(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?

(B) Lesson Objectives:

a. Review & practice the algebraic skills of expanding and factoring
b. Use the skills of factoring and expanding in application problems

(C) Review of Skills: Practice – Graphing & Word Problem Context

(CA) 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.

a. Determine an equation that can you used to model Mr. S.'s expected revenues.
b. What price should he charge to maximize his revenues?
c. What is his maximum revenue?

(D) Practice – Factoring Special Quadratics

1) $x^2 - 9$	2) $x^2 - 36$	3) $x^2 - 121$	4) $64x^2 - 81$
5) $9x^2 - 25$	6) $144x^2 - 49$	7) $x^2 - 225$	8) $x^2 - 100$
9) $x^2 - 6x + 9$	10) $x^2 - 12x + 36$	11) $x^2 - 4x + 4$	12) $x^2 + 8x + 16$
13) $4x^2 - 20x + 25$	14) $9x^2 + 24x + 16$	15) $4x^2 - 28x + 49$	16) $x^2 + 20x + 100$

(E) Practice – Factoring Quadratic Trinomials where a ≠ 1

Factor the following expressions. If any of the following expressions cannot be factored, please indicate so by stating "prime".

1) $2x^2 + 15x + 7$	2) $3x^2 - 5x - 12$	3) $9x^2 + 11x + 2$	4) $7x^2 - 22x + 3$
5) $18x^2 - 9x - 2$	6) $4x^2 + - 7x - 2$	7) $2x^2 + 13x + 21$	8) $11x^2 - 98x - 9$
9) $3x^2 - 20x - 63$	10) $3x^2 - 20x - 7$	11) $8x^2 + 13x - 6$	12) $4x^2 - 17x - 42$
13) $2x^2 - 9x - 18$	14) $6x^2 + 17x - 14$	15) $3x^2 + 5x - 12$	16) $2x^2 + 9x + 4$

9. The area of a rectangle is given by each of the following trinomials.
K Determine expressions for the length and width of the rectangle.
a) $A = 6x^2 + 17x - 3$ **b)** $A = 8x^2 - 26x + 15$

10. Identify possible integers, k, that allow each quadratic trinomial
T to be factored.
a) $kx^2 + 5x + 2$ **b)** $9x^2 + kx - 5$ **c)** $12x^2 - 20x + k$

14. A computer software company models the profit on its latest video
A game using the relation $P = -4x^2 + 20x - 9$, where x is the number of games produced in hundred thousands and P is the profit in millions of dollars.
a) What are the break-even points for the company?
b) What is the maximum profit that the company can earn?
c) How many games must the company produce to earn the maximum profit?

(F)<u>Solving (by Factoring) Quadratic Equations ➔ CI Application Problems</u>

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.

(G) <u>Changing from Factored Form to Standard & Vertex Forms</u>

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 and in vertex form.

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

(b) 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 $h(-1) = h(11) = 0$ and the minimum value 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.