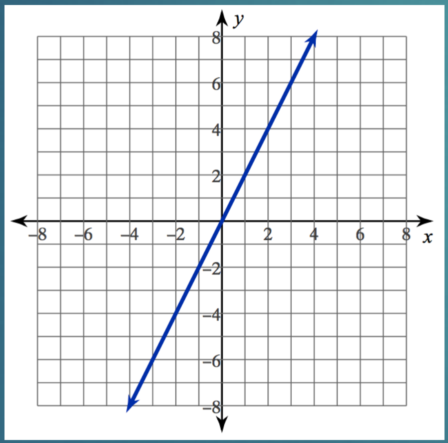
Break-Even Analysis

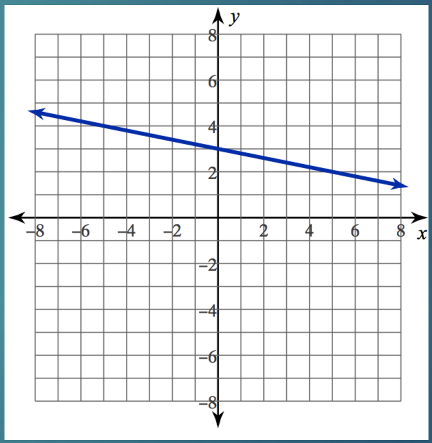
UNIT 4 – MODELING A BUSINESS

Graphs & Equations Review

- A **linear equation** makes a graph that is a straight line.
  - General equation: $y = mx + b$



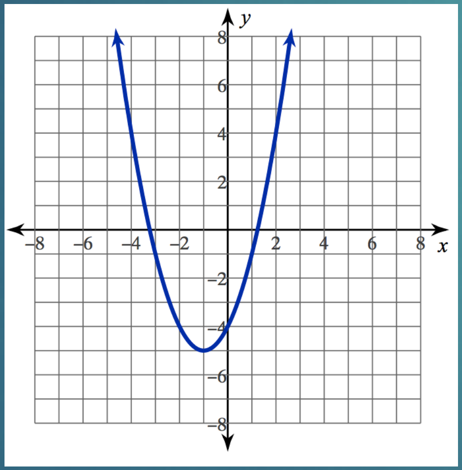
$y = 2x + 0$



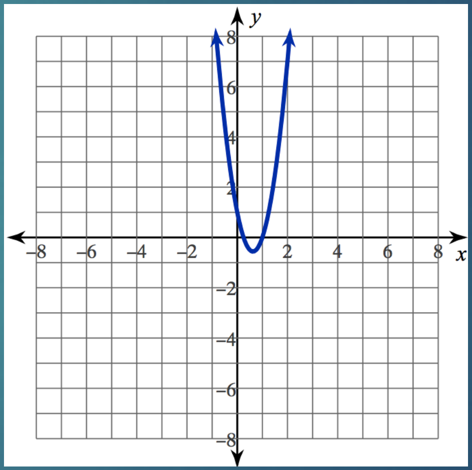
$y = -0.2x + 3$

Graphs & Equations Review

- A **quadratic equation** makes a graph that is a parabola.
  - General equation: $y = ax^2 + bx + c$



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



$y = 4x^2 - 5x + 1$

What happens when revenue equals expense?

<u>Remember</u>: This is when you breakeven.

- Business analysts must examine the **revenue and expense graphs**.
- They will **recommend prices** for products to yield **maximum revenue**.

What happens when revenue equals expense?

- Part of this process is examining breakeven points. This is called a **breakeven analysis**.

- **Calculations & interpretations** must be done during a breakeven analysis.

Example 1:

The expense equation for the production of a certain cell phone is $E = 1{,}250q + 800{,}000$. At a particular price, the breakeven revenue is \$2,600,000. What is the quantity demanded at the breakeven point?

Remember: breakeven occurs when $R = E$

so…

$$2{,}600{,}000 = 1{,}250q + 800{,}000$$

$-800{,}000$ $\qquad$ $-800{,}000$

$$1{,}800{,}000 = 1{,}250q$$

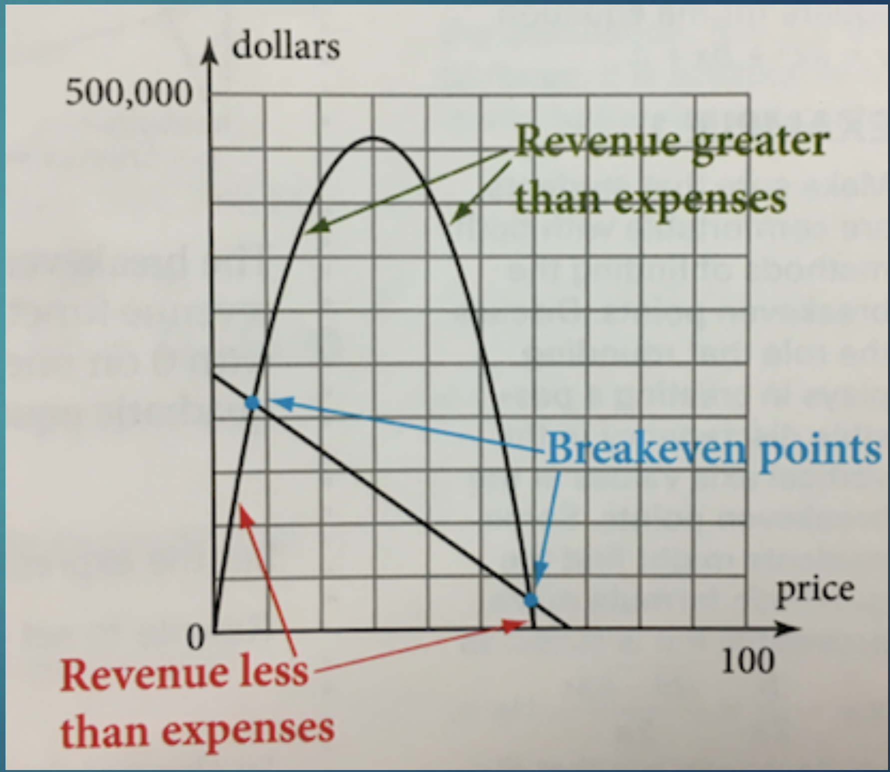
$\div\ 1{,}250$ $\qquad$ $\div\ 1{,}250$

$$\boxed{1{,}440 = q}$$

What happens when revenue equals expense?

- When the revenue function is a **quadratic function**, you need to use the **quadratic formula** to solve for the breakeven points.

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



Example 2:

Determine the prices at the breakeven points for a certain paint product.

Expense Function

$E = -3{,}500q + 238{,}000$

Revenue Function

$R = -500q^2 + 30{,}000q$

$$E = R$$

$$-3{,}500q + 238{,}000 = -500q^2 + 30{,}000q$$

$+ 500q^2 \quad - 30{,}000q \qquad\qquad + 500q^2 \quad - 30{,}000q$

$$500q^2 + -33{,}500q + 238{,}000 = 0$$

Now use the quadratic formula to solve for *q*.

Example 2:

$500q^2 + -33{,}500q + 238{,}000 = 0$ a = 500 b = -33,500 c = 238,000

$$q = \frac{-(-33{,}500) \pm \sqrt{(-33{,}500)^2 - (4 \times 500 \times 238{,}000)}}{2 \times 500}$$

$$q = \frac{33{,}500 \pm \sqrt{1{,}122{,}250{,}000 - (476{,}000{,}000)}}{1{,}000}$$

$$q = \frac{33{,}500 \pm \sqrt{646{,}250{,}000}}{1{,}000}$$

$$q = \frac{33{,}500 \pm 25421.45}{1{,}000}$$

$$q = \frac{33{,}500 + 25421.45}{1{,}000} = \frac{58{,}921.45}{1{,}000} \boxed{= \mathbf{58.92}}$$

$$q = \frac{33{,}500 - 25421.45}{1{,}000} = \frac{8078.55}{1{,}000} \boxed{= \mathbf{8.08}}$$

Example 3:

Determine the revenue and expense for the paints product at the breakeven points from example 1.

Expense Function

$E = -3{,}500q + 238{,}000$

Revenue Function

$R = -500q^2 + 30{,}000q$

Breakeven Points

$q = 58.92$ & $q = 8.08$

$E = -3{,}500(58.92) + 238{,}000$

$E = 31{,}780$

$R = -500(58.92)^2 + 30{,}000(58.92)$

$R = 31{,}780$

$E = -3{,}500(8.08) + 238{,}000$

$E = 209{,}720$

$R = -500(8.08)^2 + 30{,}000(8.08)$

$R = 209{,}720$