Name: Key

Lesson 4.2 Analyzing a Graph

Quadratic = equation with x^2 : $ax^2+bx+c=0$

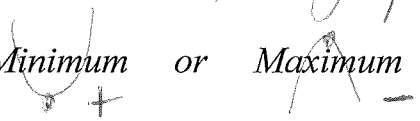
NOT x^3, 2^x, $\sqrt{x}$, x^{-1}, $x^{1/2}$

Parabola = shape of the graph

Regular Pattern: +1, +3, +5, +7 ...

Vertex = where the graph changes direction

Minimum or *Maximum*



Axis of Symmetry = Line down the middle of parabola

Equation for the Axis of Symmetry: $x=p$

Domain = all possible x-values

All quadratic equations have a domain of all reals

Range = all possible y-values

All quadratic equations have a range limited by the min/max

Intercepts = where the graph crosses the axis

Y-Intercept = $(x=0)$ *X-Intercept* = $(y=0)$

Vertex Form = $y=a(x-p)^2+q$

The vertex form is used for graphing

Standard Form = $ax^2+bx+c=0$

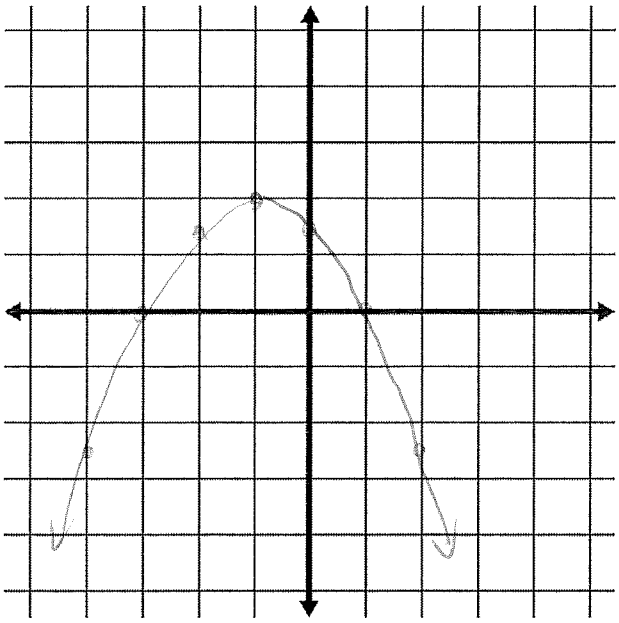
The standard form is for solving

Using your calculator:

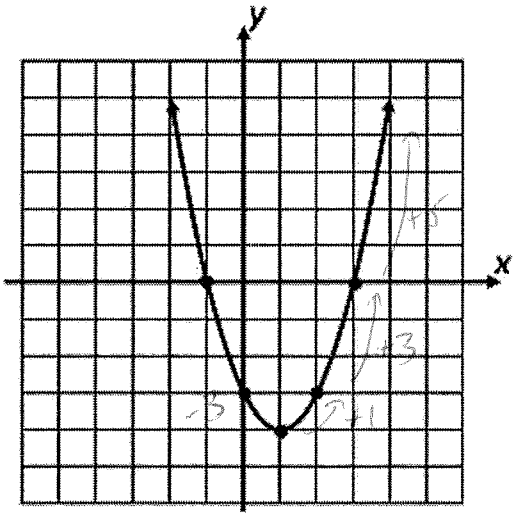
Example #1: Create a table of values and graph the parabola

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

x	y
-1	2
0	1.5
2	-2.5



Example #2: Analyze the graph and write an equation to match:



Vertex: (1, -4)

Axis of Symmetry: x = 1

Y-Intercept: -3

X-Intercepts: -1, 3

Domain: all reals

Range: $y \geq -4$

Pattern: +1, +3, +5

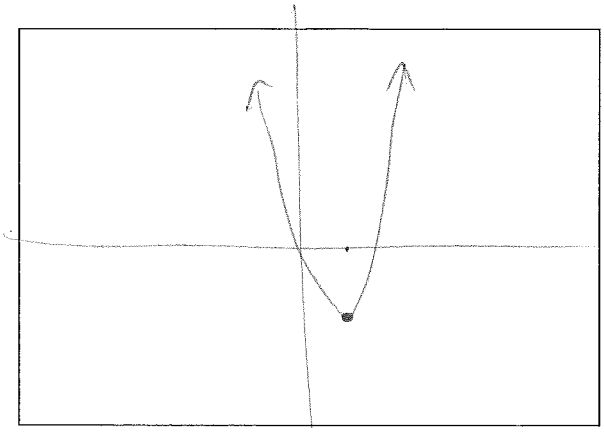
Equation: $y = (x-1)^2 - 4$

Example #3: Analyze the equation $y + 4 = 2(x - 2)^2$

a) Arrange the equation so that it follows the vertex form of $y = a(x - p)^2 + q$

$y = 2(x-2)^2 - 4$

b) Sketch the graph and indicate your window size:



c) Use your calculator to determine the vertex:

CALC minimum = (2, -4)

d) What is the equation for the Axis of Symmetry?

$x = 2$

e) What are the x and y intercepts for the graph?

CALC value $x=0 \rightarrow y=-4$ CALC zero $x = .586$, $x = 3.41$

e) What is the domain and range of the graph?

D: $x \in R$ (all reals) R: $y \geq -4$

f) What is the pattern that each value goes up by?

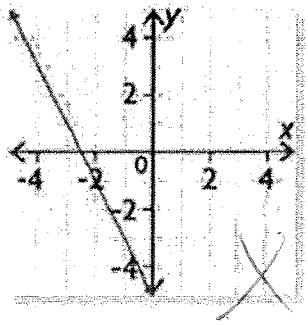
+2, +6, +10 . . .

Assignment

Part 1:

1) Which graphs appear to represent quadratic relations? (parabolas)

a)



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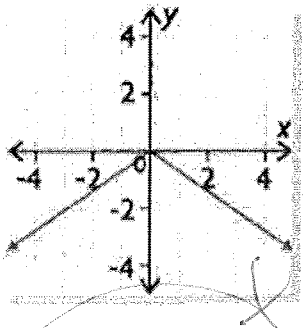

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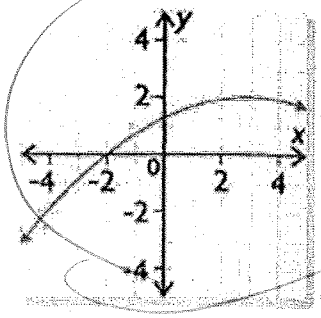
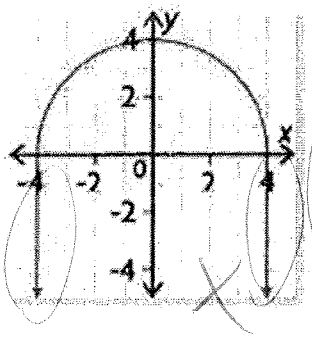
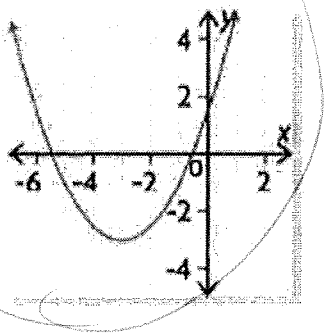


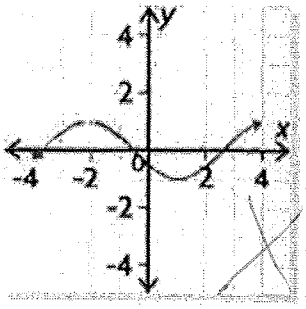
b)



d)



f)



2) Which of the following relations are quadratic?

a) $y = 2x - 7$ No
b) $y = 2x(x + 3)$ $2x^2+6x$ ✓
c) $y = (x + 4)^2+1$ ✓
d) $y = x^2 - 5x - 6$ ✓
e) $y = 4x^3 + x^2 - x$ No
f) $y = x(x + 1)^2 - 7$ x^3 ✗

3) Find the y-intercept for each quadratic relation in #2 (HINT: when $x = 0$)

a)
b) $y=2(0)(0+3)=0$
c) $y=(0+4)^2+1=17$
d) $y=0^2-5(0)-6=-6$
e)
f)

4) Explain why a cannot be zero for a quadratic in the form of
$y = ax^2 + bx + c$

if a was 0, there would be no x^2 term
$y = bx + c$ is just a straight line.

5) Does the parabola open up or down?
a) $y = x^2 - 4$ up
b) $y = -2x^2 + 6x$ down
c) $y = 9 - x + 3x^2$ up
d) $y = -\frac{2}{3}x^2 - 6x + 1$ down

6) Does each parabola open up or down?

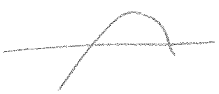
a)

x	−4	−3	−2	−1	0	1
y	12	5	0	−3	−4	−3


up

b)

x	0	1	2	3	4	5
y	−13	−3	3	5	3	−3


down

c)

x	−5	−4	−3	−2	−1	0
y	3.0	−0.5	−3.0	−4.5	−5.0	−4.5


up

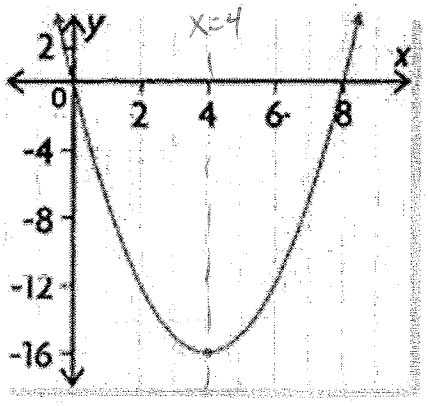
d)

x	0	1	2	3	4	5
y	−4	19	40	59	76	91


down

Part 2:

1) Analyze the following parabola:



a) equation of the axis of symmetry = $x = 4$

b) Vertex: $(4, -16)$

c) Domain: all reals Range: $y \geq -16$

2) State the coordinates of the y-intercept and two additional points for each function

a) $f(x) = 2x^2 + 8x + 8$

y-intercept = 8

two other points

x	y	
1	18	$2(1)^2 + 8(1) + 8$
2	32	$2(2)^2 + 8(2) + 8$

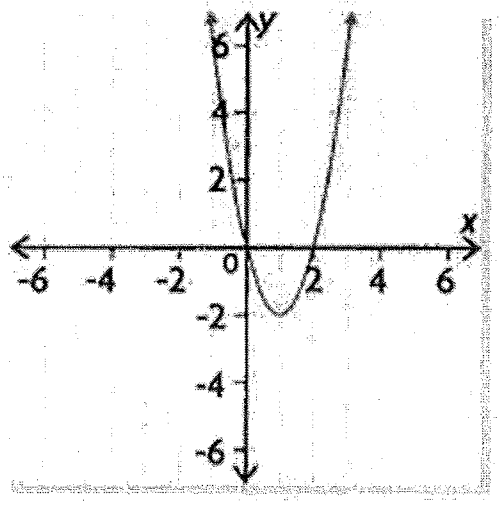
b) $f(x) = 4x - x^2$

y-intercept = 0

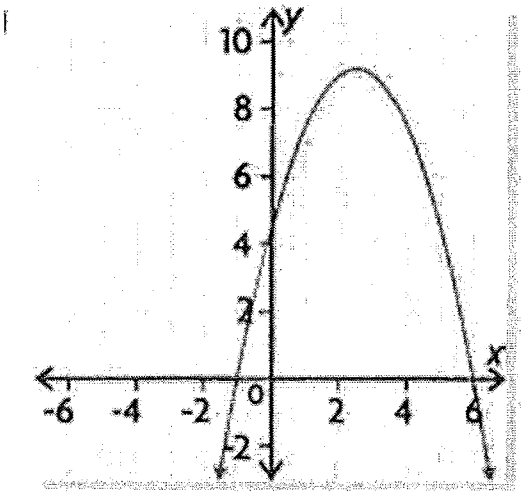
two other points

x	y	
1	3	$4(1) - (1)^2$
2	4	$4(2) - (2)^2$

3) Analyze each of the following



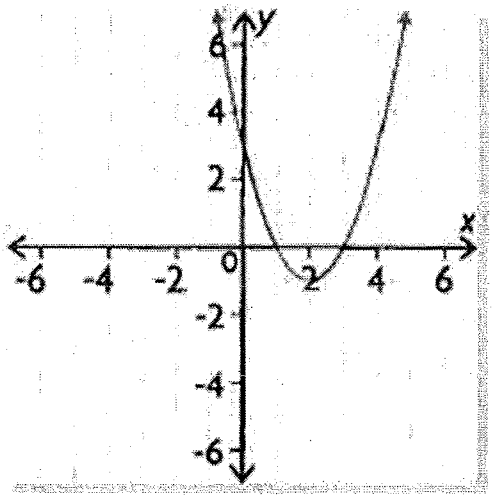
x-intercept	0, 2
y-intercept	0
Axis of Symmetry	x=1
Vertex	(1, -2)
Domain	all reals
Range	y≥-2



x-intercept	-1, 6
y-intercept	4
Axis of Symmetry	x=3
Vertex	(3, 9)
Domain	all reals
Range	y≤9

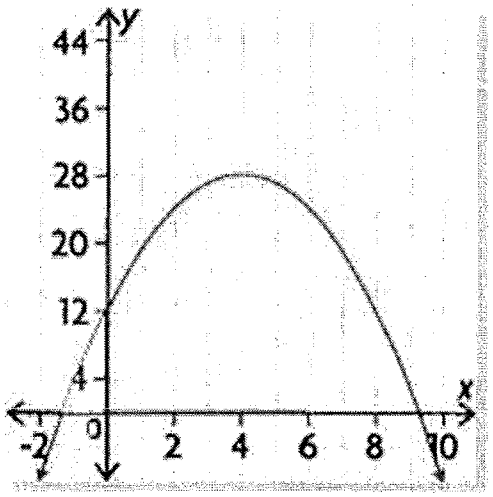
4) Analyze each of the following:

a)



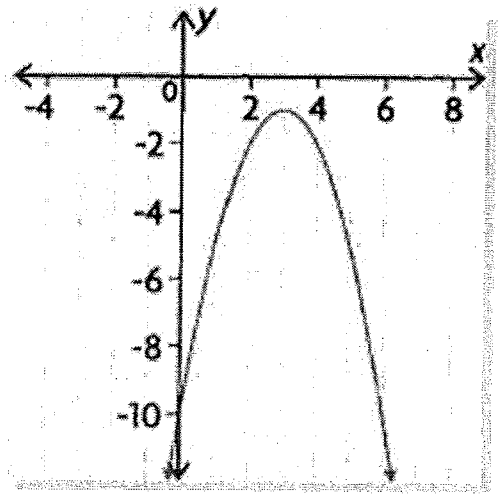
Axis of Symmetry	x=2
Vertex	(2, -1)
Domain	all reals
Range	y≥-1

b)



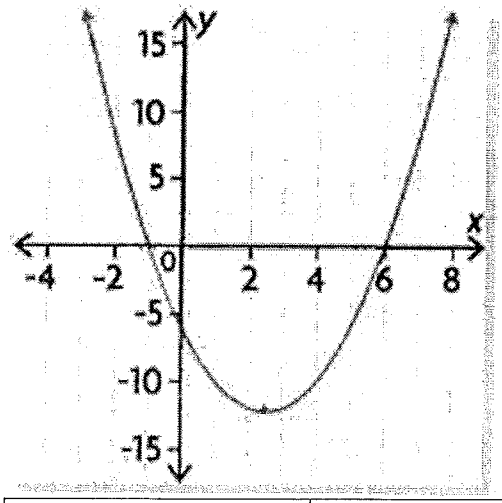
Axis of Symmetry	x=4
Vertex	(4, 28)
Domain	all reals
Range	y≤28

c)



Axis of Symmetry	x=3
Vertex	(3,-1)
Domain	all reals
Range	y≤-1

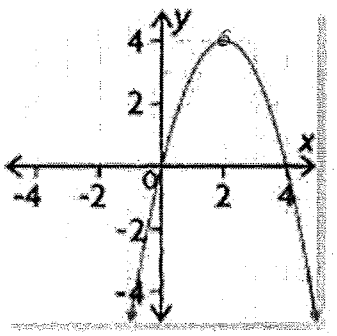
d)



Axis of Symmetry	x=2,5
Vertex	(2.5, -12)
Domain	all reals
Range	y≥-12

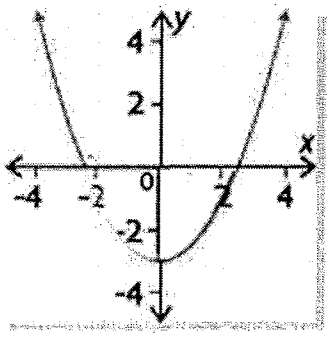
6) Find the minimum or maximum value

a)



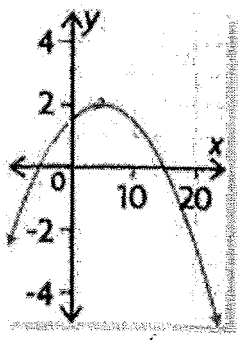
MAX (2,4)

b)



MIN (0,-3)

c)



MAX (5,2)

Answers:

Part 1

1. a) not a quadratic relation
   b) not a quadratic relation
   c) not a quadratic relation
   d) quadratic relation
   e) quadratic relation
   f) not a quadratic relation
2. a) not a quadratic relation
   b) quadratic relation
   c) quadratic relation
   d) quadratic relation
   e) not a quadratic relation
   f) not a quadratic relation
3. b) 0 c) 17 d) −6
4. e.g., If $a = 0$, then $y = bx + c$, which is a linear relation, not a quadratic relation.
5. a) up, $a > 0$
   b) down, $a < 0$
   c) up, $a > 0$
   d) down, $a < 0$
6. a) up
   b) down
   c) up
   d) down

Part 2

1. a) $x = 4$
   b) (4, −16)
   c) $\{(x, y) \mid x \in R, y \geq -16, y \in R\}$
2. a) (0, 8); e.g., (1, 18), (−1, 2)
   b) (0, 0); e.g., (1, 3), (−1, −5)
3. a) (0, 0), (2, 0); (0, 0); $x = 1$; (1, −2); $\{(x, y) \mid x \in R, y \geq -2, y \in R\}$
   b) (−1, 0), (6, 0); (0, 4.5); $x = 2.5$; (2.5, 9.2); $\{(x, y) \mid x \in R, y \leq 9.2, y \in R\}$
4. a) $x = 2$; (2, −1); $\{(x, y) \mid x \in R, y \geq -1, y \in R\}$
   b) $x = 4$; (4, 28); $\{(x, y) \mid x \in R, y \leq 28, y \in R\}$
   c) $x = 3$; (3, −1); $\{(x, y) \mid x \in R, y \leq -1, y \in R\}$
   d) $x = 2.5$; (2.5, −12.25); $\{(x, y) \mid x \in R, y \geq -12.25, y \in R\}$
5. a) graph d; (2.5, −12.25)
   b) graph b; (4, 28)
   c) graph c; (3, −1)
   d) graph a; (2, −1)
6. a) maximum of 4
   b) minimum of −3
   c) maximum of 2

Practice Quiz

Analyze the following quadratic equation and then draw the graph:

$y = -2(x+4)^2 + 8$

Horizontal shift (p)	
Vertical shift (q)	
Vertex	
Stretch factor (a)	
Compressed Vertically OR **Stretched** Vertically	
Minimum (opens up) OR **Maximum** (opens down)	
Equation of the Axis of Symmetry	
Domain	
Range	

x	*y*