

Are there any Homework Questions you would like to see on the board?

pp. 239-241 # 2, 4-8, 13 AND

READ p. 253 AND 6, 7

Work ahead on Review: pp. 254-255 # 1 - 10

### Today's Learning Goal(s):

By the end of the class, I will be able to:

- a) Determine the equation of a curve using vertex form.

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3. A cliff diver dives from about 17 m above the water. The diver's height above the water,  $h(t)$ , in metres, after  $t$  seconds is modelled by  $h(t) = -4.9t^2 + 1.5t + 17$ . Explain how to determine when the diver is 5 m above the water.

4. Determine when the diver in question 3 is 5 m above the water.

$$\text{Let } h(t) = 5$$

$$5 = -4.9t^2 + 1.5t + 17$$

$$0 = -4.9t^2 + 1.5t + 17 - 5$$

$$0 = -4.9t^2 + 1.5t + 12$$

$$a = -4.9 \quad b = 1.5 \quad c = 12$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-1.5 \pm \sqrt{(1.5)^2 - 4(-4.9)(12)}}{2(-4.9)}$$

$$= \frac{-1.5 \pm \sqrt{237.45}}{-9.8}$$

$\therefore$  the diver is 5 m above the water at 1.73 sec.

$$t = \frac{-1.5 - \sqrt{237.45}}{-9.8} \quad t = \frac{-1.5 + \sqrt{237.45}}{-9.8}$$

$\therefore -1.41$   
inadmissible

5. The population of a town is modelled by the function

A  $P(t) = 6t^2 + 110t + 4000$ , where  $P(t)$  is the population and  $t$  is the time in years since 2000.

- a) What will the population be in 2020?  
b) When will the population be 6000?  
c) Will the population ever be 0? Explain your answer.

a)  $t = 2020 - 2000$

$$= 20$$

$$P(20) = 6(20)^2 + 110(20) + 4000$$

$$= 8600$$

$\therefore$  the population will be 8600 in 2020.

b) Let  $P(t) = 6000$

$$6000 = 6t^2 + 110t + 4000$$

$$0 = 6t^2 + 110t + 4000 - 6000$$

$$= 6t^2 + 110t - 2000$$

$$= 2(3t^2 + 55t - 1000)$$

$$a = 3 \quad b = 55 \quad c = -1000$$

$$t = \frac{-55 \pm \sqrt{55^2 - 4(3)(-1000)}}{2(3)}$$

$$= \frac{-55 \pm \sqrt{15025}}{6}$$

↙ ↓

$$t = \frac{-55 + \sqrt{15025}}{6} \quad \text{or} \quad t = \frac{-55 - \sqrt{15025}}{6}$$

$$= 11.26$$

$$= -29.59$$

$$\therefore 2000 + 11.2$$

inadmissible time  $> 0$

$$= 2011.2$$

$\therefore$  the population will reach 6000 people in the year 2011.

- p. 240 7. The profit of a shoe company is modelled by the quadratic function  $P(x) = -5(x - 4)^2 + 45$ , where  $x$  is the number of pairs of shoes produced, in thousands, and  $P(x)$  is the profit, in thousands of dollars. How many thousands of pairs of shoes will the company need to sell to earn a profit?

Let  $P(x) = 0$

$$0 = -5(x - 4)^2 + 45$$

Optim 2:

$$0 = -5(x^2 - 8x + 16) + 45$$

$$= -5x^2 + 40x - 80 + 45$$

$$= -5x^2 + 40x - 35$$

$$a = -5 \quad b = 40 \quad c = -35$$

$$x = \frac{-40 \pm \sqrt{40^2 - 4(-5)(-35)}}{2(-5)}$$

$$= \frac{-40 \pm \sqrt{900}}{-10}$$

$$= \frac{-40 \pm 30}{-10}$$

$$x = \frac{-40 + 30}{-10} \quad \text{or} \quad x = \frac{-40 - 30}{-10}$$

$$= \frac{-10}{-10} \quad = \frac{-70}{-10}$$

$$= 1 \quad = 7 \quad \rightarrow$$

$\therefore x = 1000$  or  $x = 7000$  pairs of shoes  
to break even ( $= 0$  profit)

Optim 1:

$$-45 = -5(x - 4)^2$$

$$\frac{-45}{-5} = (x - 4)^2$$

$$9 = (x - 4)^2$$

$$\pm\sqrt{9} = x - 4$$

$$4 \pm 3 = x$$

$$x = 4 + 3 \quad \text{or} \quad x = 4 - 3$$

$$x = 7 \quad = 1$$

$\therefore 1000$  or  $7000$  pairs of shoes break even.

$\therefore$  sell  $1001$  pairs to make a profit

## 4.6 Using Vertex Form to Create Quadratic Models from Data-s18

April 9, 2018

MCF 3M1 4.6 Using Vertex Form to Create Quadratic Models (from Data)

Date: Apr. 9/18

**Recall:** Three forms of a quadratic relation:

Vertex Form

$$y = a(x-h)^2 + k$$

Standard Form

$$y = ax^2 + bx + c$$

Factored Form

$$y = a(x-r)(x-s)$$

Ex.1: A hose sprays a stream of water across a lawn.

The table shows the approximate height of the stream above the lawn at various distances from the person holding the nozzle.

- Determine an algebraic model (in vertex form) that relates the height of the water to the distance from the person.
- State any restrictions on the domain and range of the model.
- Use the model to predict when the water will hit the ground.

Distance from Nozzle (m)	0	1	2	3	4	5	6	7	8
Height above Lawn (m)	0.5	1.4	2.1	2.6	2.9	3.0	2.9	2.5	1.9

$$a) y = a(x-h)^2 + k$$

$$h(x) = a(x-5)^2 + 3$$

$$0.5 = a(0-5)^2 + 3$$

$$0.5 = a(-5)^2 + 3$$

$$0.5 = a(25) + 3$$

$$0.5 - 3 = 25a$$

$$\frac{-2.5}{25} = \frac{25a}{25}$$

$$-\frac{1}{10} = a$$

$$(or a = -0.1)$$

$$\therefore h(x) = -0.1(x-5)^2 + 3$$

is the equation.

part c using quadratic formula

$$0 = -0.1(x-5)^2 + 3$$

$$= -0.1(x^2 - 10x + 25) + 3$$

$$= -0.1x^2 + x - 2.5 + 3$$

$$= -0.1x^2 + x + 0.5$$

$$a = -0.1, b = 1, c = 0.5$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-1 \pm \sqrt{1.2}}{-0.2}$$

$$x = \frac{-1 + \sqrt{1.2}}{-0.2} \text{ or } x = \frac{-1 - \sqrt{1.2}}{-0.2}$$

$$\therefore -0.477 \quad \therefore 10.477$$

$$\therefore 10.48$$

Same answer, but the solution in black ink was less work.  
Today's Homework:

pp. 250-252 #3 4ac 5 & 14