(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 Lessons 4,5 & 6, you learned about factoring quadratic expressions	Where we are We can algebraically solve quad eqns by factoring **_IF_** the eqn is written in the form of f(x) = 0	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 factoring
b. Understand what solving a quadratic equation in the form of $ax^2 + bx + c = 0$ means in terms of graphs
c. Use the skills of factoring to solve quadratic equations

(C) FAST FIVE: Understanding Terms ➔ SOLVE EACH EQN ALGEBRAICALLY AND THEN VERIFY GRAPHICALLY

To SOLVE an equation means:

(a) If $f(x) = 2x + 8,$ solve $f(x) = 0$

(b) If $f(x) = 2x + 8,$ solve $f(x) = -6$

(c) If $(x) = x - 3,$ solve $f(x) = 0$

(d) If $f(x) = x - 3,$ solve $f(x) = 6$

(e) If $f(x) = 2^x - 8,$ solve $f(x) = 0$

(f) If $f(x) = 2^x - 8,$ solve $f(x) = 24$

(g) If $f(x) = x^2 - 2x - 24,$ solve $f(x) = 0$

(h) If $f(x) = x^2 - 2x - 24,$ solve $f(x) = -21$

(i) If $f(x) = (2x + 5)(x - 3),$ solve $f(x) = 0$

(j) If $f(x) = (2x + 5)(x - 3),$ solve $f(x) = 13$

(C) Practice with Solving by Factoring

More Quadratic Equations – Solve by Factoring

Solve by factoring:
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1. $x^2 - 2x - 24 = 0$ 2. $t^2 - 3t - 18 = 0$ 3. $z^2 - 6z + 5 = 0$

4. $x^2 - 7v + 6 = 0$ 5. $x^2 + 9x + 8 = 0$ 6. $v^2 + 10v + 9 = 0$

7. $x^2 - 10x + 25 = 0$ 8. $y^2 - 12y + 36 = 0$ 9. $10y^2 + 5y = 0$

10. $8x^2 - 12x = 0$ 11. $x^2 - 21 = 4x$ 12. $t^2 - 20 = t$

13. $2x^2 + x = 10$ 14. $4x^2 + 12x = -9$ 15. $5r^2 = 12 + 11r$

16. $3x^2 = x + 2$ 17. $5y^2 = 11y - 2$ 18. $16v^2 - 8v + 1 = 0$

19. $25y^2 - 10y + 1 = 0$ 20. $x^2 - 1 = 0$ 21. $t^2 - 25 = 0$

22. $16y^2 - 1 = 0$ 23. $4z^2 - 25 = 0$ 24. $x + 28 = x\,(x - 2)$

25. $y + 12 = y(y - 3)$ 26. $x^2 - 4x - 4 = 3x^2 - 5x - 3$

27. $x^2 + 2x + 3 = (2x - 1)\,(x + 5)$ 29. $x^2 + x - 1 = (2x + 1)\,(x + 2)$

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(D)Changing from Factored Form to Standard Form

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

SKILLS REVIEW: A fcn has two zeroes at x = -3 and x = 5 and let the value of **a** be 2	SKILLS REVIEW: A fcn has 2 zeroes at x = 4 and x = 9 and the y-intercept is (0,-72)	The fcn y = h(x) has h(-1) = h(11) = 0 and the minimum value is -72.
The equation f(x) = 0 has solutions of x = -3 and x = 2.5 and we also know that f(0) = 30	The equation g(x) = 0 has solutions of x = -3 and x = -3 and we also know that g(-5) = -8	The zeroes of y = f(x) are at 5 and -5. The maximum value of f(x) is $\dfrac{25}{4}$.
The two solutions to the eqn f(x) = 0 are $x_1 = \dfrac{2}{3}$ and $x_2 = -\dfrac{1}{2}$ and we also know that f(0) = -4	The two solutions to the eqn g(x) = 0 are $x_1 = \dfrac{5}{7}$ and $x_2 = -\dfrac{4}{3}$ and we also know that g(0) = 5.	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.

(E) Solving (by Factoring) Quadratic Equations ➜ GDC-I Application Problems

11. A model rocket is shot into the air and its path is approximated by
$h = -5t^2 + 30t$, where h is the height of the rocket above the ground in metres
and t is the elapsed time in seconds.
(a) When will the rocket hit the ground?
(b) What is the maximum height of the rocket?

12. A baseball is thrown from the top of a building and falls to the ground below. Its
path is approximated by the relation $h = -5t^2 + 5t + 30$, where h is the height
above ground in metres and t is the elapsed time in seconds.
(a) How tall is the building?
(b) When will the ball hit the ground?
(c) When does the ball reach its maximum height?
(d) How high above the building is the ball at its maximum height?

13. **Application:** A small company that manufactures snowboards uses the relation
$P = 162x - 81x^2$ to model its profit. In the model, x represents the number of
snowboards in thousands, and P represents the profit in thousands of dollars.
(a) What is the maximum profit the company can earn?
(b) How many snowboards must it produce to earn this profit?
(c) The company breaks even when there is neither a profit nor a loss. What are
the break-even points for the company?

14. A computer software company models the profit on its latest game using the
relation $P = -2x^2 + 28x - 90$, where x is the number of games it produces in
hundred thousands and P is the profit in millions of dollars.
(a) What is the maximum profit the company can earn?
(b) How many games must it produce to earn this profit?
(c) What are the break-even points for the company?

18. **Thinking, Inquiry, Problem Solving:** Soundz Inc. makes CD players. Last year,
accountants modelled the company's profit by $P = -5x^2 + 60x - 135$. Over the
course of the year, in an effort to become more efficient, Soundz Inc. restructured its
operation, eliminating some employees and reducing costs. This year, accountants are
using $P = -7x^2 + 70x - 63$ to project the company's profit. In both models, P is the
profit in hundreds of thousands of dollars and x is the number of CD players made, in
hundreds of thousands. Was Soundz Inc.'s restructuring effective? Justify your answer.

(F) 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