



4-5 Linear Automobile Depreciation

Advanced Financial Algebra

What is the Value of Your Car?

- ◇ Most cars depreciate (lose value) over time.
- ◇ A few cars appreciate (gain value).
- ◇ One type of depreciation is linear (line).
Where the car loses the same amount of value each year (not very common).
- ◇ We will also explore some exponential depreciation which is more common.

Linear
information
you may
remember?

◇ $y = mx + b$

◇ (x,y) points on the line

◇ $m = \text{slope} = \frac{\quad}{\quad} = \quad$

◇ $y - \text{intercept} = (0, b)$

Example 1 – x and y- intercepts

◇ Suppose that you purchase a car for \$27,000. According to your online research, this make and model of car loses all of its *marketable value* after 12 years. (it depreciates to a value of zero dollars 12 years after the purchase date). If this car depreciates in a straight line form, what are the coordinates of the intercepts of the depreciation equation?

◇ SOLUTION:

(0, maximum car value) and (maximum lifespan, 0)

◇ y – intercept = (0, \$27,000)

◇ x – intercept = (12, \$0)

Example 2 – Slope

◆ Determine the slope of the straight line depreciation equation for the situation in Example 1.

◆ SOLUTION:

◆ y – intercept = (0, \$27,000) and x – intercept = (12, \$0) in example 1

$$\text{◆ Slope} = \frac{-}{-} = \frac{0 - 27000}{12 - 0} = \frac{-27000}{12} = -2,250$$

◆ This means that the car loses \$2,250 worth of value each year.

Example 3 – straight line depreciation equation

◇ Write the straight line depreciation equation for the situation discussed in Examples 1 and 2. Then draw the graph of the equation.

◇ SOLUTION:

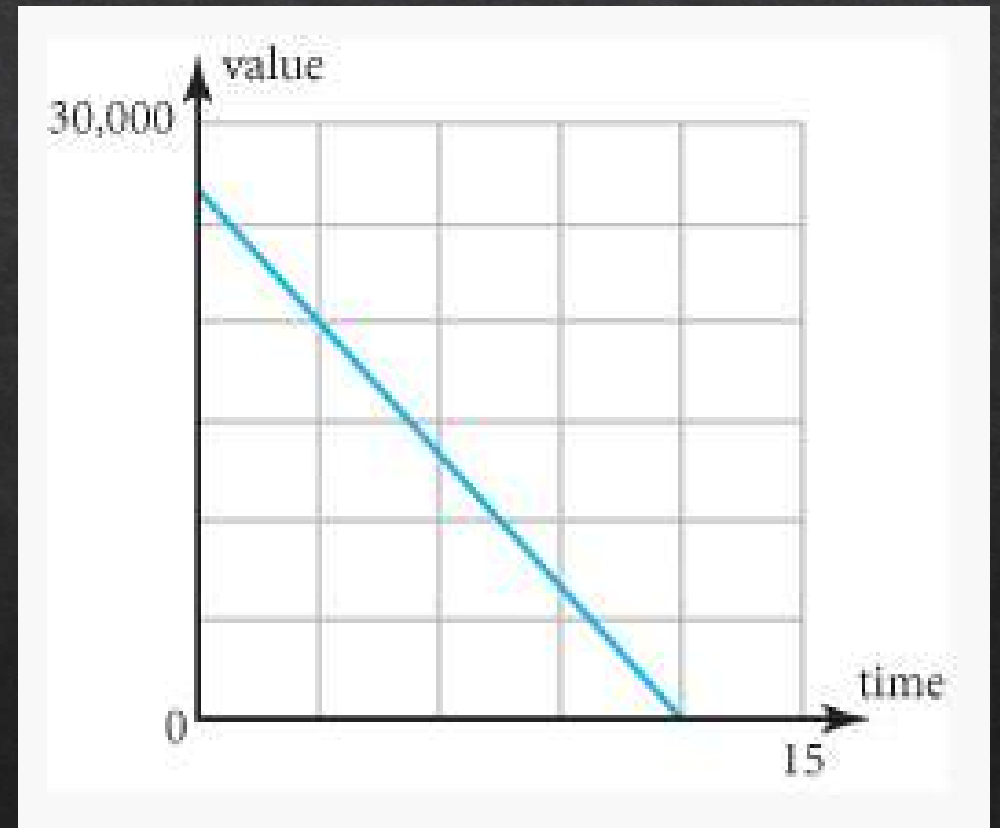
◇ $y = mx + b$ where $m = \text{slope}$ and $(0, b)$ is the **y-intercept**

◇ From example #1, y – intercept = $(0, \$27,000)$

◇ Therefore, $b = 27,000$

◇ From example #2, slope = $-2,250 = m$

◇ Substitution gives you $y = -2250x + 27000$



Example 4 - future prediction (use this in your car project)

◇ Suppose that Jack purchased a car 5 years ago at a price of \$27,600. According to research on this make and model, similar cars have straight line depreciated to 0 value after 12 years. How much will Jack's car be worth after 66 months?

◇ SOLUTION:

$$\text{◇ Slope} = \frac{-}{-} = \frac{0 - 27000}{12 - 0} = \frac{-27600}{12} = -2,300$$

◇ Substitution gives you $y = -2300x + 27600$

◇ 66 months / 12 = 5.5 years

$$\text{◇ } y = -2300(5.5) + 27,600 = 14,950$$

◇ Jack's car will be worth about \$14,950 after 66 months.

Automobile Expense Function

- ◇ This is different from the depreciation formula which tells you how much a car is worth over time.
- ◇ The automobile expense function calculates how much money total was spent on a car purchase for all payments including the down-payment.
- ◇ Later, we will add in insurance, repairs, etc.

Example 6 question – skip examples 5 & 7

- ◇ Celine bought a new car for \$33,600. She made a \$4,000 down payment and pays \$560 each month for 5 years to pay off her loan. She knows from her research that the make and model of the car she purchased straight line depreciates to zero over 10 years.
- ◇ a) Create an expense and depreciation function.
- ◇ b) Graph these functions on the same axes.
- ◇ c) Interpret the region before, at, and after the intersection point.

◇ SOLUTION:

- ◇ a) Create a depreciation function first like we did in example #3. This is the “CAR VALUE”

◇ **Slope = m** = $\frac{-}{-} = \frac{0 - 33600}{10 - 0} = -3,360$ and the y-intercepts is \$33,600

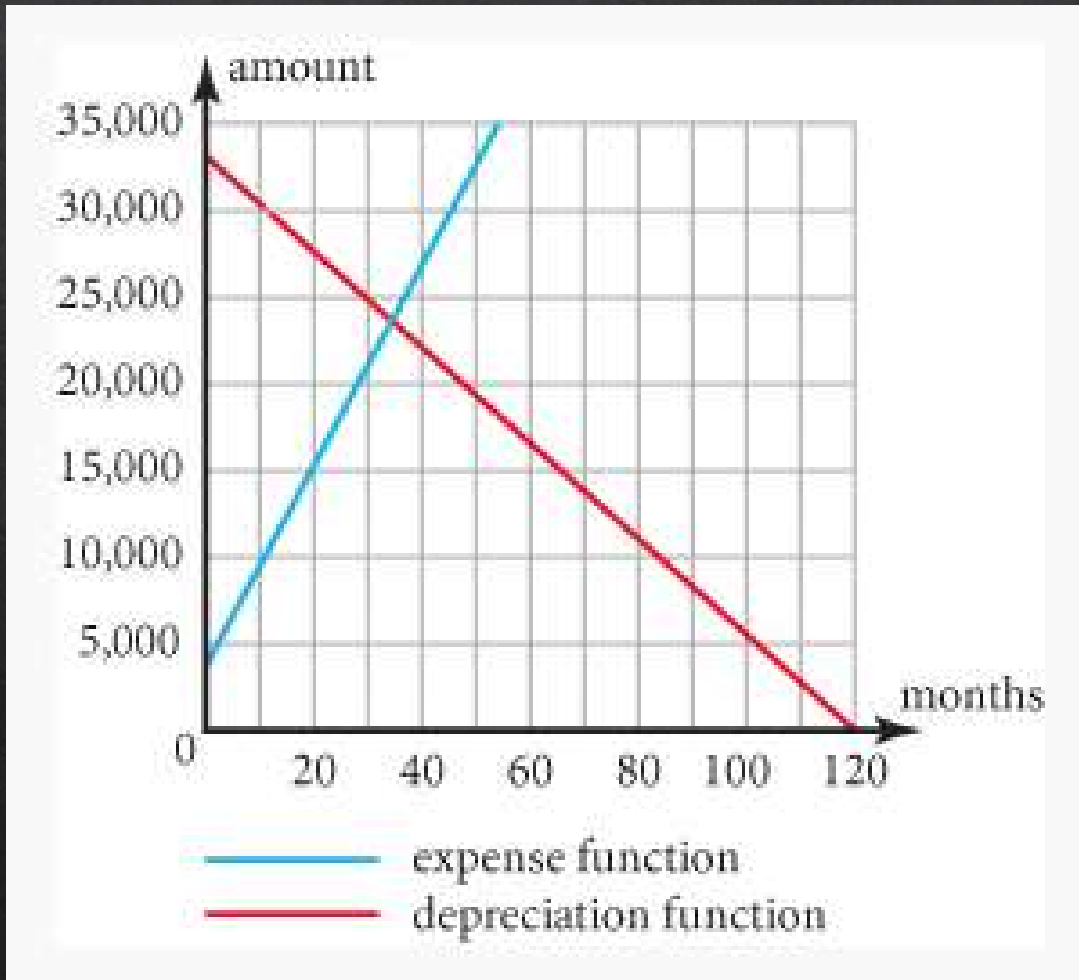
◇ **y = mx + b** and substitution give you **y = -3360x + 33600** (this is in YEARS)

Example 6 SOLUTION continued

- ◇ a) continued: Create an expense function. This is “\$ CELINE SPENT”
- ◇ NOTE: \$4,000 down payment and \$560 per month car payment
- ◇ $y = 4000 + 560x$ for five years = $560x + 4000$ (this is in MONTHS)

- ◇ b) We cannot graph years and months on the same graph so we have to change the depreciation function to months so that we can graph both lines on the same axes:
$$y = -3360x + 33600 \text{ and } -3360/12 = -280$$
- ◇ New depreciation function is $y = -280x + 33600$

Example 6 SOLUTION continued



◇ d)

The region before (to the left of) the point of intersection is where the car is worth MORE than she has paid for it up until that time.

The region after (to the right of) the point of intersection is where she has paid more for the car than it is worth at that time.

Assignment: pg 247 # 2-10 even, 14

#2 Delia purchased a new car for \$25,350. This make and model straight line depreciates to zero after 13 years.

- a) Identify the coordinates of the x- and y-intercepts for the depreciation equation.
- b) Determine the slope of the depreciation equation.
- c) Write the straight line depreciation equation that models this situation.
- d) Draw the graph of the straight line depreciation equation.

#3 Vince purchased a used car for \$11,200. This make and model used car straight line depreciates to zero after 7 years.

- a) Identify the coordinates of the x- and y-intercepts for the depreciation equation.
- b) Determine the slope of the depreciation equation.
- c) Write the straight line depreciation equation that models this situation.
- d) Draw the graph of the straight line depreciation equation.

Assignment: pg 247 # 2-10 even, 14 continued

#4 Examine the straight line depreciation graph for a car.

- a) At what price was the car purchased?
- b) After how many years does the car totally depreciate?
- c) Write the equation of the straight line depreciation graph shown.

#5 The straight line depreciation equation for a luxury car is $y = -3,400x + 85,000$.

- a) What is the original price of the car?
- b) How much value does the car lose per year?
- c) How many years will it take for the car to totally depreciate?

Assignment: pg 247 # 2-10 even, 14 continued

◇ #6

The straight line depreciation equation for a motorcycle is $y = -2,150x + 17,200$. (Express your answers as whole numbers.)

a. What is the original price of the motorcycle?

b. How much value does the motorcycle lose per year?

c. How many years will it take for the motorcycle to totally depreciate?

#7 The straight line depreciation equation for a car is $y = -2,750x + 22,000$.

a) What is the car worth after 5 years?

b) What is the car worth after 8 years?

Assignment: pg 247 # 2-10 even, 14 continued

◇ #8

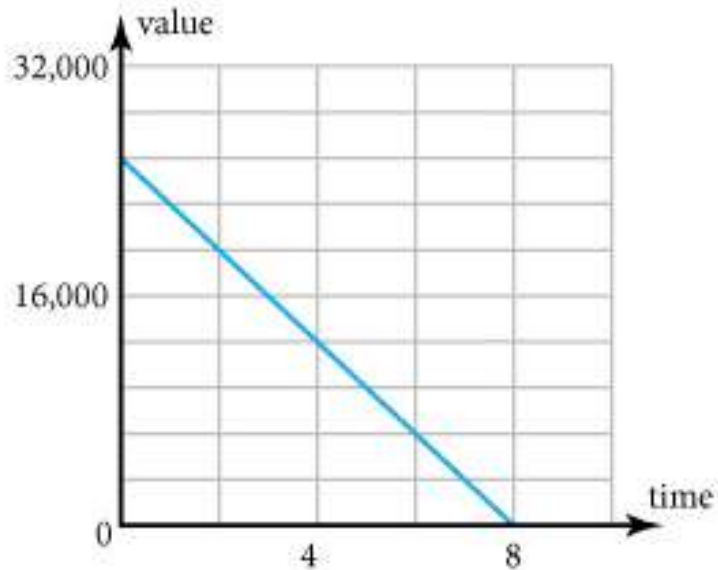
The straight line depreciation equation for a car is $y = -2,680x + 26,800$.

- a) What is the car worth after 48 months?
- b) What is the car worth after 75 months?

Assignment: pg 247 # 2-10 even, 14 continued

◇ #9

The graph of a straight line depreciation equation is shown. (Express your answers as whole numbers.)



a. Use the graph to approximate the value of the car after 4 years.

b. Use the graph to approximate the value of the car after 5 years.

c. Use the graph to approximate when the car will be worth half its original value. (Determine the number of years.)

Assignment: pg 247 # 2-10 even, 14 continued

#10

A car is originally worth \$34,450. It takes 13 years for this car to totally depreciate.

- Write the straight line depreciation equation for this situation.
- How long will it take for the car to be worth half its value?
- How long will it take for the car to be worth \$10,000? Round your answer to the nearest tenth of a year.

#14

Milo's car straight line depreciates monthly over time. He knew that after 7 months his car was worth \$26,930. According to an online car value calculator after 30 months, he determined that his car was worth \$19,800. How much does his car depreciate each month?