Decimals are a way to record place values based on decimal fractions. 

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<td>2</td>
<td>5</td>
<td>3</td>
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- 2 hundreds
- 5 tens
- 3 ones

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<tbody>
<tr>
<td>0</td>
<td>2</td>
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- 2 tenths
- 5 hundredths
- 3 thousandths

1. Write the decimal as a sum of a whole number and decimal fractions.
   a) $2.17 = \frac{2}{10} + \frac{1}{10} + \frac{7}{100}$
   b) $5.37 = \frac{5}{10} + \frac{3}{10} + \frac{7}{100}$
   c) $6.41 = \frac{6}{10} + \frac{4}{10} + \frac{1}{100}$
   d) $8.92 = \frac{8}{10} + \frac{9}{10} + \frac{2}{100}$
   e) $4.24 = \frac{4}{10} + \frac{2}{10} + \frac{4}{100}$
   f) $0.53 = \frac{5}{10} + \frac{3}{10} + \frac{3}{100}$
   g) $2.756 = \frac{2}{10} + \frac{7}{100} + \frac{5}{1000} + \frac{6}{10000}$
   h) $3.41 = \frac{3}{10} + \frac{4}{10} + \frac{1}{100}$
   i) $9.207 = \frac{9}{10} + \frac{2}{100} + \frac{0}{1000} + \frac{7}{10000}$
   j) $8.019 = \frac{8}{10} + \frac{0}{100} + \frac{1}{1000} + \frac{9}{10000}$

2. Write the decimal as a sum of a whole number and decimal fractions.
   Do not write the fractions with a numerator of 0.
   a) $4.017 = 4 + \frac{1}{10} + \frac{7}{1000}$
   b) $6.305 = 6 + \frac{3}{10} + \frac{5}{1000}$
   c) $2.035 = 2 + \frac{3}{10} + \frac{5}{1000}$
   d) $0.401 = \frac{401}{1000}$
   e) $0.005 = \frac{5}{1000}$
   f) $3.007 = 3 + \frac{7}{1000}$

3. What is the value of the 9 in the decimal? Write the answer two ways.
   a) $0.497 \frac{9}{100}$ or 9 hundredths
   b) $3.921 \frac{9}{10}$ or 9 tenths
   c) $8.294 \frac{9}{10}$ or 9 tenths
   d) $3.159 \frac{9}{10}$ or 9 tenths
   e) $3.009 \frac{9}{10}$ or 9 tenths
   f) $8.913 \frac{9}{10}$ or 9 tenths
   g) $0.904 \frac{9}{10}$ or 9 tenths
   h) $6.291 \frac{9}{10}$ or 9 tenths
4. Write the decimal fractions in the place value chart, then write the number as a decimal.

a) \( \frac{3}{10} = 0.3 \)

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<th>Ones</th>
<th>Tenths</th>
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<tbody>
<tr>
<td>0</td>
<td>3</td>
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d) \( \frac{6}{10} = 0.6 \)

<table>
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<tr>
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<th>Tenths</th>
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<tbody>
<tr>
<td>0</td>
<td>6</td>
</tr>
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</table>

c) \( \frac{9}{10} = 0.9 \)

<table>
<thead>
<tr>
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<th>Tenths</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>9</td>
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</table>

e) \( 3 + \frac{1}{10} + \frac{8}{100} = 3.18 \)

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<th>Ones</th>
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<th>Hundredths</th>
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<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
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</table>
f) \( \frac{1}{10} + \frac{8}{100} = 0.08 \)

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<th>Hundredths</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>
g) \( \frac{2}{10} + \frac{4}{100} + \frac{3}{1000} = 0.243 \)

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<th>Tenths</th>
<th>Hundredths</th>
<th>Thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
h) \( 7 + \frac{3}{100} + \frac{5}{1000} = 7.035 \)

<table>
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<th>Tenths</th>
<th>Hundredths</th>
<th>Thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

5. Write the decimal in the place value chart.

<table>
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<th>Ones</th>
<th>Tenths</th>
<th>Hundredths</th>
<th>Thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>0.512</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>b)</td>
<td>4.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>0.307</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>2.727</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>9.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Underline the smallest place value. Write the decimal in words.

a) \( 0.6 = six \ \text{tenths} \)

b) \( 0.005 = five \ \text{thousandths} \)

c) \( 0.04 = four \ \text{hundredths} \)

d) \( 0.008 = eight \ \text{thousandths} \)

e) \( 0.006 = six \ \text{thousandths} \)

f) \( 0.9 = nine \ \text{tenths} \)

7. Put a decimal point in the number so that the digit 7 has the value \( \frac{7}{10} \).

a) \( 572 \)

b) \( 107 \)

c) \( 28759 \)

d) \( 71 \)
This number line is divided into tenths. Point A is at \[ \frac{6}{10} = 0.6 \].

1. Write a decimal and a fraction for each point on the number line.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td>Fraction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \frac{21}{10} )</td>
</tr>
</tbody>
</table>

2. Mark the decimal or fraction on the number line with a dot and letter.

A. 1.3  
B. 2.7  
C. 0.4  
D. \( \frac{7}{10} \)  
E. \( \frac{27}{10} \)  
F. \( \frac{16}{10} \)  
G. 0.1  
BONUS H. \( \frac{11}{10} \)

The number line is divided into hundredths. Point A is at \[ \frac{28}{100} = 0.28 \].

3. Write a decimal and a decimal fraction for each point on the number line.

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>C</th>
<th>A</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decimal Fraction</td>
<td></td>
<td></td>
<td></td>
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</table>

A. _____   B. _____   C. _____   D. _____

4. Mark the decimal or fraction on the number line with a dot and letter.

A. 0.13  
B. 0.28  
C. 0.04  
D. \( \frac{17}{100} \)
5. Cross out the labels for the points that are incorrect. Write the correct number.

\[
\begin{array}{cccccc}
& 0.1 & 1.01 & 0.2 & 1.5 \\
0 & 1 & 2 & 3
\end{array}
\]

6. Write which whole number the decimal or mixed fraction is closest to: “zero,” “one,” “two,” or “three.”

\[
\begin{array}{cccccc}
0 & 1 & 2 & 3 \\
0.1 & 1.01 & 0.2 & 1.5
\end{array}
\]

a) 1.3 is closest to [_____]  
    b) 1.9 is closest to [_____]  
    c) 2.\(\frac{2}{10}\) is closest to [_____]

7. Change all decimals to fractions with the denominator 100. Then write the numbers as fractions in order from greatest to least.

a) \(0.2\) \(0.8\) \(0.35\)  
   \(\frac{20}{100}\) \(\frac{80}{100}\) \(\frac{35}{100}\)
   \[\text{_____} > \text{_____} > \text{_____}\]

b) \(\frac{27}{100}\) \(0.9\) \(0.25\)  
   \[\frac{27}{100} > \frac{90}{100} > \frac{25}{100}\]
   \[\frac{27}{100} > \frac{90}{100} > \frac{25}{100}\]
   \[\frac{27}{100} > \frac{90}{100} > \frac{25}{100}\]

8. Use the numbers 100 and 1000 as denominators to make the statement true.

a) \(\frac{6}{100}\) > \(\frac{6}{1000}\)  
   \(\frac{6}{100}\) > \(\frac{6}{1000}\)  
   BONUS: \(\frac{7}{100}\) < \(\frac{6}{100}\)

9. Use the numbers 5 and 60 as numerators to make the statement true.

a) \(\frac{5}{100}\) < \(\frac{60}{100}\)  
   \(\frac{5}{100}\) < \(\frac{60}{100}\)  
   BONUS: \(\frac{10}{100}\) > \(\frac{10}{100}\)

10. Use all the digits 2, 4, 7, and 8 once to write a number between the given numbers.

a) \(2.478 < \text{_____} < 2.748\)  
   b) \(7.248 < \text{_____} < 7.428\)  
   c) \(8.472 < \text{_____} < 8.742\)
1. a) Write a decimal for each mark on the number line above.

b) Which decimal is equal to one half? \( \frac{1}{2} = \) ________

c) Use the number line above to compare the pair of numbers. Write < (less than), > (greater than), or = (equal to) in the box.

   i) 0.7 ________ \( \frac{1}{2} \)  
   ii) \( \frac{1}{2} \) ________ 0.6  
   iii) \( \frac{1}{2} \) ________ 0.4  
   iv) \( \frac{1}{2} \) ________ 0.5  
   v) 0.1 ________ \( \frac{1}{2} \)  
   vi) 0.2 ________ \( \frac{1}{2} \)

2. Use the number lines above to compare the pair of numbers. Write <, >, or = in the box.

   a) 0.8 ________ \( \frac{3}{4} \)  
   b) 0.4 ________ \( \frac{7}{10} \)  
   c) 0.6 ________ \( \frac{1}{2} \)  
   d) 0.2 ________ \( \frac{1}{4} \)  
   e) 0.4 ________ \( \frac{1}{2} \)  
   f) 0.35 ________ \( \frac{1}{4} \)  
   g) 0.07 ________ \( \frac{1}{2} \)  
   h) \( \frac{3}{4} \) ________ 0.7

3. Use the number lines above to compare the pair of numbers. Write <, >, or = in the box.

   a) 0.21 ________ \( \frac{1}{4} \)  
   b) \( \frac{1}{2} \) ________ 0.54  
   c) 0.75 ________ \( \frac{3}{4} \)  
   d) 0.26 ________ \( \frac{1}{4} \)  
   e) 0.74 ________ \( \frac{3}{4} \)  
   f) \( \frac{1}{4} \) ________ 0.25  
   g) 0.50 ________ \( \frac{1}{2} \)  
   h) \( \frac{3}{4} \) ________ 0.80
4. Shade $\frac{1}{2}$ of the squares. Write two fractions and two decimals for $\frac{1}{2}$.

Fractions: $\frac{1}{2} = \frac{10}{100}$
Decimals: $\frac{1}{2} = 0.\underline{5} = 0.\underline{5}$

5. Shade $\frac{1}{5}$ of the squares. Write two fractions and two decimals for $\frac{1}{5}$.

Fractions: $\frac{1}{5} = \frac{10}{100}$
Decimals: $\frac{1}{5} = 0.\underline{2} = 0.\underline{2}$

6. Write equivalent fractions.

a) $\frac{2}{5} = \frac{10}{100}$
   b) $\frac{3}{5} = \frac{10}{100}$
   c) $\frac{4}{5} = \frac{10}{100}$

7. Shade $\frac{1}{4}$ of the squares. Write a fraction and a decimal for $\frac{1}{4}$ and $\frac{3}{4}$.

Fraction: $\frac{1}{4} = \frac{100}{100}$
Fraction: $\frac{3}{4} = \frac{100}{100}$
Decimal: $\frac{1}{4} = 0.\underline{2}$
Decimal: $\frac{3}{4} = 0.\underline{7}$

8. Circle the greater number in the pair. First change all fractions and decimals to fractions with the denominator 100.

a) $\frac{1}{2}$ 0.37
   b) $\frac{1}{4}$ 0.52
   c) $\frac{5}{2}$ 0.42

   
   
   

   

   

   

   

9. Write the numbers in order from least to greatest. Explain how you found your answer.

a) 0.7 0.32 $\frac{1}{2}$
   b) $\frac{1}{4}$ $\frac{3}{5}$ 0.63
   c) $\frac{2}{5}$ 0.35 $\frac{1}{2}$
NS6-43 Ordering Decimals

1. Write an equivalent fraction.
   a) \(\frac{3}{10} = \frac{30}{100}\)  
   b) \(\frac{71}{100} = \frac{100}{100}\)  
   c) \(\frac{40}{100} = \frac{100}{100}\)  
   d) \(\frac{42}{100} = \frac{100}{100}\)  
   e) \(\frac{7}{100} = \frac{1000}{1000}\)  
   f) \(\frac{9}{10} = \frac{1000}{1000}\)  
   g) \(\frac{58}{100} = \frac{1000}{1000}\)  
   h) \(\frac{1}{100} = \frac{1000}{1000}\)

2. Fill in the blank.
   a) 2 tenths = ____ hundredths
   b) 99 hundredths = ____ thousandths
   c) 6 tenths = ____ thousandths
   d) 6 hundredths = ____ thousandths
   e) 43 hundredths = ____ thousandths
   f) 8 tenths = ____ hundredths

3. Change both decimals to fractions and then change them to fractions with the same denominator. Write < or > to show which decimal is greater.
   a) Decimals
      | 0.6 | 0.67 | 0.76 | 0.716 | 0.3 | 0.298 |
      |-----|-----|------|-------|----|------|
   Fractions
      | \(\frac{6}{10}\) | \(\frac{67}{100}\) |
   Fractions with the Same Denominator
      | \(\frac{60}{100}\) | \(\frac{67}{100}\) |
   b) Decimals
      | 0.214 | 0.05 | 0.31 | 0.099 | 0.506 | 0.6 |
      |-----|-----|------|-------|-------|-----|
   Fractions
      | | | | | |
   Fractions with the Same Denominator
      | | | | | |

4. Write the decimals as improper fractions with the denominator shown. Then order the decimals from greatest to least.
   a) \(4.6 = \frac{46}{10}\)  
      \(3.7 = \frac{37}{10}\)  
      \(4.4 = \frac{44}{10}\)  
      Decimals
      | 4.6 | 4.4 | 3.7 |
   b) \(2.97 = \frac{297}{100}\)  
      \(3.05 = \frac{305}{100}\)  
      \(2.76 = \frac{276}{100}\)  
      | | | | |
   c) \(1.3 = \frac{1300}{1000}\)  
      \(1.7 = \frac{1700}{1000}\)  
      \(1.4 = \frac{1400}{1000}\)  
      | | | |

Number Sense 6-43
To compare decimals, Rani writes zeros to the right of the last digit so all numbers have the same number of digits after the decimal point.

Example: 0.6 and 0.42 Write zero to the right of 0.6: 0.6
60 hundredths are greater than 42 hundredths, so 0.6 is greater than 0.42.

5. Make the decimals have the same number of digits after the decimal point. Circle the greatest decimal.
   a) 0.76 0.80
   b) 0.4 0.05
   c) 0.9 0.814
   d) 0.13 0.31 0.103
   e) 0.7 0.47 0.407
   f) 0.720 0.80 0.716
   g) 3.53 0.4573 0.66
   h) 12.31 0.230 0.12
   i) 3.1 0.31 0.301

6. Write the numbers in the place value chart. Order the numbers from greatest to least.
   a) 0.242, 1.368, 1.70
   b) 37.03, 7.306, 3.706
   
<table>
<thead>
<tr>
<th>Tens</th>
<th>Ones</th>
<th>Tenths</th>
<th>Hundredths</th>
<th>Thousandths</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>2</td>
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   c) 45.25, 45.193, 45.210
   d) 0.654, 0.655, 0.65
   
<table>
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<th>Tens</th>
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<th>Tenths</th>
<th>Hundredths</th>
<th>Thousandths</th>
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   7. Arrange the numbers from least to greatest.
   a) 2.45, 2.054, 245
   b) 0.070, 0.007, 0.071

   8. Write a decimal that matches the description.
   a) between 0.83 and 0.89  0.____
   b) between 0.457 and 0.5  0.____

9. Which numbers are less than 0.1: 0.12, 0.011, 1.0, 0.09, 0.1? Explain how you know.
NS6-44 Adding Decimals

A base ten representation for decimal tenths and hundredths:

1 one 1 tenth 1 hundredth

1 one = 10 tenths

1 tenth = 10 hundredths

1. Regroup every 10 tenths as 1 one.

a) 

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_____ ones + _____ tenths

_____ ones + _____ tenths

b) 16 tenths = _____ one + _____ tenths   c) 23 tenths = _____ ones + _____ tenths
d) 49 tenths = _____ ones + _____ tenths   e) 52 tenths = _____ ones + _____ tenths

2. Regroup so that each place value has a single digit.

a) 3 ones + 12 tenths = _____ ones + _____ tenths

b) 7 tenths + 14 hundredths = _____ tenths + _____ hundredths

c) 8 hundredths + 19 thousandths = _____ hundredths + _____ thousandths

d) 6 tenths + 24 hundredths = _____ tenths + _____ hundredths

BONUS ► 5 tenths + 103 thousandths = _____ tenths + _____ thousandths

3. Exchange 1 tenth for 10 hundredths or 1 hundredth for 10 thousandths.

a) 4 tenths + 0 hundredths = _____ tenths + _____ hundredths

b) 8 tenths + 0 hundredths = _____ tenths + _____ hundredths

c) 4 hundredths + 3 thousandths = _____ hundredths + _____ thousandths

d) 6 tenths + 8 hundredths = _____ tenths + _____ hundredths

e) 3 hundredths + 4 thousandths = _____ hundredths + _____ thousandths

BONUS ►

2 tenths + 9 hundredths + 23 thousandths = _____ tenths _____ hundredths + _____ thousandths
4. Write a fraction for each shaded part. Then add the fractions and shade your answer.

a) \[
\frac{25}{100} + \frac{50}{100} = \frac{75}{100}
\]

b) \[
\]

c) \[
\]

d) \[
\]

5. Write the decimals that correspond to the fractions in Question 4.

a) \[0.25 + 0.50 = 0.75\]

b) \[
\]

c) \[
\]

d) \[
\]

6. Add by adding each place value.

a) \[41.2 + 7.48\]

\[
\begin{array}{cccc}
\text{Tens} & \text{Ones} & \text{Tenths} & \text{Hundredths} \\
4 & 1 & 2 & \\
+ & 7 & 4 & 8 \\
4 & 8 & 6 & 8 \\
\end{array}
\]

b) \[36.84 + 42.1\]

\[
\begin{array}{cccc}
\text{Tens} & \text{Ones} & \text{Tenths} & \text{Hundredths} \\
\text{ } & \text{ } & \text{ } & \\
+ & & & \\
\text{ } & \text{ } & \text{ } & \\
\text{ } & \text{ } & \text{ } & \\
\end{array}
\]

7. Add by adding each place value. Then regroup.

a) \[4.65 + 0.73\]

\[
\begin{array}{ccc}
\text{Ones} & \text{Tenths} & \text{Hundredths} \\
4 & 6 & 5 \\
0 & 7 & 3 \\
4 & 13 & 8 \\
5 & 3 & 8 \\
\end{array}
\]

b) \[31.4 + 5.87\]

\[
\begin{array}{cccc}
\text{Tens} & \text{Ones} & \text{Tenths} & \text{Hundredths} \\
\text{ } & \text{ } & \text{ } & \\
+ & & & \\
\text{ } & \text{ } & \text{ } & \\
\text{ } & \text{ } & \text{ } & \\
\text{ } & \text{ } & \text{ } & \\
\end{array}
\]
8. Add the decimals by lining up the decimal points.
   a) \(0.41 + 0.37 = \)
   
   b) \(0.52 + 0.46 = \)
   
   c) \(0.05 + 0.83 = \)
   
   d) \(0.4 + 0.39 = \)

You can show regrouping on a grid. Example: \(4.8 + 3.5\)

You can show regrouping on a grid. Example: \(4.8 + 3.5\)

   \[\begin{array}{c}
   8 \text{ tenths} \quad + \quad 5 \text{ tenths} = 13 \text{ tenths were regrouped as 1 one and 3 tenths}
   \end{array}\]

9. Add the decimals by lining up the decimal points. You will need to regroup.
   a) \(0.7 + 0.48 = \)
   
   b) \(0.26 + 0.57 = \)
   
   c) \(0.63 + 0.84 = \)
   
   d) \(0.17 + 0.43 + 1.25 = \)

10. On a grid, line up the decimal points and add the numbers.
    a) \(2.51 + 4.28 = \)
    
    b) \(5.47 + 3.43 = \)
    
    c) \(8.48 + 0.39 = \)
    
    d) \(0.87 + 0.04 = \)

11. a) Add \(0.37 + 0.4\) by changing the decimals to fractions:
    \[
    0.37 + 0.4 = \frac{37}{100} + \frac{4}{10}
    \]
    
    b) Add \(0.37 + 0.4\) by lining up the decimal points.
    
    c) Did you get the same answer both ways? _____
    If not, find your mistake.

12. The mass of a dime is 1.75 g, and the mass of a quarter is 4.4 g. What is the total mass of one dime and two quarters?

NS6-45 Subtractiong and Adding Decimals

1. Subtract by crossing out the correct number of boxes. Give the answer as a fraction.

a) \[
\begin{array}{c}
50 \\
100
\end{array}
\]
\[
\begin{array}{c}
30 \\
100
\end{array}
\]
\[
\frac{50}{100} - \frac{30}{100} = \frac{20}{100}
\]

b) \[
\begin{array}{c}
38 \\
100
\end{array}
\]
\[
\begin{array}{c}
12 \\
100
\end{array}
\]
\[
\frac{38}{100} - \frac{12}{100} = \frac{26}{100}
\]

c) \[
\begin{array}{c}
69 \\
100
\end{array}
\]
\[
\begin{array}{c}
34 \\
100
\end{array}
\]
\[
\frac{69}{100} - \frac{34}{100} = \frac{35}{100}
\]

d) \[
\begin{array}{c}
57 \\
100
\end{array}
\]
\[
\begin{array}{c}
25 \\
100
\end{array}
\]
\[
\frac{57}{100} - \frac{25}{100} = \frac{32}{100}
\]

2. Write the equations in Question 1 as decimals.

a) \[
0.50 - 0.30 = 0.20
\]

b) \[
\]

c) \[
\]

d) \[
\]

3. Subtract the decimals by lining up the decimal points.

a) \[
\begin{array}{c}
0.74 \\
\end{array}
\]
\[
\begin{array}{c}
0.31 \\
\end{array}
\]
\[
0.74 - 0.31 = 0.43
\]

b) \[
\begin{array}{c}
0.56 \\
\end{array}
\]
\[
\begin{array}{c}
0.24 \\
\end{array}
\]
\[
0.56 - 0.24 = 0.32
\]

c) \[
\begin{array}{c}
3.47 \\
\end{array}
\]
\[
\begin{array}{c}
2.2 \\
\end{array}
\]
\[
3.47 - 2.2 = 1.27
\]

d) \[
\begin{array}{c}
6.49 \\
\end{array}
\]
\[
\begin{array}{c}
0.35 \\
\end{array}
\]
\[
6.49 - 0.35 = 6.14
\]

e) \[
\begin{array}{c}
2.53 \\
\end{array}
\]
\[
\begin{array}{c}
1.51 \\
\end{array}
\]
\[
2.53 - 1.51 = 1.02
\]

f) \[
\begin{array}{c}
3.79 \\
\end{array}
\]
\[
\begin{array}{c}
2.66 \\
\end{array}
\]
\[
3.79 - 2.66 = 1.13
\]

g) \[
\begin{array}{c}
8.84 \\
\end{array}
\]
\[
\begin{array}{c}
7.10 \\
\end{array}
\]
\[
8.84 - 7.10 = 1.74
\]

h) \[
\begin{array}{c}
5.19 \\
\end{array}
\]
\[
\begin{array}{c}
3.07 \\
\end{array}
\]
\[
5.19 - 3.07 = 2.12
\]

i) \[
\begin{array}{c}
4.08 \\
\end{array}
\]
\[
\begin{array}{c}
4.04 \\
\end{array}
\]
\[
4.08 - 4.04 = 0.04
\]

j) \[
\begin{array}{c}
2.15 \\
\end{array}
\]
\[
\begin{array}{c}
2.03 \\
\end{array}
\]
\[
2.15 - 2.03 = 0.12
\]

k) \[
\begin{array}{c}
5.53 \\
\end{array}
\]
\[
\begin{array}{c}
2.41 \\
\end{array}
\]
\[
5.53 - 2.41 = 3.12
\]

l) \[
\begin{array}{c}
9.83 \\
\end{array}
\]
\[
\begin{array}{c}
2.71 \\
\end{array}
\]
\[
\]

When subtracting decimals, you may have to regroup.

Example:

\[
\begin{array}{c}
5 \\
1 \\
\end{array}
\]
\[
\begin{array}{c}
7 \\
2 \\
\end{array}
\]
\[
\begin{array}{c}
0 \\
4 \\
\end{array}
\]
\[
\begin{array}{c}
6 \\
1 \\
\end{array}
\]
\[
\begin{array}{c}
10 \\
2 \\
\end{array}
\]
\[
\frac{57}{100} - \frac{25}{100} = \frac{32}{100}
\]

Regroup 1 tenth as 10 hundredths.
4. Subtract the decimals. Put a decimal point in your answer on the grid.
   a) \(0.81 - 0.58\)  
   b) \(5.72 - 3.56\)  
   c) \(6.15 - 4.2\)  
   d) \(2.46 - 0.27\)

5. To calculate the sum, write the decimals as fractions with a common denominator.
   a) \(0.27 + 0.6 = \frac{27}{100} + \frac{6}{10} = \frac{27}{100} + \frac{100}{100} = \frac{127}{100}\)
   b) \(0.57 + 0.76 = \frac{57}{100} + \frac{76}{100} = \frac{133}{100}\)
   c) \(2.02 + 0.99 = \frac{202}{100} + \frac{99}{100} = \frac{201}{100}\)

6. Subtract the decimals on grid paper.
   a) \(0.87 - 0.26\)  
   b) \(9.46 - 3.12\)  
   c) \(5.83 - 3.69\)

7. Add or subtract mentally.
   a) \(0.54 + 0.31 = \)  
   b) \(4.95 - 2.84 = \)  
   c) \(7.09 - 4.02 = \)
   d) \(2.37 + 1.22 = \)  
   e) \(5.73 - 1.62 = \)  
   f) \(6.73 - 2.53 = \)
   g) \(6.32 + 2.54 = \)  
   h) \(4.35 - 2.12 = \)  
   i) \(9.47 - 7.46 = \)

8. What is the difference in the thickness of the coins?
   a) A quarter (1.58 mm) and a dime (1.22 mm)  
   b) A loonie (1.95 mm) and a toonie (1.75 mm)

9. Sara made fruit drink by mixing 0.37 L of juice with 0.62 L of ginger ale. How many litres of fruit drink did she make?

10. A male Bengal tiger’s body and head are 1.9 m long. The tail is 0.95 m. What is the total length of the Bengal tiger?
1. Add.
   a) $5.45 + $3.23
      \[
      \begin{array}{c}
      \$5.45 \\
      + \$3.23 \\
      \hline
      \$8.68
      \end{array}
      \]
   b) $26.15 + $32.23
      \[
      \begin{array}{c}
      \$26.15 \\
      + \$32.23 \\
      \hline
      \$58.38
      \end{array}
      \]
   c) $19.57 + $30.32
      \[
      \begin{array}{c}
      \$19.57 \\
      + \$30.32 \\
      \hline
      \$49.89
      \end{array}
      \]

2. Add. You will have to regroup.
   a) $1660 + 2375
      \[
      \begin{array}{c}
      \$1660 \\
      + \$2375 \\
      \hline
      \$3935
      \end{array}
      \]
   b) $2745 + $4512
      \[
      \begin{array}{c}
      \$2745 \\
      + \$4512 \\
      \hline
      \$7257
      \end{array}
      \]
   c) $8741 + $6522
      \[
      \begin{array}{c}
      \$8741 \\
      + \$6522 \\
      \hline
      \$15263
      \end{array}
      \]
   d) $3460 + $2600
      \[
      \begin{array}{c}
      \$3460 \\
      + \$2600 \\
      \hline
      \$6060
      \end{array}
      \]
   e) $3840 + $4425
      \[
      \begin{array}{c}
      \$3840 \\
      + \$4425 \\
      \hline
      \$8265
      \end{array}
      \]
   f) $1652 + $4825
      \[
      \begin{array}{c}
      \$1652 \\
      + \$4825 \\
      \hline
      \$6477
      \end{array}
      \]

3. Subtract the amount. You may have to regroup.
   a) $2450 - 2175
      \[
      \begin{array}{c}
      \$2450 \\
      - \$2175 \\
      \hline
      \$275
      \end{array}
      \]
   b) $3645 - $1380
      \[
      \begin{array}{c}
      \$3645 \\
      - \$1380 \\
      \hline
      \$2265
      \end{array}
      \]
   c) $4523 - $672
      \[
      \begin{array}{c}
      \$4523 \\
      - \$672 \\
      \hline
      \$3851
      \end{array}
      \]
   d) $5314 - $1603
      \[
      \begin{array}{c}
      \$5314 \\
      - \$1603 \\
      \hline
      \$3711
      \end{array}
      \]
   e) $7062 - $2551
      \[
      \begin{array}{c}
      \$7062 \\
      - \$2551 \\
      \hline
      \$4511
      \end{array}
      \]
   f) $8417 - $3909
      \[
      \begin{array}{c}
      \$8417 \\
      - \$3909 \\
      \hline
      \$4508
      \end{array}
      \]

4. Jasmin bought a pack of socks for $7.25 and a cap for $23.53. How much money does she need to pay the bill?

5. A library spent $270.25 on novels and $389.82 on non-fiction books. How much did the library spend in total?
6. Eric bought three shirts that cost $12.30 each. How much did he pay in total?

7. Raj has $25. If he buys a chess game for $9.50 and a book for $10.35, will he have enough money left to buy a second book costing $5.10?

8. The regular price for a pair of eyeglasses is $69.99. Today they are on sale for $10.50 off per pair. If Lela buys her eyeglasses today, how much will she pay?

**BONUS** ► The seller offered Lela an extra $5.25 off for a second pair of eyeglasses. If Lela wants to buy two pairs of eyeglasses today, how much will she pay in total?

9. Answer the question by looking at the items and their prices below.
   a) If you bought a watch and a soccer ball, how much would you pay?
   b) Which costs more: a watch and a backpack or pants and a soccer ball?
   c) Could you buy a soccer ball, a pair of tennis rackets, and pants for $100?
   d) What is the total cost of the three most expensive things in the picture?
   e) Make up your own problem using the items.

10. Try to find the answer mentally.
   a) How much do 4 loaves of bread cost at $2.30 each?
   b) Apples cost 40¢ each. How many could you buy with $3.00?
   c) Permanent markers cost $3.10 each. How many could you buy if you had $25.00?
   d) Is $10.00 enough to pay for a book costing $4.75 and a pen costing $5.34?
   e) Which costs more: 4 apples at 32¢ per apple or 3 oranges at 45¢ per orange?
NS6-47  Estimating Sums and Differences for Decimals

1. Draw an arrow to the 0 or 1.0 to show whether the circled decimal is closer to 0 or 1.0.
   a)  
   b)  
   c)  
   d)  

2. a) Which decimal numbers are closer to the number? 
   i) 0 _______
   ii) 1.0 _______
   b) Why is 0.5 a special case? ____________________________

3. Draw an arrow to show which whole number you would round the circled number to. Then round to the nearest whole number.
   a)  
   Round to ______
   b)  
   Round to ______

4. Circle the correct answer.
   a) 2.9 is closer to: 2.0 or 3.0  
   b) 1.4 is closer to: 1.0 or 2.0  
   c) 13.6 is closer to: 13.0 or 14.0  
   d) 57.2 is closer to: 57.0 or 58.0

5. Draw an arrow to show whether the circled number is closer to 0 or 1.00.
   a)  
   b)  

6. Circle the correct answer.
   a) 0.80 is closer to: 0 or 1.00  
   b) 0.24 is closer to: 0 or 1.00  
   c) 2.61 is closer to: 2.00 or 3.00  
   d) 6.45 is closer to: 6.00 or 7.00
7. Draw an arrow to show whether the circled number is closer to 0 or 1.000.

8. Circle the correct answer.
   a) 0.800 is closer to: 0 or 1.000
   b) 0.400 is closer to: 0 or 1.000
   c) 8.499 is closer to: 8.000 or 9.000
   d) 4.507 is closer to: 4.000 or 5.000

9. Draw an arrow to show which whole number you would round the circled number to.

REMINDER ★ When rounding to the nearest whole number, if the tenth digit is:
   0, 1, 2, 3, or 4 ★ you round down.
   5, 6, 7, 8, or 9 ★ you round up.

10. Round to the nearest whole number.
    a) 2.2
    b) 2.6
    c) 7.3
    d) 11.1
    e) 30.7
    f) 19.6

11. Round to the nearest tenth. Underline the tenths digit first. Then put your pencil on the
digit to the right (the hundredths digit). This digit tells you whether to round up or down.
    a) 1.45
    b) 1.83
    c) 3.61
    d) 3.42
    e) 5.54
    f) 6.67

12. Round the decimal to the nearest hundredth. Underline the hundredths digit first.
    Then put your pencil on the digit to the right (the thousandths digit).
    a) 2.734
    b) 1.492
    c) 3.547
    d) 4.270
    e) 9.167
    f) 5.317

13. Underline the digit you are rounding to. Then circle whether you would round up or down.
    a) tenths
    b) hundredths
    c) tenths

Number Sense 6-47

23
Round the digit underlined up or down.
• To round up, add 1 to the digit.
• To round down, keep the digit the same.

<table>
<thead>
<tr>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>round up (ru)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>round down (rd)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

The digits to the right of the rounded digit become zeros.

The digits to the left remain the same.

14. Round to the tenths digit using the steps of rounding from Question 13 and the grey box above.

a) \(3 \cdot 2 \cdot 0 \cdot 1\)  
   Round down (rd)  
   \(3 \cdot 5 \cdot 8 \cdot 3 \cdot 5\)  
   Round up (ru)  
   \(9 \cdot 4 \cdot 2 \cdot 7 \cdot 1\)  
   Round up (ru)

15. Sometimes in rounding, you have to regroup. Example: Round 3.985 to the nearest tenth.

Round 9 tenths up to 10 tenths.  
Regroup the 10 tenths as 1 (ones)  
and add it to the 3 (ones).

16. Round the number to the given digit. Regroup if necessary.
   a) 2.195 hundredths  
   b) 5.96 tenths  
   c) 39.897 hundredths

Mathematicians use the symbol \(\approx\) to mean "approximately equal to."

16. Estimate the sum or difference using the whole-number parts of the decimal.
   Example: For 14.357 + 0.23 + 5.741, estimate 14 + 0 + 5 = 19.

a) \(3.462 + 4.251 \approx \_ + \_ = \_
   b) \(7.03 - 5.465 \approx \_ - \_ = \_
   c) \(3.2 + 5.1 + 4.6 \approx \_ + \_ + \_ = \_
   d) \(9.601 - 3.02 - 4.9 \approx \_ - \_ - \_ = \_

17. Estimate by rounding to the nearest tenth. Then add or subtract.

a) \(0.42 \rightarrow \boxed{0.40}\)  
   + 5.23             
   \[5.60\]  
   \(0.28 \rightarrow \boxed{0.28}\)  
   + 0.54             
   \[0.82\]  
   \(2.62 \rightarrow \boxed{2.62}\)  
   - 0.19            
   \[2.43\]  
   \(4.87 \rightarrow \boxed{4.87}\)  
   - 1.57            
   \[3.30\]

b) \(0.73 + 2.17 \approx 0.70 + 2.20 = 2.90\)  
   f) \(0.89 - 0.46 \approx \_

g) \(0.63 - 0.26 \approx \_
   h) \(3.82 + 2.47 \approx \_

Number Sense 6-47
18. Estimate by rounding to the nearest hundredth. Then add or subtract.

a) \[ 3.223 + 1.366 = 4.59 \]
b) \[ 1.347 + 0.632 = 2.00 \]
c) \[ 5.653 - 3.137 = 2.51 \]
d) \[ 6.840 - 0.550 = 6.29 \]

(\[ e) \ 1.347 - 1.213 \]
\[ f) \ 1.561 + 0.937 \]
\[ g) \ 2.193 - 0.768 \]
\[ h) \ 2.714 - 1.656 \]

19. The decimal hundredths that could be rounded to 4.7 are from 4.65 to 4.74. Which decimal hundredths could be rounded to 5.4? Explain how you know.

For Questions 20 to 22, estimate the answer before calculating.

20. Mary wants to buy a pair of shoes for $24.99, a T-shirt for $6.50, and a pair of pants for $19.99. If she has $50 with her, does she have enough money to buy all three items?

21. The planet Mercury is an average distance of 57.9 million kilometres from the Sun. Earth is 149.6 million kilometres from the Sun. How much farther from the Sun is Earth?

22. The average high temperature last April in Winnipeg, MB was 8.89°C. The average high temperature last April in Toronto, ON, was 3.89°C more than in Winnipeg. What was the average high temperature last April in Toronto?

23. In the 2012 Summer Olympics, the gold-medal throw for shot put was 21.89 m. The throw that won the silver medal was 21.86 m.

a) Was the difference between the throws more or less than 0.1 m?

b) Round both throws to the nearest tenth. What is the difference between the rounded amounts?

c) Make up two throws that would round to the same number when rounded to the tenths.

d) Why are Olympic shot put throws measured so precisely?
1. Multiply the number of tens blocks by 10. Then show how many hundreds blocks there are to complete the multiplication statement. The first one is done for you.
   a) \(10 \times \) \(=\) 100
   b) \(10 \times \) \(=\) 10
   c) \(10 \times \) \(=\) 10
   10 \times 0.3 = 3
   10 \times 0.2 = ______
   10 \times 0.5 = ______

2. Multiply by 10 by shifting the decimal point one place to the right.
   a) \(10 \times \) 0.5 = _____
   b) \(10 \times \) 0.6 = ______
   c) \(10 \times \) 1.4 = ______
   d) \(10 \times \) 2.4 = ______
   e) \(3.5 \times \) 10 = ______
   f) \(14.5 \times \) 10 = ______
   g) \(10 \times \) 2.06 = 20.6
   h) \(10 \times \) 2.75 = ______
   i) \(10 \times \) 97.6 = ______

To convert from centimetres to millimetres, you multiply by 10. There are 10 mm in 1 cm.

3. Convert the measurement in centimetres to millimetres.
   a) 0.4 cm = ______ mm
   b) 0.8 cm = ______ mm
   c) 7.5 cm = ______ mm

4. \(10 \times 4\) can be written as a sum: \(4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4\).
   Write \(10 \times 0.4\) as a sum, and skip count by 0.4 to find the answer.

5. A dime is a tenth of a dollar (\(10\cent = \$0.10\)). Draw a picture or use play money to show that \(10 \times \$0.10 = \$1.00\).
1.0 = 0.01 and 100

If a hundreds block represents 1 whole, then … a ones block represents 1 hundredth (or 0.01), and … 100 hundredths make 1 whole: 100 × 0.01 = 1.0.

6. Write a multiplication statement for the picture.

a) 100 × □ =

b) 100 × □ =

100 × 0.02 =

The picture shows why the decimal point shifts two places to the right when multiplying by 100:

100 × 100 × 0.12 = 12

100 × 0.1 = 10

100 × 0.02 = 2

7. Multiply by 100. Do your rough work in the grid.

a) 100 × 0.8 = 80

b) 100 × 3.5 =

c) 7.2 × 100 =

d) 6.0 × 100 =

e) 100 × 0.34 =

f) 100 × 0.07 =

8. a) What do 1000 thousandths add up to? ________  b) What is 1000 × 0.001? ________

9. Look at your answers to Question 8. How many places right does the decimal point shift when you multiply by 1000? ___________________

BONUS ▶ Multiply by shifting the decimal point.

a) 1000 × 0.932 = ________  b) 6.325 × 1000 = ________  c) 1000 × 0.72 = ________
## NS6-49  Multiplying and Dividing by Powers of 10

<table>
<thead>
<tr>
<th>Division Problem</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \div 10 = )</td>
<td>( \div 10 = )</td>
</tr>
<tr>
<td>1.0 ÷ 10 = 0.1</td>
<td>0.1 ÷ 10 = 0.01</td>
</tr>
<tr>
<td>1.0 ÷ 100 = 0.01</td>
<td></td>
</tr>
</tbody>
</table>

### 1. Complete the picture and write a division equation.

**a)**

\[ \square \square \div 10 = \square \]

\[ 2.0 \div 10 = 0.2 \]

**b)**

\[ \square \square \div 10 = \square \]

\[ \square \square \div 10 = \square \]

**c)**

\[ \square \square \div 10 = \square \]

\[ 0.4 \div 10 = \square \]

**d)**

\[ \square \square \div 10 = \square \]

\[ \square \square \div 10 = \square \]

**e)**

\[ \square \square \square \div 10 = \square \]

\[ \square \square \square \div 10 = \square \]

**f)**

\[ \square \square \div 10 = \square \]

\[ 1.1 \div 10 = \square \]

**g)**

\[ \square \square \square \div 10 = \square \]

\[ \square \square \square \div 10 = \square \]

**h)**

\[ \square \square \square \div 10 = \square \]

\[ \square \square \square \div 10 = \square \]

### REMINDER

Division can be used to “undo” a multiplication.

\[ 6 \times 2 = 12 \text{ and } 12 \div 2 = 6 \]

### 2. How do you undo multiplying by 10 or 100?

**a)** To multiply by 10, I move the decimal point _____ place(s) to the ________.

so to divide by 10, I move the decimal point _____ place(s) to the ________.

**b)** To multiply by 100, I move the decimal point _____ place(s) to the ________.

so to divide by 100, I move the decimal point _____ place(s) to the ________.
3. Shift the decimal point one or two places to the left. Draw an arrow to show a shift.
   Hint: If there is no decimal point, write it to the right of the number first.
   a) \(0.4 \div 10 = \underline{0.04}\) or \(0.04\)
   b) \(0.7 \div 10 = \underline{0.07}\)
   c) \(0.6 \div 10 = \underline{0.06}\)
   d) \(3.1 \div 10 = \underline{0.31}\)
   e) \(26.0 \div 10 = \underline{2.6}\)
   f) \(81.4 \div 10 = \underline{8.14}\)
   g) \(25.4 \div 10 = \underline{2.54}\)
   h) \(0.32 \div 10 = \underline{0.032}\)
   i) \(0.5 \div 100 = \underline{0.005}\)
   j) \(7 \div 100 = \underline{0.07}\)
   k) \(9.1 \div 100 = \underline{0.091}\)
   l) \(91 \div 100 = \underline{0.91}\)

4. a) To multiply by 10, I move the decimal point \(1\) place(s) to the \(right\).
    b) To multiply by 1000, I move the decimal point \(3\) place(s) to the \(right\).
    c) To divide by 100, I move the decimal point \(2\) place(s) to the \(left\).
    d) To divide by 10, I move the decimal point \(1\) place(s) to the \(right\).
    e) To divide by 1000, I move the decimal point \(3\) place(s) to the \(left\).
    f) To multiply by 100, I move the decimal point \(2\) place(s) to the \(right\).
    g) To \(divide\) by 1000, I move the decimal point \(3\) place(s) to the \(left\).
    h) To \(divide\) by 10, I move the decimal point \(1\) place(s) to the \(left\).
    i) To \(divide\) by 100, I move the decimal point \(2\) place(s) to the \(right\).
    j) To \(divide\) by 10, I move the decimal point \(1\) place(s) to the \(right\).
    k) To \(divide\) by 100, I move the decimal point \(2\) place(s) to the \(left\).
    l) To \(divide\) by 1000, I move the decimal point \(3\) place(s) to the \(right\).
5. Fill in the blanks. Draw arrows to show how you would shift the decimal point. Then write your answer in the grid.

a) $7.325 \times 100$
   - Move the decimal point __ places __ right.

b) $4.6 \div 100$
   - Move the decimal point __ places __ left.

c) $724.6 \div 100$
   - Move the decimal point __ places ______.

d) $900.03 \div 10$
   - Move the decimal point __ place ______.

BONUS ►

e) $0.407 \times 100$
   - Move the decimal point __ places ______.

f) $521.692 \times 1000$
   - Move the decimal point __ places ______.

6. Multiply or divide on grid paper. Show how you shift the decimal point.

a) $3.41 \times 1000$
   b) $5.002 \times 100$
   c) $0.71 \times 10$
   d) $124.05 \times 1000$
   e) $0.52 \div 10$
   f) $800.4 \div 100$
   g) $276.9 \div 100$
   h) $47.02 \div 10$
   i) $0.31 \times 100$
   j) $134.8 \div 100$

BONUS ► $0.04027 \times 10000$

7. Explain why $1.00 \div 10 = 0.1$, using a dollar as the whole.

8. A wall 2.5 m wide is painted with 100 stripes of equal width. How wide is each stripe?

9. Find the missing number.

a) $12.3 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$
   b) $3.412 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

   c) $1.76 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$
   d) $52.3 \text{ km} = \underline{\hspace{2cm}} \text{ m}$
NS6-52 Dividing Decimals by Whole Numbers (Introduction)

REMINDER

\[ \frac{\square}{\square} = 1 \]
\[ \frac{\square}{\square} = 0.1 \]

1. Write the division equation for the base ten model.

<table>
<thead>
<tr>
<th>a)</th>
<th>b)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Base Ten Model" /></td>
<td><img src="image" alt="Base Ten Model" /></td>
</tr>
</tbody>
</table>

\[ 0.4 \div 2 = 0.2 \]

<table>
<thead>
<tr>
<th>c)</th>
<th>d)</th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="Base Ten Model" /></td>
<td><img src="image" alt="Base Ten Model" /></td>
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</table>

<table>
<thead>
<tr>
<th>e)</th>
<th>f)</th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="Base Ten Model" /></td>
<td><img src="image" alt="Base Ten Model" /></td>
</tr>
</tbody>
</table>

2. Divide by writing the decimal using ones and tenths.

<table>
<thead>
<tr>
<th>a) ( 4.8 \div 2 )</th>
<th>b) ( 6.9 \div 3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( = (\quad \text{ones} + \quad \text{tenths}) \div 2 )</td>
<td>( = (\quad \text{ones} + \quad \text{tenths}) \div 3 )</td>
</tr>
<tr>
<td>( = \quad \text{ones} + \quad \text{tenths} )</td>
<td>( = \quad \text{ones} + \quad \text{tenths} )</td>
</tr>
<tr>
<td>( = \quad 2.4 )</td>
<td>( = \quad )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c) ( 8.4 \div 4 )</th>
<th>d) ( 8.6 \div 2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( = (\quad \text{ones} + \quad \text{tenths}) \div 4 )</td>
<td>( = (\quad \text{ones} + \quad \text{tenths}) \div 2 )</td>
</tr>
<tr>
<td>( = \quad \text{ones} + \quad \text{tenths} )</td>
<td>( = \quad \text{ones} + \quad \text{tenths} )</td>
</tr>
<tr>
<td>( = \quad )</td>
<td>( = \quad )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>e) ( 9.6 \div 3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( = )</td>
</tr>
</tbody>
</table>

| BONUS \( 4.08 \div 4 \) |
3. Divide the decimal by a whole number by first dividing as if both numbers were whole numbers. Then count the number of decimal digits in the question to put the decimal point in the answer.

a) \( 48 \div 2 = \quad 24 \) 
so \( 4.8 \div 2 = \quad 2.4 \)

b) \( 63 \div 3 = \quad \) 
so \( 6.3 \div 3 = \quad \)

so \( 4.8 \div 4 = \quad \)

c) \( 48 \div 4 = \quad \)

\( 4.8 \div 2 = \quad 2.4 \)
so \( 6.3 \div 3 = \quad \)
so \( 4.8 \div 4 = \quad \)

d) \( 246 \div 2 = \quad 123 \) 
so \( 24.6 \div 2 = \quad 12.3 \)

e) \( 639 \div 3 = \quad \) 
so \( 63.9 \div 3 = \quad \)

so \( 48.8 \div 4 = \quad \)

f) \( 488 \div 4 = \quad \)

Sometimes you need to regroup:

If we divide as if they were whole numbers, we get \( 126 \div 3 = 42 \):

\[
\begin{array}{c|c|c|c}
& 4 & 2 \\
\hline
3 & 1 & 2 & 6 \\
\hline
1 & 2 & 6
\end{array}
\]

\[
\begin{array}{c|c|c|c}
& 3 & 0 \\
\hline
1 & 2 & 6
\end{array}
\]

4. The decimal has been divided as if it was a whole number. Count the number of decimal digits to insert the decimal point.

a) \( 148 \div 2 = 74 \) 
so \( 14.8 \div 2 = \quad 7.4 \)

so \( 21.6 \div 3 = \quad \)
so \( 36.4 \div 4 = \quad \)

b) \( 216 \div 3 = 72 \)

c) \( 364 \div 4 = 91 \)

so \( 15.6 \div 3 = \quad \)
so \( 32.8 \div 8 = \quad \)
so \( 45.9 \div 9 = \quad \)

d) \( 156 \div 3 = 52 \)

e) \( 328 \div 8 = 41 \)

f) \( 459 \div 9 = 51 \)

so \( 105 \div 5 = 21 \)

BONUS \( 24608 \div 4 = 6152 \)

so \( 10.5 \div 5 = \quad \)
so \( 2460.8 \div 4 = \quad \)

5. Raj runs 1.8 km in 9 minutes. How far does he run in 1 minute? ______________

6. A row of 4 nickels placed side by side is 84.8 mm long. What is the width of 1 nickel? ______________
237 ÷ 50 and 23 ÷ 5 have the same quotient but different remainders. Since 5 \times 4 = 20, then 50 \times 4 = 200, and the answers are:

\[
\begin{array}{c|c|c}
5 & 23 & \text{quotient} \\
\hline
\text{quotient} & 4 & 37 \\
\text{remainder} & 20 & 37 \\
\end{array}
\]

1. Divide by long division.
   a) \[
   \begin{array}{c|c|c|c}
   30 & 6 & \text{use } 3 \frac{1}{19} \text{ to find 6} \\
   \hline
   19 & 6 & \text{196} \\
   \hline
   16 & \\
   \end{array}
   \]
   b) \[
   \begin{array}{c|c|c|c}
   20 & 1 & 7 & 4 \\
   \hline
   6 & \text{30 \times 6} & \\
   \hline
   5 & \text{180} \\
   \end{array}
   \]
   c) \[
   \begin{array}{c|c|c|c}
   60 & 5 & 2 & 1 \\
   \hline
   16 & \text{196} \\
   \hline
   3 & \\
   \end{array}
   \]
   d) \[
   \begin{array}{c|c|c|c}
   40 & 2 & 1 & 8 \\
   \hline
   1 & 6 & \text{180} \\
   \hline
   3 & \\
   \end{array}
   \]
   e) \[
   \begin{array}{c|c|c|c}
   50 & 1 & 6 & 9 \\
   \hline
   1 & 6 & \text{180} \\
   \hline
   3 & \\
   \end{array}
   \]
   f) \[
   \begin{array}{c|c|c|c}
   80 & 5 & 1 & 3 \\
   \hline
   4 & \text{196} \\
   \hline
   3 & \\
   \end{array}
   \]
   g) \[
   \begin{array}{c|c|c|c}
   50 & 3 & 6 & 7 \\
   \hline
   1 & 6 & \text{180} \\
   \hline
   3 & \\
   \end{array}
   \]

38 is close to 40, so 176 ÷ 38 is close to 176 ÷ 40.

2. Round the divisor to the nearest ten. Then estimate the quotient.
   a) \[
   \begin{array}{c|c|c|c}
   48 & 1 & 6 & 3 \\
   \hline
   3 & \text{19} \\
   \hline
   14 & \\
   \end{array}
   \]
   b) \[
   \begin{array}{c|c|c|c}
   69 & 4 & 7 & 8 \\
   \hline
   3 \frac{2}{3} & \text{235} \\
   \hline
   144 & \\
   \end{array}
   \]
   c) \[
   \begin{array}{c|c|c|c}
   41 & 3 & 3 & 3 \\
   \hline
   3 & \text{235} \\
   \hline
   144 & \\
   \end{array}
   \]
   d) \[
   \begin{array}{c|c|c|c}
   41 & 2 & 5 & 6 \\
   \hline
   3 \frac{2}{3} & \text{268} \\
   \hline
   144 & \\
   \end{array}
   \]

3. Multiply the divisor by the estimated quotient. Write the answer under the dividend.
   a) \[
   \begin{array}{c|c|c|c}
   48 & 1 & 6 & 2 \\
   \hline
   3 \times 3 & \text{144} \\
   \hline
   144 & \\
   \end{array}
   \]
   b) \[
   \begin{array}{c|c|c|c}
   41 & 2 & 5 & 6 \\
   \hline
   3 \frac{2}{3} \times 3 & \text{144} \\
   \hline
   144 & \\
   \end{array}
   \]
   c) \[
   \begin{array}{c|c|c|c}
   19 & 1 & 4 & 2 \\
   \hline
   7 \times 3 & \text{144} \\
   \hline
   144 & \\
   \end{array}
   \]
   d) \[
   \begin{array}{c|c|c|c}
   32 & 2 & 6 & 8 \\
   \hline
   8 \times 3 & \text{144} \\
   \hline
   144 & \\
   \end{array}
   \]
To divide $172 \div 38$:

**Step 1:** Round the divisor to the nearest ten. 

**Step 2:** Estimate the quotient. Use $172 \div 40$ or $17 \div 4$.

**Step 3:** Multiply the divisor by the estimated quotient: $38 \times 4 = 152$.

**Step 4:** Subtract to find the remainder.

4. Round the divisor and estimate the quotient by the divisor (not the rounded divisor).

a) $20$

```
18)122
  \- 108
  \- 108
    4
```

b) $40$

```
42)353
  \- 320
  \- 320
    13
```

c) $40$

```
49)378
  \- 32
  \- 32
    58
```

d) $40$

```
32)268
  \- 240
  \- 240
    28
```

5. Subtract to find the remainder.

a) $62$

```
62)274
  \- 248
  \- 248
    26
```

b) $29$

```
29)196
  \- 174
  \- 174
    22
```

c) $41$

```
41)213
  \- 205
  \- 205
    8
```

d) $78$

```
78)594
  \- 546
  \- 546
    48
```

6. Divide using the steps above.

a) $60$

```
58)253
  \- 232
  \- 232
    21
```

c) $19$

```
19)143
  \- 130
  \- 130
    13
```

d) $32$

```
32)130
  \- 128
  \- 128
    2
```

e) $49$

```
49)385
  \- 380
  \- 380
    5
```

f) $21$

```
21)173
  \- 173
  \- 173
    0
```
2-Digit Division—Guess and Check

When estimating the quotient in a division problem, your estimate might be too high or too low.

Examples:

\[
\begin{align*}
42 \div 161 & \quad 16 \div 123 \\
& \quad - 168 \quad - 96 \\
\text{but } 168 > 161 & \quad \text{but } 27 > 16 \\
\text{TOO HIGH!} & \quad \text{TOO LOW!}
\end{align*}
\]

1. Was the estimate too high or too low?

a) \[18 \div 135 \]
   \[\underline{108}\]
   \[6 \text{ is too } \underline{\text{low}}.\]

b) \[23 \div 135 \]
   \[\underline{138}\]
   \[6 \text{ is too } \underline{\text{low}}.\]

c) \[43 \div 362 \]
   \[\underline{387}\]
   \[9 \text{ is too } \underline{\text{low}}.\]

d) \[27 \div 149 \]
   \[\underline{108}\]
   \[4 \text{ is too } \underline{\text{low}}.\]

2. Use the first estimate to make a better estimate. Then divide.

a) \[26 \div 149 \]
   \[\underline{104}\]
   \[45 \text{ but } 45 > 26 \text{ TOO LOW!}\]

b) \[17 \div 135 \]
   \[\underline{102}\]
   \[33 \text{ but } 33 > 17 \text{ TOO LOW!}\]

c) \[17 \div 121 \]
   \[\underline{102}\]
   \[19 \text{ but } 19 > 17 \text{ TOO LOW!}\]

d) \[23 \div 129 \]
   \[\underline{138}\]
   \[\text{but } 138 > 129 \text{ TOO HIGH!}\]

e) \[34 \div 263 \]
   \[\underline{272}\]
   \[\text{but } 272 > 263 \text{ TOO HIGH!}\]

f) \[44 \div 362 \]
   \[\underline{396}\]
   \[\text{but } 396 > 362 \text{ TOO HIGH!}\]

3. Divide.

a) \[291 \div 43\]

b) \[784 \div 85\]

c) \[473 \div 67\]

d) \[658 \div 74\]
4. Circle the first part of the dividend that is at least as big as the divisor.

\[ \begin{array}{ccc}
\text{dividend} & \text{divisor} \\
48 & 321 \\
73 & 5123 \\
27 & 2749 \\
\end{array} \]

5. Estimate how many times 26 goes into the circled number. Multiply to check your estimate.

\[ \begin{array}{ccc}
\text{dividend} & \text{circled number} \\
6132 & 26 \\
1427 & 26 \\
8476 & 26 \\
\end{array} \]

6. Divide using long division. Hint: Circle the first part of the dividend that is at least as big as the divisor.

\[ \begin{array}{ccc}
36 & 984 \\
54 & 3618 \\
36 & 2376 \\
\end{array} \]

\[ \begin{array}{ccc}
172.8 \div 24 \\
16.8 \div 48 \\
153.7 \div 53 \\
\end{array} \]

7. a) Is your answer to 2376 \( \div \) 36 greater than your answer to 984 \( \div \) 36? 
   
   b) Explain why a student who answered “no” to part a) should look for a mistake.

8. a) Use long division to find 854 divided by 10. Write your answer ...
   
   i) with a remainder.  
   ii) as a mixed number.  
   iii) as a decimal.
   
   b) How could you have predicted the answer to part iii)?

9. A teacher divides 360 crackers among 24 students. How many crackers does each student get?

10. Thirty-two people share the total cost of a bus trip: $2144. How much does each person pay?

11. Tessa has $145.50. How many $15 notebooks can she buy?

12. How many books that are 35 mm thick will fit along a book shelf that is 94.5 cm long?
NS6-56  Word Problems—Division by 2-Digit Numbers

1. Juice boxes are packaged 12 to a case. How many cases are needed for 432 juice bottles?

2. A parking garage collected $1092 in parking fees for 78 cars. How much was the charge for each car?

3. A school takes 1288 students to a theme park for a school trip. Each bus holds 56 students. How many buses were used?

4. A photocopier costs $0.20 per copy. Ben has $7.80 to make copies of a poster. How many copies can he make?

5. A cow produces about 30.3 L of milk a day. Farmer Jones has 15 cows. A carton of milk holds about 2 L of milk.
   a) How many litres of milk are produced by all of the cows?
   b) How many cartons are needed to hold all the milk?

6. The speed of sound at sea level is about 1225 044.0 m per hour. How far does sound travel in 1 minute?
   BONUS ▶ How far does sound travel in 10 seconds? In 1 second?

7. Amy cleans houses as a part-time job. She charges $34 for each hour that she cleans. Last year she earned $4250. How much more could she have earned if she had charged $36 instead?

8. A mobile phone company offers either a plan that charges $0.20 per minute for phone calls or a plan at $35 per month for unlimited minutes of phone calls. Avril usually talks for about 150 minutes a month.
   a) What would she be charged if she chose the first plan?
   b) Suppose she talks for 200 minutes a month. Which plan is better for Avril?

9. A banquet hall charges $160 in rent for an event, plus $26.50 for food per person attending.
   a) Find the total cost for 40 people.
   b) What should each person pay to cover the total costs?
Josh slides a dot from one position to another. To move the dot from position 1 to position 2, Josh slides the dot 4 units right. In mathematics, slides are called translations.

1. How many units right did the dot slide from position 1 to position 2?
   a) ______ units right
   b) ______ units right
   c) ______ units right

2. How many units left did the dot slide from position 1 to position 2?
   a) ______ units left
   b) ______ units left
   c) ______ units left

3. Follow the instructions to translate the dot to a new position.
   a) 3 units right
   b) 4 units left
   c) 5 units right

4. Describe the translation of the dot from position 1 to position 2.
   a) ______ units right
   ______ units down
   b) ______ units right
   ______ units down
   c) ______ units right
   ______ unit down

5. Translate the dot.
   a) 5 units right, 2 units down
   b) 4 units left, 2 units up
   c) 3 units left, 4 units down
The result of a translation is called the image under translation. You can use the prime symbol (′) to label the image. Example: The image of $P$ under translation is $P′$. 

6. a) Use a ruler and protractor to measure the sides and the angles of the triangle.

\[\begin{align*}
AB &= \text{____ mm} & \angle A &= \text{____} \\
AC &= \text{____ mm} & \angle B &= \text{____} \\
BC &= \text{____ mm} & \angle C &= \text{____} \\
DE &= \text{____ mm} & \angle D &= \text{____} \\
EF &= \text{____ mm} & \angle E &= \text{____} \\
DF &= \text{____ mm} & \angle F &= \text{____}
\end{align*}\]

b) Translate the triangle by translating the vertices. Use ′ to label the images of the vertices.

i) 5 units right and 2 units down
ii) 4 units left and 1 unit up

c) Measure the sides and the angles of the image.

\[\begin{align*}
A'B' &= \text{____ mm} & \angle A' &= \text{____} \\
A'C' &= \text{____ mm} & \angle B' &= \text{____} \\
B'C' &= \text{____ mm} & \angle C' &= \text{____} \\
D'E' &= \text{____ mm} & \angle D' &= \text{____} \\
E'F' &= \text{____ mm} & \angle E' &= \text{____} \\
D'F' &= \text{____ mm} & \angle F' &= \text{____}
\end{align*}\]

d) What do you notice about the sides and angles of the triangles and their images?

7. True or false? If the statement is true, explain why. If the statement is false, draw an example to show it is not true.

a) A triangle and its image under translation are congruent.

______________________________

______________________________

**BONUS** If two triangles are congruent, there is always a translation that takes one of them onto the other.

______________________________

______________________________
8. a) Translate triangle $T$ as given. Label the image $T'$. Then translate the image again from $T'$ to $T^*$.
   
   i) 2 units up and 3 units left, then 1 unit up and 5 units right

   ii) 4 units down and 3 units right, then 3 units up and 4 units left

b) Draw arrows joining the corresponding vertices of triangles $T$ and $T^*$.

   What do you notice about the direction of the arrows? ________________

c) Measure the arrows in millimetres. What do you notice about the length of the arrows? ________________

d) Can you use one translation to take triangle $T$ to $T^*$? ____ If yes, describe the translation.
   
   i) ____ units ________ and ____ units ________

   ii) ____ unit ________ and ____ unit ________

9. a) Draw a quadrilateral that is not a rectangle in the shaded zone on the grid. Label it $Q$.

   b) Predict the result of combining two translations:

   $Q$ to $Q'$: 6 units right and 3 units down

   $Q'$ to $Q^*$: 4 units left and 4 units down

   $Q$ to $Q^*$: ____ units ________ and ____ units ________

   c) Translate $Q$ to $Q'$ and $Q'$ to $Q^*$ to check your prediction. Was your prediction correct? ____

10. Jax thinks translating a shape 3 units up and 4 units left, then 4 units right and 3 units down results in the original shape. Is he correct? Explain.
G6-14 Reflections

To reflect a point $P$ in a mirror line $m$:

**Step 1:** Draw a line through $P$ perpendicular to $m$. Extend it beyond $m$.

**Step 2:** Measure the distance from $P$ to $m$ along the perpendicular.

**Step 3:** Mark the point $P'$ on the perpendicular on the other side of $m$ so that $P$ and $P'$ are the same distance from the mirror line $m$.

Point $P'$ is the **mirror image** of $P$. Mathematicians say that $P'$ is the **image of $P$ under reflection** in the line $m$.

1. Count the grid squares to reflect point $A$ in the given line.
   a) ![Grid with point A](image)
   b) ![Grid with point A](image)
   c) ![Grid with point A](image)

To reflect a shape in a mirror line, reflect the shape's vertices and then join the images of the vertices.

2. a) Use a ruler and protractor to measure the sides and the angles of the triangle.
   i) ![Triangle with sides and angles](image)
   
   $AB = \text{______ mm}$  $\angle A = \text{______}$
   
   $AC = \text{______ mm}$  $\angle B = \text{______}$
   
   $BC = \text{______ mm}$  $\angle C = \text{______}$
   
   $DE = \text{______ mm}$  $\angle D = \text{______}$
   
   $EF = \text{______ mm}$  $\angle E = \text{______}$
   
   $DF = \text{______ mm}$  $\angle F = \text{______}$
   
   b) Reflect each triangle in the given line. Use ' to label the images of the vertices.
   c) Measure the sides and the angles of each image.
   i) $A'B' = \text{______ mm}$  $\angle A' = \text{______}$
   
   $A'C' = \text{______ mm}$  $\angle B' = \text{______}$
   
   $B'C' = \text{______ mm}$  $\angle C' = \text{______}$
   
   $D'E' = \text{______ mm}$  $\angle D' = \text{______}$
   
   $E'F' = \text{______ mm}$  $\angle E' = \text{______}$
   
   $D'F' = \text{______ mm}$  $\angle F' = \text{______}$
   
   d) What do you notice about the sides and the angles of each triangle and its image? __________

Do reflections take triangles to congruent triangles? __________
3. a) Reflect the polygon in the given mirror line.
   
   i) ![Reflective polygon](image1)
   
   ii) ![Reflective polygon](image2)

   b) Draw a line segment between each vertex in part a) and its image. What do you notice about the line segments? ________________

   c) On the grids above, mark the midpoints of the line segments you drew in part b).

   What do you notice about the midpoints? ________________

   The **midpoint** of a line segment is the point halfway between the end points of the line segment.

   The shapes ABC and A'B'C' are mirror images of each other when:
   • line segments between each vertex and its possible image are parallel; and
   • all the midpoints of these line segments fall on the same perpendicular line.

   Note: The line segments between the vertices have different lengths.

4. a) Draw line segments between the vertices of the shape and their images.
   
   i) ![Line segments](image3)
   
   ii) ![Line segments](image4)

   b) Find the midpoint of each line segment you drew in part a). Are the midpoints on the same line?

   c) Are the shapes reflections of each other? How do you know?

   **BONUS** If your answer in part c) was “no” for any pair of shapes, identify the transformation that takes one shape into the other.
5. Fill in the table to summarize what happens to a shape that is reflected. What happens when a shape is translated?

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Lengths of Sides</th>
<th>Sizes of Angles</th>
<th>Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Translation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. a) Reflect triangle T in the mirror line. Label the image T'.

   i) ![Reflection of T]
   
   ii) ![Reflection of T]
   
   iii) ![Reflection of T]

b) Translate T' as given. Label the image T*.
   
   i) 3 units down
   
   ii) 4 units right
   
   iii) 3 units up and 2 units right

c) Draw the line segments joining each vertex in T to its image in T*. Are the line segments parallel?
   
   i) ________________
   
   ii) ________________
   
   iii) ________________

d) Are the line segments you drew in part c) equal?
   
   i) ________________
   
   ii) ________________
   
   iii) ________________

e) If possible, draw the translation arrow or the mirror line from T to T*.

f) Are triangles T and T* congruent? How do you know?

7. a) Reflect the trapezoid R in line ℓ. Label the image R'.

   i) ![Reflection of R]
   
   ii) ![Reflection of R]
   
   ![BONUS]

b) Reflect R' in line m. Label the image R*.

   ![Reflection of R']

   Is there a reflection or a translation that takes R to R'? If yes, describe it.
G6-15  Rotations

1. From the dark arrow, draw an arc showing the direction of the given 90° turn. Draw the arrow after turning.
   a) clockwise    b) counter-clockwise   c) clockwise    d) counter-clockwise

To rotate point $P$ around point $O$ 90° clockwise:

**Step 1:** Draw line segment $OP$. Measure its length.

**Step 3:** Place a set square so that:
   - the arc points at the diagonal side,
   - the right angle is at point $O$, and
   - one arm of the right angle aligns with $OP$.

**Step 4:** Draw a ray from point $O$ along the side of the square corner.

**Step 2:** Draw an arc clockwise to show the direction of rotation.

**Step 5:** On the new ray, measure and mark the image point $P'$ so that $OP' = OP$.

2. Rotate point $P$ 90° around point $O$ in the direction given. Label the image $P'$.
   a) clockwise    b) counter-clockwise   c) clockwise    d) counter-clockwise

3. Is point $P'$ in Question 2 always on a grid line intersection? Yes If not, fix your mistake.
To rotate a shape around point $O$, rotate the shape's vertices and join the images of the vertices. The point $O$ is called the **centre of rotation**. The centre of rotation can be outside, inside, or on a side of the shape. The centre of rotation is the only **fixed point** during a rotation; it does not move.

4. a) Measure the sides and the angles of the triangle.
   
   ![Diagram of triangle ABC]
   
   $AB = \ldots \quad \angle A = \ldots$
   
   $AC = \ldots \quad \angle B = \ldots$
   
   $BC = \ldots \quad \angle C = \ldots$

   ![Diagram of triangle EDO]
   
   $DE = \ldots \quad \angle D = \ldots$
   
   $EO = \ldots \quad \angle E = \ldots$
   
   $DO = \ldots \quad \angle O = \ldots$

   b) Rotate the triangle 90° counter-clockwise around point $O$. Use ′ to label the vertices of the image.

   c) Measure the sides and the angles of the image.

      i) $A'B' = \ldots \quad \angle A' = \ldots$

      ii) $D'E' = \ldots \quad \angle D' = \ldots$

      i) $A'C' = \ldots \quad \angle B' = \ldots$

      ii) $E'O = \ldots \quad \angle E' = \ldots$

      $B'C' = \ldots \quad \angle C' = \ldots$

      $D'O = \ldots \quad \angle O = \ldots$

   d) What do you notice about the sides and the angles of each triangle and its image? ____________

   Does rotation take polygons to congruent polygons? ____________

5. True or false? If the statement is true, explain why. If the statement is false, draw an example showing it is false.

   a) A polygon and its image under rotation are congruent.

   b) If two polygons are congruent, there is always a rotation that takes one polygon onto the other.

6. Fill in the table to summarize. What happens to a polygon that is reflected? Translated? Rotated?

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Lengths of Sides</th>
<th>Sizes of Angles</th>
<th>Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Translation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
You can rotate a triangle 90° using a grid instead of a set square.

Triangle $OED$ has a horizontal side 2 units long and a vertical side 3 units long.

Rotations take triangles to congruent triangles. A rotation of 90° takes horizontal lines to vertical lines and vertical lines to horizontal lines.

Triangle $OE'D'$ has a horizontal side 3 units long and a vertical side 2 units long.

7. Rotate the triangle 90° counter-clockwise around point $O$. Start with the side marked by an arrow. Hint: Note the direction first.

a) [Image]

b) [Image]

c) [Image]

d) [Image]

To rotate a point on a grid 90° clockwise around the point $O$:

**Step 1:** Draw line segment $OP$.

**Step 2:** Shade a right triangle with $OP$ as one side.

**Step 3:** Rotate the triangle 90° clockwise around $O$.

**Step 4:** Mark the image point.

8. Imagine the triangles to rotate the vertices of the polygon around the point $O$.

Join the vertices to create the image of the polygon.

a) 90° clockwise

[Image]

b) 90° counter-clockwise

[Image]

**BONUS** Use a ruler to draw a scalene obtuse triangle $ABC$. Find the midpoint of side $AC$ and label it $M$. Rotate triangle $ABC$ 180° clockwise around point $M$.

What type of quadrilateral do triangle $ABC$ and its image make together? Explain.
PA6-11 Solving Equations—Preserving Equality

1. Write the number that makes the equation true.
   a) $8 + 4 - \underline{\quad} = 8$ 
   b) $8 \times 3 \div \underline{\quad} = 8$ 
   c) $8 \div 2 \times \underline{\quad} = 8$
   d) $12 \div 4 \times \underline{\quad} = 12$ 
   e) $13 - 6 + \underline{\quad} = 13$ 
   f) $19 + 3 - \underline{\quad} = 19$

2. Write the operation that makes the equation true.
   a) 7 + $2 \quad 2 = 7$ 
   b) $8 \times 3 \quad 3 = 8$ 
   c) $12 \div 2 \quad 2 = 12$
   d) $15 - 4 \quad 4 = 15$ 
   e) $18 \div 3 \quad 3 = 18$ 
   f) $6 + 4 \quad 4 = 6$

3. Write the operation and number that make the equation true.
   a) $17 + 3 - 3 = 17$ 
   b) $20 \div 4 \quad \underline{\quad} = 20$ 
   c) $18 \times 2 \underline{\quad} = 18$
   d) $11 - 4 \underline{\quad} = 11$ 
   e) $4 \times 3 \underline{\quad} = 4$ 
   f) $15 + 2 \underline{\quad} = 15$
   g) $5 \times 2 \underline{\quad} = 5$ 
   h) $5 \div 2 \underline{\quad} = 5$ 
   i) $5 - 2 \underline{\quad} = 5$
   j) $n + 3 - 3 = n$ 
   k) $n \times 3 \underline{\quad} = n$ 
   l) $5m \underline{\quad} = m$
   m) $x - 5 \underline{\quad} = x$ 
   n) $x + 7 \underline{\quad} = x$ 
   o) $z \div 5 \underline{\quad} = z$

**REMINDER** The variable $x$ represents a number, so you can treat it like a number.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Result</th>
<th>Operation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add 3 to $x$.</td>
<td>$x + 3$</td>
<td>Multiply 3 by $x$.</td>
<td>$3 \times x$ (or $3x$)</td>
</tr>
<tr>
<td>Add $x$ to 3.</td>
<td>$3 + x$</td>
<td>Multiply $x$ by 3.</td>
<td>$x \times 3$ (or $3x$)</td>
</tr>
<tr>
<td>Subtract 3 from $x$.</td>
<td>$x - 3$</td>
<td>Divide $x$ by 3.</td>
<td>$x \div 3$</td>
</tr>
<tr>
<td>Subtract $x$ from 3.</td>
<td>$3 - x$</td>
<td>Divide 3 by $x$.</td>
<td>$3 \div x$</td>
</tr>
</tbody>
</table>

4. Show the result of the operation.
   a) Multiply $x$ by 7. $7x$ 
   b) Add 4 to $x$. $x + 4$ 
   c) Subtract 5 from $x$. $\underline{\quad}$
   d) Subtract $x$ from 5. $\underline{\quad}$ 
   e) Divide $x$ by 10. $\underline{\quad}$ 
   f) Divide 9 by $x$. $\underline{\quad}$
   g) Multiply 8 by $x$. $\underline{\quad}$ 
   h) Add $x$ to 9. $\underline{\quad}$

**BONUS** Add $x$ to $y$. $\underline{\quad}$

5. How could you undo the operation and get back to the number you started with?
   a) Add 4. subtract 4 
   b) Multiply by 3. $\underline{\quad}$ 
   c) Subtract 9. $\underline{\quad}$
   d) Divide by 2. $\underline{\quad}$ 
   e) Add 7. $\underline{\quad}$ 
   f) Multiply by 5. $\underline{\quad}$
   g) Multiply by 2. $\underline{\quad}$ 
   h) Divide by 8. $\underline{\quad}$ 
   i) Subtract $x$. $\underline{\quad}$
6. Solve for $x$ by doing the same thing to both sides of the equation. Check your answer.

a) $3x = 12$

$$3x \div 3 = 12 \div 3$$

$$x = 4$$

Check by replacing $x$ with your answer: $3(4) = 12$ ✓

b) $x \div 6 = 3$

c) $x - 4 = 20$

$$x \div 6 \times 6 = 3 \times 6$$

$$x = 4$$

d) $x \div 3 = 5$

e) $12 + x = 22$

$$12 \div 3 = 12 \div 3$$

$$x = 4$$

f) $44 = 4x$

$$x = 11$$

BONUS ➤ $x + 9 = 9 + 45$

7. Solve the equation in two steps like Lela. Check your answer.

a) $12 - x = 6$

$$12 - x + x = 6 + x$$

$$12 = 6 + x$$

$$12 - 6 = 6 + x - 6$$

$$6 = x$$

Check by replacing $x$ with your answer: $12 - 6 = 6$ ✓

d) $3 = 15 - x$

e) $59 - x = 56$

$$59 - x = 56$$

$$x = 3$$

f) $26 = 43 - x$

g) $31 - x = 11$

$$31 - x = 11$$

$$x = 20$$

h) $73 - x = 41$

$$73 - x = 41$$

$$x = 32$$

i) $17 - x = 17$

$$17 - x = 17$$

$$x = 0$$
To solve the equation \( x + 3 = 8 \), Mike and Jill use different methods.

**Mike uses preserving equality:**

\[
x + 3 = 8 \\
x + 3 - 3 = 8 - 3 \\
x = 5
\]

**Jill uses logic.** She thinks about how addition and subtraction are related:

\[
x + 3 = 8 \text{ means I have to add 3 to } x \text{ to get 8.}
\]

So, I have to subtract 3 from 8 to find \( x \).

\[
x = 8 - 3 = 5
\]

1. Use Jill’s method to solve the equation.

   a) \( x + 5 = 12 \)  
      \[
x = 12 - 5 \\
x = 7
\]

   b) \( x + 3 = 10 \)  
      \[
x = 10 - 3 \\
x = 7
\]

   c) \( x + 25 = 41 \)  
      \[
x = 41 - 25 \\
x = 16
\]

   d) \( 21 + x = 34 \)  
      \[
x = 34 - 21 \\
x = 13
\]

   e) \( 28 = 8 + x \)  
      \[
x = 28 - 8 \\
x = 20
\]

   f) \( 41 = x + 14 \)  
      \[
x = 41 - 14 \\
x = 27
\]

   g) \( 17 + x = 56 \)  
      \[
x = 56 - 17 \\
x = 39
\]

   h) \( x + 22 = 33 \)  
      \[
x = 33 - 22 \\
x = 11
\]

   i) \( 16 + x = 34 \)  
      \[
x = 34 - 16 \\
x = 18
\]

   j) \( x + 35 = 61 \)  
      \[
x = 61 - 35 \\
x = 26
\]

   k) \( 6 + x = 100 \)  
      \[
x = 100 - 6 \\
x = 94
\]

   l) \( 5 + x + 2 = 18 \)  
      \[
x = 18 - 7 \\
x = 11
\]

Mike and Jill solve the equation \( x - 2 = 5 \).

**Mike uses preserving equality:**

\[
x - 2 = 5 \\
x - 2 + 2 = 5 + 2 \\
x = 7
\]

Jill uses logic:

\[
x - 2 = 5 \text{ means I have to subtract 2 from } x \text{ to get 5.}
\]

So, I have to add 2 to 5 to find \( x \).

\[
x = 5 + 2 = 7
\]

2. Use Jill’s method to solve the equation.

   a) \( x - 5 = 12 \)  
      \[
x = 12 + 5 \\
x = 17
\]

   b) \( x - 12 = 5 \)  
      \[
x = 12 + 5 \\
x = 17
\]

   c) \( 26 = x - 3 \)  
      \[
x = 26 + 3 \\
x = 29
\]

   d) \( x - 19 = 9 \)  
      \[
x = 19 + 9 \\
x = 28
\]

   e) \( x - 7 = 28 \)  
      \[
x = 28 + 7 \\
x = 35
\]

   f) \( x - 13 = 22 \)  
      \[
x = 22 + 13 \\
x = 35
\]

   g) \( 14 = x - 27 \)  
      \[
x = 14 + 27 \\
x = 41
\]

   h) \( 29 = x - 32 \)  
      \[
x = 29 + 32 \\
x = 61
\]

   i) \( x - 15 = 62 \)  
      \[
x = 62 + 15 \\
x = 77
\]

   j) \( 43 = x - 19 \)  
      \[
x = 43 + 19 \\
x = 62
\]

   k) \( x - 51 = 49 \)  
      \[
x = 51 + 49 \\
x = 100
\]

   l) \( 73 = x - 21 \)  
      \[
x = 73 + 21 \\
x = 94
\]
REMINDER ▶ Division is often written in fractional form.

Examples: \(12 ÷ 4 = \frac{12}{4}\) \(15 ÷ 5 = \frac{15}{5}\) \(x ÷ 3 = \frac{x}{3}\) \(w ÷ 7 = \frac{w}{7}\)

3. Solve the division problem.
   a) \(\frac{6}{3} = \square\) b) \(\frac{12}{6} = \square\) c) \(\frac{12}{4} = \square\) d) \(\frac{15}{5} = \square\)

Mike and Jill solve the equation \(3x = 12\).

Mike uses preserving equality:
   \[
   \begin{align*}
   3x &= 12 \\
   x &= \frac{12}{3} \\
   x &= 4
   \end{align*}
   \]

Jill uses logic:
   \[
   \begin{align*}
   x &= \frac{12}{3} \\
   x &= 4
   \end{align*}
   \]

4. Use Mike’s method to solve the equation by preserving equality.
   a) \(4x = 12\) b) \(2x = 10\) c) \(6x = 42\) d) \(2x = 14\)
   \[
   \begin{align*}
   4x ÷ 4 &= 12 ÷ 4 \\
   x &= 3
   \end{align*}
   \]
   e) \(7x = 28\) f) \(6x = 18\) g) \(7x = 49\) h) \(8x = 48\)

Mike and Jill solve the equation \(x ÷ 3 = 8\).

Mike uses preserving equality:
   \[
   \begin{align*}
   x ÷ 3 &= 8 \\
   x &= 8 × 3 \\
   x &= 24
   \end{align*}
   \]

Jill uses logic:
   \[
   \begin{align*}
   x &= 8 × 3, \text{ so } x = 24
   \end{align*}
   \]

5. Solve the equation using logic.
   a) \(x ÷ 2 = 3\) b) \(2x = 8\) c) \(x ÷ 4 = 5\) d) \(3 + x = 8\) e) \(x - 5 = 6\)
   \[
   \begin{align*}
   x &= 3 × 2 \\
   x &= 6
   \end{align*}
   \]
   f) \(x ÷ 3 = 4\) g) \(5 + x = 12\) h) \(12 = 2x\) i) \(15 = 3x\) j) \(4 = x ÷ 3\)
   \[
   \begin{align*}
   x &= 3 × 2 \\
   x &= 6
   \end{align*}
   \]
   k) \(x ÷ 7 = 4\) l) \(x ÷ 4 = 7\) m) \(3x = 27\) n) \(36 = 12x\) BONUS ▶ \(\frac{x}{3} = 5\)
PA6-13 Solving Equations—Guess and Check

Finding the value of a variable that makes an equation true is called solving for the variable. Arsham uses a table to solve $2x + 1 = 7$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$2x + 1$</th>
<th>Is the equation true?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>$\times$</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>$\times$</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>$\checkmark$</td>
</tr>
</tbody>
</table>

So $x = 3$ makes the equation true.

1. Complete the table, then solve for $x$.
   a) $3x + 2 = 14$
   
   $x$  | $3x + 2$ | True? |
   ----|---------|-------|
   1   | 3(1) + 2 = 5 | $\times$ |
   2   | 3(2) + 2 = 8  | $\times$ |

   so $x = ____$

   b) $4x + 3 = 23$
   
   $x$  | $4x + 3$ | True? |
   ----|---------|-------|
   1   | 4(1) + 3 = 7 | $\times$ |

   so $x = ____$

   c) $5x - 2 = 13$
   
   $x$  | $5x - 2$ | True? |
   ----|---------|-------|

   so $x = ____$

2. Replace $n$ with 5 and say whether 5 is too high or too low. Then try a lower or higher number.
   a) $3n + 2 = 20$
   
   $n$  | $3n + 2$ | Answer |
   ----|---------|--------|
   5   | 3(5) + 2 | 17     |

   5 is ______ too low

   b) $5n + 1 = 21$
   
   $n$  | $5n + 1$ | Answer |
   ----|---------|--------|
   5   | 5(5) + 1 |        |

   5 is ____________

   c) $2n + 3 = 15$
   
   $n$  | $2n + 3$ | Answer |
   ----|---------|--------|
   5   |          |        |

   5 is ____________

   d) $4n + 3 = 27$
   
   $n$  | $4n + 3$ | Answer |
   ----|---------|--------|
   5   |          |        |

   5 is ____________

   e) $5n - 6 = 14$
   
   $n$  | $5n - 6$ | Answer |
   ----|---------|--------|
   5   | 5(5) - 6 |        |

   5 is ____________

   f) $3n - 3 = 15$
   
   $n$  | $3n - 3$ | Answer |
   ----|---------|--------|
   5   |          |        |

   5 is ____________

3. Solve for $n$ by guessing small values, checking, and revising.
   a) $3n + 2 = 14$
   b) $5n + 2 = 13$
   c) $4n - 1 = 15$
   d) $6n - 5 = 31$
   e) $7n - 2 = 19$
   f) $2n + 3 = 9$

Patterns and Algebra 6-13
### PA6-14 Word Problems—Addition and Subtraction Equations

1. Fill in the table. Write \( x \) for the number you need to find. Cross out the cell you do not use.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Parts</th>
<th>How Many?</th>
<th>Difference</th>
<th>Equation and Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Ethan has 2 dogs and 5 fish. How many pets does he have?</td>
<td>dogs</td>
<td>2</td>
<td></td>
<td>( 2 + 5 = x ) ( x = 7 )</td>
</tr>
<tr>
<td>b) Sharon hiked 13 km on Saturday. She hiked 14 km on Sunday. How far did Sharon hike in two days?</td>
<td></td>
<td></td>
<td>Difference:</td>
<td></td>
</tr>
<tr>
<td>c) Lucy saved $43 in January. She saved $14 less in February than in January. How much money did she save in February?</td>
<td></td>
<td></td>
<td>Difference:</td>
<td></td>
</tr>
<tr>
<td>d) The Leviathan roller coaster in Canada is 93 m tall. It is 46 m shorter than the Kingda Ka roller coaster in the United States. How tall is Kingda Ka?</td>
<td></td>
<td></td>
<td>Difference:</td>
<td></td>
</tr>
<tr>
<td>e) A supermarket sold 473 bags of white and yellow potatoes. If 139 of the bags were filled with white potatoes, how many bags of yellow potatoes were sold?</td>
<td></td>
<td></td>
<td>Difference:</td>
<td></td>
</tr>
</tbody>
</table>

2. Write the parts and how many of each part. Then write and solve an equation.

   a) Clara watched TV for 45 minutes. She spent 15 minutes less on her homework than on watching TV. How much time did she spend on homework?

   b) A recreation pass costs $24. It is $9 more than a movie pass. How much do the two passes cost together?

   c) The Mercury City Tower in Moscow is 339 m tall. The CN Tower in Toronto is 553 m tall. How much taller is the CN Tower than the Mercury City Tower?
3. Solve the problem using an equation for each part. Use your answer from part i) as data for part ii).
   a) Alex read for 30 minutes before dinner and 45 minutes after dinner.
      i) How many minutes did he spend reading altogether?
      ii) Alex’s dinner took 30 minutes. If he finished his after-dinner reading at 7:50 p.m., when did Alex start eating dinner?
   b) There are 18 players on a soccer team. Seven of them are reserve players and the rest are field players.
      i) How many field players are on the team?
      ii) How many more field players than reserve players are on the team?

4. Solve the two-step problem by writing equations.
   a) Mary bought 16 red stickers and 25 blue stickers. She used 13 of them. How many stickers does she have left?
   b) There are 28 students in a sixth grade class. Thirteen of them don’t wear glasses. How many more students wear glasses than don’t wear glasses?
   c) Shawn read 7 mysteries. He read 3 more science fiction books than mysteries. How many books did he read altogether?
   d) Ava had $75. She spent $12 on two shirts, $32 on shoes, and $25 on a jacket. Does she have enough money to buy a pair of pants for $14?

5. There are 23 500 houses and 12 700 apartments in a town. Use equations to answer the question.
   a) How many houses and apartments are there in total?
   b) How many more houses are there than apartments?
   c) The town plans to tear down 750 houses and replace them with 2400 apartments. How many more houses than apartments will there be?

BONUS ► The table shows Sun’s savings account balances from June to August. She did not withdraw money from her savings account.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>End of June</td>
<td>$237.57</td>
</tr>
<tr>
<td>End of July</td>
<td>$352.24</td>
</tr>
<tr>
<td>End of August</td>
<td>$528.06</td>
</tr>
</tbody>
</table>

   a) How much did she deposit in July?
   b) How much did she deposit in July and August altogether?
   c) How much more did Sun deposit in August than in July?
   d) Sun wants to buy a computer for $699.98 by the end of September. Her father told her that he will pay the tax. How much does Sun need to save in September to be able to buy the computer?
**PA6-15 Word Problems—Multiplication Equations**

Smaller part: [ ]
Larger part: [ ]

The larger part is 3 times the size of the smaller part.
The scale factor is 3.

You can write an equation to find one part from the other:
Larger part = scale factor × smaller part

1. Circle the larger thing or quantity. Underline the smaller thing or quantity.
   a) A high rise is seven times as tall as a house.
   b) There are five times as many apples as pears.
   c) There are four times as many cats as dogs.
   d) Ed’s wallet is one-sixth times as heavy as his suitcase.
   e) A kitten is four times as big as a mouse.
   f) A bus holds ten times as many people as a car.

2. Write an equation to find the answer. Use x for the unknown amount.
   a) Jen has 6 times as many stamps as Dan. Jen has 24 stamps. How many stamps does Dan have?

   Larger amount: **number of Jen’s stamps** 24
   Smaller amount: **number of Dan’s stamps** x

   Equation: \[ \frac{24}{\text{Larger part}} = \frac{6}{\text{Scale factor}} \times \frac{x}{\text{Smaller part}} \]

   b) A cherry is 10 times as light as an apple. An apple weighs 90 grams. How much does the cherry weigh?

   Larger amount: [ ]
   Smaller amount: [ ]

   Equation: \[ \frac{\text{Larger part}}{\text{Larger part}} = \frac{\text{Scale factor}}{\text{Scale factor}} \times \frac{x}{\text{Smaller part}} \]

   c) A tablet costs $225. A computer costs three times as much. How much does the computer cost?

   BONUS Lara is one tenth as old as Amir. Lara is 5 years old. How old is Amir?

3. Write and solve an equation for the problem.
   a) Carl planted 8 times as many tomato plants as rose bushes. He planted 32 rose bushes. How many tomato plants did Carl plant?
   b) A whale shark is five times as long as a great white shark. A whale shark is 20 metres long. How long is the great white shark?
   c) A table is four times as heavy as a chair. The table weighs 220 kg. How much does the chair weigh?
   d) A male Nile crocodile weighs 620 kg, four times as much as a female American alligator. How much does the female American alligator weigh?
REMINDER ▶ Total number of things = number of sets × number in each set

4. Fill in the table. Use $x$ for the unknown.

<table>
<thead>
<tr>
<th>Total Number of Things</th>
<th>Number of Sets</th>
<th>Number in Each Set</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 40 pictures</td>
<td>40</td>
<td>$x$</td>
<td>8</td>
</tr>
<tr>
<td>8 pictures on each page</td>
<td></td>
<td></td>
<td>40 = 8$x$</td>
</tr>
<tr>
<td>b) 30 people</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 vans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) 24 flowers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 pots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) 4 chairs at each table</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 tables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) 50 houses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 houses on each block</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) 9 boxes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 pencils in each box</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Solve each equation in Question 4.

6. Write and solve an equation for the problem.
   a) A train has 10 cars and 1960 seats. How many seats are in each car?
   b) A parking lot has 12 equal rows and 492 parking spots. How many cars can park in each row?
   c) A maple tree is 10 m tall. A pine tree is 3 times as tall as the maple tree. How tall is the pine tree?
   d) A board game costs 3 times as much as a soft toy. The board game costs $19.50. How much does the soft toy cost?
   e) Ben is twice as old as Ella. Ben is 12 years old. How old is Ella?

7. Solve the problem by writing an equation.
   a) Jane has 7 stickers. Mark has 5 times as many stickers as Jane. How many stickers do they have altogether?
   b) There are 4 times as many people in City A as in City B. There are 257 301 people in City B. How many people are in City A?
   c) The planet Uranus is about 2.871 billion kilometres from the sun. Uranus is twice as far from the sun as the planet Saturn. Imagine that the sun, Saturn, and Uranus form a straight line in that order.
      i) How far from the sun is Saturn?
      ii) How far is Uranus from Saturn?
ME6-9 Area and Perimeter

1. a) Measure the length and the width of each rectangle in centimetres. Find the perimeter and area of each rectangle. Write the answers in the table.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Perimeter</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>( (2 \times 3 \text{ cm}) + (2 \times 5 \text{ cm}) = 16 \text{ cm} )</td>
<td>( 3 \text{ cm} \times 5 \text{ cm} = 15 \text{ cm}^2 )</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Shape E has a greater perimeter than Shape A. Does it also have a greater area? _______

c) Name two rectangles that have the same perimeter and different areas. _______ and _______

d) Write the shapes in order from greatest to least perimeter. ______________________________________

e) Write the shapes in order from greatest to least area. ______________________________________

f) Are the orders in parts d) and e) the same? _______

g) Alice thinks that a rectangle with larger area always has a larger perimeter. Is she correct? Explain.

h) Tristan thinks that a rectangle with larger perimeter always has a larger area. Is he correct? Explain.
2. a) Write an equation for the area of a rectangle with 
length 4 units and width 3 units. ________________
b) Write another pair of numbers that multiply to 12.
______ × ______ = 12
c) Draw a rectangle on the grid with length and width equal to 
your numbers.
d) What is the perimeter of the rectangle in part a) and the rectangle in part c)?
Are they the same?

3. a) Fill in the first two columns of the table to find all rectangles 
with perimeter 12 units and sides with lengths that are 
whole numbers.
b) Find the area of the rectangles to finish filling in the table.
c) Draw two rectangles on the grid with the same perimeter and 
different areas.

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Each square on the grid is 1 cm long.
a) Draw a square with perimeter 12 cm.
What is its area? __________
b) Draw a square with area 16 cm².
What is its perimeter? __________
c) Can you draw two different squares with 
perimeter 12 cm? Explain.
d) Can you draw two different squares with 
area 16 cm²? Explain.

5. Do you need to find the area or the perimeter to answer the question?
a) How much paper is needed to cover a bulletin board?
b) What is the distance around a field?
c) How much carpet is needed for a room?
d) How much ribbon is needed to make a border for a picture?
ME6-11 Area of Parallelograms

1. Move the shaded triangle to make a rectangle with the same area as the parallelogram. Find the base and the height of the parallelogram and the width and the height of the rectangle.

   a)
   
   ![Diagram](image1)
   
   Base = 4
   Width =
   Height = 5

   b)
   
   ![Diagram](image2)
   
   Base =
   Width =
   Height =

   c)
   
   ![Diagram](image3)
   
   Base =
   Width =
   Height =

   d)
   
   ![Diagram](image4)
   
   Base =
   Width =
   Height =

2. a) Look at your answers in Question 1. Complete each sentence with the word “base” or “height.”

   The height of the rectangle is the same as the ________________ of the parallelogram.

   The width of the rectangle is the same as the ________________ of the parallelogram.

   b) Area of rectangle = width × height. What is the formula for the area of a parallelogram?

   Area of parallelogram = ________________ × ________________
Area of parallelogram = base \times height \quad \text{or} \quad A = b \times h

3. Find the area of the parallelogram given the base and height.
   
   a) Base = 5 cm \quad b) Base = 4 m \quad c) Base = 8 mm \quad d) Base = 3.7 cm
   
   Height = 7 cm \quad Height = 3 m \quad Height = 6.5 mm \quad Height = 6 cm
   
   Area = \quad Area = \quad Area = \quad Area = \quad

   Any side of a parallelogram can be used as a base. The height is always perpendicular to the base.

   4. Find the area in two ways, by using different sides as base. Use a ruler.

   Area = \quad Area =

   5. Draw a perpendicular to the base of the parallelogram (thick line) using a protractor or a set square.

   a)  
   b)  

   Estimate the height and the base of the parallelogram to the closest centimetre.
   Estimate the area. Then check your estimate by measurement.

   6. A bus has ten windows that are parallelograms with height 1 m and base 1.3 m. Glass costs $23 for each 1 m². How much will it cost to replace the glass in all ten windows?
ME6-12 Area of Triangles

Two congruent right triangles make a rectangle.

Area of right triangle = Area of rectangle ÷ 2

1. Find the area of the triangle in square units.
   a) 
   b) 
   c) 
   d) 

   Area = ______ Area = ______ Area = ______ Area = ______

2. Draw a line to divide the triangle into two right triangles. Find the areas of all the triangles in square units.
   a) 
   b) 
   c) 
   d) 

   Triangle 1 = ______ Triangle 1 = ______ Triangle 1 = ______ Triangle 1 = ______
   Triangle 2 = ______ Triangle 2 = ______ Triangle 2 = ______ Triangle 2 = ______
   Total area = ______ Total area = ______ Total area = ______ Total area = ______

3. Rectangle C is made of Rectangles A and B. Triangle C is made of Triangles A and B.
   a) Find the areas.
      Area of Rectangle A = ______ Area of Triangle A = ______
      Area of Rectangle B = ______ Area of Triangle B = ______
      Area of Rectangle C = ______ Area of Triangle C = ______
   b) What fraction of the area of Rectangle C is the area of Triangle C? ______

4. Jun says: The area of Triangle T is half of the area of the rectangle.
   Is he correct? Explain. ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
Triangles have base and height. Height is measured along a perpendicular to the base.

5. a) Each grid square is 1 cm². Find the base and the height of the triangle. Then fill in the table.

<table>
<thead>
<tr>
<th>Base of Triangle</th>
<th>5 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of Triangle</td>
<td>4 cm</td>
</tr>
<tr>
<td>Width of Rectangle</td>
<td>5 cm</td>
</tr>
<tr>
<td>Height of Rectangle</td>
<td>4 cm</td>
</tr>
<tr>
<td>Area of Rectangle</td>
<td>20 cm²</td>
</tr>
<tr>
<td>Area of Triangle</td>
<td>10 cm²</td>
</tr>
</tbody>
</table>

b) Look at the table in part a). Complete each sentence with the word “base” or “height.”

The height of the rectangle is the same as the ___________ of the triangle.
The width of the rectangle is the same as the ___________ of the triangle.

\[ \text{Area of triangle} = \frac{\text{base} \times \text{height}}{2} \quad \text{or} \quad A = \frac{b \times h}{2} \]

6. Find the area of the triangle given the base and height. Do not forget the units.
   a) Base = 5 cm  
   Height = 8 cm  
   Area = ________  
   b) Base = 4 cm  
   Height = 3 cm  
   Area = ________  
   c) Base = 8 cm  
   Height = 6 cm  
   Area = ________  
   d) Base = 3.7 cm  
   Height = 6 cm  
   Area = ________

7. Find the area of the triangle.
   a)  
   Area = ________  
   b)  
   Area = ________  
   c)  
   Area = ________  
   d)  
   Area = ________
ME6-15 Variables and Area

1. a) Fill in the measurements you are given. Use a variable for what you do not know.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Base or Width</th>
<th>Height</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>$A = 20 \text{ cm}^2$</td>
<td>$5 \text{ cm}$</td>
<td>$h$</td>
</tr>
<tr>
<td>ii)</td>
<td>$3 \text{ m}$</td>
<td></td>
<td>$6 \text{ m}$</td>
</tr>
<tr>
<td>iii)</td>
<td>$A = 5 \text{ m}^2$</td>
<td>$2 \text{ m}$</td>
<td></td>
</tr>
<tr>
<td>iv)</td>
<td>$6 \text{ cm}$</td>
<td></td>
<td>$18 \text{ cm}^2$</td>
</tr>
<tr>
<td>v)</td>
<td>A rectangle with area 24 cm$^2$ has height 3 cm. What is its width?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vi)</td>
<td>A triangle has base 43 mm and height 36 mm. What is its area?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vii)</td>
<td>A parallelogram with base 4 km has area 20 km$^2$. What is the height of the parallelogram?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>viii)</td>
<td>A rectangle has width 7 m and height 6 m. What is its area?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) For each problem in the table in part a), use the area formula to write an equation. Then solve the equation.

i) $5 \text{ cm} \times h = 20 \text{ cm}^2$

ii) $h = 20 \text{ cm}^2 \div 5 \text{ cm}$

$= 4 \text{ cm}$

v)       

vi)      

vii)     

viii)
2. Organize the data. Write the formula you could use and an equation. Then solve the equation.

a) A parallelogram has base 5 cm and area 35 cm$^2$. What is its height?

Given: \( \text{base} = 5 \text{ cm} \)  
Equation: \( 5 \text{ cm} \times h = 35 \text{ cm}^2 \)

\[
\frac{\text{area} = 35 \text{ cm}^2}{h} = 7 \text{ cm}
\]

Find: \( \text{height of parallelogram} \)

Formula: \( \text{Area} = \text{base} \times \text{height} \)

b) What is the height of a parallelogram with base 3 m and area 12 m$^2$?

Given: 
Equation: 

Find: 

Formula: 

c) A cereal bar wrapper is a rectangle 10 cm wide, with area 300 cm$^2$. What is the length of the wrapper?

Given: 
Equation: 

Find: 

Formula: 

d) A flower bed is a rectangle that covers 2.4 m$^2$. It is 3 m long. How wide is it?

Given: 
Equation: 

Find: 

Formula: 

e) A company logo is a parallelogram with height 80 cm. It covers an area of 6000 cm$^2$. How long is the horizontal side of the logo?

f) Rani’s bedroom has area 10.2 m$^2$. The room is 3 m long. What is the width of the room?

BONUS ▶ A hexagon with sides 8 cm and area 168 cm$^2$ is made of three congruent rhombuses. What is the area of each rhombus? What is the height of each rhombus?
ME6-16 Changing Units of Area

REMINDER ★ 1 m = 100 cm
To convert a measurement in metres to centimetres, multiply by 100.

1. Convert the measurement in metres to centimetres.
   a) 2.35 m = ____ cm b) 5.21 m = ____ cm c) 2.97 m = ____ cm
d) 6.7 m = ____ cm e) 2.03 m = ____ cm f) 0.32 m = ____ cm

2. a) Write the length and width of the square in centimetres. The square is not drawn
to scale.
   i) 1 m = ____ cm ii) 2 m = ____ cm iii) 3 m = ____ cm

   b) Find the area of the square from part a) in square metres and in square centimetres.
   i) Area = ____ m² ii) Area = ____ m² iii) Area = ____ m²
      ____ cm × ____ cm ____ cm × ____ cm ____ cm × ____ cm
      = ________ cm² = ________ cm² = ________ cm²
   c) To convert square metres to square centimetres you multiply by ________________.

3. Convert the measurement in square metres to square centimetres.
   a) 12 m² = ____ cm² b) 0.95 m² = ____ cm² c) 2.4 m² = ____ cm²

4. a) The area of a rectangle is 25 m². It is 250 cm long. What is the width of the rectangle?
    Show your work.

   b) The area of a parallelogram is 0.24 m². Its height is 40 cm. What is the base?
    Show your work.
5. A parallelogram has base 2 m and height 80 cm.
   a) Lynn thinks its area is $2 \times 80 = 160 \text{ cm}^2$. Is she correct? _____ Explain. ____________________________
   b) Cam thinks its area is $2 \times 80 = 160 \text{ m}^2$. Is he correct? _____ Explain. ____________________________
   c) $80 \text{ cm} = 0.8 \text{ m}$
      Area of parallelogram = _____ m$^2$
   d) Convert the base of the parallelogram to centimetres. Base = _____ cm
      Area of parallelogram = __________ cm$^2$
   e) Is your area in part c) equal to your area in part d)? If not, find your mistake.

6. Find the area of the shaded shape.
   a) 
   b) 
   c) 

7. A garden has a path in the shape of a parallelogram.
The shaded areas are flower beds.
   a) What is the height of the path?
   b) The base of the path is 1 m. What is the area of the path?
   c) What is the total area of the flower beds? Show your work.
   d) The path is covered in tiles. It cost $3 per square metre to lay the tiles. It cost $5 per square metre to plant the flower beds. How much did it cost to create the garden?

8. The shape on the right is made from two parallelograms.
   Its area is 32.5 m$^2$. What is the height of the larger parallelogram?

BONUS

The ancient Maya used units of length called kaans. An ancient Mayan field is rhombus-shaped. Its area is 20 square kaans. Each side of the field is 5 kaans long. What is the height of the rhombus-shaped field? Hint: A rhombus is a parallelogram.
NS6-59 Equivalent Ratios

In the picture, there are 3 circles for every 2 squares. There are also 6 circles for every 4 squares. The ratios 3 : 2 and 6 : 4 are equivalent.

1. Find two equivalent ratios for the picture.
   a) circles to squares = 3 : ______ = 6 : ______
   b) circles to squares = 1 : ______ = 2 : ______
   c) circles to squares = 2 : ______ = 6 : ______
   d) circles to squares = 3 : ______ = 9 : ______

2. Complete the pictures so the ratio of triangles to squares is the same in each column. Then create a sequence of equivalent ratios.

<table>
<thead>
<tr>
<th>Triangles</th>
<th>△△</th>
<th>△△</th>
<th>△△</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squares</td>
<td>□ □</td>
<td>□ □</td>
<td>□ □</td>
</tr>
<tr>
<td>Ratio</td>
<td>2 : 3</td>
<td>□ □</td>
<td>□ □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Triangles</th>
<th>△△△△</th>
<th>△△△△</th>
<th>△△△△</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squares</td>
<td>□ □ □</td>
<td>□ □ □</td>
<td>□ □ □</td>
</tr>
<tr>
<td>Ratio</td>
<td>6 : 2</td>
<td>□ □ □</td>
<td>□ □ □</td>
</tr>
</tbody>
</table>

3. Skip count to write a sequence of three equivalent ratios.
   a) 3 : 2 = 6 : 4 = 12 : 8 
   b) 3 : 5 = 6 : 10 = 9 : 15 
   c) 5 : 8 = 10 : 16 = 15 : 24 
   d) 3 : 10 = 6 : 20 = 9 : 30 
   e) 5 : 4 = 10 : 8 = 15 : 12 
   f) 4 : 9 = 8 : 18 = 12 : 27

4. Find the missing term(s).
   a) 3 : 7 = ______ : 14 
   b) 5 : 6 = 10 : ______ = 15 : 18 
   c) 2 : 5 = ______ : 20
There are 5 blue marbles for every 2 red marbles in a jar. There are 20 blue marbles. To find out how many red marbles are in the jar, write out a sequence of equivalent ratios. Stop when there are 20 blue marbles. There are 8 red marbles in the jar.

<table>
<thead>
<tr>
<th></th>
<th>Blue</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

5. Write a sequence of equivalent ratios to solve the problem.

a) There are 5 red marbles for every 4 blue marbles in a jar with 20 red marbles. How many blue marbles are in the jar?

b) There are 4 red beads for every 3 blue beads in a bracelet. The bracelet has 12 red beads. How many blue beads are in the bracelet?

c) A recipe for soup calls for 3 cups of cream for every 5 cups of tomatoes. How many cups of cream are needed for 15 cups of tomatoes?

d) A team has 2 wins for every loss. They won 10 games. How many games did they lose?

e) A mixture for green paint has 5 cups of blue paint for every 6 cups of yellow paint. How much blue paint would you need if you have 30 cups of yellow paint?
1. The column was made by skip counting by a number. Complete the column.

<table>
<thead>
<tr>
<th></th>
<th>a) 4</th>
<th>b) 5</th>
<th>c) 3</th>
<th>d) 2</th>
<th>e) 7</th>
<th>f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Marc makes orange paint by mixing 1 cup of red paint for every 3 cups of yellow paint. He records the number of cups in a **ratio table**.

In a ratio table, multiply the numbers in the **first row** by the same number to get another row.

<table>
<thead>
<tr>
<th>Cups of Red</th>
<th>Cups of Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

2. Use skip counting or multiplication to complete a ratio table for the ratio.

<table>
<thead>
<tr>
<th></th>
<th>a) 4 : 1</th>
<th>b) 1 : 2</th>
<th>c) 3 : 1</th>
<th>d) 1 : 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>4</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>e) 2 : 3</th>
<th>f) 5 : 2</th>
<th>g) 6 : 4</th>
<th>h) 3 : 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Find the missing number(s) in the ratio table.

<table>
<thead>
<tr>
<th></th>
<th>a) 2 : 7</th>
<th>b) 4 : 1</th>
<th>c) 3 : 2</th>
<th>BONUS ▶ 6 :</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>8</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>
4. Jackie created an increasing pattern with squares and recorded the number of squares in a table.

<table>
<thead>
<tr>
<th>Figure</th>
<th># of Squares</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

Is this a ratio table? Explain how you know.

5. Circle the tables that are ratio tables.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>9</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>28</td>
<td>12</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Dory makes punch. She needs 5 cups of ginger ale for every 3 cups of cranberry juice. Use the ratio table to find out how many cups of ginger ale she needs for 9 cups of cranberry juice.

<table>
<thead>
<tr>
<th>Cups of Ginger Ale</th>
<th>Cups of Cranberry Juice</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

BONUS In Question 6, how many cups each of ginger ale and cranberry juice does Dory need to make 40 cups of punch? Use the ratio table to find out.

<table>
<thead>
<tr>
<th>Cups of Ginger Ale</th>
<th>Cups of Cranberry Juice</th>
<th>Cups in Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In a unit rate, one quantity is equal to 1.
For example, “30¢ for each apple” is a unit rate.

1. Complete the table for the unit rate.
   a) Each ticket costs $4.
   b) 3 hours of practice every day
   c) 25 students in each class
   
<table>
<thead>
<tr>
<th># of Tickets</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>
   
<table>
<thead>
<tr>
<th>Time (hr)</th>
<th># of Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>
   
<table>
<thead>
<tr>
<th># of Students</th>
<th># of Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   d) Each pot has 5 flowers.
   e) 60 kilometres every hour
   f) 6 cards for each boy

<table>
<thead>
<tr>
<th># of Pots</th>
<th># of Flowers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
</tr>
</tbody>
</table>
   
<table>
<thead>
<tr>
<th># of Cards</th>
<th># of Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. A blue whale typically travels 20 kilometres every hour. Use the ratio table to find out how long it takes for a blue whale to travel 80 kilometres.

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Multiply to find the missing information.
   a) 1 book costs $5
   b) 3 km in 1 hour
   c) 1 box for 25 cookies

   $20 \times 4$ books cost
   _____ km in 5 hours
   3 boxes for _____ cookies
4. Measure the height of the picture. Then find the height of the animal in real life if 1 cm in the picture represents 50 cm in real life.

a) Height of picture ____ cm  
b) Height of picture ____ cm  
c) Height of picture ____ cm  
Height of animal ____ cm  
Height of animal ____ cm  
Height of animal ____ cm

5. Find the missing information.

a) $15 allowance in 1 week  
b) 60 km in 1 hour  
_____ allowance in 4 weeks  
_____ km in 5 hours

6. David earns $15 per hour for mowing lawns. How much will he earn in 6 hours?

7. The fuel economy of a car (how far it can go with a unit of gas) is reported in kilometres per litre (KPL). Car A has a fuel economy of 12 KPL and Car B has a fuel economy of 15 KPL.

a) Complete the ratio tables to find out which car uses less gas for a 60 kilometre trip.

<table>
<thead>
<tr>
<th>Car A</th>
<th>Car B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Used (L)</td>
<td>Distance (km)</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

b) Suppose gas costs $1.10 for every litre. How much will the gas for the trip cost?

Car A: __________________________ Car B: __________________________

c) Which car has a better fuel economy? _____ Explain how you know. __________________________
NS6-62  Finding and Comparing Unit Rates

1. Divide to find the missing information.
   a) 6 mangoes cost $18
      \( \frac{6}{6} \) mango costs _____
   b) 4 cakes cost $16
      1 cake costs _____
   c) 5 pears cost $20
      1 pear costs _____
   d) 3 notebooks cost $24
      1 notebook costs _____
   e) 2 jackets cost $20
      1 jacket costs _____

BONUS 140 km per 7 litres

Jen paid $10 for 5 hot dogs. She wants to know how much 1 hot dog costs.

Step 1: She makes a ratio table showing the cost for each quantity of hot dogs.
   She writes a question mark (?) for the missing quantity.

<table>
<thead>
<tr>
<th>Hot Dogs</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>?</td>
</tr>
</tbody>
</table>

Step 2: She finds the number being divided by in the first column.
   She divides by that number in the second column to find the missing number.

<table>
<thead>
<tr>
<th>Hot Dogs</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Jen finds that 1 hot dog costs $2.

2. a) Ronin earns $66 babysitting for 6 hours.
      How much does he earn in an hour?
   b) Tina earns $75 cutting lawns for 5 hours.
      How much does she earn in an hour?

3. Find the unit rate.
   a) 3 kg of rice for 24 cups of water
      1 kg of rice for _____ cups of water
   b) 36 kilometres in 3 hours
      _____ kilometres in 1 hour

4. Find the unit rate from the ratio table.
   a) # of Tickets | Cost ($) |
      3            | 15       |
      4            | 20       |
      5            | 25       |
      $5 for each ticket
   b) Time (hr) | Distance (km) |
      2            | 50       |
      3            | 75       |
      4            | 100      |
      _____ km every hour
   c) # of Buses | # of Students |
      2            | 40       |
      4            | 80       |
      8            | 160      |
      _____ students in each bus
5. Divide to find the missing information.
   a) 4 tickets cost $84  
   b) 3 meals cost $69  
   c) 126 kilometres per 6 litres  
      1 ticket costs _____  
      1 meal costs _____  
      _____ kilometres per 1 litre

6. Find the unit rate and circle the best deal for renting bicycles.  
   A. $13 for 2 hours  
   B. $18 for 3 hours  
   C. $22 for 4 hours

REMINDER  
1 km = 1000 m  
1 m = 100 cm  
1 cm = 10 mm  
1 kg = 1000 g  
$1 = 100¢

7. Convert the measurement and fill in the table.  
   a) m  cm  
      3  
      17  
      92.4  
   b) kg  g  
      2  
      1.3  
      3.27  
   c) $  ¢  
      5  
      2.5  
      7.65

8. A stack of 10 nickels is 1.76 cm high. How many millimetres thick is 1 nickel?

9. a) 4 pears cost $1.80  
   b) 1.2 kg of pasta serves 8 people  
      How many cents does 1 pear cost? _____  
      How many grams are in 1 serving? _____

10. If 3 stickers cost $4.95, how much do 12 stickers cost?
**NS6-64 Percentages**

A **percentage** is a ratio that compares a number to 100.

The term “percent” means “per 100” or “for every 100” or “out of 100.” For example, 84% on a test means 84 out of 100.

You can think of a percentage as a short form for a fraction with denominator 100. Example: $45\% = \frac{45}{100}$

1. Write the percentage as a fraction.
   a) 7%  
   b) 92%  
   c) 5%  
   d) 15%  
   e) 50%  
   f) 100%  
   g) 2%  
   h) 17%

2. Write the fraction as a percentage.
   a) $\frac{2}{100}$  
   b) $\frac{31}{100}$  
   c) $\frac{52}{100}$  
   d) $\frac{100}{100}$  
   e) $\frac{17}{100}$  
   f) $\frac{88}{100}$  
   g) $\frac{7}{100}$  
   h) $\frac{1}{100}$

3. Write the decimal as a fraction and then a percentage.
   a) $0.72 = \frac{72}{100} = 72\%$
   b) $0.27 = \phantom{00}$
   c) $0.04 = \phantom{00}$

4. Write the fraction as a percentage by first changing it to a fraction with denominator 100.
   a) $\frac{3 \times 20}{5 \times 20} = \frac{60}{100} = 60\%$
   b) $\frac{2}{5}$
   c) $\frac{4}{5}$
   d) $\frac{1}{4}$
   e) $\frac{3}{4}$
   f) $\frac{1}{2}$
   g) $\frac{3}{10}$
   h) $\frac{7}{10}$
   i) $\frac{17}{25}$
   j) $\frac{17}{20}$
   k) $\frac{3}{25}$
   l) $\frac{19}{20}$
   m) $\frac{23}{50}$
   n) $\frac{47}{50}$
5. Write the decimal as a percentage.
   a) \(0.2 = \frac{2}{10} \times 10 = \frac{20}{100} = 20\%\)
   b) \(0.5\)
   c) \(0.7\)
   d) \(0.9\)

6. What percentage of the figure is shaded?
   a) 
   b) 
   c) 
   d) 

7. Change the fraction to a percentage by first writing it with the smallest numbers.
   a) \(\frac{9}{15} \div 3 = \frac{3}{5} = \frac{3 \times 20}{5 \times 20} = \frac{60}{100} = 60\%\)
   b) \(\frac{12}{15}\)
   c) \(\frac{3}{6}\)
   d) \(\frac{7}{35}\)
   e) \(\frac{21}{28}\)
   f) \(\frac{1}{2}\)
   g) \(\frac{12}{30}\)
   h) \(\frac{10}{40}\)
   i) \(\frac{20}{40}\)
   j) \(\frac{16}{40}\)
   k) \(\frac{60}{150}\)
   l) \(\frac{45}{75}\)
   m) \(\frac{80}{200}\)
   n) \(\frac{72}{80}\)
1. Fill in the chart.

<table>
<thead>
<tr>
<th>Picture</th>
<th>Fraction</th>
<th>Decimal</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td>$\frac{23}{100}$</td>
<td>0.23</td>
<td>23%</td>
</tr>
<tr>
<td><img src="image2" alt="Diagram" /></td>
<td>$\frac{100}{100}$</td>
<td>0.</td>
<td>63%</td>
</tr>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td>$\frac{45}{100}$</td>
<td>0.</td>
<td>____%</td>
</tr>
<tr>
<td><img src="image4" alt="Diagram" /></td>
<td>$\frac{100}{100}$</td>
<td>0.81</td>
<td>____%</td>
</tr>
</tbody>
</table>

Use a ruler for Questions 2 to 4.

2. Shade 50% of the shape.
   a) ![Diagram](image5)  
   b) ![Diagram](image6)  
   c) ![Diagram](image7)  

3. Shade 25% of the box.
   a) ![Diagram](image8)  
   b) ![Diagram](image9)  
   c) ![Diagram](image10)  

4. Colour 50% of the rectangle blue, 40% red, and 10% green.
   ![Diagram](image11)  

5. a) Write a fraction for the shaded part: $\frac{20}{20}$
   b) Write the fraction with a denominator of 100: ____
   c) Write a decimal and a percentage for the shaded part: ____ ____
6. Write a fraction and a percentage for each division of the number line.

<table>
<thead>
<tr>
<th>Fraction</th>
<th>0</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Draw marks to show 25%, 50%, and 75% of the line segment. Hint: Mark 50% first.

a) __________

b) __________

c) __________

d) __________

8. Circle whether the mark is closer to 25%, 50%, or 75%.

a) __________

b) __________

c) __________

d) __________

e) __________

9. Estimate the percentage of the line segment to the left of the mark.

a) __________

b) __________

10. Draw a rough sketch of a floor plan for a museum.

The different collections should take up the following amounts of space:

- Dinosaurs: 40%
- Animals: 20%
- Rocks and Minerals: 10%
- Ancient Artifacts: 20%

Washrooms should take up the final 10% of the floor space.

11. Asia covers 30% of the world’s land mass.

Using a globe, compare the size of Asia to the size of Australia. Approximately what percentage of the world’s land mass does Australia cover?
1. Is the fraction closest to 10%, 25%, 50%, or 75%?
   a) $\frac{3}{5}$  
   b) $\frac{4}{5}$  
   c) $\frac{2}{5}$  
   d) $\frac{2}{10}$  
   e) $\frac{1}{10}$  
   f) $\frac{4}{10}$  
   g) $\frac{9}{10}$  
   h) $\frac{4}{25}$  
   i) $\frac{11}{20}$  
   j) $\frac{16}{20}$  
   k) $\frac{37}{40}$  
   l) $\frac{1}{12}$

2. Change the numbers in the pair to fractions with the same denominator. Then write <, >, or = in the box.
   a) $\frac{1}{2}$, 47%  
   b) $\frac{1}{2}$, 53%  
   c) $\frac{1}{4}$, 23%  
   d) $\frac{3}{4}$, 70%  

   \[
   \frac{50 \times 1}{50 \times 2} = \frac{47}{100}  
   \]
   \[
   \frac{50}{100} > \frac{47}{100}  
   \]
   e) $\frac{2}{5}$, 32%  
   f) 0.27, 62%  
   g) 0.02, 11%  
   h) $\frac{1}{10}$, 10%  

   i) $\frac{19}{25}$, 93%  
   j) $\frac{23}{50}$, 46%  
   k) 0.9, 10%  
   l) $\frac{11}{20}$, 19%

3. Write the numbers in order from least to greatest by first changing each number to a fraction.
   a) $\frac{3}{5}$, 42%, 0.73  
   b) $\frac{1}{2}$, 0.67, 80%  
   c) $\frac{1}{4}$, 0.09, 15%  
   d) $\frac{2}{3}$, 57%, 0.62
Finding Percentages

If you use a thousands cube to represent 1 whole, you can see that taking \( \frac{1}{10} \) of a number is the same as dividing the number by 10—the decimal point shifts one place left.

1. Find \( \frac{1}{10} \) of the number by shifting the decimal point.
   a) \( 4 (= 4.0) \) ______
   b) 7 ______
   c) 32 ______
   d) 120 ______
   e) 3.8 ______
   f) 2.5 ______

2. 10% is short for \( \frac{1}{10} \). Find 10% of the number.
   a) 9 ______
   b) 5.7 ______
   c) 4.05 ______
   d) 6.35 ______
   e) 0.06 ______
   f) 21.1 ______

You can find percentages that are multiples of 10.

Example: To find 30% of 21, find 10% of 21 and multiply the result by 3.

**Step 1:**
10% of 21 = 2.1

**Step 2:**
\( 3 \times 2.1 = 6.3 \)

30% of 21 = 6.3

3. Find the percentage using the method above.
   a) 40% of 15
      i) 10% of \( 15 = \) ______
      ii) \( 4 \times \) ______ = ______
   b) 60% of 25
      i) 10% of ______ = ______
      ii) \( \) \times ______ = ______
   c) 90% of 31
      i) 10% of ______ = ______
      ii) \( \) \times ______ = ______

4. a) If you want to estimate what percentage of 120 is 81, would your estimate be 60% or 70%?
    Hint: Find 60% of 120 and 70% of 120 to see which one is closer to 81.

   b) 15 out of 32 students in a class walk to school. About what percentage of students walk to school?
NS6-69 Percentages Word Problems

1. Find the percentage of the stamp collection that comes from “other” countries.
   Hint: Change all fractions to percentages.
   a) Anne’s collection:
      USA | Canada | Other
      40% | 1/2
   b) Braden’s collection:
      Canada | England | Other
      80% | 1/10
   c) Jun’s collection:
      Mexico | Canada | Other
      1/2 | 40%
   d) Lela’s collection:
      Canada | Nigeria | Other
      22% | 3/5
   e) Grace’s collection:
      Jamaica | Canada | Other
      3/4 | 15%
   f) Carl’s collection:
      France | Italy | Other
      3/4 | 10%

2. A painter spends $500.00 on art supplies. Complete the chart.

<table>
<thead>
<tr>
<th>Fraction of Money Spent</th>
<th>Percentage of Money Spent</th>
<th>Amount of Money Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brushes</td>
<td></td>
<td>$50.00</td>
</tr>
<tr>
<td>Paint</td>
<td>4/10</td>
<td></td>
</tr>
<tr>
<td>Canvas</td>
<td>50%</td>
<td></td>
</tr>
</tbody>
</table>

3. Iva spent 1 hour doing homework. The chart shows the time she spent on each subject.
   a) Complete the chart.
   b) How did you find the amount of time spent on math?

<table>
<thead>
<tr>
<th>Subject</th>
<th>Fraction of 1 Hour</th>
<th>Percentage of 1 Hour</th>
<th>Decimal</th>
<th>Number of Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>1/4</td>
<td>0.25</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>1/20</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td></td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>French</td>
<td></td>
<td>0.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Raj wants to buy a deck of cards that costs $8.00. The taxes are 15%. How much will he pay in taxes?

5. There are 15 blue balloons and 12 green balloons at a birthday party. 3/4 of the green balloons have writing on them, and 60% of the blue balloons have writing on them. How many balloons have writing on them?