(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. Understand the connection between the factored form of a quadratic equation and the zeroes of a parabola
b. Understand the connection between the vertex form of a quadratic equation and the maximums/minimums of a parabola
c. Start to see how additional features of a parabola can be determined from an equation (i.e how can an axis of symmetry be predicted from factored form? How can the zeroes be predicted from vertex form?)

(C) Opening Exercise

Ex 1 ➜ (CI) Mr. S throws a ball upward from the roof of the building that is 75 m tall. The ball reaches a maximum height of 100m above the ground after 4s and hits the ground 12s after being thrown.

a. Draw an accurate graph of the height of ball and the time in flight.
b. Where are the zeroes of the relation?
c. What are the co-ordinates of the vertex?
d. Determine an equation that models this situation, both in vertex form and in intercept form.
e. What is the meaning of each zero?

Ex 2 ➜ (CA) a company called SAMSOONG introduces a new cellphone and its PROFITS are modelled by the equation $P(m) = -5m^2 + 80m - 100$ where m is time in months and $P(m)$ is the profit in millions of dollars. The cellphone is sold for a period of 2 years.

a. Graph the profit function on your TI-84.
b. Calculate the zeroes of the quadratic and interpret what they mean.
c. Write the equation in factored form, given your work in (b).
d. Calculate the co-ordinates of the vertex and interpret.
e. Evaluate $P(5)$ and interpret.
f. Solve $P(m) = -25$ and interpret
g. Solve $P(m) < 0$ and interpret
h. For what values of m are the profits DECREASING? Explain how you determined your answer.

(C) SUMMARY OF KEY POINTS from Problem Set 5.5:

EQUATION FORM	EQUATION	KEY FEATURE	EXTENSION ➔ ADDITIONAL FEATURE:
(1) Standard Form			
(2) Factored Form			
(3) Vertex Form			

(D) Special Features of Parabolas – From an EQUATION & the TI-84

(CA) From the equation $f(x) = 2x^2 - 12x - 32$, complete the required analysis using the TI-84:

(a) Direction of opening
(b) Vertex/optimum point/Max or Min **POINT**
(c) Optimal value/max or min **VALUE**
(d) Zeroes/x-intercepts
(e) y-intercept
(f) Axis of Symmetry
(g) Evaluate $f(1)$
(h) Solve $f(x) = -49.5$
(i) Show a sketch with the key features labelled

(CI) From the equation $h(x) = -2(x + 4)(x - 7)$, complete the required analysis using your TI-84:

(a) Direction of opening
(b) Vertex/optimum point/Max or Min **POINT**
(c) Optimal value/max or min **VALUE**
(d) Zeroes/x-intercepts
(e) y-intercept
(f) Axis of Symmetry
(g) Evaluate $h(5.5)$
(h) Solve $h(x) = 30$

(CI) From the equation $g(x) = -\frac{1}{4}(x - 5)^2 + 4$, complete this analysis without using the TI-84:

(a) Direction of opening
(b) Vertex/optimum point/Max or Min **POINT**
(c) Optimal value/max or min **VALUE**
(d) Zeroes/x-intercepts
(e) y-intercept
(f) Axis of Symmetry
(g) Evaluate $g(-8)$
(h) Solve $g(x) = -12$
(i) Show a sketch with the key features labelled.

(CA) From the equation $P(t) = 3t^2 + 10t - 5$, complete the required analysis using your TI-84:

(a) Direction of opening
(b) Vertex/optimum point/Max or Min **POINT**
(c) Optimal value/max or min **VALUE**
(d) Zeroes/x-intercepts
(e) y-intercept
(f) Axis of Symmetry
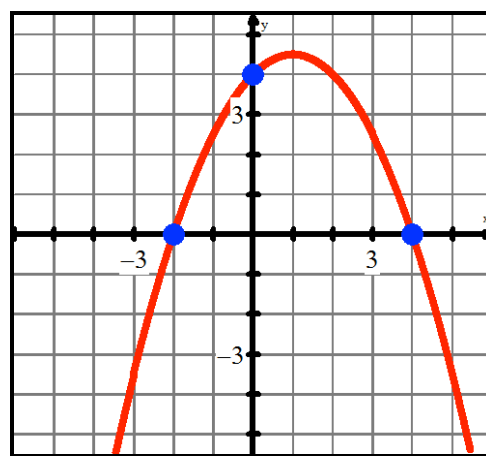(g) Evaluate $P(-8)$
(h) Solve $P(t) = -12$

(E) Determining Equations from Graphs

Determine the equations of the following graphs (or listed information), recalling that the equation of a quadratic function in factored form is $f(x) = a(x - R)(x - S)$ and that vertex form is $f(x) = a(x - h)^2 + k$
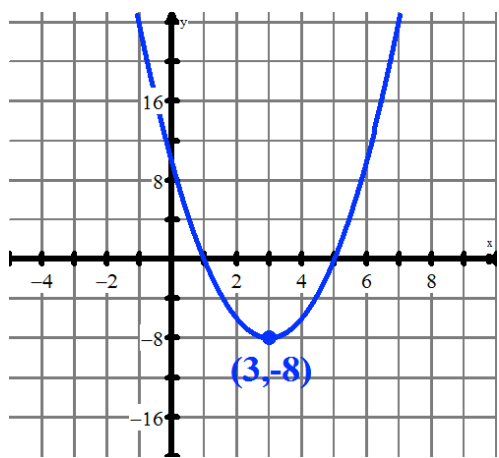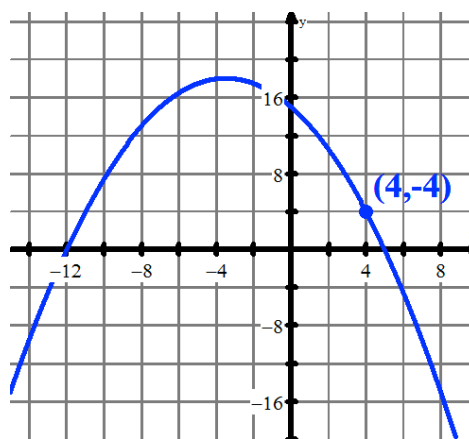
(a)

(0,-48)

(b)

(c)

(3,-8)

(d)

(4,-4)
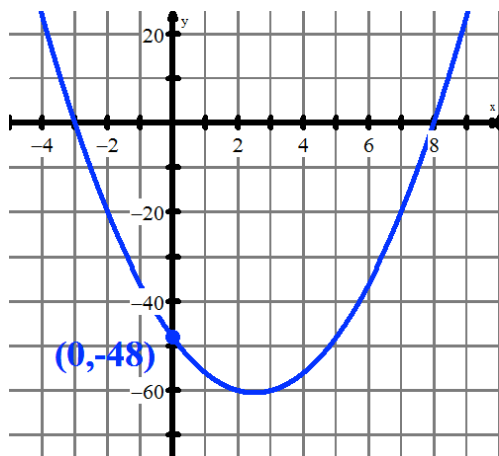
(e) the zeroes are at x = 7 and x = -3, and the y-intercept is at -63

(f) the x-intercepts are (5,0) and (-2,0) and the minimum value is -24.5

(g) one zero is at 4 and the vertex is at (1,-45)

(g) one zero is at -6 and two points are at (-4,-24) and at (2,-24)