## Section 1.5B
Break Even Analysis

When a company neither makes a profit nor sustains a loss this is called the **break-even level of operation.**

Note: The break even level of operation is represented by the point of intersection of two lines.

The break even level of production means the profit is zero. This means $P(x) = R(x) - C(x) = 0$, which implies that $R(x) = C(x)$.

Consider the following graph:
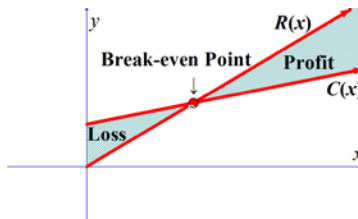
The point of intersection above, (x_o, y_o), is referred to as the break-even point.

x_o = break even quantity y_o = break even revenue

$-ve$

If $x < x_o$ then $R(x) < C(x)$. Hence, $P(x) = R(x) - C(x) < 0$ which indicates a LOSS.

$+ve$

If $x > x_o$ then $R(x) > C(x)$. Hence, $P(x) = R(x) - C(x) > 0$ which indicates a PROFIT.

units   Revenue

Example 1: A company has a break-even point of (1,575, $125,000). If it produces and sells 2,000 units would the company make a profit or sustain a loss? How do you know?

$$2000 > 1575 \qquad Profit \qquad x_o = 1575$$
$$x = 2000$$

(If x=1325   1325 < 1575   LOSS)

Example 2: A company has a profit function of $P(x) = 32x - 300,000$.
a. What is the break even quantity?

$$32x - 300000 = 0$$
$$32x = 300000$$
$$x = 9375 \text{ units}$$

b. How many units must the company produce and sell to make a profit of $84,000?

$$32x - 300000 = 84000$$
$$x = 12000 \text{ units}$$

$$P(x) = 0 \qquad R(x) = C(x)$$
$$P(x) = R(x) - C(x) = 0$$

Example 3: Find the break-even quantity and break-even revenue if
$C(x) = 32x + 375000$ and $R(x) = 62x$

$$32x + 375000 = 62x$$
$$375000 = 30x$$
$$x = 12500 \text{ items}$$
$$R(12500) = 62(12500) = \$775000$$

break-even quantity: 12500 $\qquad$ *break-even revenue:* \$775,000

Example 4: The XYZ Company has a fixed cost of 200,000, a production cost of \$12 for each unit produced and a selling price of \$20 for each unit produced.

a. Find the break-even point for the company.

$$C(x) = 12x + 200000 \qquad\qquad R(x) = 20x$$
$$C(x) = R(x)$$
$$12x + 200000 = 20x$$
$$200000 = 8x$$
$$x = 25000 \qquad (25000, 500000)$$

$$R(25000) = 20(25000) = \$500000$$

break-even quantity: 25000 $\qquad$ *break-even revenue:* 500000

b. If the company produces and sells 33,000 units, would it have a profit or loss?

$$33000 > 25000 \qquad\qquad \text{Profit}$$

c. If the company produces and sells 40,000 units, what would be the profit?

$$40000 > 25000 \qquad \text{Profit}$$
$$R(40000) = 20(40000) = \$800000$$
$$C(40000) = 12(40000) + 200000 = \$680000$$
Section 1.5B – Break-Even Analysis $\quad P(40000) = 800000 - 680000$
$$= \$120000$$

Example 5: *Iota Airplane Supplier* manufactures a certain airplane part for small airplanes. Each part sells for $250 and the variable cost of producing each unit is 42% of the selling price. The manufacturer's monthly fixed cost is $638,000. What is the manufacturer's break-even point?

$$R(x) = 250x$$

$$\text{variable cost} = 42\% \text{ of } \$250$$

$$= \frac{42}{100} \times 250 = \$105$$

$$C(x) = 105x + 638000$$

$$C(x) = R(x)$$

$$105x + 638000 = 250x$$

$$638000 = 145x$$

$$x = 4400$$

Break even quanity = 4400

Break even Revenue $= 250(4400)$

$$= \$1100000$$

$$(4400, 1100000)$$