Answers:

1. \(-\frac{13}{10}, \frac{1}{4}, -\frac{11}{10}, \frac{3}{5}\)

2. \(-\frac{17}{2}, -\frac{11}{16}, -\frac{3}{4}, -1, -\frac{11}{16}\)

From left to right the values on the number line should be \(-\frac{17}{2}, -\frac{1}{8}, -1, -\frac{3}{4}, -\frac{11}{16}\)

3. a. <  b. >  c. <  d. >

4. \(\frac{7}{10}\)

5. a. \(\frac{1}{12}\)  b. 14  c. -15  d. \(\frac{27}{4}\)
   e. \(\frac{6}{5}\)  f. -12  g. -27  h. \(-\frac{14}{9}\)
   i. \(\frac{19}{12}\)  j. \(-\frac{22}{35}\)  k. \(-\frac{3}{2}\)  l. \(\frac{169}{40}\)

6. The amount of space taken by the 12 letters and 11 gaps between the letters is
   \(12 \times \frac{3}{5} + 11 \times \frac{1}{5} = \frac{36}{5} + \frac{11}{5} = \frac{47}{5}\) feet.

   The amount of space left for the two ends is \(15 - \frac{47}{5} = \frac{75}{5} - \frac{47}{5} = \frac{28}{5}\) feet.

   Thus, the number of feet left at each of the two ends is \(\frac{14}{5}\) feet.
### Grade 9

**Number Sense and Numeration: Rationals**

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7. 

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{1}{6}$</td>
<td>$-\frac{5}{12}$</td>
<td>0</td>
</tr>
<tr>
<td>$-\frac{1}{4}$</td>
<td>$-\frac{1}{12}$</td>
<td>$\frac{1}{12}$</td>
</tr>
<tr>
<td>$-\frac{1}{6}$</td>
<td>$\frac{1}{4}$</td>
<td>$-\frac{1}{3}$</td>
</tr>
</tbody>
</table>

8.  

a. $\frac{44}{63}$  
b. $\frac{27}{4}$  
c. $\frac{11}{38}$

9.  

a. $\frac{13}{24}$  
b. $\frac{39}{40}$  
c. $-\frac{35}{36}$  
d. $\frac{14}{3}$  
e. $\frac{6}{7}$

10. Let $x$ represent the investment club’s earnings.

After the President takes half the earnings, there is $\frac{1}{2}x$ remaining.

The vice-president takes $\frac{1}{4}\left(\frac{1}{2}x\right) = \frac{1}{8}x$.

The amount remaining is now $1 - \left(\frac{1}{2}x + \frac{1}{8}x\right) = \frac{3}{8}x$.

The secretary takes $\frac{1}{3}\left(\frac{3}{8}x\right) = \frac{1}{8}x$. The amount now remaining is $\frac{2}{8}x = \frac{1}{4}x$.

Since you receive half of this your share is $\frac{1}{8}x$.

Since $\frac{1}{8}x = 300$, then the investment club’s total earnings are $2400$.  

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For more activities and resources from the University of Waterloo’s Faculty of Mathematics, please visit [www.cemc.uwaterloo.ca](http://www.cemc.uwaterloo.ca).
11. If \( a \oplus b = \frac{a + b - a}{b} \)

then \( 5 \oplus 3 = \frac{\frac{5}{3} + \frac{3 - 5}{5}}{5} \)

\[ = \frac{25 - 6}{15} \]

\[ = \frac{19}{15} \]

12. \[
\frac{4}{3} - \frac{5}{4} = \frac{6}{4} - \frac{1}{4} = \frac{2}{4} - \frac{2}{4} = \frac{0}{4} = 0
\]

13. The integers from 1 to 1000 that have 4 as the sum of their digits are:

4, 13, 22, 31, 40, 103, 112, 121, 130, 202, 211, 220, 301, 310, 400.

The prime numbers are underlined.

This gives a fraction \( \frac{4}{15} \), which represents the fraction of these numbers that are prime divided by the number of integers that have a sum of digits equal to 4.

Therefore, \( \frac{a}{b} \) is equal to \( \frac{4}{15} \).
Grade 9

NUMBER SENSE AND NUMERATION: RATIONALS

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14. \[
\begin{align*}
\frac{37}{13} &= 2 + \frac{11}{13} \\
\frac{37}{13} &= 2 + \frac{1}{\frac{11}{13}} \\
\frac{37}{13} &= 2 + \frac{1}{1 + \frac{2}{11}} \\
\frac{37}{13} &= 2 + \frac{1}{1 + \frac{1}{\frac{11}{2}}} \\
\frac{37}{13} &= 2 + \frac{1}{1 + \frac{1}{5 + \frac{1}{2}}} \\
\end{align*}
\]
Therefore, \[x + y + z = 2 + 1 + 5 = 8\]