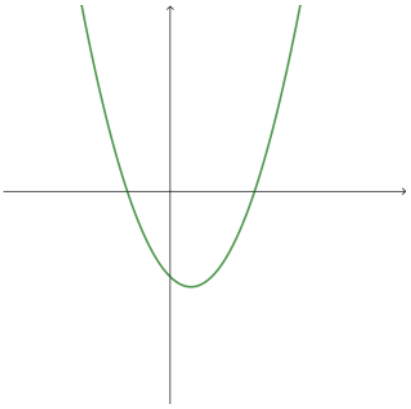
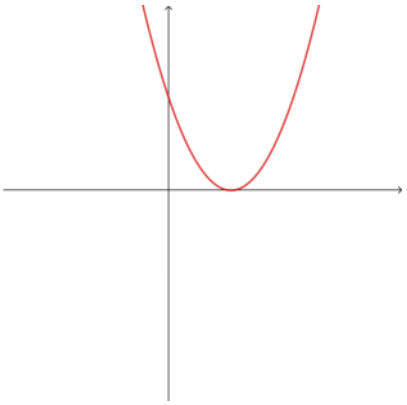
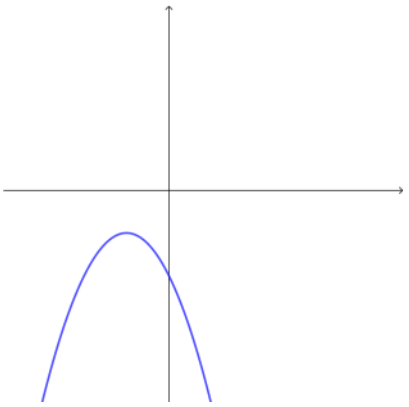
What are roots?



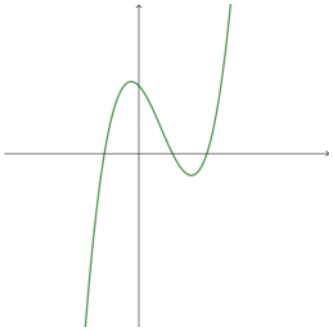
2 real roots



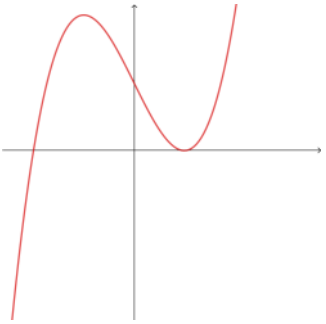
1 repeated real root



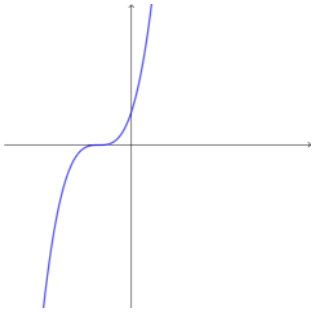
0 real roots
2 complex roots



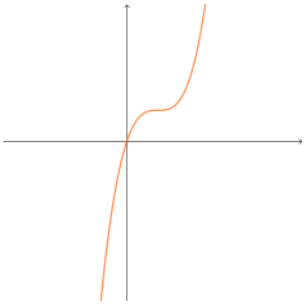
3 real roots



2 real roots (1 repeated)



1 real root (repeated)



1 real root, 2 complex roots

$2x^2 - 7x + 6 = 0$

$(2x - 3)(x - 2) = 0$

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

Sum of roots $= \frac{3}{2} + 2 = \frac{7}{2}$

Product of roots $= \frac{3}{2} \times 2 = 3$

$$2\left(x-\frac{3}{2}\right)(x-2)=0$$

$$ax^2+bx+c=0$$
$$a(x-\alpha)(x-\beta)=0$$

$$ax^2-a(\alpha+\beta)x+a\alpha\beta=0$$

Sum of roots $=-\frac{b}{a}$

Product of roots$=\frac{c}{a}$

$$3x^3-10x^2+x+6=0$$

$$(3x+2)(x-1)(x-3)=0$$

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

Sum of roots $=-\frac{2}{3}+1+3=\frac{10}{3}$

Product of roots$=-\frac{2}{3}\times 1\times 3=-2$

$$3\left(x+\frac{2}{3}\right)(x-1)(x-3)=0$$

$$ax^3+bx^2+cx+d=0$$
$$a(x-\alpha)(x-\beta)(x-\gamma)=0$$

$$ax^3-a(\alpha+\beta+\gamma)x^2+a(\alpha\beta+\alpha\gamma+\beta\gamma)x-a\alpha\beta\gamma=0$$

Sum of roots $=-\frac{b}{a}$

Product of roots$=-\frac{d}{a}$

$$ax^4+bx^3+cx^2+dx+e=0$$
$$a(x-\alpha)(x-\beta)(x-\gamma)(x-\delta)=0$$

$$ax^4-a(\alpha+\beta+\gamma+\delta)x^3+\cdots-\cdots+a\alpha\beta\gamma\delta=0$$

Sum of roots $=-\frac{b}{a}$

Product of roots$=\frac{e}{a}$

degree	Polynomial equation	Sum of roots	Product of roots
2	$ax^2 + bx + c = 0$	$-\frac{b}{a}$	$\frac{c}{a}$
3	$ax^3 + bx^2 + cx + d = 0$	$-\frac{b}{a}$	$-\frac{d}{a}$
4	$ax^4 + bx^3 + cx^2 + dx + e = 0$	$-\frac{b}{a}$	$\frac{e}{a}$
5	$ax^5 + bx^4 + cx^3 + dx^2 + ex + f = 0$	$-\frac{b}{a}$	$-\frac{f}{a}$

degree	Polynomial equation	Sum of roots	Product of roots
2	$a_2x^2 + a_1x + a_0 = 0$	$-\frac{a_1}{a_2}$	$\frac{a_0}{a_2}$
3	$a_3x^3 + a_2x^2 + a_1x + a_0 = 0$	$-\frac{a_2}{a_3}$	$-\frac{a_0}{a_3}$
4	$a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0 = 0$	$-\frac{a_3}{a_4}$	$\frac{a_0}{a_4}$
5	$a_5x^5 + a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0 = 0$	$-\frac{a_4}{a_5}$	$-\frac{a_0}{a_5}$
n	$a_nx^n + a_{n-1}x^{n-1} + \cdots + a_1x + a_0 = 0$	$-\frac{a_{n-1}}{a_n}$	$(-1)^n\frac{a_0}{a_n}$
n	$\sum_{r=1}^{n} a_r x^r$	$-\frac{a_{n-1}}{a_n}$	$(-1)^n\frac{a_0}{a_n}$