

Lesson – Forms of Quadratic Equations – Standard Form & Factoring Date:

(A) Lesson Objectives

- Introduce the standard form of the equation of a quadratic relation by means of investigations
- Determine how to change from the standard form of an equation to the factored form
- Present real world applications involving zeroes of parabolas.

(B) Standard Form of the Quadratic Equation

All of the quadratics you will investigate are presented in the form of $y = ax^2 + bx + c$. How do the values of the **parameters a, b, c** affect the graph?

- Use a graphing calculator to graph $y = 2x^2 + 4x + c$ when $c = 0$. Describe what happens to the y-intercept as you change the value of c to 6, 3, -3, -6.

- Use a graphing calculator to graph the equations below. Use the GDC to calculate the co-ordinates of the vertex and thus the axis of symmetry. Then, evaluate the expression $-\frac{b}{2a}$ from the coefficients of the equation $y = ax^2 + bx + c$.

EQUATION	Axis of Symmetry from GDC	$-\frac{b}{2a}$
$y = 2x^2 + 8x + 2$		
$y = 3x^2 + 18x + 2$		
$y = x^2 + 5x + 2$		
$y = -2x^2 - 4x + 2$		
$y = 2x^2 - 8x + 2$		

- Which of the quantities a, b , or c affects whether the graph has a maximum or a minimum value? How can you PREDICT where a parabola has a maximum or minimum?
- Which of the quantities a, b , or c affects where the graph has its axis of symmetry? How can you PREDICT where a parabola has a maximum or minimum?
- Which of the quantities a, b , or c affects where the graph has its y-intercept? How can you PREDICT where a parabola has its y-intercept?

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(C) Consolidation of Investigations → Key Points

- a. Equations in the form of $y = ax^2 + bx + c$ 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 _____.

(D) Finding the Zeroes from Standard Form → Factoring

- a. Factor each expression:

(a) $x^2 - 16$	(b) $x^2 + 4x + 4$	(c) $x^2 - 5x + 6$	(d) $x^2 - 14x + 45$	(e) $4x^2 + 12x - 40$

- b. Solve by factoring:

(a) $x^2 - 25 = 0$	(b) $x^2 + 6x + 9 = 0$	(c) $x^2 - 3x - 10 = 0$	(d) $x^2 - 2x - 15 = 0$	(e) $3x^2 + 9x - 30 = 0$

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c. Solve by factoring:

(a) $3x^2 + 8x + 4 = 0$	(b) $10x^2 + 3x - 1 = 0$	(c) $5x^2 - 11x + 2 = 0$
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d. A parabola has the equation $y = -x^2 + 3x + 18$. 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.* Sketch the parabola.

e. Ex 3 → 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 $h = -5t^2 + 5t + 30$, 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 zeroes of the relation? What do they mean?
- iii.* What are the co-ordinates of the vertex? What does the vertex mean?

(E) Homework

From the Nelson 10 textbook, Sec 3.9, p315, Q1ch, 2abhik, 3bfhi, 6ac, and Q9,12,13,15 are word problems

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(F) Investigation #1 – Pillow Toss

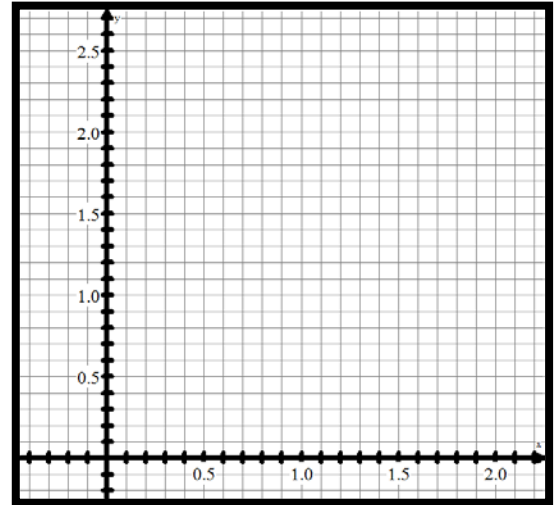
Recall in Station #1, you gathered data for a pillow toss → Today you will write the equation(s) that model how the pillow's height changes over time .

a. Complete a data here

Time (sec)	0	0.55	0.9	1.55	1.8	2.05
Height (m)	1.27	2.36	2.52	1.65	0.95	0.02

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. Only one of the zeroes has a meaning in the context of the question. Which one and why?

f. Now we will do a QUADRATIC REGRESSION calculation → record the equation that the calculator presents to you → _____. This equation is written in STANDARD FORM.