

Example

Total Cost The *total cost* C for a manufacturer during a given time period is a function of the number N of items produced during that period. To determine a formula for the total cost, we need to know two things. The first is the manufacturer's fixed costs. This amount covers expenses such as plant maintenance and insurance, and it is the same no matter how many items are produced. The second thing we need to know is the cost for each unit produced, which is called the variable cost.

Suppose that a manufacturer of widgets has fixed costs of \$1500 per month and that the variable cost is \$20 per widget (so it costs \$20 to produce 1 widget).

C : Total cost

N : number of items

F : Fixed cost

Total cost = Fixed cost + Variable cost

does not

depend on

N

depends on

N

$$C = \text{Fixed cost} + (\text{cost for 1 item}) * N$$

a constant

C is a linear function of N

$$C = 1500 + 20 * N$$

Another widget manufacturer has a variable cost of \$12 per widget, and the total cost is \$3100 when 150 widgets are produced in a month.

What are the fixed costs for this manufacturer?

$$\begin{array}{ccccccc} C & = & \text{Fixed cost} & + & (\text{cost for 1 item}) & * & N \\ \downarrow & & & & \underbrace{\hspace{1cm}}_{=12} & & \underbrace{\hspace{1cm}}_{150} \\ 3100 & & & & & & \end{array}$$

$$3100 = \text{Fixed cost} + 12 * 150$$

$$\Rightarrow \text{Fixed cost} = 3100 - 12 * 150 = 1300$$

Yet another widget manufacturer has determined the following: The total cost is \$2700 when 100 widgets are produced in a month, and the total cost is \$3500 when 150 widgets are produced in a month. What are the fixed costs and variable cost for this manufacturer?

$$C = \underbrace{\text{Fixed cost}} + \underbrace{(\text{cost for 1 item})} * N$$

$$C = F + I * N$$

$$3500 = F + I * 150$$

$$- \quad 2700 = F + I * 100$$

$$800 = 150 I - 100 I$$

$$\Rightarrow 800 = 50 I \quad \Rightarrow I = \frac{800}{50} = 16$$

$$\Rightarrow 3500 = F + 16 * 150$$

$$\Rightarrow F = 3500 - 16 * 150 = 1100$$

$F = 1100$
$I = 16$

Total Revenue and Profit This is a continuation of ~~Exercise 12~~. The total revenue R for a manufacturer during a given time period is a function of the number N of items produced during that period. In this exercise, we assume that the selling price per unit of the item is a constant, so it does not depend on the number of items produced. The profit P for a manufacturer is the total revenue minus the total cost. If the profit is zero, then the manufacturer is at a break-even point.

We consider again the manufacturer of widgets in Exercise 13 with fixed costs of \$1500 per month and a variable cost of \$20 per widget. Suppose the manufacturer sells 100 widgets for \$2300 total.

Find the break-even point

$$C = 1500 + 20 \cdot N$$

$$R = (\text{price for item}) \cdot N$$

← 23

Find N so that $R = C$

First we need to find price for 1 item

$$100 \text{ widgets} = \$2300$$

$$\Rightarrow 1 \text{ widget} = \$23$$

$$\Rightarrow R = 23 \cdot N$$

$$R = C \Rightarrow \underbrace{1500 + 20N}_{\text{cost}} = \underbrace{23N}_{\text{Revenue}}$$

total cost

$$C = F + I \cdot N$$

$$R = (\text{price for 1 item}) \cdot N$$

$$P = R - C$$

profit

$$\Rightarrow 23N = 20N + 1500$$

$$\Rightarrow 23N - 20N = 1500$$

$$\Rightarrow 3N = 1500$$

$$N = \frac{1500}{3} = \underline{500}$$

Assignment 2

widget manufacturer has a variable cost of \$12 per widget, and the total cost is \$3100 when 150 widgets are produced in a month.

- (a) Find the fixed cost of this manufacturer
- (b) The manufacturer sell 100 widgets for \$2000. Find the price for each item
- (c) Find the break-even point for the manufacturer
- (d) ^{extra credits} How many items the manufacturer has to sell to have the profit of \$10,000?