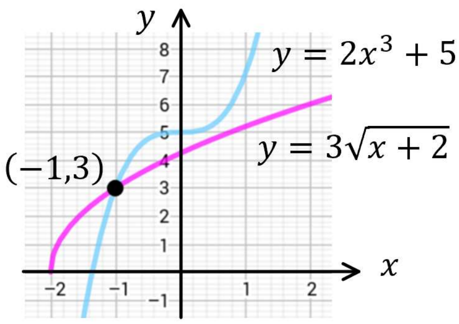
# Equations of the Form $f(x) = g(x)$

## Solving Equations

The solution to the equation $f(x) = g(x)$ where $f$ and $g$ are polynomial or power functions can be found graphically, numerically, and algebraically. This may be phrased as finding the intersections between $y = f(x)$ and $y = g(x)$ or solving them simultaneously. If the coordinate is required to a number of decimal places, then a CAS may be used to find the coordinate.

### Example

The point of intersection of the graphs of $y = 2x^3 + 5$ and $y = 3\sqrt{x+2}$ is $(-1, 3)$.




For a polynomial equation, $P(x) = Q(x)$, expanding both polynomials (if necessary) and moving all terms onto one side of the equation:

$$P(x) - Q(x) = 0$$

$$R(x) = 0$$

If you can factorise $R(x)$, you can use the null factor law to solve each factor of $R(x)$ separately equal to 0. Alternatively, if $R(x)$ is a quadratic, then you can use the quadratic formula.

### Example VCAA 2002 Exam 1 Question 8a

The $x$-coordinates of the points of intersection of the line with equation $y = 3x + 1$ and the parabola with equation $y = 2x^2 + 4x - 5$ are

$y = 3x + 1$ and $y = 2x^2 + 4x - 5$

$$3x + 1 = 2x^2 + 4x - 5$$

$$\Rightarrow 0 = 2x^2 + x - 6$$

$$\Rightarrow x = \frac{-1 \pm \sqrt{1^2 - 4(2)(-6)}}{2(2)} = \frac{-1 \pm \sqrt{1 + 48}}{4} = \frac{-1 \pm 7}{4}$$

$$\Rightarrow x = -\frac{8}{4} = -2, \qquad \Rightarrow x = \frac{6}{4} = \frac{3}{2}$$