Lesson Plan

Grade 10 Academic Math **Lesson: 6 - 4**

Unit: Quadratic Equations **Topic: Problems that Involve Quadratic Models**

- ***homework check:*** **Discriminant Investigation**

- ***note:*** **Solving Problems using Quadratic Models**

When solving problems that involve quadratic models, you might have to rearrange the model into standard form in order to solve. Choose whether factoring or using the quadratic formula is appropriate. Complete the square if you are asked to find a maximum or minimum value. Keep reality in mind in order to decide the relativity of your solutions. It is possible that one of the solutions may not make sense in the context given. For example,

a) The length of a field is represented by the expression (2 x + 5) and the width by the expression (- x + 4). What are the dimensions of the field that yield a maximum area?

*asked for max are – complete the square

$$A = (2x+5)(-x+4)$$
$$= -2x^2 + 3x + 20$$
$$= -2\left(x^2 - \frac{3}{2}x\right) + 20$$
$$= -2\left(x^2 - \frac{3}{2}x + \frac{9}{16}\right) + \frac{9}{4} + 20$$
$$= -2\left(x - \frac{3}{4}\right)^2 + \frac{9+80}{4}$$
$$= -2\left(x - \frac{3}{4}\right)^2 + \frac{89}{4}$$
$$\max\left(\frac{3}{4}, \frac{89}{4}\right)$$

The area of the field is maximized when $x = \frac{3}{4} = 0.75$. Therefore, the dimensions of the field are:

length	width
$2x+5 = 2(0.75)+5$	$-x+4 = -(0.75)+4$
$= 6.5 units$	$= 3.25 units$

b) Carla is a platform diver. Her latest dive can be modeled by the equation $y = -4x^2 + 6x + 5.75$. Find

i) her maximum height in metres
ii) the height of the platform in metres
iii) how long she was in the air in seconds

i) her max height can be found by completing the square

$$y = -4x^2 + 6x + 5.75$$

$$y = -4\left(x^2 - 1.5x\right) + 5.75$$

$$= -4\left(x^2 - 1.5x + 0.5625\right) + 2.25 + 5.75$$

$$= -4\left(x - 0.75\right)^2 + 8$$

max at $(0.75, 8)$

Her maximum height was 8 m.

ii) the height of the platform is the same as the y intercept

The y intercept is found by setting x = 0.

$$y = -4x^2 + 6x + 5.75$$

$$y = -4(0)^2 + 6(0) + 5.75$$

$$y = 5.75m$$

iii) how long she was in the air will come from the x intercepts

The x intercepts can be found by setting y = 0 and solving by factoring or quad formula.

$$y = -4x^2 + 6x + 5.75$$

$$0 = -4x^2 + 6x + 5.75$$

can't factor - use quad form

$$x = \frac{-6 \pm \sqrt{6^2 - 4(-4)(5.75)}}{2(-4)}$$

$$x = \frac{-6 \pm \sqrt{128}}{-8}$$

$$x = \frac{6 \pm 8\sqrt{2}}{8}$$

$$x = \frac{3 \pm 4\sqrt{2}}{4}$$

**Does the negative root of* $\frac{3 - 4\sqrt{2}}{4}$ *make sense in this context? This would mean that negative time exists. So the negative root in this context is extraneous and can be dismissed.*

This means that Carla was in the air for $\frac{3+4\sqrt{2}}{4} \doteq 2.2\text{seconds}$.

c) Barry can throw a baseball 16m at a maximum height of 9.6m. During one throw, his friend caught the ball at a height of 2.25m and was 15 m away. Write an equation that models his throw.
*start with vertex form of the equation and substitute the given point for (x, y)

$y = a(x-8)^2 + 9.6$

$2.25 = a(15-8)^2 + 9.6$

$-7.35 = 49a$

$a = -0.15$

$y = -0.15(x-8)^2 + 9.6$

⌗ ***homework assignment:*** **<u>Principles of Mathematics 10</u> p. 357 #2, 4, 8, 9, 12, 14**