Interesting things about parabolas

1. The y-values start to repeat themselves at some point. (This point is called the vertex.)

2. The graph is symmetrical. The point at which we can fold our graph in half is the vertex. The “crease” down the middle of the graph is called the axis of symmetry.

3. If we find the vertex of the parabola first, the y-values on either side of the vertex are the same.

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>4</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Vertex →
How to find the vertex of a parabola

Given \( f(x) = ax^2 + bx + c \):

1) The x-value of the vertex = \(-\dfrac{b}{2a}\)

2) The y-value of the vertex \(\Rightarrow\) plug what you get for \(x\) into \(ax^2 + bx + c\).

Ex: \( f(x) = 2x^2 + 4x - 3 \) Find the vertex of the parabola.

\[
x = -\dfrac{b}{2a} = -\left(\dfrac{4}{2 \cdot 2}\right) = -\left(-\dfrac{2}{2}\right) = \text{_____}
\]

\[
y = 2\left(-\dfrac{2}{2}\right)^2 + 4\left(-\dfrac{2}{2}\right) - 3 = 2\left(-\dfrac{2}{2}\right) + \text{_____} - 3
\]

\[
= \text{_____} + \text{_____} - 3 = \text{_____}
\]

Vertex = (\text{_____}, \text{_____})
How to graph a parabola

1) Find the vertex.

2) For the other x-values, pick the previous two integers and next two integers with respect to the x-value of the vertex.

3) Plug each of those x-values into the equation to get the corresponding y-values.

4) Plot your points!

Ex: Graph the parabola given by \( f(x) = x^2 + 6x + 8 \).

1) Find the vertex.
\[
x = -\frac{b}{2a} = -\left(\frac{\underline{\ldots}}{2 \cdot \underline{\ldots}}\right) = -\left(\underline{\ldots}\right) = \underline{\ldots}
\]
\[
y = (\underline{\ldots})^2 + 6(\underline{\ldots}) + 8 = (\underline{\ldots}) + \underline{\ldots} + 8
\]
\[
= \underline{\ldots} + \underline{\ldots} + 8 = \underline{\ldots}
\]
Vertex = (\underline{\ldots}, \underline{\ldots})

2) Pick the x-values:

Vertex →
3) Plug in those x-values to get the corresponding y-values.

\[ f(x) = x^2 + 6x + 8 \]