5.5: Writing Linear Equations in Different Forms

Hawaii Content and Performance Standards (HCPS) III

- **Standard 10**: Patterns, Functions, and Algebra: SYMBOLIC REPRESENTATION: Use symbolic forms to represent, model and analyze mathematical situations.
- **Benchmark MA.AI.10.4**: Determine the equation of a line when given the graph of the line, the slope and a point on the line, or two points on the line.

Common Core State Standards (CCSS) for High School Mathematics

- **A.CED.2**: Create equations that describe numbers or relationships.
  Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
- **S.ID.7**: Interpret linear models.
  Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*

Objectives(s):
- To write linear equations in different forms.

### Write Linear Equations in Different Forms

<table>
<thead>
<tr>
<th>Form</th>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope-Intercept</td>
<td>$y = mx + b$</td>
<td>$m$ is the slope, and $b$ is the $y$-intercept.</td>
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</table>
| Standard      | $Ax + By = C$       | □ Separate $x$ and $y$ variables.  
 □ $A > 0$  
 □ $A$ and $B$ are both not zero.  
 □ $A$, $B$ and $C$ are integers.  
 □ The GCF $A$, $B$ and $C$ is 1. |
| Point-Slope   | $y - y_1 = m(x - x_1)$ | $M$ is the slope and $(x_1, y_1)$ is a given point. |

### Steps to Writing Linear Equations in Different Forms

1. Calculate the slope $m$, if not given.
2. Write the equation of the line in Point-Slope Form by substituting the values of a given point $(x_1, y_1)$ and the slope $m$.
3. Determine which form you want to write the linear equation.
   - To write the linear equation in Slope-Intercept form, solve for $y$.
   - To write the linear equation in Standard Form, move $x$ and $y$ to one side of the equal sign, where $x$ is positive. Be sure all criteria of Standard Form are met.
Example 1: Write a Linear Equation Given a Point and Slope
Write an equation of a line that passes through (-2, 3) with a slope of -4 in the following forms:

a.) Point-Slope Form
b.) Slope-Intercept Form
c.) Standard form

Example 2: Write a Linear Equation Given a Point and Slope
Write an equation of a line that passes through (-5, 2) with a slope of $\frac{1}{2}$ in the following forms:

a.) Point-Slope Form
b.) Slope-Intercept Form
c.) Standard form
Example 3: Write a Linear Equation Given Two Points

Write an equation of a line that passes through (2, 2) and (6, 4) in the following forms:

a.) Point-Slope Form

b.) Slope-Intercept Form

c.) Standard form
Write Equations for Horizontal and Vertical Lines

**Example 4: Write a Linear Equation for a Horizontal Line**
Write an equation of a horizontal line that passes through the given point.

a.) (5, -1)  

b.) (-3, 2)

![Graph of horizontal lines passing through points (5, -1) and (-3, 2)]

**Example 5: Write a Linear Equation for a Vertical Line**
Write an equation of a vertical line that passes through the given point.

a.) (3, 2)  

b.) (-1, 4)

![Graph of vertical lines passing through points (3, 2) and (-1, 4)]