Today's Learning Goal(s):

Date: Mar. 19/19

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

a) determine the equation of the inverse of a quadratic function.

Last day's work:

pp. 153-154 #3, 4ace, 5ac, 7ac, 8, 11

p. 153

5. Each function is the demand function of some item, where x is the number of items sold, in thousands. Determine

i) the revenue function

ii) the maximum revenue in thousands of dollars

a) $p(x) = -x + 5$ c) $p(x) = -0.6x + 15$

b) $p(x) = -4x + 12$ **d)** $p(x) = -1.2x + 4.8$

a) Revenue = Demand × Number of Items

i) $R(x) = p(x) \cdot x$

$= (-x+5)x$

$= -x^2+5x$

ii) $= -(x^2-5x)$

$= -(x^2-5x+(2.5)^2-(2.5)^2)$

$= -(x^2-5x+6.25-6.25)$

$= -(x-2.5)^2+6.25$

$\therefore$ max. revenue is 6.25×1000

$= \$6\,250$

c) $R(x) = (-0.6x+15)x$

$= -0.6x^2+15x$

ii) $= -0.6(x^2-25x)$

$= -0.6(x^2-25x+12.5^2-12.5^2)$

$= -0.6(x-12.5)^2-0.6(-156.25)$

$= -0.6(x-12.5)^2+93.75$

$\therefore$ Max Revenue $\$93\,750$.

p. 154

7. For each pair of revenue and cost functions, determine

i) the profit function

ii) the value of x that maximizes profit

a) $R(x) = -x^2 + 24x$, $C(x) = 12x + 28$

b) $R(x) = -2x^2 + 32x$, $C(x) = 14x + 45$

c) $R(x) = -3x^2 + 26x$, $C(x) = 8x + 18$

d) $R(x) = -2x^2 + 25x$, $C(x) = 3x + 17$

a) $P(x) = R(x) - C(x)$

$= -x^2 + 24x - (12x + 28)$

$= -x^2 + 24x - 12x - 28$

$= -x^2 + 12x - 28$

$= -(x^2 - 12x) - 28$

$= -(x^2 - 12x + 6^2 - 6^2) - 28$

$= -(x-6)^2 - (-36) - 28$

$= -(x-6)^2 + 6$

$\therefore x = 6$ maximizes the profit

c) $P(x) = R(x) - C(x)$

$= -3x^2 + 26x - (8x + 18)$

$= -3x^2 + 26x - 8x - 18$

i) $P(x) = -3x^2 + 18x - 18$

ii) $= -3(x^2 - 6x) - 18$

$= -3(x^2 - 6x + 9 - 9) - 18$

$= -3(x-3)^2 - 3(-9) - 18$

$= -3(x-3)^2 + 27 - 18$

$= -3(x-3)^2 + 9$

$\therefore x = 3$ maximizes profit.

8. The height of a ball thrown vertically upward from a rooftop is modelled by $h(t) = -5t^2 + 20t + 50$, where $h(t)$ is the ball's height above the ground, in metres, at time t seconds after the throw.

a) Determine the maximum height of the ball.

b) How long does it take for the ball to reach its maximum height?

c) How high is the rooftop?

a) $h(t) = -5t^2 + 20t + 50$

$= -5(t^2 - 4t) + 50$

$= -5(t^2 - 4t + 4 - 4) + 50$

$= -5(t-2)^2 + 20 + 50$

$= -5(t-2)^2 + 70$

a) $\therefore$ the max. height of the ball is 70 m.

b) it takes 2 seconds for the ball to reach max. height

c) The ball is on the rooftop when time = 0 seconds.

$\therefore h(0) = -5(0)^2 + 20(0) + 50$

$= 50$

$\therefore$ the rooftop is 50 m.

Today's Learning Goal(s):

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

a) determine the equation of the inverse of a quadratic function.

3.3 The Inverse of a Quadratic Function

Date: Mar. 19/19

Recall: The inverse of a function undoes a function.
To find the equation, switch the x and y variables and rearrange for y.
For a function with coordinates (x, y), the inverse will have coordinates (y, x).

Ex. 1:
a) Graph $f(x) = 2(x - 2)^2 - 4$ and its inverse.
b) Is the inverse a function?

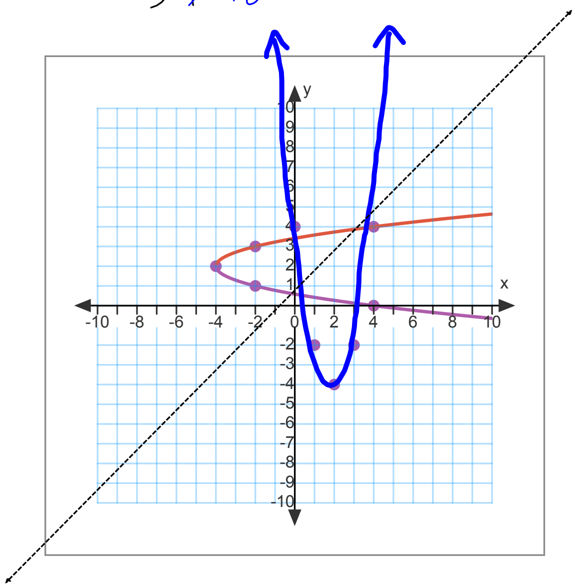
f(x)
V(2,-4)

MG a=2
1 1→2
2 4→8
3 9→18

Inverse
(2,-4)→(-4,2)

∴ No, it FAILS the VLT.

c) Determine the equation of the inverse.



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

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

$x + 4 = 2(y-2)^2$

$\frac{x+4}{2} = (y-2)^2$

$\pm\sqrt{\frac{x+4}{2}} = y - 2$

$y = \pm\sqrt{\frac{x+4}{2}} + 2$

OR

$y = \pm\sqrt{\frac{1}{2}(x+4)} + 2$

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

$$y = 2 + \sqrt{\frac{x+4}{2}}$$

$$y = 2 - \sqrt{\frac{x+4}{2}}$$

d) Determine the Domain and Range of $f(x)$ and the inverse.

$D_f: \{x \in \mathbb{R}\}$

$R_f: \{y \in \mathbb{R} \mid y \geq -4\}$

Inverse

$D: \{x \in \mathbb{R} \mid x \geq -4\}$

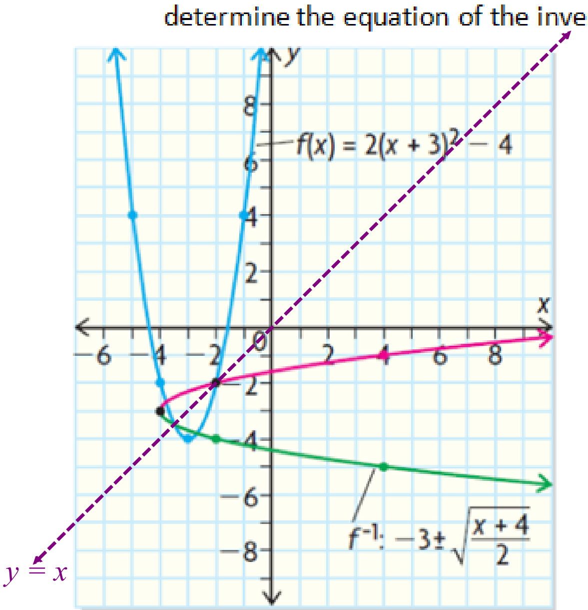
$R: \{y \in \mathbb{R}\}$

p.157 Ex.2

3.3 The Inverse of a Quadratic Function

Recall: The inverse of a function undoes a function. To find the equation, switch the x- and y-variables and rearrange for y. For a function with coordinates (x, y), the inverse will have coordinates (y, x).

Eg. 1) Given the quadratic function $f(x) = 2(x + 3)^2 - 4$, graph f(x) and it's inverse. Also determine the equation of the inverse.



$$f(x) = 2(x+3)^2 - 4$$
$$y = 2(x+3)^2 - 4$$
$$x = 2(y+3)^2 - 4$$
$$x + 4 = 2(y+3)^2$$
$$\frac{x+4}{2} = (y+3)^2$$
$$\pm\sqrt{\frac{x+4}{2}} = y + 3$$
$$-3 \pm \sqrt{\frac{x+4}{2}} = y$$

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

Last day's work: pp. 153-154 #3, 4ace, 5ac, 7ac, 8, 11

Today's Homework Practice includes:

pp. 160-162 #1 – 5, 7, 9, 13 [17]