{2x+6} \geq 0$$

$$x^2 - x - 2 \leq 0$$

$$1 + x^2 > 37$$

$$x^2 - 2x - 3 \geq 0$$

$$(2x - 3)(3x + 5) \geq 0$$

$$\frac{2}{x+3} \leq \frac{1}{x-3}$$

$$\frac{x^2 - 4x + 3}{x^2 - 3x + 2} \geq 0$$

## Absolute values inequalities

$$|x + 1| \geq 0$$

$$|x - 4| < 9$$

$$|x + 1| + |x + 2| > 5$$

$$|x - 2| \cdot |x - 5| \leq 0$$

$$||x - 1| - 2| > 1$$

$$|x| - |1 - 2x| < -0.5$$

$$|x - |2x - 0.5|| \geq |x - |2x - \frac{1}{2}||$$

## Exponential and logarithmic inequalities

$$8^{\frac{4}{5}x-3} < 8^{-7x}$$

$$\frac{3^x}{3^x - 1} - \frac{1}{3^x + 1} \leq 0$$

$$\log_{\frac{1}{3}}(x - 1) > 1$$

$$81^{3-x} < \left(\frac{1}{3}\right)^{5x-6}$$

$$3^x + 3^{x+1} > \frac{4}{9}$$

$$\frac{x + 5}{2x + 6} \geq 0$$

$$\log_{\frac{1}{2}}\left(\frac{3 - 2x}{x}\right) < 0$$

$$25^x < 6 \times 5^x$$

## Irrational inequalities

$$\sqrt{2x + \sqrt{3x + 1}} = 2$$

$$\sqrt{\sqrt{x}} \leq \sqrt{x}$$

$$\sqrt{1 - 2x} < \sqrt{4 - x}$$

$$\sqrt{4x^2 + 2x + 1} - \sqrt{x - 1} \geq 0$$

$$\frac{x - 5}{\sqrt{x + 1}} \geq 0$$

$$\sqrt{6x + 6} \geq \sqrt{3x} + \sqrt{3}$$

## Systems of inequalities

$$\begin{cases} x - \frac{1}{2} \geq 0 \\ x - 0.5 \leq 0 \end{cases}$$

$$\begin{cases} x^2 - 4 \leq 0 \\ x > -1 \end{cases}$$

$$\begin{cases} x + 2 > 3 \\ -2x + 5 < -5 \end{cases}$$

$$\begin{cases} \log_9(x - 8) - \frac{3}{2} \leq 0 \\ 0 < 2 - \log_x\left(\frac{1}{9}\right) \end{cases}$$

$$\begin{cases} 2x + x > 3 \\ x + 2 > -3 \\ 5x - 2x > 3 + 2 - x \end{cases}$$

$$\begin{cases} 2x - x > 1 \\ x > \frac{1}{2} + \frac{1}{2} \\ 3x + 2x - 1 > 0 \end{cases}$$

## Logarithmic and exponential functions

$$\log_3 3$$

$$3^{\log_9 25}$$

$$\log_6 36$$

$$5^{\log_5 10}$$

$$\log_{0.2} 25$$

$$\log_8 0.25$$

$$\left(\frac{1}{3}\right)^{-2 - \log_9 25}$$

$$\log 0.0001$$

$$\log_5 2 + \log_5 2.5$$

$$2 \log_5 \sqrt{5} + 3 \log_2 8$$

$$\log_3 8 \cdot \log_8 9$$

$$3 \log_3 \sqrt[3]{3} - 2 \log_2 \sqrt{2}$$

## Trigonometry

$$\sin(30^\circ)$$

$$\tan(45^\circ)$$

$$\csc(90^\circ)$$

$$\sin\left(\frac{2\pi}{3}\right)$$

$$\cos\left(\frac{3\pi}{4}\right)$$

$$\arcsin\left(-\frac{1}{2}\right)$$

$$\cos(100^\circ) \cos(40^\circ) + \sin(100^\circ) \sin(40^\circ)$$

$$\sin\left(\frac{11\pi}{12}\right) + \sin\left(\frac{5\pi}{12}\right)$$

$$\sin^2(1) + \cos^2(1)$$

$$\frac{2 \tan(a)}{1 - \tan^2(a)}$$

$$\frac{\cot^2(a) - 1}{2 \cot(a)}$$

$$\frac{3 \tan(t) - \tan^3(t)}{1 - 3 \tan^2(t)}$$

$$\frac{3 \cot(t) - \cot^3(t)}{1 - 3 \cot^2(t)}$$

## Binomial coefficient

$$\binom{7}{3}$$

$$\binom{n+1}{3}$$

$$\binom{10}{6} \cdot \binom{10}{5} - \binom{10}{5}$$

$$\binom{100}{97} + \binom{100}{98}$$

## Complex numbers

$$(8 + 3i) - (7 + 5i)$$

$$(5 + i)(8 + i)$$

$$\frac{(1 + 3i)}{(7 - 2i)}$$

$$|3 + 11i|$$

$$i^{51}$$

$$\left| \frac{(2 + i)}{(3 + 4i)} \right|$$

$$i^{(-2)}$$

$$(2 + 3i)^3$$

For this type of problem you can calculate: **Complex conjugate, Modulus, Real and the Imaginary parts**

$$4 + 3i$$

## Limits

$$\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$$

$$\lim_{x \rightarrow +\infty} (x^3 - x^2 + 5)$$

$$\lim_{x \rightarrow 0} \left( \frac{\sin(5x)}{(5x)} \right)$$

$$\lim_{x \rightarrow -2} x^2 + 3x - 2$$

$$\lim_{x \rightarrow 0} \frac{(x^2 - 1)}{(x + 3)}$$

$$\lim_{x \rightarrow -3} \frac{(x^3 + 27)}{(x^2 - 9)}$$

$$\lim_{x \rightarrow 5} \frac{(\sqrt{x} - \sqrt{5})}{(x - 5)}$$

$$\lim_{x \rightarrow 2} \frac{(x - 2)}{(x^2 - 4)}$$



## Derivation and integration

$$\frac{d}{dx}(3x^2)$$

$$\frac{d}{dx}(\cos(\theta))$$

$$\frac{d}{dx}(x + x^2)$$

$$\frac{d}{dx}(3x^3 - 2x^2 + 3x - 1)$$

$$\frac{d}{dx}(x \cdot \ln(2x))$$

$$\frac{d}{dx}(\sqrt{2} \cdot \sin(3x))$$

$$\frac{d}{dx}((x^2 - 2x + 2)e^x)$$

$$\frac{d}{dx}\left(\ln\left(\frac{1+x^2}{1-x^2}\right)\right)$$

$$\int \sin 2x \, dx$$

$$\int 2x \, dx$$

$$\int (2x^3 - 4x^2) \, dx$$

$$\int \frac{1}{\sqrt{x}} \, dx$$

$$\int_2^3 \left(\frac{z}{1+z^2}\right) \, dz$$