Characteristics of Quadratic Relations

Key Concepts:

- vertex
- zeroes
  - where are they?
  - how many? 0, 1, or 2
- axis of symmetry
- direction of opening
- maximum or minimum value

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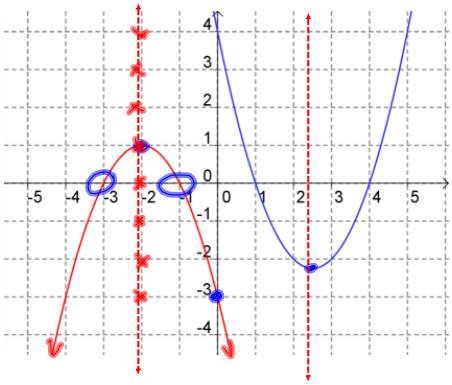
Consider the two graphs shown:



Can you deduce values for each of the following?

Property	$y = -x^2 - 4x - 3$	$y = x^2 - 5x + 4$
Location of Vertex?	(-2, 1)	(2.5, -2.25)
Maximum or Minimum?	max	min
Max/Min Value?	1	-2.25
Number of Zeroes?	2	2
Location of Zeroes?	-3, -1	1, 4
Symmetry?	$x = -2$	$x = 2.5$
y-int	-3 or (0, -3)	4 or (0, 4)

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The vertex is the highest or lowest point on the parabola, and we refer to its coordinates as (h, k).

The axis of symmetry is the vertical line passing through the vertex, having the equation x = h.

If the parabola opens up, the coefficient of x^2 is positive ($\Delta^2 y > 0$)
- the vertex is the lowest point
- the minimum (or optimum) value is k

$\Delta y = y_2 - y_1$ 1st difference

$\Delta^2 y = \Delta y_2 - \Delta y_1$ 2nd diff.

If the parabola opens down, the coefficient of x^2 is negative ($\Delta^2 y < 0$):
- the vertex is the highest point
- the maximum (or optimum) value is k

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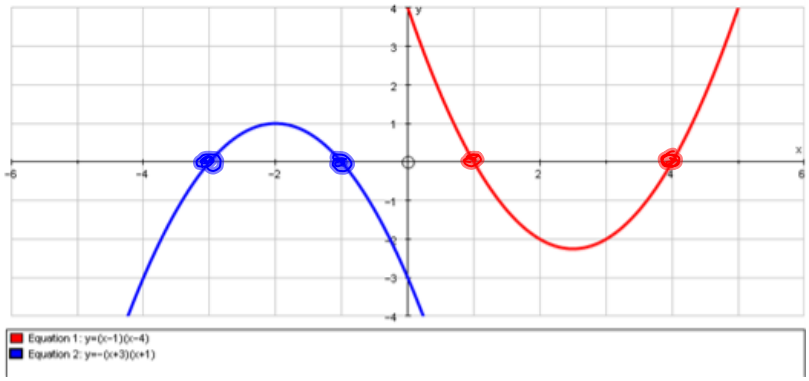
If the parabola crosses the x-axis, the x-coordinates of the crossing points are called the zeroes, or roots, or x-intercepts.

A parabola may have two zeros:



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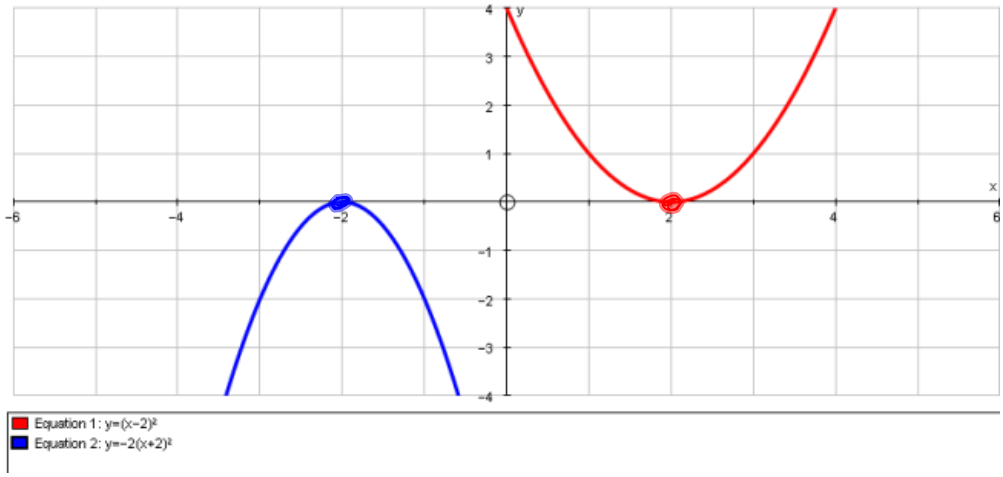
Or one zero:



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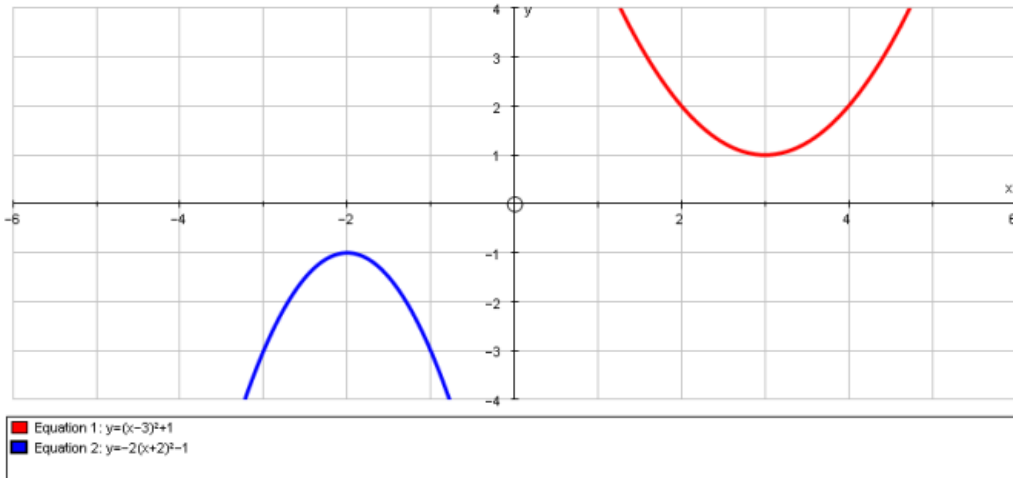
Or no zeroes:



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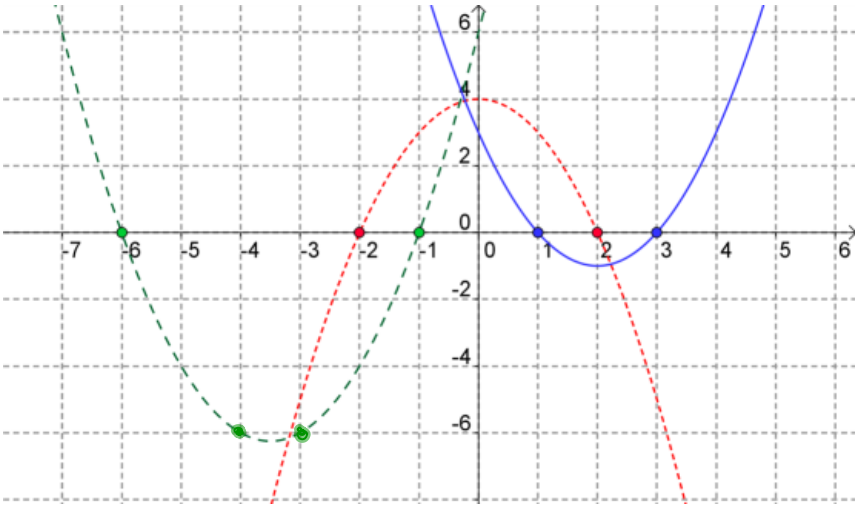
Ex.1. From your graphs, determine key features of each.

$y = x^2 - 4x + 3$ $y = -x^2 + 4$ $y = x^2 + 7x + 6$



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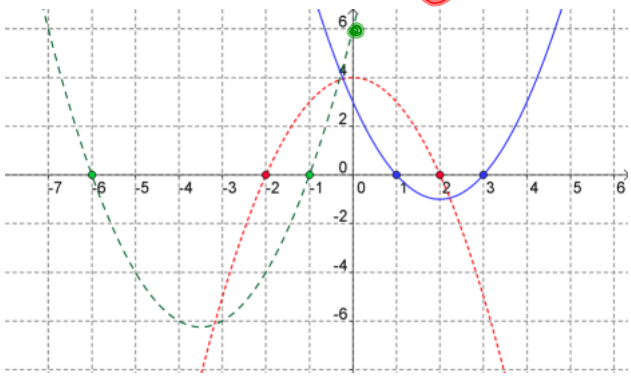
$y = x^2 - 4x + 3$ $y = -x^2 + 4$ $y = x^2 + 7x + 6$

vertex	(2, -1)	(0,4)	(-3.5, -6.25)
opening	up	down	up
max/min?	min	max	min
max/min value	-1	4	-6.25
y-intercept	3	(0,4)	6
zeroes	1, 3	{-2, 2}	-6, -1
axis of symmetry	x = 2	x=0.	x = -3.5



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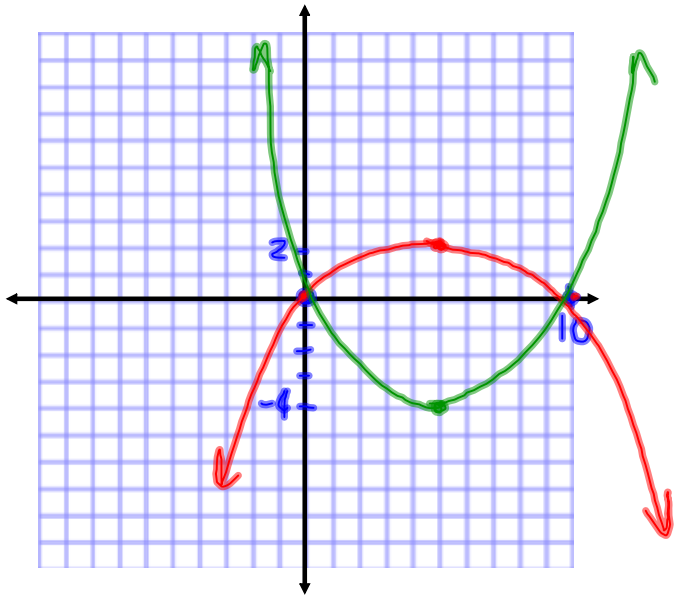
Assigned Work:

p. 145 # 1-6, 7ef, 9ab

p 146 # 3 (0,0) (10, 0)



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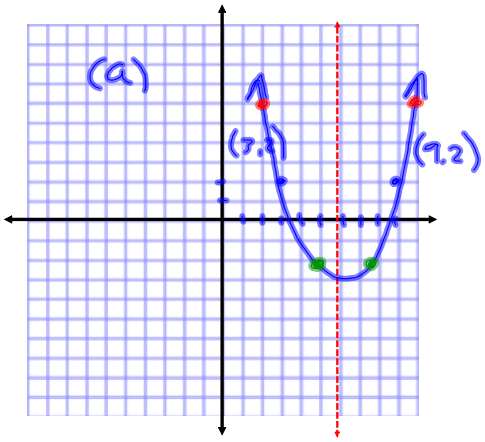
p.147 #9

(a)



(b) $(-18, 3)$
$(7, 3)$

$x_m = \frac{x_1 + x_2}{2}$

$= \frac{-18+7}{2}$

$= -5.5$

AoS: $x = -5.5$

Given ~~(3,2)~~, $(-5, 4)$, $(11, 4)$
find the AoS.

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