

## Exam 2 – Practice 3 Math 110.

Exam Guidelines This is an in-class, written exam with a 75-minute time limit.

- **Permitted Materials:** You may use a basic calculator and formula sheets.
- **Formula Sheet Restrictions:** Your sheets must contain formulas only; no examples or worked problems are permitted. All sheets will be inspected at the start of the exam.
- **Prohibited Items:** Phones and all other smart devices are strictly forbidden.
- **Academic Integrity:** The use of AI is prohibited. Any AI usage will result in an automatic F for the exam and may lead to failing the entire course.
- Show **ALL** your work for credits.

1. Solve each quadratic by factoring or the quadratic formula.

a.  $x^2 = 4$

$x = 2; x = -2$

b.  $2x^2 - 12x + 18 = 0$

$x = 3$

c.  $-3x^2 - 6x + 9 = 0$

$x = -3; x = 1$

d.  $x^2 + 3x = 2x + 6$

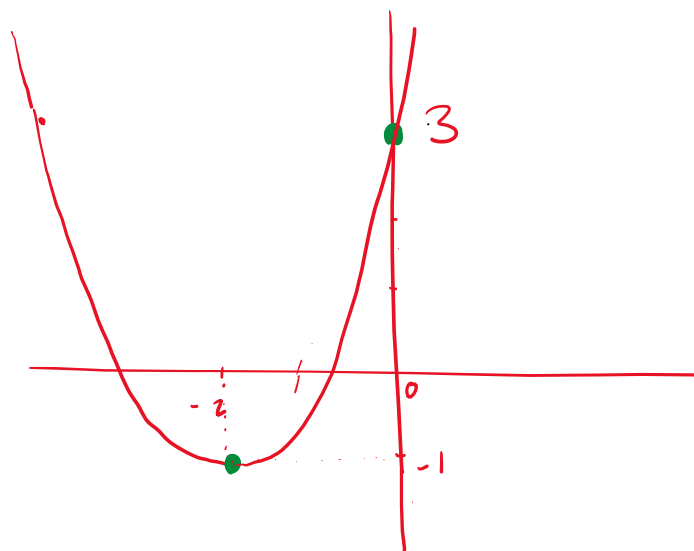
$x = -3; x = 2$

2. Graph of the quadratic functions. Label the vertex and another point.

a.  $y = x^2 + 4x + 3$

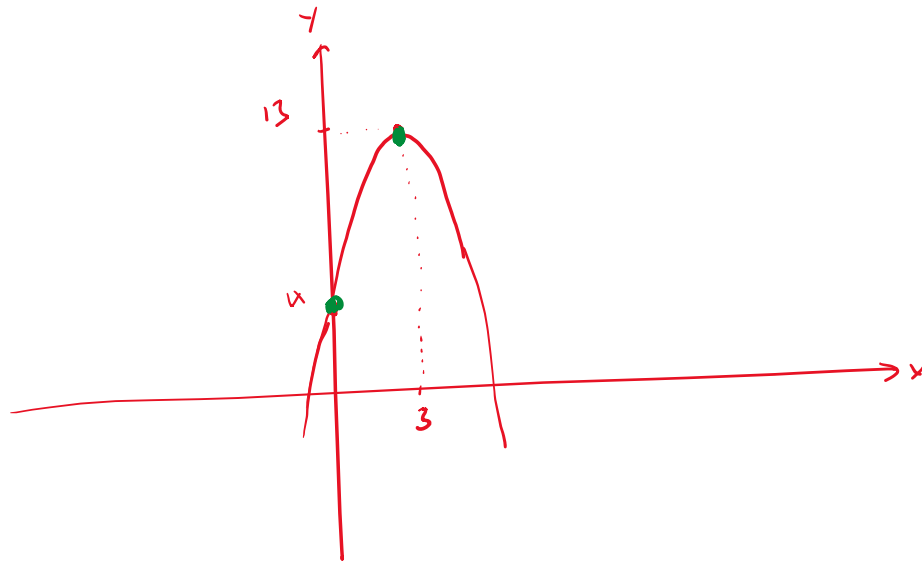
Vertex  $(-2; -1)$

Another point  $(0, 3)$



b.  $y = -x^2 + 6x + 4$

Vertex  $(3; 13)$  Another point  $(0, 4)$



3. Suppose that in a monopoly market the total cost per week of producing a high-tech product is given by  $C = 1800 + 80q + q^2$ . Suppose further that the sales price function for this product is  $p = 260 - 2q$ .

- a. Find the revenue function in term of  $q$ .

$$R = q \cdot (260 - 2q) = 260q - 2q^2$$

- b. Find the number of units that will **maximize the revenue**.

$$q = 65$$

- c. Find the profit function

$$\text{Profit} = R - C = -3q^2 + 180q - 1800$$

- d. Find the number of units that will give **break-even** for the product

$$-3q^2 + 180q - 1800 = 0$$

$$q = \frac{-180 \pm \sqrt{180^2 - 4 \cdot (-3) \cdot (-1800)}}{-3 \cdot 2}$$

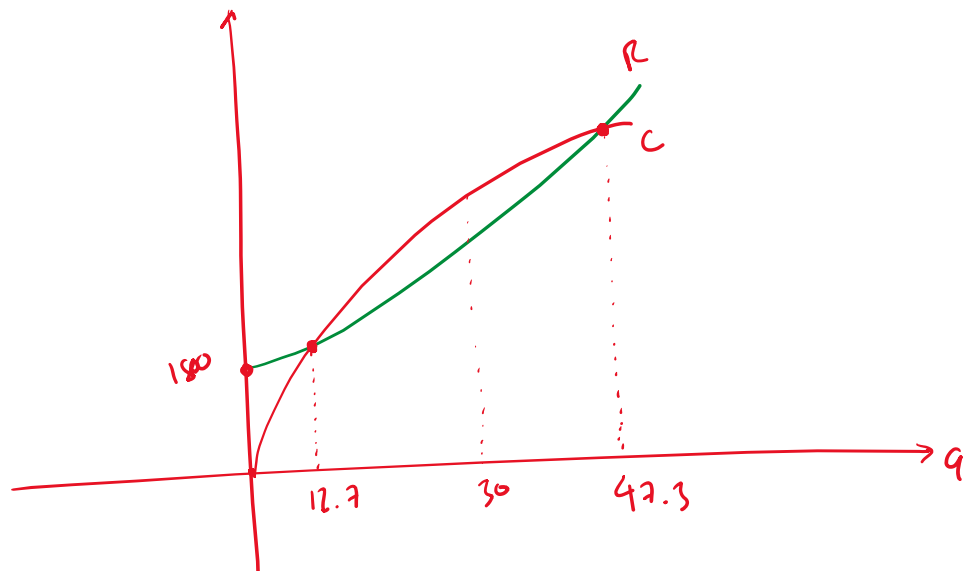
$$q \approx 12.7 ; \quad q = 47.3$$

- e. Find **the maximum profit** and the number of products need to maximize the profit.

$$q = 30$$

$$\text{Max profit} = 900$$

- f. Graph the revenue function and the cost function label the break-even points, fixed cost, and the maximized profit point.



4. On a certain route, an airline carries 5000 passengers per month, each paying \$30. A market survey indicates that for each \$1 increase in the ticket price, the airline will lose 80 passengers.

- a. What is the airline's current revenue?

$$R = 150\,000$$

- b. Create an income (revenue) function if “ $x$ ” is defined as the number of \$1 price increases

$$R = (30 + x)(5000 - 80x)$$

- c. Find the number of \$1 price increases that will maximize the revenue.

$$x = 16.25$$

- d. Find the new ticket price (that will maximize the revenue)

$$\text{new price} = 30 + x = 46.25$$

- e. Find the number of passengers at that price in d.

$$5000 - 80 \times x = 3700$$

- f. Find the new maximum income (income at that price in d)

$$171125$$

5. If the supply function for a commodity is given by  $p = 5q^2 + 10q$  and the demand function is given by  $p = 200 - 5q^2$ , find the point of market equilibrium (Supply equals Demands).

$$5q^2 + 10q = 200 - 5q^2$$

$$\Leftrightarrow 10q^2 + 10q - 200 = 0$$

$$\Leftrightarrow q^2 + q - 20 = 0$$

$$q = 4$$

$$p = 200 - 5q^2 = 120$$