1. The equation $P = 1.25x - 135$ represents the profit in dollars when $x$ widgets are sold. Find the profit if 450 widgets are sold.

A. $427.50  
B. $697.50  
C. $562.50  
D. $56,115.00  
E. $561.15

**Solution:**  
$P = 1.25(450) - 135 = 427.50$

Use the data given in the stem-and-leaf table below to answer questions 2 – 4.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 5 5 6</td>
</tr>
<tr>
<td>4</td>
<td>1 2 3 3 6 8</td>
</tr>
<tr>
<td>5</td>
<td>1 2 3 5 5 6 7</td>
</tr>
<tr>
<td>6</td>
<td>1 3 4 4 4 5 5 6</td>
</tr>
<tr>
<td>7</td>
<td>1 2 3 4 5 5 6 7 7</td>
</tr>
</tbody>
</table>

Stem: tens  
Leaf: units

2. Find the lower quartile, $Q_1$ of the data.

A. 63  
B. 47  
C. 72.5  
D. 42  
E. 13.13

**Solution:**  
B  
There are 29 data points which means there are 14 in the bottom half. The lower quartile is the median of the bottom half. In this case it is half way between the 7th and 8th data points. The 7th data point is 46 and the 8th data point is 48, so the lower quartile is 47.

3. A boxplot of the data is pictured below. Which region contains the largest number of data points?

A. whisker A  
B. box B  
C. box C  
D. whisker D  
E. none of these

**Solution:**  
E  
A boxplot divides the data into four equal sections, each having the same number of data points.
4. Draw a histogram of the data.

\[ \text{Solution:} \]
\[
\begin{array}{cccccccccccc}
35 & 45 & 55 & 65 & 75 & 85 \\
6 & 6 & 4 & 8 & 6 & 5 \\
\end{array}
\]

5. The following scores are the SAT math scores for an Algebra class of 20 students:

\[
\begin{array}{cccccccccccc}
663 & 657 & 609 & 669 & 639 & 642 & 674 & 649 & 675 & 574 \\
\end{array}
\]

The distribution of the scores is

A. symmetric  
B. skewed left  
C. skewed right  
D. uniform  
E. bimodal

\textit{Solution:}  \textbf{B}  The data is heavily concentrated at the right, therefore the tail is to the left and the data is skewed left.

6. The histogram shown is of a set of test scores. Which of the following statements are true?

I. The middle (median) score is 75.
II. If the passing score is 60, most students failed.
III. More students scored between 50 and 60 than between 90 and 100.

\[ \text{Solution:} \textbf{C} \quad \text{There are 36 students’ scores represented in the table. The median occurs between the 18th and 19th score. We don’t know what the values are; we just know this occurs in the third bar. So, I may not be true. There are 12 students in the first bar which is a score below 60 so most students did not fail. There are 6 students with scores between 90 and 100 and 12 between 50 and 60 so III is true.} \]
7. A manufacturer of timing devices finds that most of them go off at approximately the same time. However, there is a tendency for more to go off too early than too late. Such a population would possess which shape?

   A. skewed left  B. skewed right  C. bimodal  D. symmetric  E. uniform

**Solution:**  B  If the timing devices go off too early, the times are concentrated at the low end, therefore, the distribution is skewed right.

8. Consider the following back-to-back stemplots comparing car battery lives (in months) of samples of two popular brands.

<table>
<thead>
<tr>
<th></th>
<th>Brand A</th>
<th></th>
<th>Brand B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
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<td>3 4 8 8</td>
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<tr>
<td>3 2</td>
<td>15</td>
<td>1 4</td>
<td>5 6 7 8 9 9</td>
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<td>8 7 5 4</td>
<td>16</td>
<td>3 4 6 6 8</td>
<td></td>
</tr>
<tr>
<td>9 6 5 3 3 0</td>
<td>17</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>6 5 4 3 3 3 1</td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

stems: tens
leaves: units

Which of the following are true statements?

I. The sample sizes are the same.
II. The ranges are the same.
III. The means are the same.
IV. The medians are the same.

A. I and II  B. I and III  C. II and IV  D. III and IV  E. I, II, and III

**Solution:**  A  Both sets of data contain 20 observations so I is true. Both ranges are 39 so II is true. It is impossible for III and IV to be true.
9. You have a summer job as a lifeguard. Your last task of the summer is to drain the pool. You open the drain and after 40 minutes there are 13,000 gallons of water left in the pool. One hour after you open the drain, there are 10,000 gallons left. Assume that the number of gallons of water remaining in the pool varies linearly with the among of time since the drain was open.

a. Write the particular equation expressing the number of gallons of water left in the pool in terms of number of hours since you opened the drain.

Solution: Let \( t \) represent the number of hours since the drain was opened
Let \( G \) represent the number of gallons remaining in the pool
You know two ordered pairs \((t, G)\): \((2/3, 13,000)\) and \((1, 10,000)\)
The slope of the line is \( \frac{10,000 - 13,000}{1 - \frac{2}{3}} = \frac{-3000}{\frac{1}{3}} = -9000 \)
The equation of the line is
\[
G - 10,000 = -9000(t - 1) \Rightarrow \\
G - 10,000 = -9000t + 9000 \Rightarrow \\
G = -9000t + 19000
\]

b. How many gallons would be left after 20 minutes? After 50 minutes?

Solution: \( G(1/3) = 16000 \) gallons; \( G(5/6) = 11,500 \) gallons

c. Find the gallon intercept. What does this number represent in the real world?

Solution: The gallon intercept occurs when \( t = 0 \) so it is 19000. In the real world this represents the number of gallons of water that were in the pool when the drain was opened.

d. Find the time intercept. What does this number represent in the real world?

Solution: The time intercept occurs when \( G = 0 \). This occurs when \( t = 19/9 \) or 2.1111. This means it takes approximately 2 hours, 6 minutes and 40 seconds to drain the pool.

e. Plot the graph of this linear function. Use a suitable domain.

Solution: This is a first quadrant graph because negative values for time and gallons are nonsensical.
f. What are the units of the slope? What does this number represent in the real world?

**Solution:** Slope is in gallons per hour. This is the rate at which the tub drains. The negative sign indicates that the amount of water is decreasing. So, the slope indicates that the water is draining out of the pool at a rate of 9000 gallons per hour.

g. In reality, a linear model is not the best model of this situation. Draw a graph illustrating a better model.

**Solution:** The water would drain out of the tub fastest at the beginning when there is a great deal of water pressure from the weight of all of the water. As most of the water drains out, the flow of the water will be less. The graph probably looks something like the one at the right.

![Graph](image)

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10. The weights of objects made of the same substance are directly proportional to their volumes. Suppose we know that a 30 gallon barrel holds 250 pounds of water.

a. Write the particular equation expressing pounds of water in terms of gallons.

**Solution:** Since this is a direct variation, we know \( y = kx \). In this case, let \( g = \) gallons and \( w = \) weight in pounds. So, \( w = kg \). We have one ordered pair \((30, 250)\), so

\[
250 = k(30) \quad \text{and} \quad k = \frac{250}{30} = \frac{25}{3}.
\]

Therefore, our equation is \( w = \frac{25}{3} g \).

b. In this particular case, the proportionality constant yields the “density” of the substance. What is the density of water? Be sure to include units.

**Solution:** Density is \( \frac{25}{3} \) or \( 8 \frac{1}{3} \) pounds per gallon

c. How much would 24 gallons of water weigh? 50 gallons? 4 gallons?

**Solution:** 200 pounds, 416 \( \frac{2}{3} \) pounds, 33 \( \frac{1}{3} \)

d. How big a container would be needed to hold one ton (2000 pounds) of water?

**Solution:** 240 gallons