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Transportation Costs (or Trucker's Dilemma)

Math 1050 College Algebra Project



A truck driving 260 miles over a flat interstate at a constant rate of 50 miles per hour gets 7 miles to the gallon. Fuel costs \$3.50 per gallon. For each mile per hour increase in speed, the truck loses a tenth of a mile per gallon in its mileage. Drivers get \$27.50 per hour in wages and fixed costs for running the truck amount to \$11.33 per hour. What constant speed (between 50 mph and the speed limit of 65 mph) should the truck drive to minimize the total cost of the trip?

Part I: To solve a problem like this, it is a good idea to start with calculating an actual example. We will begin by finding the total cost if the truck is driven at 50 miles per hour. The cost is made up of two components: the fuel cost and the time cost. Be sure to include the correct units with each value below.

A. Let's start out by finding how long the trip will take.

The length of time required for the trip is 5.2 hrs. (Do not round.)

B. Now, with this time known, how much will it cost to pay the driver and run the truck?

$$\begin{aligned} 27.50(5.2) &= 50.916 \\ 11.33(5.2) &= 143 \end{aligned} \quad \text{Add!} = \$201.916$$

The amount needed to pay the driver and run the truck is \$201.92. (Round to nearest cent.)

C. Next determine, at 7 miles per gallon for 260 miles, how much fuel will be required.

$$260/7 = 37\frac{1}{7}$$

The amount of fuel required is $37\frac{1}{7}$ gal. (Do not round. Leave as a fraction.)

D. With the amount of fuel known, how much will the fuel cost to make the 260 miles?

$$37\frac{1}{7} \cdot \$3.50 = 130$$

The cost of the fuel is \$130. (Round to nearest cent.)

E. Finally we can find the TOTAL cost.

$$201.92 + 130 = 331.92$$

The total cost for the trip is \$331.92. (Round to nearest cent.)

Part III. We should now have a good process for determining the total cost of a trip for any rate of speed greater than or equal to 50 miles per hour. Next is to create a Total Cost function using X as the unknown rate in miles per hour. Simplify your answers and remember to include units. As you work through each step, test your answers by plugging in 50 mph and then 65 mph and comparing with results from parts I and II.

A. Let's find how long the trip will take.

$$\frac{260}{x} = \text{speed}$$

The length of time required for the trip is $\frac{260}{x}$.

B. Now with this time known, how much will it cost to pay the driver and run the truck?

$$\left(27.50 \cdot \frac{260}{x}\right) + \left(11.33 \cdot \frac{260}{x}\right)$$

$$\frac{260}{x} (27.50 + 11.33) = \frac{260}{x} (38.83) = \frac{10095.8}{x}$$

The amount of money needed to pay the driver and run the truck is $\frac{10095.8}{x}$.

C. Next, to begin determining the fuel cost, we need to find the mileage (miles per gallon of fuel) when the truck is travelling at X miles per hour.

$$7 - \frac{1}{10}(x - 50)$$

$$7 - \frac{1}{10}x + 5$$

The mileage at X miles per hour is $12 - \frac{1}{10}x$.

D. With the fuel mileage known, how much fuel will be needed for the 260 miles?

$$\frac{260}{12 - \frac{1}{10}x}$$

The amount of fuel required is $\frac{260}{12 - \frac{1}{10}x}$.

E. With the amount of fuel known, how much will the fuel cost to make the 260 miles?

$$\frac{260}{12 - \frac{1}{10}x} \cdot \frac{3.50}{1}$$

The cost of the fuel is $\frac{910}{12 - \frac{x}{10}}$.

F. Now we can find the TOTAL cost function. Express your function as C(X) =

$$C(x) = \frac{910}{12 - \frac{x}{10}} + \frac{10095.8}{x}$$

TOTAL Trip Cost Function is $C(x) = \frac{910}{12 - \frac{x}{10}} + \frac{10095.8}{x}$