

Math 10250 Activity 2: Linear and Quadratic Functions (sect. 0.4 and 0.5)

GOAL: Understand the concept of slope for lines and linear functions and learn how to visualize quadratic functions by completing the square.

► A **linear function** is a function of the form

$$f(x) = mx + b \quad \text{where } m \text{ and } b \text{ are given numbers}$$

\uparrow \uparrow
 slope y -intercept

• **Slope** = m =

Exercise 1 Find the slope of the line passing through $(-1, 1)$ and $(2, 7)$.

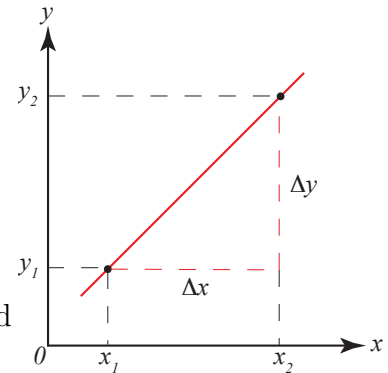


Figure 1

• **Equation of line passing through a point (x_1, y_1) and with a given slope m :**

If (x, y) is another point on the line then $\frac{y - y_1}{x - x_1} = m$. So we have

point-slope form :

Exercise 2 Find the equation of the line through $(-1, 1)$ and with slope 2.

Exercise 3 A small surf shop has fixed expenses of \$850 per month. Each surfboard costs \$100 to make and sells for \$550.

(a) Write the monthly **cost, revenue, and profit as functions** of the number x of surfboards made.

$$\text{Cost function} = C(x) \stackrel{?}{=}$$

$$\text{Revenue function} = R(x) \stackrel{?}{=}$$

$$\text{Profit function} = P(x) \stackrel{?}{=}$$

(b) Find the break-even point.

Ans. $x \approx 2$

Exercise 4 The **demand curve** of bread in a bakery shop is $q = D(p) = -50(p - 5)$ and its **supply curve** is $q = S(p) = 50(p - 1)$, where the price p is in dollars and the quantity q is in loaves. Find the **equilibrium price p_e** and **equilibrium quantity q_e** .

Ans. $p_e = 3, q_e = 100$

► A **quadratic function** is a function of the form $f(x) = ax^2 + bx + c$, where $a \neq 0$, b and c are given numbers. It always can be written in the **informative** form $f(x) = a(x - h)^2 + k$, which is a **horizontal translation** by h and a **vertical translation** by k of the **simple parabola** $f(x) = ax^2$.

Exercise 5 Consider the quadratic function $f(x) = -x^2 + 6x - 5$.

(i) Complete the square to write it in the form $f(x) = a(x - h)^2 + k$.

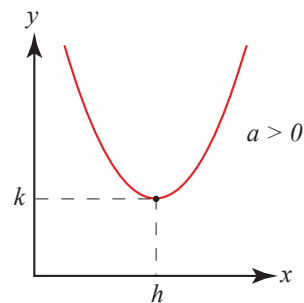


Figure 2

(ii) Use (i) to decide whether $f(x)$ has a minimum value or a maximum value and where it is taken.

(iii) Use (i) to find the roots of $f(x)$.

(iv) Determine the axis of symmetry and the y -intercept and sketch the graph of $f(x)$.

Exercise 6 A furniture company making oak desks has a fixed cost of \$5,000 per month and a cost per desk of \$500. Find how many desks per month it should produce to maximize its profit if the price is given by $p = 1000 - 2.5x$, where x denotes the number of oak desks produced by the company.

Ans. $x = 100$

Exercise 7 Consider the quadratic $f(x) = x^2 - 5x + 4$.

(a) Find its zeros using the **quadratic** formula: $x = \frac{-b \pm \sqrt{\quad}}{\quad}$

(b) Factor it.

(c) Determine the sign of $f(x)$.