Before we begin, are there any questions from last day's work?

pp.217-218 1, 2c, 3d, 4b, 6, 7

SWYK 2.1 is first.

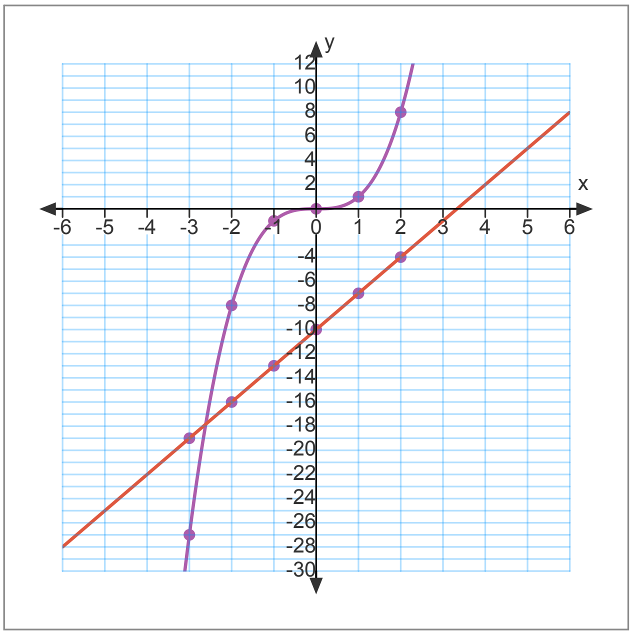
Today's Learning Goal(s):

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

a) use a quadratic model to solve a problem with ***and without*** technology.

2c) Solve *graphically*: $x^3 + 2x = 5x - 10$

$x^3 = 5x - 2x - 10 \rightarrow y_1 = x^3, \ y_2 = 3x - 10$

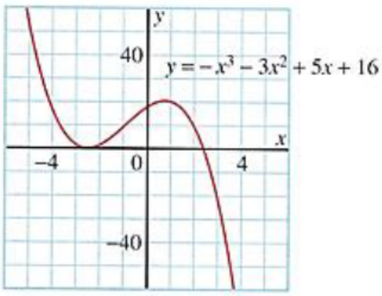


$y = 3x - 10$

$y = x^3$

6. a) In exercise 1b, can you be sure there are two equal negative zeros? Explain.
   b) If there are not two equal negative zeros, what other possibilities are there for this function?
   c) How could you tell which possibility in part b is correct? Explain.

b) $g(x) = -x^3 - 3x^2 + 5x + 16$



7. Consider the equation $x^2 - 2x = 20$.

a) Solve the equation by graphing $y = x^2 - 2x$ and $y = 20$ and using the points of intersection to determine the roots.

b) Solve the equation by graphing $y = x^2 - 2x - 20$ and using the x-intercepts to determine the roots.

c) Compare the methods in parts a and b.

i) Does one method give more accurate results than the other? Explain.

ii) Is one method more reliable than the other? Explain.

Today's Learning Goal(s):

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

a) use a quadratic model to solve a problem with ***and without***technology.

2.8.1 Modeling using Quadratic Functions

Date: Oct, 3/19

Ex.1

Sixteen metres of fencing are available to enclose a rectangular garden.

a) Represent the area of the garden as a function of the length of one side.

b) Graph the function.

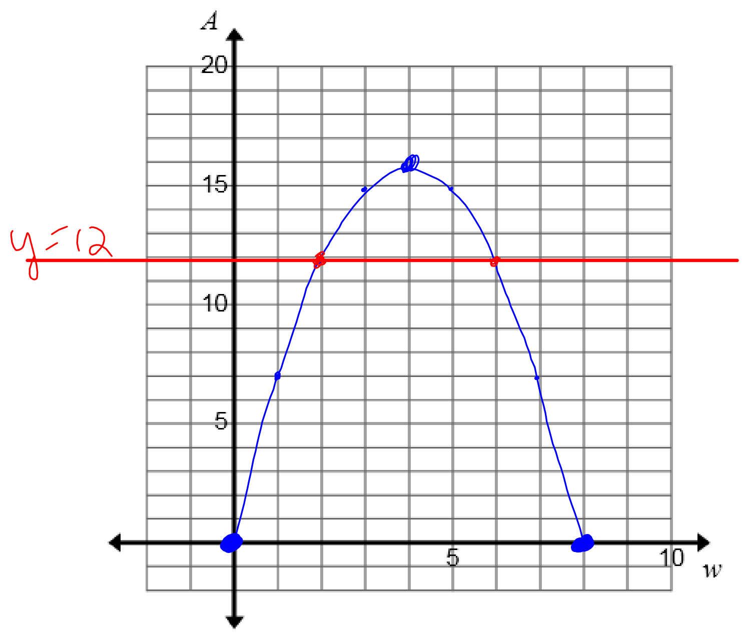
c) What dimensions provide an area greater than 12 m^2?

Solution

a) Let w represent the width of the garden in m.
Let l represent the length of the garden in m.

l

A= l x w $\quad w$



P = 2l +2w

16 = 2l +2w

8 = l +w

8 — w = l

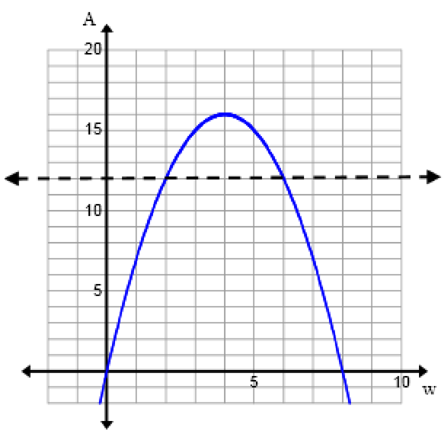
Since A = l w

=(8—w)w

$= 8w - w^2$

$= -w^2 + 8w$

b)



the zeros (x-intercepts) are 0 and 8

Find the vertex half way between the zeros,

or complete the square to get A = -1(w—4)² + 16

if $w = 4$

$A = (8-4)(4)$

$= (4)(4)$

$= 16\ m^2$

c) **Draw in the horizontal line y = 12.**

The intersection points represent the width of the garden when the area is 12m².

∴if the width is between (but NOT INCLUDING) 2 and 6 m,

the dimensions provide an area greater than 12m².

This is written 2 < w < 6

if c) asked $< 12 m^2$

$\therefore 0 \le w < 2$ and $6 < w \le 8$

2.8.1 Modeling using Quadratic Functions

Ex. 2
When bicycles are sold for \$300 each, a cycle store can sell 160 in a season.
For every \$25 increase in the price, the number sold drops by 10.

a) Represent the sales revenue as a function of the price.
b) Use a graphing calculator to graph the function.
c) How many bicycles were sold when the total sales revenue is \$33 000?
   What is the price of one bicycle?
d) What range of prices will give sales revenue that exceeds \$40 000?

Solution
a) The quantities that vary all need to be defined (as variables).

Let p represent the selling price, in dollars.
Let n represent the number of bicycles sold.
Let R represent the revenue, in dollars.

Revenue = (price of a bicycle) x (number of bicycles sold)
p x (*needs to be represented as a function of price*)

(This is the hardest part of this problem.)

Rough work:
i) the price increase $= p - 300$

Check: If the new price is \$375,
then the price increase $= p - 300$
$= 375 - 300$
$= 75$

ii) the number of \$25 increases $= \dfrac{p-300}{25}$

Check: If the new price is \$375,
then the number of \$25 increases $= \dfrac{375-300}{25}$
$= \dfrac{75}{25}$
$=$ 3 increases of \$25

iii) the number of bicycles sold

$$= 160 - \cancel{10}^{\,2}\left(\frac{p-300}{\cancel{25}_{\,5}}\right)$$

←Show Cancelling

$$= 160 - 2\left(\frac{p-300}{5}\right)$$

$$= 160 - \frac{2}{5}(p-300)$$

$$-\frac{2}{\cancel{5}_{\,1}}\left(-\cancel{300}^{\,-60}\right) = 120$$

$$= 160 - \frac{2}{5}p + 120$$

$$= -\frac{2}{5}p + 280$$

Now, Revenue = (price of a bicycle) x (number of bicycles sold)

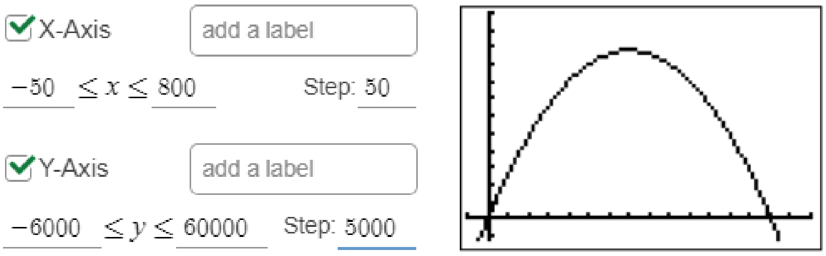
$$= p\left(-\frac{2}{5}p + 280\right)$$

$$= -\frac{2}{5}p^2 + 280p$$

or $(= -0.4p^2 + 280p)$

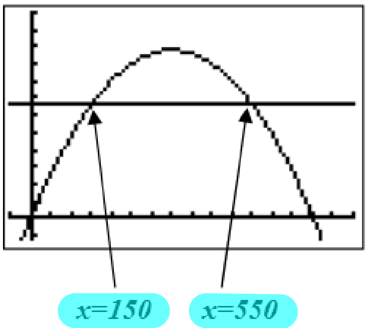
b) Use a graphing calculator to graph the function.

let $y_1 = -0.4x^2 + 280x$ or $y_1 = -\frac{2}{5}x^2 + 280x$



c) How many bicycles were sold when the total sales revenue is \$33 000?
What is the price of one bicycle?

If $R = 33\ 000$, let $y_2 = 33000$



Find the intersection points to represent the price of one bicycle when the revenue is \$33 000.

$\therefore p =$ **150** or $p =$ **550**

$\therefore$ the price of one bicycle is **\$150** or **\$550**

Recall: Revenue = (price of a bicycle) x (number of bicycles sold)

$\therefore$ number of bicycles sold $= \dfrac{\text{Revenue}}{\text{price of a bicycle}}$

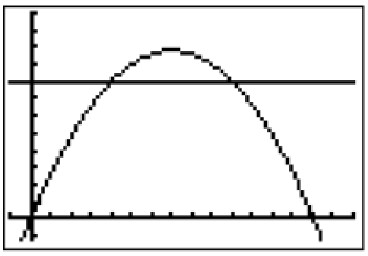
if $p =$ **150**	or if $p =$ **550**
number of bicycles $= \dfrac{33\ 000}{\mathbf{150}}$	or number of bicycles $= \dfrac{33\ 000}{\mathbf{550}}$
$=$ **220**	or $=$ **60**

$\therefore$ **60** bicycles were sold if the sales revenue is \$33 000.
(since the price *increases* will result in *lower* sales)

d) What range of prices will give sales revenue that exceeds \$40 000?

If $R = 40\ 000$, let $y_3 = 40000$

(Don't forget to "turn off" y_2)



Find the intersection points to represent the price of one bicycle when the revenue is exactly \$40 000.

$\therefore p =$ **200** or $p =$ **500**

Because we want when the revenue exceeds \$40 000,
we DO NOT INCLUDE the intersection points in the solution.

$\therefore$ if $R >$ \$40 000, then **200** $< p <$ **500**

Assigned Work pp. 224-225 #4(a-c), 6, 7, 10