KEY

# 10.2 Graph $y = ax^2 + bx + c$

NOTICE WE NOW HAVE A B TERM

**Goal** • Graph general quadratic functions.

Your Notes

## VOCABULARY

STANDARD FORM OF A QF.

### PROPERTIES OF THE GRAPH OF A QUADRATIC FUNCTION

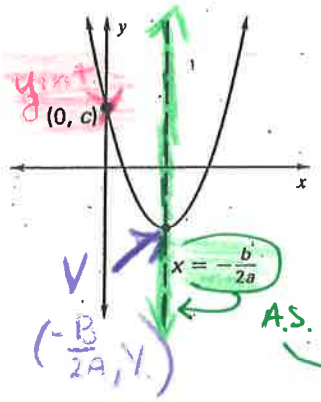
A ≠ 0
A, B, C are real numbers

The graph of $y = ax^2 + bx + c$ is a parabola that:

"a" determines the shape

+A -A

- opens UP if $a > 0$ and opens down if $a < 0$.
- ~~is narrower than the graph of $y = x^2$ if $|a| > 1$~~ and ~~wider if $|a| < 1$.~~
- has an axis of symmetry of (A.S.) $x = -b/2a$. opposite of b divided by 2A
- has a vertex with an $x$-coordinate of $-b/2a$.
- has a y-intercept of C. So, the point ( ∅ , C ) is on the parabola.




A.S. LINE EQ $x = \#$

Why can't a ≠ 1?
b/c it would be a linear EQ.

**Your Notes**

A = −1 ∩

B = 4

C = −1 y int

**Example 1** *Graph $y = ax^2 + bx + c$*

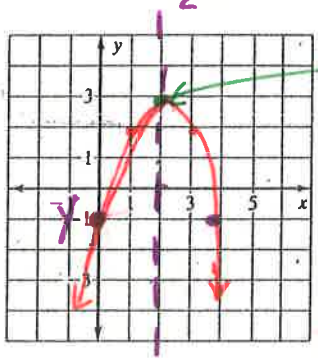
**Graph $y = -x^2 + 4x - 1$.**

**Step 1** **Determine** whether the parabola opens up or down. Because $a$ < 0, the parabola opens DOWN.

**Step 2** **Find** and draw the axis of symmetry:

$$x = \frac{-b}{2a} = \frac{-4}{2(-1)} \quad x = 2$$

A.S. $x = 2$




Vertex (2, 3)

**Step 3** **Find** and plot the vertex.

From A.S. The $x$-coordinate of the vertex is $\frac{-B}{2A}$, or 2.

To find the $y$-coordinate, substitute 2 for $x$ in the function and simplify.

orig EQ → $y = -(2)^2 + 4(2) - 1 = 3$

So, the vertex is (2, 3).

**Step 4** **Plot** 5 points. Choose +/− 2 x-values around the $x$-coordinate of the vertex. Then find the corresponding $y$-values

VERTEX

| x | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| y | −1 | 2 | 3 | 2 | −1 |

NOTICE: Points reflect around the A.S.

**Step 5** **Draw** a parabola through the plotted points.

# 10.2 Daily HW Quiz

1. Find the axis of symmetry, vertex, and the y-intercept for the function $y = -4x^2 + 8x - 9$ A = -4 B = 8 C = -9

y-intercept (0, -9)

A.S: $x = \frac{-B}{2A} = \frac{-8}{2(-4)}$ $x = 1$ ← remember A.S. is a line

VERTEX (1, -5) ← 1 point $y = -4(1)^2 + 8(1) - 9 = -5$

2. Find the axis of symmetry, vertex, and the y-intercept for the function: $y = -2x^2 - x$ A = -2 B = -1 C = 0

y-intercept (0, 0)

A.S. $x = \frac{1}{2(-2)} = \frac{-1}{4} = -.25$

$x = -1/4$ or $-.25$

VERTEX (-.25, .125) (-1/4, 1/8)

$y = -2\left(\frac{-1}{4}\right)^2 + 1\left(\frac{-1}{4}\right)$

$= -2(1/16) + 1/4$

$= -1/8 + 1/4 = 1/8$ or .125

$y = 1/8$

3. **Graph** $y = -2x^2 + 4x + 1$

Create a table, label A.S., Vertex, and y-intercept.

A = -2 B = 4 C = 1

A.S: $x = \frac{-4}{2(-2)} = 1$ $x = 1$

Table

| x | y |
|---|---|
| -1 | -5 |
| 0 | 1 |
| 1 | 3 |
| 2 | 1 |
| 3 | -5 |

AS → V

$-2 + 4 + 1$

$-2(9) + 12 + 1 = -18 + 13 = -5$