Module 5
Applications of Linear Equations in Two Variables
Things to Know

- Goal is to model the problem as an equation of the form $y = mx + b$.
- From the problem, we need to identify a point and a slope or two points.
- Slope – represents how a quantity is changing
- Points – represent a correspondence between two quantities.
Writing an equation and drawing its graph to model a real-world situation

Owners of a recreation area are filling a small pond with water. They are adding water at a rate of 30 liters per minute. There are 500 liters in the pond to start.

Let \( W \) represent the amount of water in the pond (in liters), and let \( t \) represent the number of minutes that water has been added. Write an equation relating \( W \) to \( t \), and then graph your equation using the axes below.
$W = \text{amount of water} \quad t = \# \text{ of minutes}$

<table>
<thead>
<tr>
<th>$t$</th>
<th>$W$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>1</td>
<td>500 + 30 = 530</td>
</tr>
<tr>
<td>2</td>
<td>500 + 2(30) = 560</td>
</tr>
<tr>
<td>3</td>
<td>500 + 3(30) = 590</td>
</tr>
<tr>
<td>$t$</td>
<td>$500 + t(30) = 500 + 30t$</td>
</tr>
</tbody>
</table>

$W = 500 + 30t$

$W = \frac{30t + 500}{1}$

$W = 30t + 500$
Application problem with a linear function: Problem type 1

Suppose that the weight (in pounds) of an airplane is a linear function of the total amount of fuel (in gallons) in its tank. When graphed, the function gives a line with a slope of 6.4. See the figure below.

\[ x = \text{amt of fuel} \]
\[ y = \text{weight} \]
With 45 gallons of fuel in its tank, the airplane has a weight of 2188 pounds. What is the weight of the plane with 78 gallons of fuel in its tank?

\[ y = 6.4x + 1900 \]

\[ y = 6.4(78) + 1900 \]

\[ y = 2399.2 \text{ lb} \]
Application problem with a linear function: Problem type 2

The monthly cost (in dollars) of water used is a linear function of the amount of water used (in hundreds of cubic feet, HCF). The cost for using 23 HCF of water is $39.77, and the cost for using 34 HCF is $57.92. What is the cost for using 28 HCF of water?

\[ \begin{align*}
X &= \text{amt of water} \\
Y &= \text{cost} \\
(23, 39.77) &\quad (34, 57.92)
\end{align*} \]

\[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{57.92 - 39.77}{34 - 23} = \frac{18.15}{11} = 1.65 \]

\[ y = mx + b \]

\[ 39.77 = 1.65(23) + b \]

\[ 39.77 = 37.95 + b \]

\[ b = 1.82 \]

\[ y = 1.65x + 1.82 \]

\[ y = 1.65(28) + 1.82 \]

\[ y = 48.02 \]