

3/1 Algebra 1 - Downing

Unit 7 → Graphing Quadratics

Lesson 1 → Characteristics of Quadratic Functions

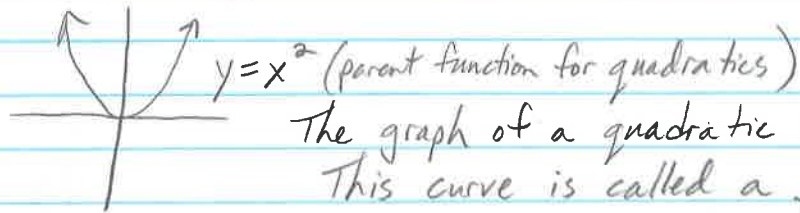
Ex) Evaluate $x^2 + 5x$ for $x=4$ and $x=-3$

$$\begin{array}{cc} (4)^2 + 5(4) & (-3)^2 + 5(-3) \\ 16 + 20 & 9 + -15 \\ \mathbf{36} & \mathbf{-6} \end{array}$$

Ex) $y = x^2 + 2$ $D: \{-2, -1, 0, 1, 2\}$

x	$y = x^2 + 2$	(x, y)	2 nd Difference
-2	$y = (-2)^2 + 2 = 6$	(-2, 6)	↓ +2 +2 +2 +2
-1	$y = (-1)^2 + 2 = 3$	(-1, 3)	
0	$y = (0)^2 + 2 = 2$	(0, 2)	
1	$y = (1)^2 + 2 = 3$	(1, 3)	
2	$y = (2)^2 + 2 = 6$	(2, 6)	

Quadratic Function
Standard Form: $f(x) = ax^2 + bx + c$



The graph of a quadratic is a "u shaped" curve. This curve is called a parabola.

Ex)

x	0	1	2	3	4
$y = x^2$	0	1	4	9	16

\uparrow +1 \uparrow +1 \uparrow +1 \uparrow +1 ← Constant change in x-values
 \downarrow +1 \downarrow +3 \downarrow +5 \downarrow +7 ← First differences
 \downarrow +2 \downarrow +2 \downarrow +2 ← Second differences

Ex) Is it Quadratic?

x	y
-2	-9
-1	-2
0	-1
1	0
2	7

\uparrow +1 \uparrow +1 \uparrow +1 \uparrow +1
 \downarrow +7 \downarrow +1 \downarrow +1 \downarrow +7
 \downarrow +6 \downarrow +0 \downarrow +6
 Not Quadratic

Ex)

x	y
-2	4
-1	1
0	0
1	1
2	4

\uparrow +1 \uparrow +1 \uparrow +1 \uparrow +1
 \downarrow -3 \downarrow -1 \downarrow +1 \downarrow +3
 \downarrow +2 \downarrow +2 \downarrow +2
 Quadratic

- * A parabola opens up when $a > 0$ (positive)
- * A parabola opens down when $a < 0$ (negative)

* Needs to be in standard form

Ex) $y - 5x^2 = 2x - 6$
 $+5x^2 \quad +5x^2$ Put in standard form

$$y = 5x^2 + 2x - 6$$

↑ opens up because 5 is positive

Ex) $y - \frac{1}{3}x^2 = x - 3$
 $+ \frac{1}{3}x^2 \quad + \frac{1}{3}x^2$

$$y = \frac{1}{3}x^2 + x - 3$$

↑ opens up.

Ex) $y = 5x - 3x^2$

$$y = -3x^2 + 5x$$

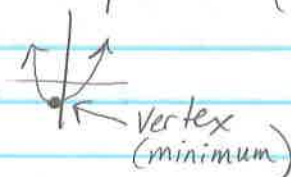
↑ opens down because 3 is negative

Ex) $f(x) = -4x^2 - x + 1$

↑ opens down

Vertex - the highest or lowest point of a parabola (write as an ordered pair)

* if $a > 0$, opens up and has a minimum



* if $a < 0$, it opens down and has a maximum

* The minimum or maximum is the y-value of the vertex



Axis of Symmetry (AOS): This is the vertical line that goes through the vertex. (x value of the vertex)



Vertex: $(-3, 2)$

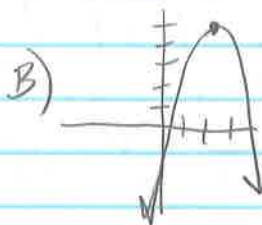
Max or (Min)?

Min: $y = 2$

AOS: $x = -3$

Domain: $x \in \mathbb{R}$

Range: $y \geq 2$



Vertex $(2, 5)$

Max or Min?

max $y = 5$

AOS: $x = 2$

Domain: $x \in \mathbb{R}$

Range: $y \leq 5$

* Remember:
Equation of a vertical line is $x = 23$

(HOY-VUX)

Domain: x is all real numbers $\{x \in \mathbb{R}\}$

Range: If it opens up than $y \geq$ (y of vertex)
If it opens down than $y \leq$ (y of vertex)

* Worksheet done in class