IM2 Problem Set 7.9 - Working with Quadratic Functions

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 functions? • How can I use graphs and equations of quadratic relations to make predictions from data sets & their models

1. (CI) Factor the following quadratic equations and then find the x-intercepts of the parabola.

   a. (i) $y = x^2 + 6x - 40$ (ii) $y = 3x^2 + 24x + 45$ (iii) $y = 9x^2 - 25$
   b. (i) $y = 4x^2 - 16x + 15$ (ii) $y = 2x^2 + 5x - 12$ (iii) $y = 6x^2 + 5x + 1$

2. (CI) Solve for the zeros by factoring (after your rearrange the equations into standard form.)

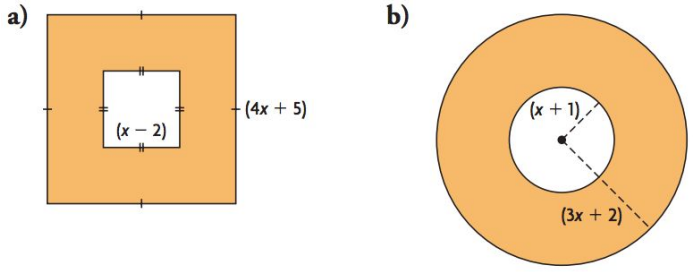
   a. $2x^2 + 20x - 50 = 5x$
   b. $x(x + 1) = 12$
   c. $2x(x + 4) = x + 4$
   d. $3x(x + 2) = 2x^2 - (4 - x)$

3. (CI) given the following equations in factored form by:

   a. finding the axis of symmetry
   b. then finding the vertex and hence rewriting the equation in vertex form
   c. then finding the zeroes using inverse operations from vertex form

   (i) $f(x) = 2x^2 - 20x + 41$ (ii) $g(x) = -4x^2 - 12x + 7$

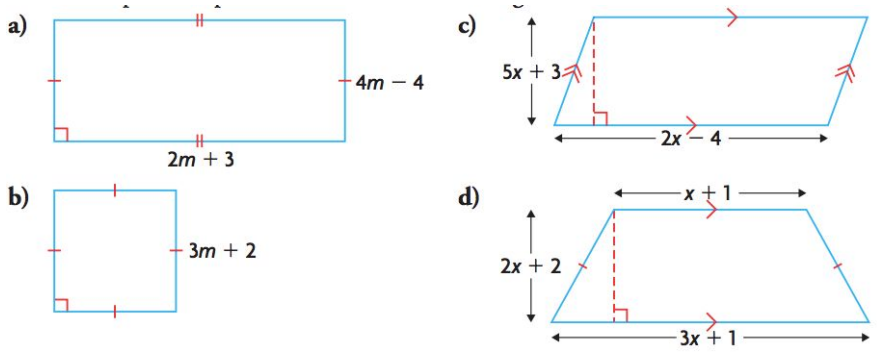
4. (CI) Determine a simplified expression for the shaded area in each figure.



5. (CA) Determine the equations of the following parabolas:

   a. The vertex is at (-3,2) and the parabola passes through (5,9)
   b. The zeroes are at $x = 5$ and $x = -3$ and the parabola passes through (0,-45)
   c. The zeroes are at $x = 2.5$ and $x = -1.5$ and the parabola passes through (-1,14)

6. (CI) Write a simplified expression for the area of each figure:



7. (CA) Accountants for the HiTech Shoe Company have determined that the quadratic relation $P(x) = -2x^2 + 24x - 54$ models the company's profits for the next year. In this relation, P represents the profit (in \$100,000s) and x represents the number of shoes sold (in 100,000s)

    a. If P(4) = 10, explain what the point (4,10) means in this question.
    b. Find the y-intercept and give one reason that the y-intercept is negative.
    c. Express the equation in factored form.
    d. State the window settings you used to graph the relation.
    e. Where are the zeroes and what do they represent?
    f. Determine the number of shoes that must be sold to maximize the profits? What are the maximum profits of the company?

8. (CA) The Next Cup Coffee Shop sells its coffee for \$2.60 per mug and at that price, the shop sells 200 cups of coffee. However, it is known (through marketing research) that every \$0.05 decrease in the price of a cup of coffee, the shop will sell 10 more cups of coffee. Determine the price for a cup of coffee that will maximize the daily revenue from the sales of coffee. What is the maximum revenue that the shop will have at this price?

EXTENSION PROBLEMS

9. (CA) The underside of a concrete railway underpass forms a parabolic arch. The arch is 30.0 m wide at its base and 10.8 m high in the center. The upper surface of the underpass is 40.0 m wide and concrete is 2.0 m thick at the center. Can a truck that is 5.0 m wide and 7.5 m tall get through this underpass?