(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? • What algebraic strategies come into play for this new type of data relationship?

(B) Lesson Objectives:

a. Review the algebraic skills and strategies for solving equations and of factoring
b. Understand what solving a quadratic equation in the form of $ax^2 + bx + c = 0$ means in terms of graphs and functions
c. Use the skills of factoring to solve quadratic equations

(C) Opening Exercise: Skills Review

1. (CI) Given the parabola $f(x) = 2x^2 + 2x + 5$;
   a. Use the discriminant to determine whether or not this parabola has any x-intercepts
   b. Find the vertex of $f(x)$.
   c. Find two other points on the parabola
   d. Sketch the parabola.
   e. Determine the intersection point(s) of this parabola with $g(x) = 8 + 3x$.

2. (CA) Use the quadratic formula to solve the equation $3x^2 – 2x – 5 = 2 + x$.

3. (CI) Given the quadratic function $h(t) = 2t^2 + t – 15$,
   a. Factor the equation;
   b. Hence, solve the equation $h(t) = 0$
   c. Hence, solve the **inequality** $2t^2 + t – 15 > 0$

(D) *Applications: Problem Solving With Quadratics*

1. The area of a rectangle is given by $A = x^2 + 18x + 72$.
   a. Use factoring to find an expression for the dimensions of the rectangle.
   b. If the area of the rectangle is 7 square feet, what are the possible values of x?
   c. What are the dimensions of the rectangle?

2. Recall the area of a circle is given by $A = \pi r^2$, where r is the radius of the circle.
   a. If a particular circle is given by $A = \pi(x^2 – 20x + 100)$, find an expression for the radius of the circle.
   b. If the area of the circle is 16π square feet, what is the value of x?

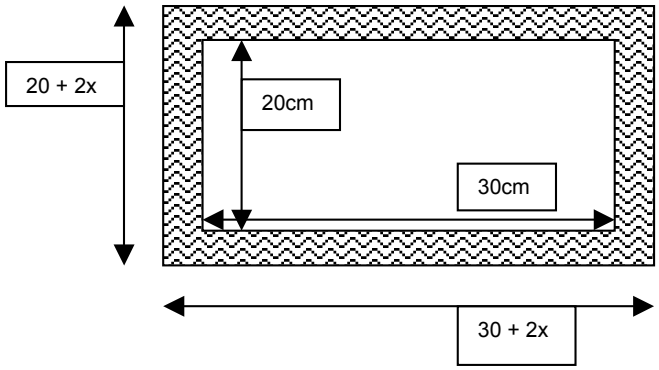
3. The product of two consecutive odd integers is 1 less than four times their sum. Find the two integers. Hint: There will be two sets of solutions.

4. The hypotenuse of a right triangle is 6 more than the shorter leg. The longer leg is three more than the shorter leg. Find the length of the shorter leg. Hint: Draw a right triangle and apply the Pythagorean Theorem.

5. Extension Q ➔ Two cars leave an intersection. One car travels north and the other car travels east. When the car traveling north had gone 24 miles, the distance between the cars was four miles more than three times the distance traveled by the car heading east. Find the distance between the cars at that time.

6. The effectiveness of an internet pop-up is based on how many viewers it receives per day. There is an **optimal** number of hits and beyond this the effectiveness drops off. The effectiveness can be described by the equation $E(n) = -2n^2 + 18n + 44$ where E represents the percent effectiveness and n represents the number of viewers in millions of people. Determine:
   a. the maximum effectiveness and how many viewers are needed to achieve this
   b. the number of viewers needed to make the pop-up 80% effective
   c. when the pop-up is 0% effective

7. Yasmeen is trying to calculate the width of a matte to go around a 20cm by 30cm photograph she wants to display. She has decided that the matte will have the same area as the photo (the Home Depot book suggested this). She just isn't sure how thick the matte should be. Using the diagram shown determine:
   a. an expression for the area of the photo's matte (remember, the area would be the big rectangle subtract the small rectangle)
   b. the area of the photograph
   c. an equation for the area of the matte
   d. simplify the equation in (c) (put it in "standard" form)
   e. solve the equation in (d) and decide how thick the matte should be



8. An outdoor decorator was hired to design canopies for the outside of shops all the way around the block. The trouble was the decorator did not know how far out the canopy should stretch, if it was too short the rain water would run off and soak the people on the sidewalk. He had to decide how far out was long enough to pass over peoples heads but not so long as to be a waste of materials. The decorator did know the buildings dimensions (the shops were all attached) were 60m by 40m and the area of the sidewalk was 2815m². How far out do the canopies extend?

9. An apartment building 27m by 50m is built on a lot that is 383m². If a parking strip of uniform width surrounds the apartment building, how wide is the parking strip?

10. A community pool was under construction to make it bigger. It was 15m by 8m and in the construction the area doubled by adding the same amount of length onto one end and one side. How much was added?

11. A group of friends decide to go to a movie. The tickets cost $50 altogether. It is one person's birthday so the others split her ticket cost which raises theirs $1.50. How many friends are going to the movie?

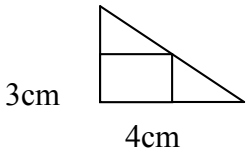
12. If a dinner out at a restaurant cost $600 but one member present cannot pay, and everyone else's cost goes up by only $2.50. How many people are present?

13. A king decided he needed a moat of uniform width around his castle. He only wanted the moat to extend far enough so the area of the moat and the land the castle was on was 16000m^2. The castle was 150m by 75m. How far out from the castle walls will the moat extend?

14. How much must be added to the shorter side of a rectangle 8cm long and 6cm wide in order to form a new rectangle that's diagonal is 7cm longer than the diagonal of the original rectangle.

15. Among all rectangles that have a perimeter of 20 feet, find the dimensions of the one with the largest area.

16. Find the area of the largest rectangle that can be inscribed in a right triangle with legs of lengths 3 cm and 4 cm if two sides of the rectangle lie along the legs as shown in the figure.



17. A farmer has 3000 feet of fence available to enclose a rectangular field. Assuming that he uses all of his fence material, find the length of each of the sides of the rectangle which will maximize the area. What is the maximum area he can enclose?

18. A farmer with 4000 meters of fencing material wants to enclose a rectangular plot that borders on a river. If the farmer does not fence the side along the river, what is the largest area that he can enclose? What will the dimensions be?

Link #1 ➔ http://mrsantowski.tripod.com/2017IntegratedMath2/ProblemSets/egglaunch.pdf

Link #2 ➔
http://mrsantowski.tripod.com/2017IntegratedMath2/ProblemSets/Sheriff_Nottingham_Assignment.pdf