Applications of Linear Functions

Supply

Demand

Equilibrium

Example 1: You own a small convenience store. You can sell 90 packs of gum per week if they are marked at $2 each, but only 30 each week if they are marked at $3/pack. You gum supplier is prepared to sell you 20 packs each week if they are marked at $1/pack and 100 each week if they are marked at $3/pack.

a. Write the demand and supply functions.

b. Find the equilibrium point. For supply to equal demand, the packs of gum must be priced at how much apiece?

c. Graph both the demand and supply function on the same axis.

You Try: The demand for your college newspaper is 2,000 copies each week if the paper is given away free of charge and drops to 800 each week if the charge is $1.50 per copy. However, the university is prepared to supply only 600 copies per week free of charge but will supply 1,500 each week at $1.50 per copy.

a. Write the demand and supply functions.

b. Find the equilibrium point. For supply to equal demand, the newspaper must be priced at how much apiece?

c. Graph both the demand and supply function on the same axis.

Cost

Variable cost

Fixed cost

Average cost

Revenue

Profit

Break-even point

Example 3: An anticlot drug can be made for $10 per unit. The total cost to produce 100 units is $1500.

a. Assuming that the cost function is linear, find its rule.

b. What are the fixed costs?

c. Find the average cost of producing 100 units.

d. Find the average cost of producing 1000 units.

You Try: A product can be made for $120 per unit. The total cost to provided 100 units is $15,800.

a. Assuming that the cost function is linear, find its rule.

b. What are the fixed costs?

c. Find the average cost of producing 100 units.

d. Find the average cost of producing 1000 units.

Example 4:
A bicycle manufacturer experiences fixed monthly costs of $124,992 and variable costs of $52 per standard model bicycle produced. The bicycles sell for $100 each.

a. Find the cost function

b. Find the revenue function

c. Graph and label the cost and revenue functions on the same set of axes. Label the break-even point.

d. Find the profit function

e. How much profit will they make by producing and selling 2000 bicycles?

f. How many bicycles must be produced and sold in order to obtain a profit of $100,000?

You Try:
A company manufactures a 65-inch smart TV that sells to retailers for $550. The costs can be described by a linear cost function with fixed costs of $213,000 and a variable cost per item of $250.

a. Find the cost function

b. Find the revenue function

c. Graph and label the cost and revenue functions on the same set of axes. Label the break-even point.

d. Find the profit function

e. How much profit will they make by producing and selling 5000 TVs?

f. How many units must be produced and sold in order to obtain a profit of $50,000?

Example 5: Suppose that the manufacturer's suggested retail price (MSRP) on a 2021 Ford F150 XL pickup truck is $38,345 and that in three years it is worth $26,120.

a. Assuming linear depreciation, find the depreciation function for this vehicle.

b. At what rate is the car depreciating?

c. What will the truck be worth in 6 years?

d. When will the vehicle be worth half of its original value?

You Try: A house increases in value in an approximately linear fashion from $222,000 to $300,000 in 6 years.

a. Find the appreciation function that gives the value of the house in year x.

b. At what rate is the house appreciating?

c. If the house continues to appreciate at this rate, what will it be worth 12 years from now?

d. When will the house be worth triple its original value?

Residuals

Line of best fit

Interpolation

Extrapolation

Example 8: The number of full-time faculty members at institutes of higher education (in thousands) in selected years is shown in the following table.

Year	2013	2015	2016	2017	2018
Faculty Members	791	807	814	823	832

a. Let x=13 correspond to the year 2013. Plot the points (x,y) where x is the year and y is the number of full time faculty.

b. Use the data points (15, 807) and (16, 814) to find a line that models these data.

c. Use the data points (17, 823) and (18, 832) to find a line that models these data.

d. For the equation in part b, determine the five residuals, square each residual, and sum the squares of the residuals.

e. For the equation in part c, determine the five residuals, square each residual, and sum the squares of the residuals.

f. Which line is the better fit? Why?

g. Use your answer from part f to approximate the number of full-time faculty members in 2024.