



Matteman

# HIGH SCHOOL MATHEMATICS

## QUADRATICS

### Quadratic expressions:

Any expression that is in the form of  $ax^2 + bx + c$

Perfect square form:

$$x^2 + 2kx + k^2 = (x + k)^2$$

Examples :  $x^2 + 6x + 9 = (x + 3)^2$

half it → square it

$$x^2 - 6x + 9 = (x - 3)^2, \quad x^2 - 10x + 25 = (x - 5)^2, \quad x^2 + 8x + 16 = (x + 4)^2$$

Completing to a square:

$$(x^2 + 2kx) = (x + k)^2 - k^2$$

### Quadratic equations:

Any equation that is in the form of  $ax^2 + bx + c = 0$  (where  $a \neq 0$ ).

Quadratic equations could be solved by:

factorisation, completing to a square or using the quadratic formula.

#### Quadratic formula

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

**Discriminant:** The number of solutions (roots) in a quadratic equation depends on the value of discriminant. If;

$b^2 - 4ac < 0 \rightarrow$  there is no real solution.

$b^2 - 4ac = 0 \rightarrow$  there is one real solution. (or could be phrased as having two equal roots.)

$b^2 - 4ac > 0 \rightarrow$  there are two distinct real solutions.

### Factorisation of quadratics [ $ax^2 + bx + c$ ]

Example :  $2x^2 + 7x + 6 = 0$

$2 \times 6 = 12$  (4 and 3)

$2x^2 + 4x + 3x + 6 = 0 \rightarrow 2x(x + 2) + 3(x + 2) = 0$

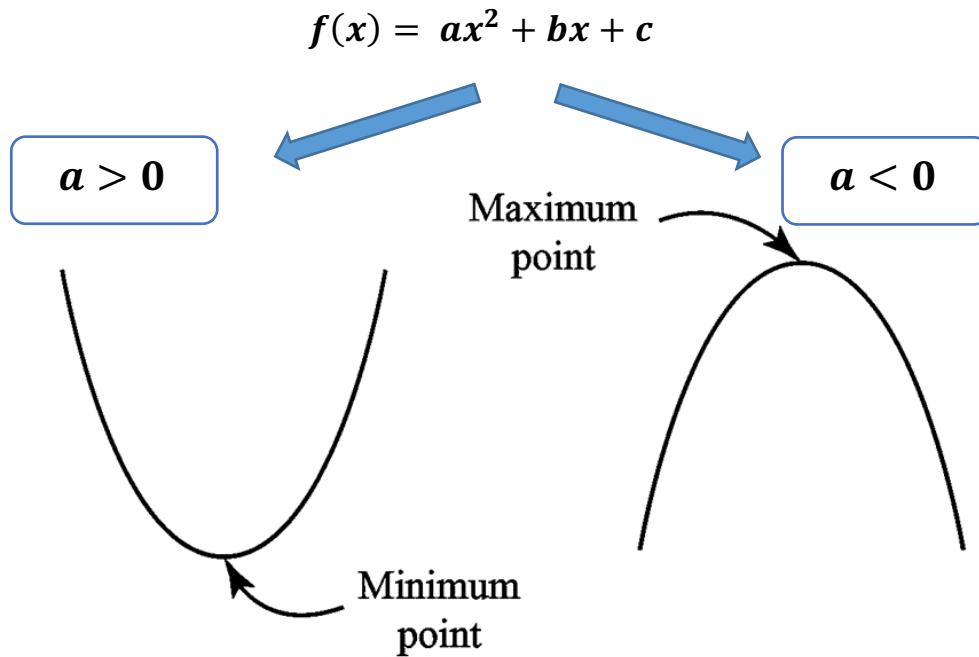
$(x + 2)(2x + 3) = 0 \rightarrow x = -2$  or  $x = -3/2$

Multiply a and c

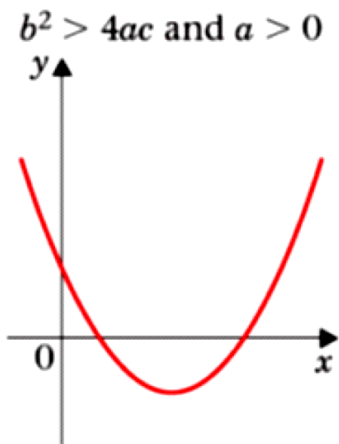
Get two factors which have the sum equal to b

Group 2 by 2 and take common factors out, then solve for x.

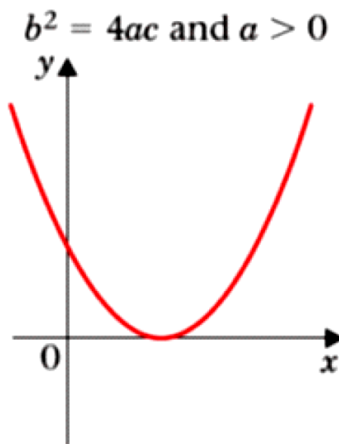
Sketching quadratic curves:



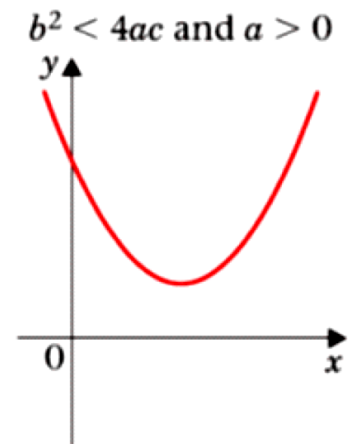
*Note: You need to clearly show x and y-intercepts. If the curve doesn't cut the x-axis you need to show the coordinates of the minimum/maximum point as well.*



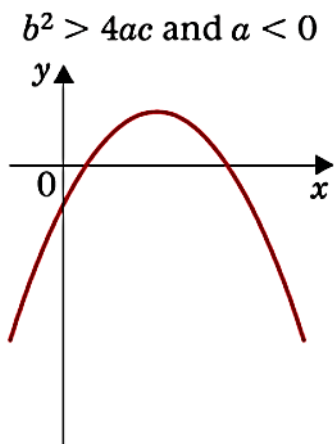
Here there are two different roots.



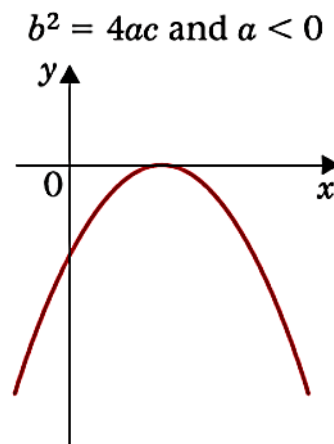
Here there are two equal roots.



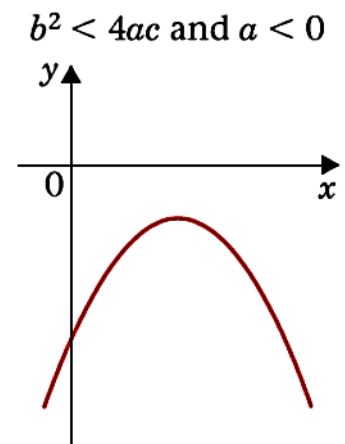
Here there are no real roots.



Here there are two different roots.



Here there are two equal roots.



Here there are no real roots.