EQAO Sample Questions for Linear Relations – Part 3:

1. This graph shows information about last year's total cost for a banquet for \( n \) students.

\[
\begin{align*}
\text{Last year} & : m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1400 - 600}{50 - 0} = 16
\\
\text{This year} & : m = \frac{1750 - 1200}{150 - 0} = 11.5
\\
(0, 600) & , (50, 1400)
\\
\therefore b = 600
\end{align*}
\]

This year the cost per person has decreased by $5, but the initial fee has doubled.

Determine an equation to represent total cost, \( C \), for this year.

\[
C = 11n + 1200
\]

Show your work.

Describe two ways the graph for total cost for this year will be different from the graph for total cost for last year.

Justify your answer.

1. The graph for this year will start at a higher point because the initial value is greater.
   E.g. $600 - \text{initial} \rightarrow $1200 - \text{initial}

2. The graph for this year will be less steep because the rate of change is less.
   E.g. $16/\text{person} \rightarrow \text{R.O.C.} \rightarrow $11/\text{person} \rightarrow \text{R.O.C.}
2. **Draining Away**

Water drains out of two different containers at constant rates. Information about the volume of water in the containers over time is given below.

![Graph and Table]

Out of which container is the water draining at a faster rate?

Circle one:  
- Container A  
- Container B

Justify your answer.

- Container A  
  \[ m = \frac{-25}{2} \text{ L/min} \]

- Container B  
  \[ m = \frac{-22}{2} \text{ L/min} \]

3. **Related Relations**

A new line

- is perpendicular to the line represented by \(3x - y = 5\) and
- has the same \(y\)-intercept as the line represented by \(4x - 3y - 12 = 0\).

Determine the equation of the new line.

Justify your answer.

The equation of the new line is  
\[ y = -\frac{1}{3}x - 4 \]
### Is It a Line?

Determine whether each of the relations in the chart below is linear or non-linear. Justify your answers. You may use the grid if you wish.

<table>
<thead>
<tr>
<th>$-2x + 6y = 18$</th>
<th>$y = 4x^2 + 3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle one:</td>
<td>Circle one:</td>
</tr>
<tr>
<td>Linear</td>
<td>Linear</td>
</tr>
<tr>
<td>Non-linear</td>
<td>Non-linear</td>
</tr>
</tbody>
</table>

**Justification**

- **$-2x + 6y = 18$**
  - $x$: $0$, $3$, $6$, $9$, $12$
  - $y$: $3$, $4$, $5$, $6$, $7$
  - **Linear**

- **$y = 4x^2 + 3$**
  - $x$: $0$, $1$, $2$, $3$, $4$
  - $y$: $3$, $7$, $11$, $15$, $19$
  - **Non-linear**

### Graph

- **Equation $y = \frac{1}{3}x + 3$**
  - By $1's$
  - By $2's$

- **Equation $x^2 + 3$ by $1's$**
  - By $2's$
5. **Lovely Lines**

Line 1 is shown on the grid below.

![Graph of Line 1](image)

Graph Line 2 on the same grid so that it passes through A(−10, 8) and has a slope that is three times the slope of Line 1.

Justify your answer.

**Line 1**

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
m = \frac{-6 - (-3)}{6 - 0}
\]

\[
m = \frac{-3}{6}
\]

\[
m = \frac{-1}{2}
\]

**Line 2**

\[m = \frac{-1}{2} \times 3 = \left(\frac{-1}{2}\right) \left(\frac{3}{1}\right) = \frac{-3}{2}\]

\[y = m x + b\]

\[
\begin{align*}
x &= -10 \\
y &= 8 \\
b &= ?
\end{align*}
\]

\[
y = \frac{-3}{2} x + b
\]

\[
8 = \left(\frac{-3}{2}\right) \left(\frac{-15}{1}\right) + b
\]

\[
8 = 15 + b
\]

\[
8 - 15 = b
\]

\[
b = -7
\]

\[
\therefore y = -\frac{3}{2} x - 7
\]

**Slope**

\[
m = \frac{\text{rise}}{\text{run}}
\]

\[
b = -7 \text{ or } (0, -7)
\]