(A) Lesson Context

BIG PICTURE of this UNIT:	• How do we analyze and then work with a data set that shows both increase and decrease • What is a parabola and what key features do they have that makes them useful in modeling applications • How do I use graphs, data tables and algebra to analyze quadratic equations?		
CONTEXT of this LESSON:	Where we've been In Lesson 7, you learned how to solve quadratic equations by factoring	Where we are We can algebraically solve quad eqns other methods & also using technology	Where we are heading How can I use graphs and equations to make predictions from quadratic data sets & quadratic models and quadratic equations

(B) Lesson Objectives:

a. Review the algebraic skills of solving by factoring
b. Practice solving quadratic equations using the Quadratic Formula
c. Use the skills of factoring to solve quadratic equations

(C) FAST FIVE: Practicing Skills: Solve by Factoring

Solve the following equations by factoring

(a) $x^2 + 9x + 18 = 0$

(b) $x^2 - 11x + 24 = 0$

(c) $x^2 - 10x + 22 = -2$

(d) $x^2 - 12 = 6 - 3x$

(e) $3x^2 - 12 = 16x$

(f) $3x^2 + 9x - 54 = 0$

(g) $7x^2 - 42 = -35x$

(h) $5x^2 - 44x + 120 = 11x - 30$

(i) $x^2 + 2x - 4 = 0$

(C) Changing from Factored Form to Standard Form: Skill REVISITED

You are now given pairs of zeroes/x-intercepts OR you are given solutions to the equation f(x) = 0 → you must write an equation of the parabola that has these zeroes/solutions, both in factored form and in standard form

(a) SKILLS REVIEW: A fcn has two zeroes at x = -3 and x = 5 and let the value of ***a*** be 2

(b) SKILLS REVIEW: A fcn has 2 zeroes at x = 4 and x = 9 and the y-intercept is (0,-72)

(c) The fcn y = h(x) has h(-1) = 0 as well as h(11) = 0 and the minimum value of h(x) is -72.

(d) The equation f(x) = 0 has solutions of x = -3 and x = 2.5 and we also know that f(0) = 30

(e) The equation g(x) = 0 has solutions of x = -3 and x = -3 and we also know that g(-5) = -8

(f) The zeroes of y = f(x) are at 5 and -5. The maximum value of f(x) is $\frac{25}{4}$.

(g) The two solutions to the eqn f(x) = 0 are $x_1 = \frac{2}{3}$ and $x_2 = -\frac{1}{2}$ and we also know that f(0) = -4

(h) The two solutions to the eqn g(x) = 0 are $x_1 = \frac{5}{7}$ and $x_2 = -\frac{4}{3}$ and we also know that g(0) = 5.

(i) The two solutions to the eqn h(t) = 0 $t_1 = -0.05$ and $t_2 = 0.20$ and we also know that h(0) = -0.1.

(D) Solving Quadratic Equations using the Quadratic Formula

RECALL: From your video HW, the Quadratic Formula is $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, which can be used to solve equations in the form of $0 = ax^2 + bx + c$.

Solve each equation using the quadratic formula:

1) $x^2 + 4x - 5 = 0$

2) $x^2 + 3x - 5 = 0$

3) $x^2 + 3x + 2 = 0$

4) $2x^2 + x - 1 = 0$

5) $3x^2 + 5x + 2 = 0$

6) $3x^2 + 5x + 1 = 0$

7) $2x^2 + x = 10$

8) $-3x^2 + 2x = 24$

9) $x^2 = x - 2$

10) $\frac{1}{2}x^2 + 8 = 6x$

11) $2x^2 - x = 4x$

12) $x^2 - 9 = 0$

(E) Investigation: Solving Quadratic Equations

You have seen two different methods of solving quadratic equations (factoring and using the quadratic formula). Recall that a quadratic equation is any equation that can be (re)written into the form of 0 = ax^2 + bx + c. To further understand how we can effectively use algebraic strategies to solve these quadratic equations, consider the following three scenarios:

In each case, you will work with the quadratic function $f(x) = ax^2 + bx + c$ and we will solve for $f(x) = 0$.

Example 1 (a = 0)	Example 2 (c = 0)	Example 3 (b = 0)
1. Write down a quadratic equation.	1. Write down a quadratic equation.	1. Write down a quadratic equation.
2. What is the value of “a” in your equation?	2. What is the value of “c” in your equation?	2. What is the value of “b” in your equation?
3. Replace/substitute your value of “a” with 0 and rewrite your equation	3. Replace/substitute your value of “c” with 0 and rewrite your equation	3. Replace/substitute your value of “b” with 0 and rewrite your equation
4. What type of equation do we have?	4. What type of equation do we have?	4. What type of equation do we have?
5. Now solve this equation.	5. Now solve this equation.	5. Now solve this equation.

(F) Solving Quadratic Equations – All Methods

1. $x^2 + 11x + 18 = 0$
2. $x^2 - 100 = 0$
3. $2x^2 - 4x = 0$
4. $(x + 2)^2 = 36$
5. $x^2 + 2x + 1 = 15$
6. $2x^2 - 50 = 14$
7. $5x - 2x^2 = 2x + x^2$
8. $x^2 - 10x + 25 = 0$
9. $7x^2 - 9x + 1 = 0$
10. $x^2 + 3x + 7 = 0$
11. $4x^2 - 80 = 0$
12. $6x - 12x^2 = 0$

(G)Practice – Graphing & Word Problem Context (GDC-Inactive)

Apply to Problems ➔ Mr. S. can sell 500 apples per week when he charges 50 cents per apple. Through market research, his wife (being smarter than Mr. S of course) knows that for every price increase of 2 cents per apple, he will sell 10 less apples.

i. Determine an equation that can you used to model Mr. S.'s expected revenues.

ii. What price should he charge to maximize his revenues?

iii. What is his maximum revenue?

iv. How many price increments are required such that his business has NO revenue?

Apply to Problems ➔ The profits of a company in its first 13 months of operations are modelled by the quadratic function $P(m) = -0.25m^2 + 3m - 5$ where m is the number of months (and m = 0 represents January 1st and m = 1.5 represents mid-February) and P(m) is measured in billions of pesos.

a. Determine when the company "breaks even".

b. Determine in which month the company maximizes its profits.

c. What are the company's maximum profits?

d. Solve and interpret P(m) < 0 given that the domain is

e. For what values of m are the profits DECREASING? Explain how you determined your answer.

f. Solve P(m) = -12 and interpret

(H)BLACK LEVEL Challenge Problems (While you wait …..)

(a) Solve $x^4 - 13x^2 + 36 = 0$

(b) Solve $x^4 + 16x^2 - 225 = 0$

(c) Solve $\frac{5}{2-x} + \frac{x-5}{x+2} + \frac{3x+8}{x^2-4} = 0$

(d) If $x^2 - 2ax + a^2 = 0$, determine the value of $\frac{x}{a}$

(e) The function $f(x) = ax^2 + bx + c$ has $f(-2) = 0$ and $-\frac{b}{2a} = 1$. Solve $f(x) = 0$

(f) For which values of b will the quadratic function $f(x) = x^2 - 2bx + 7 = 0$ have a minimum value of 6?

(g) For which values of c will the quadratic function $f(x) = x^2 - 2bx + c$ to have a minimum value of 6?

(h) MORE QUESTIONS AT http://www.mit.edu/~alexrem/MC_Algebra2.pdf