

Lesson – Forms of Quadratic Equations – Vertex Form Date:

(A) Lesson Objectives

- a. Introduce the vertex form of the equation of a quadratic relation by means of investigations
- b. Determine how to identify key features of parabolas from the vertex form of an equation
- c. Present real world applications involving the vertex form of quadratic equations

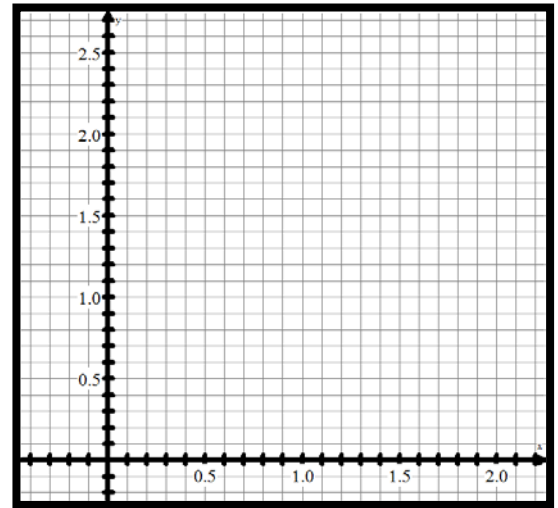
(B) Investigation #2 – Ball Bounce Experiment

Recall in Station #2, you gathered data for a ball bounce → Today you will write the equation(s) that model how the volleyball's height changes over time .

- a. Complete a data here

Time (sec)	1.2	1.4	1.65	1.95	2.05	2.15
Height (m)	0.017	0.700	1.011	0.597	0.270	0.031

- b. Graph the equation on your TI-84 in an appropriate window.
- c. Determine the equation for this quadratic relation in factored form _____.



- d. Expand your equation and record it here:

- e. Where does the vertex appear to be? _____.

- f. Rewrite your equation in the form of $y = a(x - h)^2 + k$, where h is the x co-ordinate of the vertex and k is the y co-ordinate of the vertex and a is the same value that you have determined in part (c). This equation is written in VERTEX FORM. _____.

- g. Expand your equation and record it here:

(C) Vertex Form of the Quadratic Equation

All of the quadratics you will investigate are presented in the form of $y = a(x - h)^2 + k$. How do the values of the **parameters a, h, k** affect the graph?

1. Visit the website <http://www.anlyzemath.com/quadratics/quadratics.htm>. Describe what happens to the graph as you change the value of a .

2. Visit the website <http://www.anlyzemath.com/quadratics/quadratics.htm>. Describe what happens to the graph as you change the value of h .

3. Visit the website <http://www.anlyzemath.com/quadratics/quadratics.htm>. Describe what happens to the graph as you change the value of k .

(D) Consolidation of Investigations → Key Points

- a. Equations in the form of $y = a(x - h)^2 + k$ are _____, provided that _____.
- b. The y-intercept can be found _____.
- c. If $a > 0$, the parabola opens _____ and has _____.
- d. If $a < 0$, the parabola opens _____ and has _____.
- e. The axis of symmetry can be found → _____.
- f. The optimal value can be determined → _____.
- g. The zeroes of the quadratic can be determined by setting _____ and then _____.

(E) Finding Information from the Vertex Form

a. Ex #1: For the relation $y = -3(x + 5)^2 + 12$,

- i. Find the co-ordinates of the vertex. _____.
- ii. Find the equation of the axis of symmetry _____.
- iii. Find the direction of opening _____.
- iv. State the max/min value _____. Is it a max or a min? _____.
- v. Determine the zeroes

vi. Write the equation in standard form

vii. Write the equation in factored form

viii. Sketch the parabola

b. Ex #2: Determine the equation of parabola whose vertex is at (3,-2) and has a y-intercept at -20:

c. Ex #4: A parabola has the equation $y = -x^2 + 4x + 12$. Determine:

- i.* if the parabola has a maximum or minimum value? _____.
- ii.* the equation of the axis of symmetry of the parabola. _____.
- iii.* the co-ordinates of the vertex. _____.
- iv.* The zeroes of the parabola. _____.
- v.* Write the equation in VERTEX FORM. _____.
- vi.* Sketch the parabola.

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- d. Ex #6 → Mr. S throws a ball upward from the roof of the building and it falls to the ground. Its path is approximated by the relation $h = -4.9(t - 2.4)^2 + 29$, where h is the height above the ground in meters and t is the elapsed time in seconds.
- i. How high is the building?
 - ii. What are the co-ordinates of the vertex? What does the vertex mean?
 - iii. How high was the ball after 2.0 s? Was it going up or down at the time?
 - iv. Was the ball still in the air after 5.0 s?
 - v. What are the zeroes of this relation? What do they mean?
- e. Ex #3: From our **Optimizing Profit/Loss Problem** → Recall in Station #5, you gathered data for a revenue question → A hockey arena seats 1600 people. The cost of a ticket is \$10. At this price, every ticket is sold. To increase revenue, the arena management plans to increase ticket prices. They conduct a survey and determine that for 50 cent increase in price, 50 less people will attend. Complete the data table and then write the equation of the relation in VERTEX FORM.

“x” → # of increments	0	2	4	6	8	10	12	14	16
“y” → revenue									

(F) Homework

From the [Nelson 10 textbook, Sec 4.2, p351, Q1, 2bcf, 3e, 7cd, 9e, 11](#), and Q13, 15 are word problems