Instructions for sketching a quadratic graph.

1 Find the roots of the equation.
2 Find the completed square form.
3 Find the y intercept.

$$\mathbf{3x^2 + 11x + 10 = 0}$$

1 Find the roots of the equation. This tells us where the quadratic graph goes through the x-axis.

i Determine the values of a, b and c so that $ax^2 + bx + c = 0$. In this case, **a=3, b=23 and c=10**.

ii Multiply a and c together. $\mathbf{3 \times 10 = 30.}$

iii Find the factor pairs of ac. $\mathbf{1 \times 30, 2 \times 15, 3 \times 10, 5 \times 6}$; $\mathbf{-1 \times -30, -2 \times -15,}$

$\mathbf{-3 \times -10}$, $\mathbf{-5 \times -6}$

iv Determine which factor pair of ac sums to b. **6 + 5 = 11**.

v Rewrite the equation, splitting the middle term: $\mathbf{3x^2 + 6x + 5x + 10}$

vi Group and factorise the equation: $\mathbf{3x(x + 2) + 5(x + 2)}$

v Put the terms outside the parenthesis into the first set of brackets and the terms inside the brackets into the second set. $\mathbf{(3x + 5)(x + 2).}$

vi Equate the equation to 0 and solve:

$$(3x + 5)(x + 2) = 0$$

$$3x + 5 = 0$$

$$\therefore \quad 3x = -5$$

$$\therefore \quad x = -\frac{5}{3}$$

OR

$$x + 2 = 0$$

$$\therefore x = -2$$

So the roots or solutions of the equation are $\boldsymbol{x = -\frac{5}{3}} \quad \boldsymbol{or} \quad \boldsymbol{x = -2}$

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2 Find the completed square form. This will give us the co-ordinates of the stationary point.

$$\mathbf{3x^2 + 11x + 10 = 0}$$

i Take out the factor for the x^2 and x terms (ie a and b)

$$3\left[x^2 + \frac{11}{3}x\right] + 10$$

ii $\left(x + \frac{b}{2}\right)^2 \rightarrow \mathbf{3\left[\left(x + \frac{11}{6}\right)^2\right] + 10}$

iii $\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 \rightarrow \mathbf{3\left[\left(x + \frac{11}{6}\right)^2 - \left(\frac{11}{6}\right)^2\right] + 10 \rightarrow 3\left[\left(x + \frac{11}{6}\right)^2 - \left(\frac{121}{36}\right)\right] + 10}$

iv Multiply by the common factor

$$\mathbf{3\left(x + \frac{11}{6}\right)^2 - \left(\frac{121}{12}\right) + 10}$$

v Change the +10 to twelfths to make the calculation easier

$$\mathbf{3\left(x + \frac{11}{6}\right)^2 - \left(\frac{121}{12}\right) + \frac{120}{12}}$$

vi Complete the square

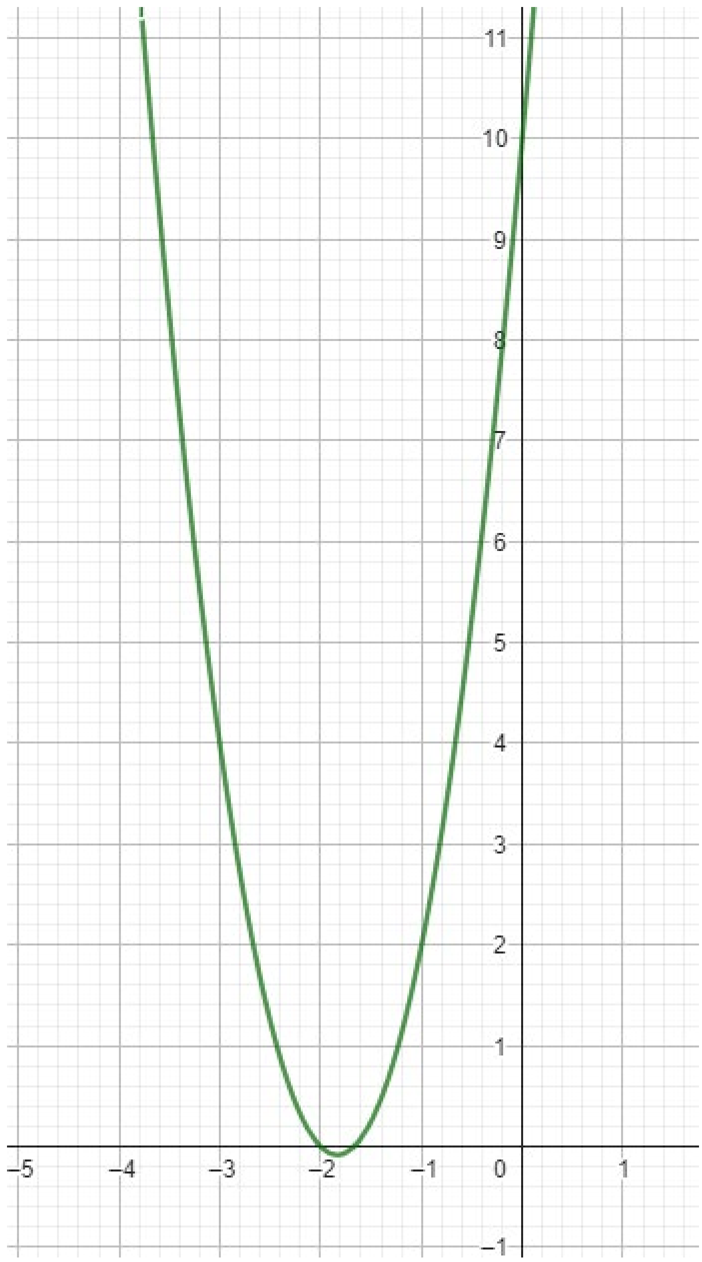
$$\mathbf{3\left(x + \frac{11}{6}\right)^2 - \frac{1}{12}}$$

vii Change the sign of the x co-ordinate and get the co-ordinates of the stationary point.

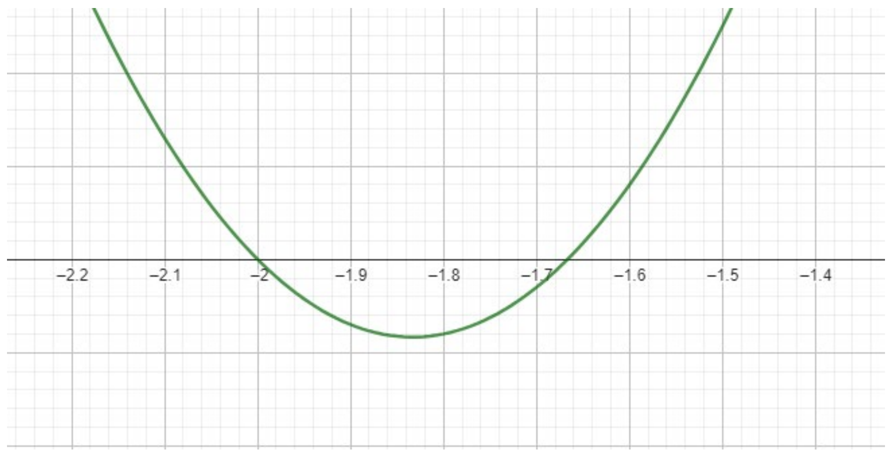
$$\mathbf{\left(-\frac{11}{6}, -\frac{1}{12}\right)}$$

3 Find the y intercept

i The y intercept is at the point (c,0) so in this case, the y intercept is at point **(10,0).**



A magnified view of where the parabola crosses the x-axis is shown below.



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