Characteristics of Quadratic Relations

Oct 19/2011

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

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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

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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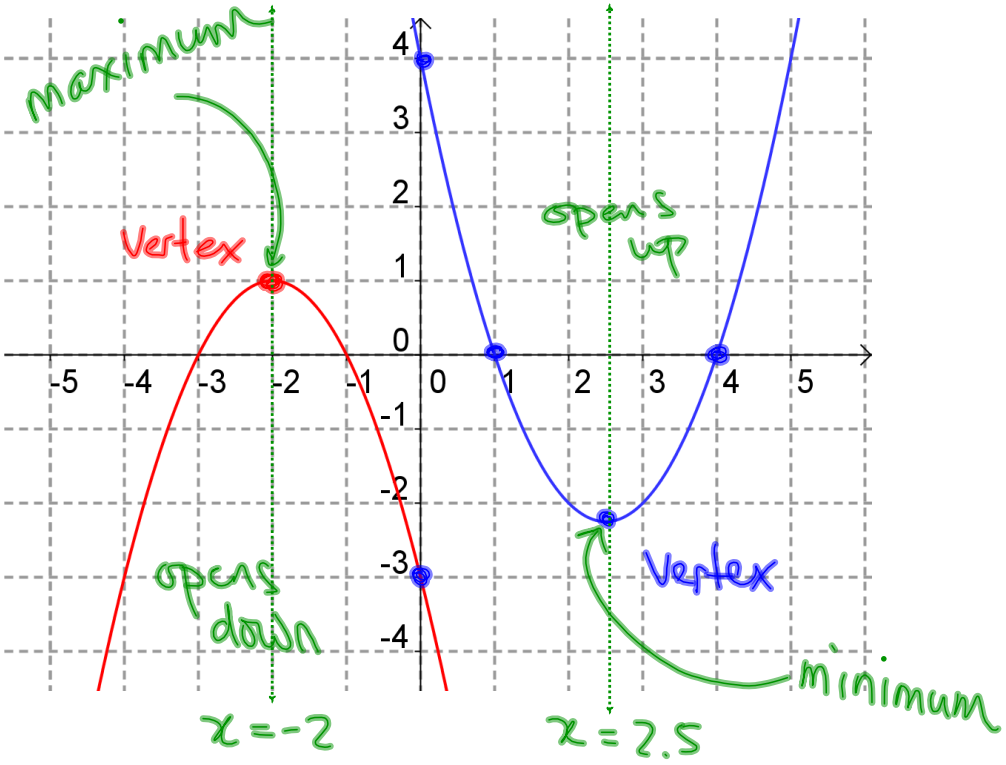
Consider the two graphs shown:



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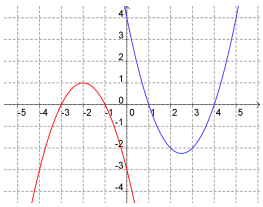
Ex.1. Consider the two graphs:

Can you deduce values for each of the following?



Property	$y = -x^2 - 4x - 3$	$y = x^2 - 5x + 4$
Direction of Opening	down	up
Maximum or Minimum	maximum	minimum
Number of Zeroes	2	2
Axis of Symmetry	$x = -2$	$x = 2.5$
Max/Min Value	1	-2.25
Location of Vertex	(-2, 1)	(2.5, -2.25)
Location of Zeroes	-1 and -3	1 and 4
y-intercept	-3	4

to find min value for $y = x^2 - 5x + 4$

Sub $x = 2.5$ $y = (2.5)^2 - 5(2.5) + 4$

$= 6.25 - 12.5 + 4$

$= -2.25$

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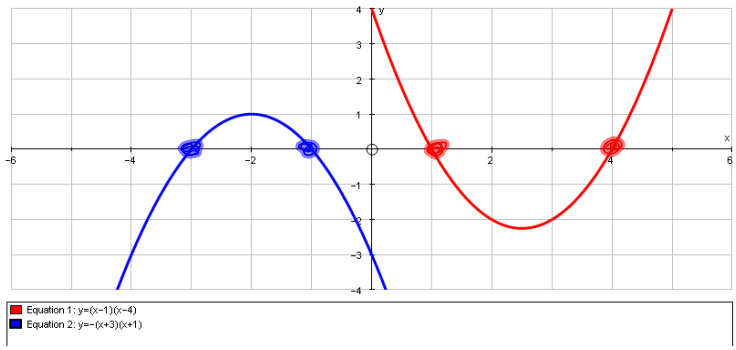
If the parabola crosses the x-axis, the x-coordinates of the crossing points are called the zeroes, or roots, or x-intercepts.

at most

A parabola may have two zeros:



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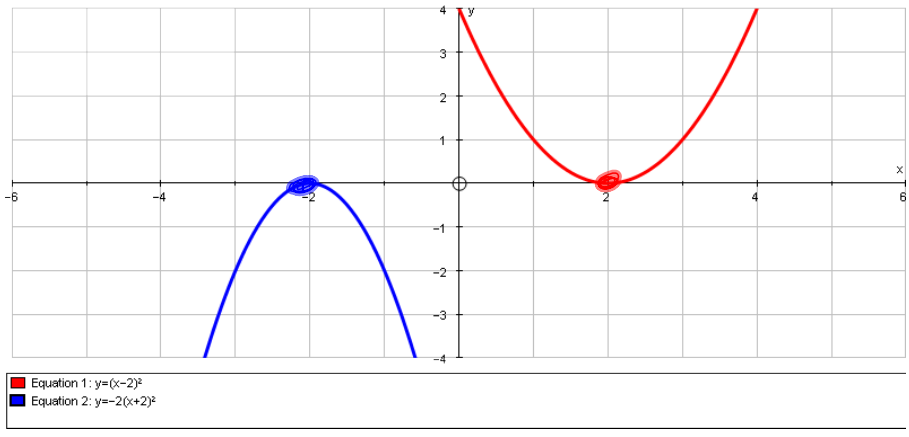
Or one zero:



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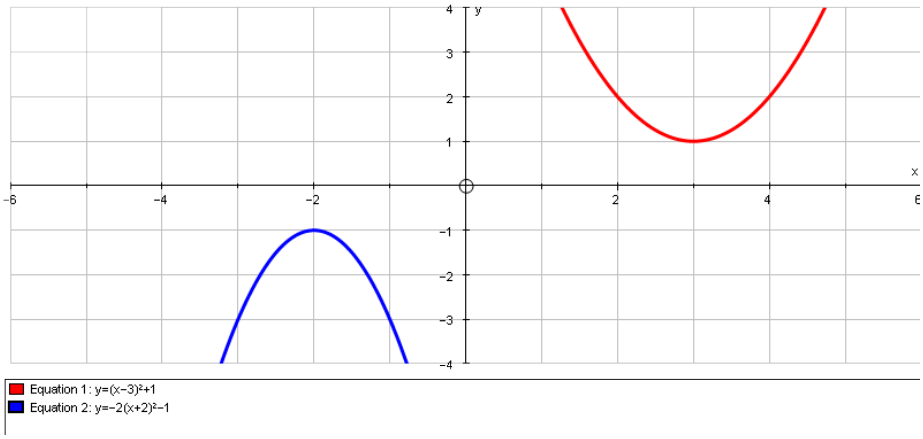
Or no zeroes:



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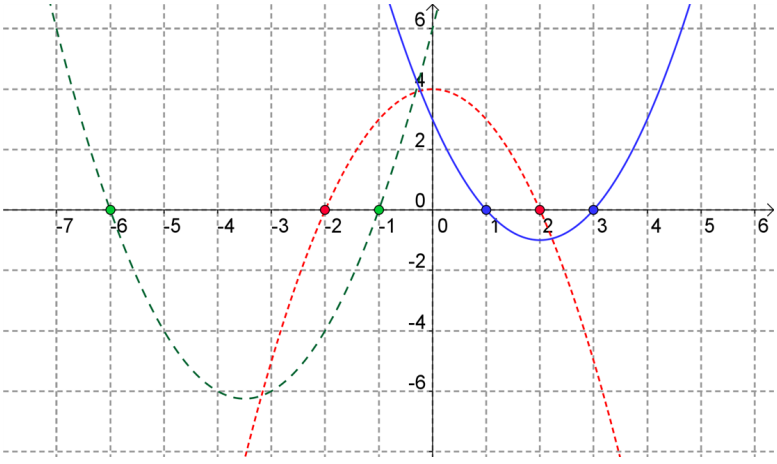
Ex.2. From your graphs, determine key features of each.

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



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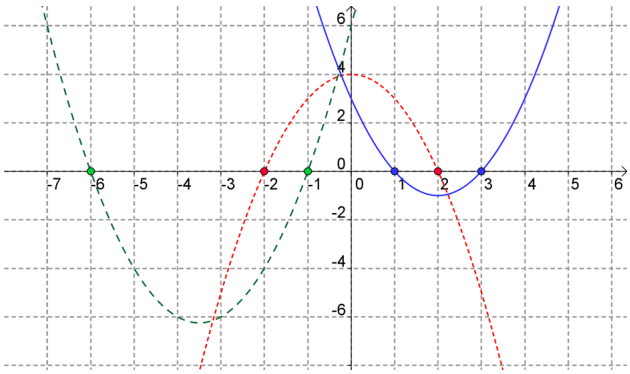
$y = x^2 - 4x + 3$ $y = -x^2 + 4$ $y = x^2 + 7x + 6$

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	4	6
zeroes	1 and 3	-2 and 2	-1 and -6
axis of symmetry	x=2	x=0	x=-3.5



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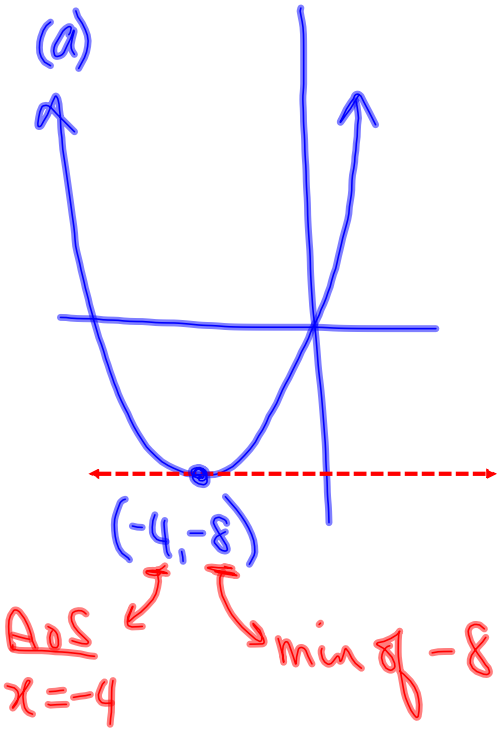
Assigned Work:

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

#6. (v) max/min.

(a)



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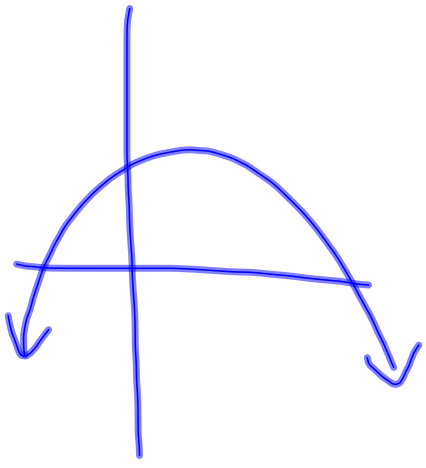
4. (iv) 2nd diff + or − ?



$\Delta^2 y$ negative

$\Delta^2 y < 0$

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