1. Bathtub Problem: You pull out the plug from the bathtub. After 40 seconds, there are 13 gallons of water left in the tub. One minute after you pull the plug, there are 10 gallons left. Assume that the number of gallons varies linearly with the time since the plug was pulled.

(a) Write the particular equation expressing the number of gallons (g) left in the tub in terms of the number of seconds (s) since you pulled the plug.

\[ y = \frac{3}{20}x + 19 \]

(b) How many gallons would be left after 20 seconds? 50 seconds?

20 seconds: \[ x = 20 \]
\[ y = \frac{3}{20}(20) + 19 \]
\[ y = 16 \text{ gallons} \]

50 seconds: \[ x = 50 \]
\[ y = \frac{3}{20}(50) + 19 \]
\[ y = 11.5 \text{ gallons} \]
Bathtub Problem: You pull out the plug from the bathtub. After 40 seconds, there are 13 gallons of water left in the tub. One minute after you pull the plug, there are 10 gallons left. Assume that the number of gallons varies linearly with the time since the plug was pulled.

(c) At what time will there be 7 gallons left in the tub?

\[ y = 7 \]

\[ y = \frac{3}{20}x + 19 \]

\[ 7 = \frac{3}{20}x + \frac{19}{5} \]

\[ -12 = \frac{3}{20}x \]

\[ x = \frac{-12 \times 20}{3} = -80 \text{ seconds} \]

Bathtub Problem: You pull out the plug from the bathtub. After 40 seconds, there are 13 gallons of water left in the tub. One minute after you pull the plug, there are 10 gallons left. Assume that the number of gallons varies linearly with the time since the plug was pulled.

(d) Find the y-intercept (gallon-intercept). What does this number represent in the real world?

\[ y = \frac{3}{20}x + 19 \]

\[ b = 0.19 \]

Tub is 19 gal full when draining began

(e) Find the x-intercept (time-intercept). What does this number represent in the real world?

\[ x \rightarrow \text{time} \]

\[ x - \text{intercept} \rightarrow y = 0 \]

\[ 0 = \frac{3}{20}x + 0.19 \]

\[ -19 = \frac{3}{20}x \]

\[ 20(-19) = \frac{3}{20}x \times \frac{20}{3} \]

\[ x = 126.67 \text{ sec} \]
Bathtub Problem: You pull out the plug from the bathtub. After 40 seconds, there are 13 gallons of water left in the tub. One minute after you pull the plug, there are 10 gallons left. Assume that the number of gallons varies linearly with the time since the plug was pulled.

(g) What is the slope? What does this number represent?

\[ y = -\frac{3}{20}x + 19 \]

\[
\frac{-3 \text{ gal}}{20 \text{ sec}} = \frac{-0.15 \text{ gal}}{1 \text{ sec}} = m
\]

unit-rate
3. **Taxi Problem**: To take a taxi in downtown St. Louis, it will cost you $3.00 to go a mile. After 6 miles, it will cost $5.25. The cost varies linearly with the distance traveled.

(a) Write the particular equation expressing cost (c) in terms of miles (d) traveled.

\[
\begin{align*}
\text{Cost} & \rightarrow c = \text{cost} \\
\text{Miles} & \rightarrow d = \text{miles}
\end{align*}
\]

\[
\begin{align*}
3 &= .45 (1) + b \\
5.25 &= .45 (6) + b \\
\frac{5.25 - 3}{6 - 1} &= \frac{3}{1} = .45 \\
\frac{2.25}{5} &= .45 \\
\frac{2.25}{5} \times 1 &= 2.55 = b \\
\end{align*}
\]

\[
y = .45x + 2.55
\]

(b) How much will it cost you to travel 10 miles in a taxi?

\[
y = .45x + 2.55 \\
y = .45 (10) + 2.55 \\
y = 4.5 + 2.55 \\
y = 7.05
\]
3. **Taxi Problem**: To take a taxi in downtown St. Louis, it will cost you $3.00 to go a mile. After 6 miles, it will cost $5.25. The cost varies linearly with the distance traveled.

(c) How many miles can you travel if you only have $20 to spend?

\[
\begin{align*}
3.00 &= 0.45x + 2.55 \\
20 &= 0.45x + 2.55 \\
17.45 &= 0.45x \\
38.89 &= x
\end{align*}
\]

(d) Calculate the cost-intercept. What does this number represent in the real world?

\[
y = 0.45x + 2.55 \quad \text{y-intercept} \rightarrow x = 0
\]

$2.55 \rightarrow \text{initial amount/fee}$

(g) What is the slope? What does this number represent?

\[
y = 0.45x + 2.55
\]

\[
\frac{\$2.25}{5 \text{ mi}} = \frac{\$0.45}{1 \text{ mi}} = \text{cost per mile}
\]
3. Taxi Problem: To take a taxi in downtown St. Louis, it will cost you $3.00 to go a mile. After 6 miles, it will cost $5.25. The cost varies linearly with the distance traveled.

(a) Write the particular equation expressing cost \( y \) in terms of miles \( x \) traveled.

\[
\begin{align*}
\text{unit rate} & = \frac{y_2 - y_1}{x_2 - x_1} \\
& = \frac{5.25 - 3.00}{6 - 1} \\
& = \frac{2.25}{5} \\
& = 0.45 \\
\Rightarrow & m = 0.45 \\
\end{align*}
\]

\[
y = mx + b
\]

\[
\begin{align*}
3 &= mx + b \\
3 &= 0.45(1) + b \\
2.55 &= b
\end{align*}
\]

\[
y = 0.45x + 2.55
\]

(b) How much will it cost you to travel 10 miles in a taxi?

\[
y = 0.45x + 2.55
\]

\[
y = 0.45(10) + 2.55 \\
y = 7.05
\]
3. **Taxi Problem**: To take a taxi in downtown St. Louis, it will cost you $3.00 to go a mile. After 6 miles, it will cost $5.25. The cost varies linearly with the distance traveled.

(c) How many miles can you travel if you only have $20 to spend?

\[
y = 0.45x + 2.55 \quad y = 20
\]

\[
20 = 0.45x + 2.55 \\
-2.55 = 0.45x \\
\frac{17.45}{0.45} = x \\
38.77 \text{ mi} = x
\]

(d) Calculate the cost-intercept. What does this number represent in the real world?

\[
y = 0.45x + 2.55
\]

$2.55 \rightarrow \text{initial amount/fee}$

$y$-intercept $\rightarrow x = 0$

Initial amount

(g) What is the slope? What does this number represent?

\[
y = 0.45x + 2.55
\]

$\frac{\$2.25}{5 \text{ mi}} = \$0.45 \text{ per mi}$

Unit rate

Cost per mile