

Notes Characteristics of Quadratic Functions

Standard Form of a Quadratic Function:

$$y = ax^2 + bx + c$$

$a \neq 0$

Make sure you can identify the a , b , and c of a quadratic function:

$$y = -4x^2 + x + 2$$

$$a = -4$$

$$b = 1$$

$$c = 2$$

$$y = x^2 - 2x + 1$$

$$a = 1$$

$$b = -2$$

$$c = 1$$

$$y = -x^2 - 9$$

$$a = -1$$

$$b = 0$$

$$c = -9$$

$$y = 2x^2 + 4x$$

$$a = 2$$

$$b = 4$$

$$c = 0$$

Quadratic Parent Function

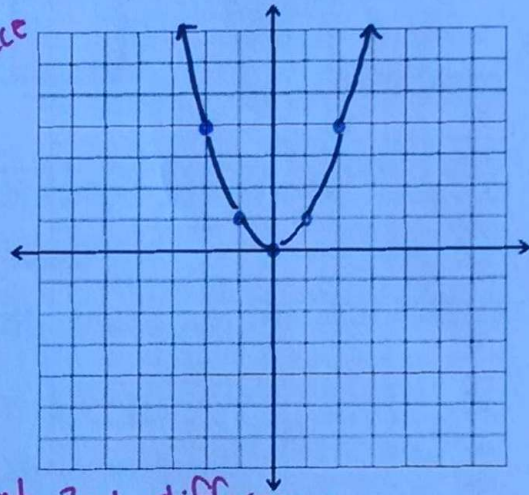
$$y = x^2$$

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

First difference
Second difference

-3
 -1
 $+1$
 $+3$

$+2$
 $+2$
 $+2$



Quadratic Functions have constant 2nd difference

Parts of the Parabola (define each characteristic in your own words and identify it on the graph)

Axis of Symmetry:

splits parabola into 2 equal halves

Vertex:

highest or lowest point where parabola changes direction

Maximum or minimum:

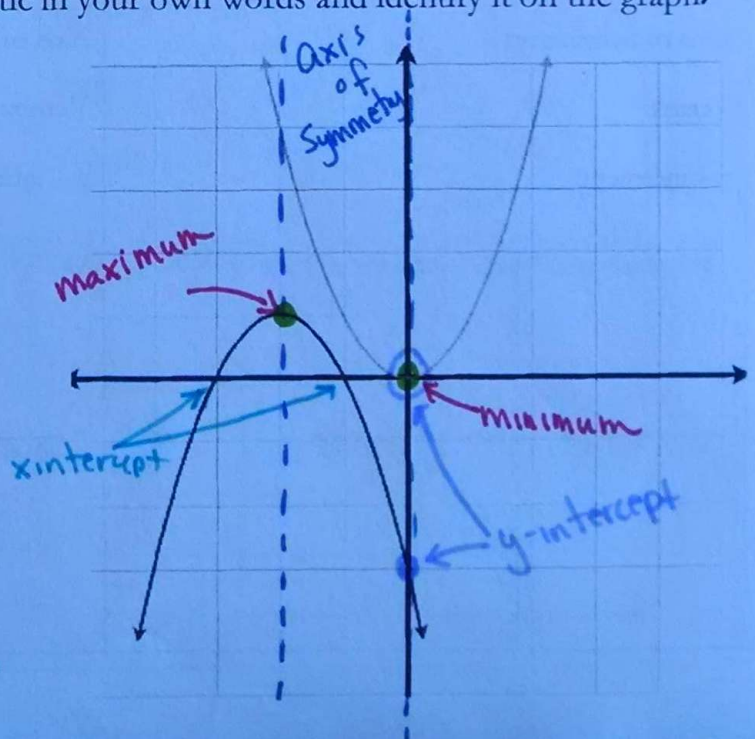
highest point
lowest point

y-intercept:

where parabola crosses y-axis
(0, y)

x-intercept: AKA roots or zeros

where parabola crosses x-axis



Graphing Quadratics

Explain how you find the following characteristics:

<p><u>Axis of symmetry:</u></p> $x = \frac{-b}{2a}$ <p>(x-value of the vertex)</p>	<p><u>Vertex:</u></p> <p>plug in x-value from axis of symmetry into function to find y-value (-b/2a)</p>	<p><u>y-intercept:</u></p> <p>(0, c)</p> $ax^2 + bx + c$
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Graph each function by finding the following characteristics.

$y = x^2 + 6x + 5$
 $a=1$ $b=6$ $c=5$
 Axis of Symmetry: $x = \frac{-b}{2a} = \frac{-6}{2(1)} = -3$
 Vertex: $(-3)^2 + 6(-3) + 5 = 9 - 18 + 5 = -4$
 y-intercept: $(0, 5)$

$(-2)^2 + 6(-2) + 5 = (-2, -3)$
 $(-4)^2 + 6(-4) + 5 = (-4, -3)$
 Domain: \mathbb{R} (all real #s)
 Range: $y \geq -4$

$y = x^2 - 4x - 8$
 $a=1$ $b=-4$ $c=-8$
 Axis of Symmetry: $x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = 2$
 Vertex: $(2)^2 - 4(2) - 8 = 4 - 8 - 8 = -12$
 y-intercept: $(0, -8)$

$(6)^2 - 4(6) - 8 = (6, 4)$
 Domain: \mathbb{R}
 Range: $y \geq -12$
 minimum value of -12

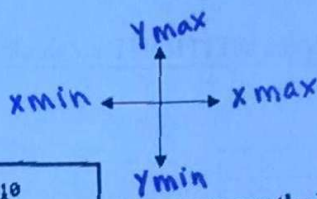
$y = 2x^2 - 4x$
 Axis of Symmetry: $x = \frac{-(-4)}{2(2)} = 1$
 Vertex: $2(1)^2 - 4(1) = 2 - 4 = -2$
 y-intercept: $(0, 0)$

$y = -\frac{1}{2}x^2 + 4x - 6$
 Axis of Symmetry: $x = \frac{-4}{2(-\frac{1}{2})} = 4$
 Vertex: $-\frac{1}{2}(4)^2 + 4(4) - 6 = -8 + 16 - 6 = 2$
 y-intercept: $(0, -6)$

Domain: \mathbb{R}
 Range: $y \leq 2$

Calculator Instruction

To Find the Vertex of a Quadratic Function

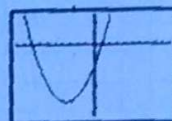


Graph function in y= Adjust the WINDOW

```

WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-10
Ymax=10
Yscl=1
Xres=1
    
```

so you can see the Vertex



2nd → TRACE (Calc) → 3: Minimum
→ 4: Maximum

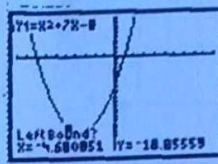
```

MATH
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
    
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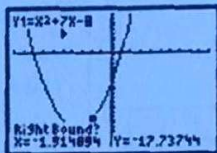
Set LEFT boundary using arrows
(use Right and Left Arrows)



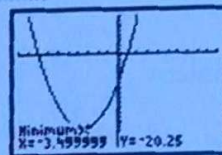
ENTER.



Set RIGHT boundary → ENTER
(use Right and Left Arrows)



ENTER again



Using a calculator find the following characteristics:

a) $y = x^2 - 8x - 20$

Vertex: $(4, -36)$

Axis of Symmetry: $x = 4$

y-intercept: $(0, -20)$

Max or Min Value: min of -36

x-intercepts: $(-2, 0) + (10, 0)$

Domain: \mathbb{R}

Range: $y \geq -36$

Factors: $(x + 2)(x - 10)$

b) $f(x) = -x^2 - 5x + 24$

Vertex: $(-2.5, 30.25)$

Axis of Symmetry: $x = -2.5$

y-intercept: $(0, 24)$

Max or Min Value: 30.25

x-intercepts: $(-8, 0) + (3, 0)$

Domain: \mathbb{R}

Range: $y \leq 30.25$

Factors:

c) An object is launched directly upward at 64 feet per second from a platform 80 feet high. The function used to model this situation: $s(t) = -16t^2 + 64t + 80$.

What will the maximum height of the object be? 144ft

When will it attain its maximum height? 2 sec

How long until the object reaches the ground? 4 sec

Domain:

$0 \leq x \leq 4$

Range:

$0 \leq y \leq 144$

