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

253

2 hundreds 5 tens 3 ones

0.253

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 = \( \frac{0}{10} + \frac{5}{100} + \frac{3}{1000} \)

g) 2.756 = \( \frac{2}{10} + \frac{7}{10} + \frac{5}{100} + \frac{6}{1000} \)

h) 3.41 = \( \frac{3}{10} + \frac{4}{100} + \frac{1}{1000} \)

i) 9.207 = \( \frac{9}{10} + \frac{2}{100} + \frac{7}{1000} \)

j) 8.019 = \( \frac{8}{10} + \frac{0}{100} + \frac{1}{1000} \)

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 = \( \frac{4}{1} + \frac{1}{100} + \frac{7}{1000} \)

b) 6.305 = \( \frac{6}{1} + \frac{3}{10} + \frac{5}{100} \)

c) 2.035 =

d) 0.401 =

e) 0.005 =

f) 3.007 =

3. What is the value of the 9 in the decimal? Write the answer two ways.

a) 0.497 \( \frac{9}{100} \) or 9 \( \text{hundredths} \)

b) 3.921 \( \frac{9}{10} \) or 9 ______________

c) 8.294 \( \frac{9}{9} \) or 9 ______________

d) 3.159 \( \frac{9}{9} \) or 9 ______________

e) 3.009 \_ or 9 ______________

f) 8.913 \_ or 9 ______________

g) 0.904 \_ or 9 ______________

h) 6.291 \_ or 9 ______________
4. Write the decimal fractions in the place value chart, then write the number as a decimal.

a) \( \frac{3}{10} = 0.\underline{3} \)

<table>
<thead>
<tr>
<th>Ones</th>
<th>Tenths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

b) \( \frac{6}{10} = 0.\underline{\phantom{3}} \)

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

c) \( \frac{9}{10} = 0.\underline{0} \)

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

d) \( \frac{5}{10} + \frac{4}{100} = \underline{.5} \underline{4} \)

<table>
<thead>
<tr>
<th>Ones</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Ones</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>

f) \( \frac{1}{10} + \frac{8}{100} = \underline{.1} \underline{8} \)

<table>
<thead>
<tr>
<th>Ones</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>
g) \( \frac{2}{10} + \frac{4}{100} + \frac{3}{1000} = \underline{.2} \underline{4} \underline{3} \)

<table>
<thead>
<tr>
<th>Ones</th>
<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) \( 7 + \frac{3}{100} + \frac{5}{1000} = \underline{7} \underline{3} \underline{5} \underline{0} \)

5. Write the decimal in the place value chart.

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

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

a) 0.6 = \textit{six tenths}
b) 0.005 = \textit{five}
c) 0.04 = \underline{0.04} = \textit{four hundredths}
d) 0.008 = \underline{0.008} = \textit{eight thousandths}
e) 0.006 = \underline{0.006} = \textit{six thousandths}
f) 0.9 = \underline{0.9} = \textit{nine}

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

a) 572
d) 71
b) 107
c) 28759
NS6-45 Subtracting and Adding Decimals

1. Subtract by crossing out the correct number of boxes. Give the answer as a fraction.
   a) \[
   \begin{array}{c}
   50 \\
   100
   \end{array} - \begin{array}{c}
   30 \\
   100
   \end{array} = \begin{array}{c}
   \frac{50 - 30}{100} = 20 \\
   \end{array}
   \]
   b) \[
   \begin{array}{c}
   38 \\
   100
   \end{array} - \begin{array}{c}
   12 \\
   100
   \end{array} = \begin{array}{c}
   \frac{38 - 12}{100} = 26 \\
   \end{array}
   \]
   c) \[
   \begin{array}{c}
   69 \\
   100
   \end{array} - \begin{array}{c}
   34 \\
   100
   \end{array} = \begin{array}{c}
   \frac{69 - 34}{100} = 35 \\
   \end{array}
   \]
   d) \[
   \begin{array}{c}
   57 \\
   100
   \end{array} - \begin{array}{c}
   25 \\
   100
   \end{array} = \begin{array}{c}
   \frac{57 - 25}{100} = 32 \\
   \end{array}
   \]

2. Write the equations in Question 1 as decimals.
   a) \[0.50 - 0.30 = 0.20\]  
   b) \[\text{__________}\]  
   c) \[\text{__________}\]  
   d) \[\text{__________}\]

3. Subtract the decimals by lining up the decimal points.
   a) \[
   \begin{array}{c}
   0.74 \\
   \end{array} - \begin{array}{c}
   0.31 \\
   \end{array} = \begin{array}{c}
   0.43 \\
   \end{array}
   \]
   b) \[
   \begin{array}{c}
   0.56 \\
   \end{array} - \begin{array}{c}
   0.24 \\
   \end{array} = \begin{array}{c}
   0.32 \\
   \end{array}
   \]
   c) \[
   \begin{array}{c}
   3.47 \\
   \end{array} - \begin{array}{c}
   2.2 \\
   \end{array} = \begin{array}{c}
   1.27 \\
   \end{array}
   \]
   d) \[
   \begin{array}{c}
   6.49 \\
   \end{array} - \begin{array}{c}
   0.35 \\
   \end{array} = \begin{array}{c}
   6.14 \\
   \end{array}
   \]
   e) \[
   \begin{array}{c}
   2.53 \\
   \end{array} - \begin{array}{c}
   1.51 \\
   \end{array} = \begin{array}{c}
   1.02 \\
   \end{array}
   \]
   f) \[
   \begin{array}{c}
   3.79 \\
   \end{array} - \begin{array}{c}
   2.66 \\
   \end{array} = \begin{array}{c}
   1.13 \\
   \end{array}
   \]
   g) \[
   \begin{array}{c}
   8.84 \\
   \end{array} - \begin{array}{c}
   7.10 \\
   \end{array} = \begin{array}{c}
   1.74 \\
   \end{array}
   \]
   h) \[
   \begin{array}{c}
   5.19 \\
   \end{array} - \begin{array}{c}
   3.07 \\
   \end{array} = \begin{array}{c}
   2.12 \\
   \end{array}
   \]
   i) \[
   \begin{array}{c}
   4.08 \\
   \end{array} - \begin{array}{c}
   4.04 \\
   \end{array} = \begin{array}{c}
   0.04 \\
   \end{array}
   \]
   j) \[
   \begin{array}{c}
   2.15 \\
   \end{array} - \begin{array}{c}
   2.03 \\
   \end{array} = \begin{array}{c}
   0.12 \\
   \end{array}
   \]
   k) \[
   \begin{array}{c}
   5.53 \\
   \end{array} - \begin{array}{c}
   2.41 \\
   \end{array} = \begin{array}{c}
   3.12 \\
   \end{array}
   \]
   l) \[
   \begin{array}{c}
   9.83 \\
   \end{array} - \begin{array}{c}
   2.71 \\
   \end{array} = \begin{array}{c}
   7.12 \\
   \end{array}
   \]

When subtracting decimals, you may have to regroup.

Example:
\[
\begin{array}{c}
5 \quad 7 \quad 0 \\
1 \quad 2 \quad 4
\end{array} - \begin{array}{c}
5 \quad 7 \\
1 \quad 2
\end{array} = \begin{array}{c}
4 \quad 4 \quad 6
\end{array}
\]

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

   e) 4.5 - 2.65
   f) 31.1 - 22.2
   g) 7.45 - 6.68
   h) 5.20 - 1.23

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 + 60}{100} = \frac{87}{100} = 0.87

   b) 0.57 + 0.76 = \frac{57}{100} + \frac{76}{100} = \frac{57 + 76}{100} = \frac{133}{100} = 1.33

   c) 2.02 + 0.99 = \frac{202}{100} + \frac{99}{100} = \frac{202 + 99}{100} = \frac{301}{100} = 3.01

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?
NS6-46 Money and Decimals

1. Add.
   a) $5.45 + $3.23
   $5 4 5
   + $3 2 3
   $8 6 8
   b) $26.15 + $32.23
   $2 6 1 5
   + $3 2 2 3
   $5 8 3 8
   c) $19.57 + $30.32
   $1 9 5 7
   + $3 0 3 2
   $5 0 8 9

2. Add. You will have to regroup.
   a) $16.60 + $23.75
   $1 6 6 0
   + $2 3 7 5
   $4 0 3 5
   b) $27.45 + $51.22
   $2 7 4 5
   + $5 1 2 2
   $7 8 6 7
   c) $87.41 + $65.2
   $8 7 4 1
   + $6 5 2 0
   $1 5 2 6 2
   d) $34.60 + $26.00
   $3 4 6 0
   + $2 6 0 0
   $6 0 6 0
   e) $38.40 + $42.5
   $3 8 4 0
   + $4 2 5 0
   $8 0 9 0
   f) $165.2 + $482.5
   $1 6 5 2
   + $4 8 2 5
   $6 4 7 7

3. Subtract the amount. You may have to regroup.
   a) $24.50 - $21.75
   $2 4 5 0
   - $2 1 7 5
   $2 7 5 0
   b) $36.45 - $13.80
   $3 6 4 5
   - $1 3 8 0
   $2 2 6 5
   c) $45.23 - $67.2
   $4 5 2 3
   - $6 7 2 0
   $-2 2 2 0
   d) $531.4 - $160.3
   $5 3 1 4
   - $1 6 0 3
   $3 7 1 1
   e) $706.2 - $255.1
   $7 0 6 2
   - $2 5 5 1
   $4 5 1 1
   f) $841.7 - $390.9
   $8 4 1 7
   - $3 9 0 9
   $4 5 0 8

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

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) [Diagram]
      Round to ________
   b) [Diagram]
      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) [Diagram]
   b) [Diagram]

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.

![Number Line]

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.

![Number Line]

**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 ≈ 2.0  
   b) 2.6 ≈ 3.0  
   c) 7.3 ≈ 7.0  
   d) 11.1 ≈ 11.0  
   e) 30.7 ≈ 30.0  
   f) 19.6 ≈ 20.0

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 ➔ 1.50 ➔ round up  
   b) 1.83 ➔ 1.8 ➔ round down  
   c) 3.61 ➔ 3.6 ➔ round down  
   d) 3.42 ➔ 3.4 ➔ round down  
   e) 5.54 ➔ 5.5 ➔ round down  
   f) 6.67 ➔ 6.7 ➔ round up

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 ➔ 2.73 ➔ round up  
   b) 1.492 ➔ 1.49 ➔ round up  
   c) 3.547 ➔ 3.54 ➔ round down  
   d) 4.270 ➔ 4.27 ➔ round down  
   e) 9.167 ➔ 9.16 ➔ round down  
   f) 5.317 ➔ 5.31 ➔ round down

13. Underline the digit you are rounding to. Then circle whether you would round up or down.
   a) tenths  ➔ 7 ➔ round up  
   b) hundredths ➔ 6 ➔ round down  
   c) tenths ➔ 3 ➔ round down
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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td><strong>round down (rd)</strong></td>
</tr>
</tbody>
</table>

The digits to the right of the rounded digit become zeros.
The digits to the left remain the same.

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

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

a) 
```
3 2 0 1
ru
```
```
rd
```

b) 
```
3 5 8 3 5
ru
```
```
rd
```

c) 
```
9 4 2 7 1
ru
```
```
rd
```

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

```
3 9 8 5
```

Round 9 tenths up to 10 tenths.

```
3 9 8 5
```

Regroup the 10 tenths as 1 (ones)

```
3 9 8 5
```

Complete the rounding.

15. 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 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 ∼ ____ + ____ = ____

b) 7.03 − 5.465 ∼ ____ − ____ = ____

c) 3.2 + 5.1 + 4.6 ∼ ____ + ____ + ____ = ____

d) 9.601 − 3.02 − 4.9 ∼ ____ − ____ − ____ = ____

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

a) 0.42 → 0.40

b) 0.28 →

c) 2.62 →

d) 4.87 →

e) 0.73 + 2.17 ∼ 0.70 + 2.20 = 2.90

f) 0.89 − 0.46 ∼

g) 0.63 − 0.26 ∼

h) 3.82 + 2.47 ∼
18. Estimate by rounding to the nearest hundredth. Then add or subtract.

\[
\begin{align*}
a) & \quad 3.223 & \quad 3.220 & \quad + & \quad 1.366 & \quad 4.59 \\
b) & \quad 1.347 & \quad + & \quad 0.632 & \quad & \\
c) & \quad 5.653 & & \quad - & \quad 3.137 & \\
d) & \quad 6.840 & & \quad - & \quad 0.550 & \\
e) & \quad 1.347 & \quad - & \quad 1.213 & \\
f) & \quad 1.561 & \quad + & \quad 0.937 & \\
g) & \quad 2.193 & \quad - & \quad 0.768 & \\
h) & \quad 2.714 & \quad - & \quad 1.656 & \\
\end{align*}
\]

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?
## NS6-48 Multiplying Decimals by Powers of 10

If a hundreds block represents 1 whole, then a tens block represents 1 tenth (or 0.1). 10 tenths make 1 whole: $10 \times 0.1 = 1.0$

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) $10 \times \begin{array}{c} \text{1} \\ \text{1} \\ \text{1} \\ \text{1} \end{array} = \begin{array}{c} \text{1} \\ \text{1} \\ \text{1} \\ \text{1} \\ \text{1} \end{array}$

   b) $10 \times \begin{array}{c} \text{1} \\ \text{1} \\ \text{1} \end{array} = \begin{array}{c} \text{1} \\ \text{1} \\ \text{1} \\ \text{1} \\ \text{1} \end{array}$

   $10 \times 0.3 = 3$

   $10 \times 0.2 = ____$

   c) $10 \times \begin{array}{c} \text{1} \\ \text{1} \\ \text{1} \end{array} = \begin{array}{c} \text{1} \\ \text{1} \\ \text{1} \\ \text{1} \\ \text{1} \end{array}$

   $10 \times 0.5 = ____$

2. Multiply by 10 by shifting the decimal point one place to the right.

   a) $10 \times 0.5 = 5$

   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.**

\[
\begin{array}{c}
\text{1 cm} \\
\text{1 mm} = \frac{1}{10} \text{cm} = 0.1 \text{cm}
\end{array}
\]

3. Convert the measurement in centimetres to millimetres.

   a) $0.4 \text{ cm} = _____ \text{ mm}$

   b) $0.8 \text{ cm} = _____ \text{ mm}$

   c) $7.5 \text{ cm} = _____ \text{ mm}$

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\text{¢} = $0.10). Draw a picture or use play money to show that $10 \times $0.10 = $1.00$. 

---

**Number Sense 6-48**
6. Write a multiplication statement for the picture.

a) 

\[ 100 \times \square = \] 

b) 

\[ 100 \times \square = \] 

100 \times 0.02 = 

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

\[ 100 \times 0.12 = 12 \]

\[ 100 \times 0.1 = 10 \]

\[ 100 \times 0.02 = 2 \]

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

a) \[ 100 \times 0.8 = 80 \]

b) \[ 100 \times 3.5 = \] 

c) \[ 7.2 \times 100 = \] 

d) \[ 6.0 \times 100 = \] 

e) \[ 100 \times 0.34 = \] 

f) \[ 100 \times 0.07 = \] 

8. a) What do 1000 thousandths add up to? 

b) What is \[ 1000 \times 0.001? \]

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) \[ 1000 \times 0.932 = \] 

b) \[ 6.325 \times 1000 = \] 

c) \[ 1000 \times 0.72 = \] 

Number Sense 6-48
Divide 1 whole into 10 equal parts; each part is 1 tenth. 
1.0 ÷ 10 = 0.1
Divide 1 tenth into 10 equal parts; each part is 1 hundredth. 
0.1 ÷ 10 = 0.01
Divide 1 whole into 100 equal parts; each part is 1 hundredth. 
1.0 ÷ 100 = 0.01

1. Complete the picture and write a division equation.
   a) ________________________________________________
      ____________________________________________
      2.0 ÷ 10 = 0.2
   b) ________________________________________________
      ____________________________________________
   c) ________________________________________________
      ____________________________________________
   d) ________________________________________________
      ____________________________________________
   e) ________________________________________________
      ____________________________________________
   f) ________________________________________________
      ____________________________________________
   g) ________________________________________________
      ____________________________________________
   h) ________________________________________________
      ____________________________________________

REMINDER ▶ Division can be used to “undo” a multiplication. 
6 × 2 → 12 and 12 ÷ 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 _____________.

Number Sense 6-49
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 \(0.04\)

\[
\begin{array}{c}
0.4 \\
\end{array}
\]

b) \(0.7 \div 10 = \underline{0.07}\)

\[
\begin{array}{c}
0.7 \\
\end{array}
\]

c) \(0.6 \div 10 = \underline{0.06}\)

\[
\begin{array}{c}
0.6 \\
\end{array}
\]

d) \(3.1 \div 10 = \underline{0.31}\)

\[
\begin{array}{c}
3.1 \\
\end{array}
\]

e) \(26.0 \div 10 = \underline{2.6}\)

\[
\begin{array}{c}
26.0 \\
\end{array}
\]

f) \(81.4 \div 10 = \underline{8.1}\)

\[
\begin{array}{c}
81.4 \\
\end{array}
\]

g) \(25.4 \div 10 = \underline{2.54}\)

\[
\begin{array}{c}
25.4 \\
\end{array}
\]

h) \(0.32 \div 10 = \underline{0.032}\)

\[
\begin{array}{c}
0.32 \\
\end{array}
\]

i) \(0.5 \div 100 = \underline{0.005}\)

\[
\begin{array}{c}
0.5 \\
\end{array}
\]

j) \(7 \div 100 = \underline{0.07}\)

\[
\begin{array}{c}
7 \\
\end{array}
\]

k) \(9.1 \div 100 = \underline{0.091}\)

\[
\begin{array}{c}
9.1 \\
\end{array}
\]

l) \(91 \div 100 = \underline{0.91}\)

\[
\begin{array}{c}
91 \\
\end{array}
\]

4. a) To multiply by 10, I move the decimal point \(1\) place(s) to the \(\underline{right}\).

b) To multiply by 1000, I move the decimal point \(3\) place(s) to the \(\underline{right}\).

c) To divide by 100, I move the decimal point \(2\) place(s) to the \(\underline{left}\).

d) To divide by 10, I move the decimal point \(1\) place(s) to the \(\underline{left}\).

e) To divide by 1000, I move the decimal point \(3\) place(s) to the \(\underline{left}\).

f) To multiply by 100, I move the decimal point \(2\) place(s) to the \(\underline{right}\).

g) To \(\underline{divide}\) by 1000, I move the decimal point \(3\) place(s) to the \(\underline{left}\).

h) To \(\underline{divide}\) by 10, I move the decimal point \(1\) place(s) to the \(\underline{left}\).

i) To \(\underline{divide}\) by 100, I move the decimal point \(2\) place(s) to the \(\underline{right}\).

j) To \(\underline{divide}\) by 10, I move the decimal point \(1\) place(s) to the \(\underline{right}\).

k) To \(\underline{divide}\) by 100, I move the decimal point \(2\) place(s) to the \(\underline{left}\).

l) To \(\underline{divide}\) by 1000, I move the decimal point \(3\) place(s) to the \(\underline{right}\).
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 2 places right.

   b) $4.6 \div 100$
   Move the decimal point 2 places left.

   c) $724.6 \div 100$
   Move the decimal point ___ places ________.

   d) $900.03 \div 10$
   Move the decimal point ___ place ________.

   e) $0.407 \times 100$
   Move the decimal point ___ places ________.

   f) $521.692 \times 1000$
   Move the decimal point ___ places ________.

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

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

1. Write the division equation for the base ten model.
   a) \[ \begin{array}{c}
   \text{ Hundreds} \\
   \text{ Tens} \\
   \text{ Ones} \\
   \text{Tenths}
   \end{array} \quad \begin{array}{c}
   \text{ Quarters} \\
   \text{ Dimes} \\
   \text{ Nickels} \\
   \text{ Pennies}
   \end{array} \]
   \[ 0.4 \div 2 = 0.2 \]
   b) \[ \begin{array}{c}
   \text{ Hundreds} \\
   \text{ Tens} \\
   \text{ Ones} \\
   \text{Tenths}
   \end{array} \quad \begin{array}{c}
   \text{ Quarters} \\
   \text{ Dimes} \\
   \text{ Nickels} \\
   \text{ Pennies}
   \end{array} \]
   \[ \quad \quad \]
   c) \[ \begin{array}{c}
   \text{ Hundreds} \\
   \text{ Tens} \\
   \text{ Ones} \\
   \text{Tenths}
   \end{array} \quad \begin{array}{c}
   \text{ Quarters} \\
   \text{ Dimes} \\
   \text{ Nickels} \\
   \text{ Pennies}
   \end{array} \]
   \[ \quad \quad \]
   d) \[ \begin{array}{c}
   \text{ Hundreds} \\
   \text{ Tens} \\
   \text{ Ones} \\
   \text{Tenths}
   \end{array} \quad \begin{array}{c}
   \text{ Quarters} \\
   \text{ Dimes} \\
   \text{ Nickels} \\
   \text{ Pennies}
   \end{array} \]
   \[ \quad \quad \]
   e) \[ \begin{array}{c}
   \text{ Hundreds} \\
   \text{ Tens} \\
   \text{ Ones} \\
   \text{Tenths}
   \end{array} \quad \begin{array}{c}
   \text{ Quarters} \\
   \text{ Dimes} \\
   \text{ Nickels} \\
   \text{ Pennies}
   \end{array} \]
   \[ \quad \quad \]

2. Divide by writing the decimal using ones and tenths.
   a) \[ 4.8 \div 2 \]
      \[ = (\_\_\_\_\_\; \text{ones} + \_\_\_\; \text{tenths}) \div 2 \]
      \[ = 2\; \text{ones} + 4\; \text{tenths} \]
      \[ = 2.4 \]
   b) \[ 6.9 \div 3 \]
      \[ = (\_\_\; \text{ones} + \_\_\; \text{tenths}) \div 3 \]
      \[ = \_\_\; \text{ones} + \_\_\; \text{tenths} \]
      \[ = \_\_\_\_\_\_\_ \]
   c) \[ 8.4 \div 4 \]
      \[ = (\_\_\; \text{ones} + \_\_\; \text{tenths}) \div 4 \]
      \[ = \_\_\; \text{ones} + \_\_\; \text{tenths} \]
      \[ = \_\_\_\_\_\_\_ \]
   d) \[ 8.6 \div 2 \]
      \[ = (\_\_\; \text{ones} + \_\_\; \text{tenths}) \div 2 \]
      \[ = \_\_\; \text{ones} + \_\_\; \text{tenths} \]
      \[ = \_\_\_\_\_\_\_ \]

BONUS \[ 4.08 \div 4 \]

Number Sense 6-52
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) \(48 \div 2 = \underline{24}\)  
   b) \(63 \div 3 = \underline{21}\)  
   c) \(48 \div 4 = \underline{12}\)

   so \(4.8 \div 2 = \underline{2.4}\)  
   so \(6.3 \div 3 = \underline{2.1}\)  
   so \(4.8 \div 4 = \underline{1.2}\)

   d) \(246 \div 2 = \underline{123}\)  
   e) \(639 \div 3 = \underline{213}\)  
   f) \(488 \div 4 = \underline{122}\)

   so \(24.6 \div 2 = \underline{12.3}\)  
   so \(63.9 \div 3 = \underline{21.3}\)  
   so \(48.8 \div 4 = \underline{12.2}\)

Sometimes you need to regroup:

\[
12.6 \div 3 = (1 \text{ ten} + 2 \text{ ones} + 6 \text{ tenths}) \div 3
\]

\[
= (10 \text{ ones} + 2 \text{ ones} + 6 \text{ tenths}) \div 3
\]

\[
= (12 \text{ ones} + 6 \text{ tenths}) \div 3
\]

\[
= 4 \text{ ones} + 2 \text{ tenths}
\]

\[
= 4.2
\]

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

\[
\begin{array}{c}
126 \\
\hline
3 \\
\hline
42
\end{array}
\]

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 \(14.8 \div 2 = \underline{7.4}\)  
   so \(21.6 \div 3 = \underline{7.2}\)  
   so \(36.4 \div 4 = \underline{9.1}\)

   d) \(156 \div 3 = 52\)  
   e) \(328 \div 8 = 41\)  
   so \(15.6 \div 3 = \underline{5.2}\)  
   so \(32.8 \div 8 = \underline{4.1}\)  
   so \(45.9 \div 9 = \underline{5.1}\)

   g) \(105 \div 5 = 21\)  
   so \(10.5 \div 5 = \underline{2.1}\)  
   BONUS \(24608 \div 4 = 6152\)  
   so \(2460.8 \div 4 = \underline{615.2}\)  
   so \(24608 \div 4 = \underline{6152}\)

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? ________________
1. This newspaper article describes how fast Tyrannosaurus rexes grew.

During rapid growth spurts, teenage Tyrannosaurus rexes gained almost 2.1 kg a day.

Scientists have discovered that T. rexes added 2.07 kg a day during a four-year growth spurt between the ages of 14 and 18 years but experienced little or no growth after that. An adult T. rex could weigh up to 5500 kg.

A blue whale gains 90 kg a day for the first six months of its life and can reach 200 000 kg.

a) Two different measures are given for the weight a T. rex could gain in a day.
   i) What are the two measures?    ii) Which measure is more precise?
   iii) Which measure is greater?  iv) What is the difference between the two?

b) About how many times greater is the weight gain per day for a baby blue whale than for a teen T. rex?

c) A human newborn weighs about 3 kg. If a baby grew as fast as a T. rex, how much would it weigh after 30 days?

2. Draw a picture in the space provided to show 1 tenth of the whole.

![Diagram of 1 whole and 1 tenth]

3. Add.
   a) \(3000 + 200 + 7 + 0.02 = \)  
   b) \(10000 + 500 + 20 + 0.1 + 0.05 = \)  
   c) \(6000 + 300 + 8 + 0.1 = \)  
   d) \(400 + 7 + 0.02 = \)

4. Write < or > to show which decimal is greater.
   a) 3.7  <  3.5  
   b) 2.32  <  2.37  
   c) 1.7  <  1.69  
   d) 0.5  >  0.55

Number Sense 6-57
5. If you divide a number by 10, the result is 12.9. What is the original number? Explain.

6. Rani lives 2.4 km from the park. She walks to the park and back every day. How many kilometres does she walk to and from the park in a week?

7. John cut 2.73 m off of a 10 m rope. Tom cut off another 4.46 m. How much rope was left?

8. On a three-day canoe trip, Tasha canoed 25.5 km on the first day, 32.6 km on the second, and 17.25 km on the third.
   a) How far did she canoe in total?
   b) Tasha’s canoe can hold 100 kg. Tasha weighs 45.5 kg, her tent weighs 10.3 kg, and her supplies weigh 14.5 kg. How much more weight can the canoe carry?

9. A teacher has 157.6 mL of sulphuric acid in a bottle, and she wants to divide it equally into four different containers for class assignments. How much sulphuric acid would be in each container?

10. Anna walked 12.6 m in 20 steps. How many metres was each step?

11. Jax had $25.00. He bought a taco for $3.21, a banana for $1.37, a carton of milk for $1.56, and a video game for $15.87. How much money does he have left?

**BONUS**

a) Luc earned $28.35 on Monday. On Thursday, he spent $17.52 on a shirt. He now has $32.23. How much money did he have before he started work Monday? Hint: Work backwards. How much money did he have before he bought the shirt?

b) Sun spent half of her money on a book. Then she spent $1.25 on a pen. She has $3.20 left. How much did she start with?
G6-13 Translations

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) 
   b) 
   c) 

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

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) 
   b) 
   c) 

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.

![Triangle A B C and Triangle D E F]

\[
\begin{align*}
AB &= \underline{\phantom{0}} \text{ mm} & \angle A &= \underline{\phantom{0}} \\
AC &= \underline{\phantom{0}} \text{ mm} & \angle B &= \underline{\phantom{0}} \\
BC &= \underline{\phantom{0}} \text{ mm} & \angle C &= \underline{\phantom{0}} \\
DE &= \underline{\phantom{0}} \text{ mm} & \angle D &= \underline{\phantom{0}} \\
EF &= \underline{\phantom{0}} \text{ mm} & \angle E &= \underline{\phantom{0}} \\
DF &= \underline{\phantom{0}} \text{ mm} & \angle F &= \underline{\phantom{0}} \\
\end{align*}
\]

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.

\[
\begin{align*}
A′B′ &= \underline{\phantom{0}} \text{ mm} & \angle A′ &= \underline{\phantom{0}} \\
A′C′ &= \underline{\phantom{0}} \text{ mm} & \angle B′ &= \underline{\phantom{0}} \\
B′C′ &= \underline{\phantom{0}} \text{ mm} & \angle C′ &= \underline{\phantom{0}} \\
D′E′ &= \underline{\phantom{0}} \text{ mm} & \angle D′ &= \underline{\phantom{0}} \\
E′F′ &= \underline{\phantom{0}} \text{ mm} & \angle E′ &= \underline{\phantom{0}} \\
D′F′ &= \underline{\phantom{0}} \text{ mm} & \angle F′ &= \underline{\phantom{0}} \\
\end{align*}
\]

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](image1)
   b) ![Grid with point A](image2)
   c) ![Grid with point A](image3)

   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 A](image4)
   
   \[ AB = \_\_\_\_\_\_ \text{ mm} \quad \angle A = \_\_\_\_\_\_ \]
   \[ AC = \_\_\_\_\_\_ \text{ mm} \quad \angle B = \_\_\_\_\_\_ \]
   \[ BC = \_\_\_\_\_\_ \text{ mm} \quad \angle C = \_\_\_\_\_\_ \]
   
   ![Triangle E](image5)
   
   \[ DE = \_\_\_\_\_\_ \text{ mm} \quad \angle D = \_\_\_\_\_\_ \]
   \[ EF = \_\_\_\_\_\_ \text{ mm} \quad \angle E = \_\_\_\_\_\_ \]
   \[ DF = \_\_\_\_\_\_ \text{ mm} \quad \angle F = \_\_\_\_\_\_ \]
   
   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) \[ A'B' = \_\_\_\_\_\_ \text{ mm} \quad \angle A' = \_\_\_\_\_\_ \]
   \[ A'C' = \_\_\_\_\_\_ \text{ mm} \quad \angle B' = \_\_\_\_\_\_ \]
   \[ B'C' = \_\_\_\_\_\_ \text{ mm} \quad \angle C' = \_\_\_\_\_\_ \]
   
   ii) \[ D'E' = \_\_\_\_\_\_ \text{ mm} \quad \angle D' = \_\_\_\_\_\_ \]
   \[ E'F' = \_\_\_\_\_\_ \text{ mm} \quad \angle E' = \_\_\_\_\_\_ \]
   \[ D'F' = \_\_\_\_\_\_ \text{ mm} \quad \angle F' = \_\_\_\_\_\_ \]
   
   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.

![Image of polygon and mirror line]

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

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

![Image of midpoint]

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 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.

![Image of shapes and line segments]

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) ![Image of triangle T]
   ii) ![Image of triangle T']
   iii) ![Image of triangle 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

   ![Images of triangle T translated]

   ![Images of triangle T']

   ![Images of triangle T*]

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

   ![Image showing line segments]

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

   ![Images showing line segments]

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) ![Image of trapezoid R]
   ii) ![Image of trapezoid R']
   iii) ![BONUS Image]

b) Reflect R' in line m. Label the image 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 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? _____ 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 with vertices labeled A, B, and C, and center of rotation O]

   $AB = \ldots \quad \angle A = \ldots$
   $AC = \ldots \quad \angle B = \ldots$
   $BC = \ldots \quad \angle C = \ldots$

   $DE = \ldots \quad \angle D = \ldots$
   $EO = \ldots \quad \angle E = \ldots$
   $DO = \ldots \quad \angle O = \ldots$

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.

   ![Diagram of triangle A'B'C' with vertices labeled A', B', and C', and center of rotation O]

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

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

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](image1.png)
   b) ![Image](image2.png)
   c) ![Image](image3.png)
   d) ![Image](image4.png)

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
   b) 90° counter-clockwise

**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.
G6-16 More Rotations

To rotate point \( P \) around point \( O \) 180° clockwise:

**Step 1:** Draw line segment \( OP \). Measure its length.

**Step 2:** Extend \( OP \) beyond point \( O \).

**Step 3:** Mark the point \( P' \) so that \( OP' = OP \).

1. Triangle \( A'O'B' \) is the image of triangle \( AOB \) under a 180° clockwise rotation around point \( O \).
   a) Triangle \( AOB \) has a horizontal side _____ units long and a vertical side _____ units long.
      Triangle \( A'O'B' \) has a horizontal side _____ units long and a vertical side _____ units long.
   b) Write “horizontal” or “vertical” to complete the sentence.
      A 180° rotation clockwise or counter-clockwise takes horizontal lines to
      ________________ lines and vertical lines to ________________ lines.

**BONUS** Explain why a rotation of 180° clockwise produces the same result as a rotation 180° counter-clockwise around the same centre.

2. Rotate the triangle 180° clockwise or counter-clockwise around point \( O \). Start with a horizontal or a vertical side.
   a)  
   b)  
   c)  
   d)  

3. Rotate the vertices of the polygon 180° clockwise around point \( M \). Join the vertices to create the image of the polygon.
   a)  
   b)  
4. a) Rotate polygon M 90° clockwise around point O. Label the image M'.

   i) 

   b) Rotate polygon M' 90° clockwise around point O. Label the image M*.

c) Which rotation around point O takes polygon M to polygon M*? _______________________

5. How much did the thick arrow turn? Write “90°,” “180°,” or “270°.”

   a) 
   b) 
   c) 
   d) 

   270° clockwise   _______ clockwise   _______ clockwise   _______ clockwise

6. How did the thick arrow turn? Use CW for clockwise and CCW for counter-clockwise.

   a) 
   b) 
   c) 
   d) 

   90°CCW   _______   _______   _______ 

7. Was the grey shape rotated 90° CW, 90° CCW, or 180° CW or CCW to get the white shape? Write the amount and direction of rotation.

   a) 
   b) 
   c) 
   d) 

   _______   _______   _______   _______
8. Shape B is the image of Shape A under rotation. Mark the centre of rotation and describe the rotation.

a) 

b) 

c) 

d) 

e) 

f) 

g) 

BONUS ▷

9. Dory rotates point N around point O as given. What is the image point?

a) 90° CW, then another 90° CW: ______

b) 90° CW, then 180° CW: ______

c) 180° CCW, then another 180° CCW: ______

d) 180° CW, then 90° CW: ______

e) 90° CW, then 90° CCW: ______

10. a) Reflect triangle T in line ℓ. Label the image T'.

b) Reflect T' in the line m. Label the image T*.

c) Reflect T in the line m. Label the image T''.

d) Reflect T'' in the line ℓ. Label the image T**.

e) What do you notice about T* and T**?

f) Which transformation takes T to T'? Draw the translation arrow, the mirror line, or the centre of rotation and describe the transformation.
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) $7 + 2 \underline{\quad} 2 = 7$
   b) $8 \times 3 \underline{\quad} 3 = 8$
   c) $12 \div 2 \underline{\quad} 2 = 12$
   d) $15 - 4 \underline{\quad} 4 = 15$
   e) $18 \div 3 \underline{\quad} 3 = 18$
   f) $6 + 4 \underline{\quad} 4 = 6$

3. Write the operation and number that make the equation true.
   a) $17 + 3 - 3 = 17$
   b) $20 \div 4 \underline{\quad} = 20$
   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) $\underline{5m} \underline{\quad} = m$
   m) $x - 5 \underline{\quad} = x$
   n) $x + 7 \underline{\quad} = x$
   o) $z \div 5 \underline{\quad} = z$

REMARKER ▶ 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. $\underline{\quad} 7x$ b) Add 4 to $x$. $\underline{\quad} x + 4$
   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. $\underline{\quad}$ 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: \(3(4) = 12 \checkmark\)

b) \(x \div 6 = 3\)
\[
x \div 6 \times 6 = 3 \times 6 \\
x = 18
\]

c) \(x - 4 = 20\)
\[
x = 24
\]

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

a) \(12 - x = 6\)
\[
12 - x + x = 6 + x \\
12 = 6 + x \\
12 - 6 = 6 + x - 6 \\
x = 6
\]

Check by replacing \(x\) with your answer: \(12 - 6 = 6 \checkmark\)

b) \(6 = 13 - x\)
\[
6 + x = 13 - x + x \\
6 + x = 13 \\
6 = 13 - x
\]

c) \(24 - x = 20\)
\[
24 - x + x = 20 + x \\
24 = 20 + x \\
24 - 20 = 20 + x - 20 \\
x = 4
\]
To solve the equation $x + 3 = 8$, Mike and Jill use different methods.

Mike uses preserving equality:

$\begin{align*}
x + 3 &= 8 \\
x + 3 - 3 &= 8 - 3 \\
x &= 5
\end{align*}$

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

$x + 3 = 8$ means I have to add 3 to $x$ to get 8.

$\begin{align*}
x + 3 &= 8 \\
8 &= x + 3 - 3 \\
x &= 8 - 3 = 5
\end{align*}$

To solve the equation $x - 2 = 5$, Mike and Jill also use different methods.

Mike uses preserving equality:

$\begin{align*}
x - 2 &= 5 \\
x - 2 + 2 &= 5 + 2 \\
x &= 7
\end{align*}$

Jill uses logic:

$x - 2 = 5$ means I have to subtract 2 from $x$ to get 5.

$\begin{align*}
x - 2 &= 5 \\
5 &= x - 2 + 2 \\
x &= 5 + 2 = 7
\end{align*}$

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) $x + 22 = 33$  
   $x = 33 - 22$  
   $x = 11$

16 + x = 34  
$x + 35 = 61$  
$6 + x = 100$  
$5 + x + 2 = 18$

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) $x - 13 = 22$  
   $x = 13 + 22$  
   $x = 35$

g) $14 = x - 27$  
   $x = 14 + 27$  
   $x = 41$

h) $29 = x - 32$  
   $x = 29 + 32$  
   $x = 61$

$x - 15 = 62$  
$43 = x - 19$  
$x - 51 = 49$  
$73 = x - 21$
Division is often written in fractional form.

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

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: \( 3x = 12 \)
   \( 3x \div 3 = 12 \div 3 \)
   \( x = 4 \)
   Jill uses logic: \( 3x = 12 \) means I have to multiply \( x \) by 3 to get 12.
   So, I have to divide 12 by 3 to find \( x \).
   \( x = 12 \div 3 = 4 \)

4. Use Mike’s method to solve the equation by preserving equality.
   a) \( 4x = 12 \)  b) \( 2x = 10 \)  c) \( 6x = 42 \)  d) \( 2x = 14 \)
   \( 4x \div 4 = 12 \div 4 \)
   \( x = 3 \)
   e) \( 7x = 28 \)  f) \( 6x = 18 \)  g) \( 7x = 49 \)  h) \( 8x = 48 \)

Mike and Jill solve the equation \( x \div 3 = 8 \).
   Mike uses preserving equality: \( x \div 3 = 8 \)
   \( x \div 3 \times 3 = 8 \times 3 \)
   \( x = 24 \)
   Jill uses logic: \( x \div 3 = 8 \) means I have to divide \( x \) by 3 to get 8.
   So, I have to multiply 8 by 3 to find \( x \).
   \( x = 8 \times 3, \text{ so } x = 24 \)

5. Solve the equation using logic.
   a) \( x \div 2 = 3 \)  b) \( 2x = 8 \)  c) \( x \div 4 = 5 \)  d) \( 3 + x = 8 \)  e) \( x - 5 = 6 \)
   \( x = 3 \times 2 \)
   \( x = 6 \)
   f) \( x \div 3 = 4 \)  g) \( 5 + x = 12 \)  h) \( 12 = 2x \)  i) \( 15 = 3x \)  j) \( 4 = x \div 3 \)
   k) \( x \div 7 = 4 \)  l) \( x \div 4 = 7 \)  m) \( 3x = 27 \)  n) \( 36 = 12x \)  Bonus \( \square \)
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 $2x + 1 = 7$.

So $x = 3$ makes the equation true.

<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>

1. Complete the table, then solve for $x$.
   a) $3x + 2 = 14$
   b) $4x + 3 = 23$
   c) $5x - 2 = 13$

   $x$  $3x + 2$  True?
   1    $3(1) + 2 = 5$  $\times$
   2    $3(2) + 2 = 8$  $\times$

   so $x = \underline{3}$

   $x$  $4x + 3$  True?
   1    $4(1) + 3 = 7$  $\times$

   so $x = \underline{3}$

   $x$  $5x - 2$  True?
   1    $5(1) - 2 = 3$  $\times$

   so $x = \underline{3}$

2. Replace $n$ with 5 and say whether 5 is too high or too low. Then try a lower or higher number.
   a) $3n + 2 = 20$
   b) $5n + 1 = 21$
   c) $2n + 3 = 15$

   $n$  $3n + 2$  Answer
   5    $3(5) + 2$  17

   5 is __________

   $n$  $5n + 1$  Answer
   5    $5(5) + 1$  

   5 is __________

   $n$  $2n + 3$  Answer
   5    

   5 is __________

d) $4n + 3 = 27$
   e) $5n - 6 = 14$
   f) $3n - 3 = 15$

   $n$  $4n + 3$  Answer
   5    

   5 is __________

   $n$  $5n - 6$  Answer
   5    $5(5) - 6$  

   5 is __________

   $n$  $3n - 3$  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) $2n + 3 = 9$
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 Description</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>$2 + 5 = x$</td>
</tr>
<tr>
<td></td>
<td>fish</td>
<td>5</td>
<td>$x$</td>
<td>$x = 7$</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></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></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></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></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:

\[
\text{Larger part} = \text{scale factor} \times \text{smaller part}
\]

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: \[
      \frac{24}{\text{Larger part}} = 6 \times \frac{x}{\text{Smaller part}}
      \]
   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: \[
      \frac{\text{Larger part}}{\text{Larger part}} = \text{Scale factor} \times \frac{x}{\text{Smaller part}}
      \]
   c) A tablet costs $225. A computer costs three times as much. How much does the computer cost?
   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?

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 = 8x</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?
### PA6-19 Formulas for Tables

1. **Use the gap to complete the table.**

   a) Use the gap to complete the table.
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & 3 \\
   2 & +2 \\
   3 & +2 \\
   4 & +2 \\
   \hline
   \end{array}$

   b) Use the gap to complete the table.
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & 4 \\
   2 & +2 \\
   3 & +2 \\
   4 & +2 \\
   \hline
   \end{array}$

   c) Use the gap to complete the table.
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & 15 \\
   2 & -3 \\
   3 & -3 \\
   4 & -3 \\
   \hline
   \end{array}$

   d) Use the gap to complete the table.
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & 1 \\
   2 & 4 \\
   3 & 4 \\
   4 & 4 \\
   \hline
   \end{array}$

2. **Use the rule to fill in the table. Find the gap between outputs.**

   a) Use the rule to fill in the table. Find the gap between outputs.

   i) Rule: Multiply by 3 and add 1
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & \\
   2 & \\
   3 & \\
   4 & \\
   \hline
   \end{array}$

   ii) Rule: Multiply by 0.5 and add 2
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & \\
   2 & \\
   3 & \\
   4 & \\
   \hline
   \end{array}$

   iii) Rule: Multiply by 2 and add 5
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & \\
   2 & \\
   3 & \\
   4 & \\
   \hline
   \end{array}$

   iv) Rule: Multiply by 0 and add 4
   
   $\begin{array}{|c|c|}
   \hline
   \text{Input} & \text{Output} \\
   \hline
   1 & \\
   2 & \\
   3 & \\
   4 & \\
   \hline
   \end{array}$

   b) Compare the gap and the rule for each table in part a. What do you notice?
To find the rule for how to get the output from the input:

**Step 1:** Find the gap between the numbers in the Output column.

**Step 2:** Multiply each input by the gap.

**Step 3:** What must you add (or subtract) to each number in the second column to get the output?

**Step 4:** Write the rule for the table. Rule: Multiply the input by 3, then add 2.

3. Use the steps above to find the rule for the table.

   a)  
   
<table>
<thead>
<tr>
<th>Input (n)</th>
<th>n × gap</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>11</td>
</tr>
</tbody>
</table>

   Add __

   Multiply by _______, then add _____.

   b)  
   
<table>
<thead>
<tr>
<th>Input (n)</th>
<th>n × gap</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>11</td>
</tr>
</tbody>
</table>

   Add __

   Multiply by _______, then add _____.

   c)  
   
<table>
<thead>
<tr>
<th>Input (n)</th>
<th>n × gap</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

   Subtract __

   Multiply by _______, then subtract ______.

   d)  
   
<table>
<thead>
<tr>
<th>Input (n)</th>
<th>n × gap</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>16</td>
</tr>
</tbody>
</table>

   Subtract __

   Multiply by _______, then subtract ______.

4. Make a table for the number of blocks in each figure and then find a formula for the pattern.

<table>
<thead>
<tr>
<th>Input (n)</th>
<th>n × gap</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

   Formula: ________________  ________________
5. Use the gap in the sequence to complete the table and then find the formula.

<table>
<thead>
<tr>
<th>Input ((n))</th>
<th>(n \times \text{gap} )</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>17</td>
</tr>
</tbody>
</table>

Formula: \(5n - 3\)

<table>
<thead>
<tr>
<th>Input ((n))</th>
<th>(n \times \text{gap} )</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Formula: 

<table>
<thead>
<tr>
<th>Input ((n))</th>
<th>(n \times \text{gap} )</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

Formula: 

<table>
<thead>
<tr>
<th>Input ((n))</th>
<th>(n \times \text{gap} )</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>27</td>
<td>27</td>
</tr>
</tbody>
</table>

Formula: 

Once you know the gap, you really only need to see how the first term compares to the gap in order to find the formula.

Example: In Question 5.a), the gap is 5 and the first output is 2, so the formula is \(5n - 3\).

6. Find the gaps in the sequence. Then write the formula for the sequence.

a) 3, 5, 7, 9  
Formula: 

b) 9, 20, 31, 42  
Formula: 

c) 12, 17, 22, 27  
Formula: 

d) 2, 3.5, 5, 6.5  
Formula: 

e) 53, 55, 57, 59  
Formula: 

6. Find the gaps in the sequence. Then write the formula for the sequence.

7. a) Write a formula for the number of toothpicks in the sequence shown below:

Figure 1  
Figure 2  
Figure 3  
Figure 4  

b) Use your formula to determine the number of toothpicks in the 30th figure.
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 × 3 cm) + (2 × 5 cm) = 16 cm</td>
<td>3 cm × 5 cm = 15 cm²</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.

<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>

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.

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?
ME6-10 Area of Shapes Made from Rectangles

1. a) Calculate the area of each polygon.
   b) Draw a line to show how Polygon C can be divided into Rectangles A and B.

   i)  A  B  C
       Area of A = ______
       Area of B = ______
       Area of C = ______

   ii) A  B  C
       Area of A = ______
       Area of B = ______
       Area of C = ______

   iii) A  C
        B
        Area of A = ______
        Area of B = ______
        Area of C = ______

   iv) A  C
        B
        Area of A = ______
        Area of B = ______
        Area of C = ______

   c) How can you get the area of C from the areas of A and B? Write an equation.
      Area of C =

2. Draw a line to divide the polygon into two rectangles.
   Use the areas of the rectangles to find the total area of the polygon.

   a) 4 mm
       7 mm
       3 mm
       Area of Rectangle 1 = ______
       Area of Rectangle 2 = ______
       Total area = ______

   b) 10 cm
       4 cm
       6 cm
       Area of Rectangle 1 = ______
       Area of Rectangle 2 = ______
       Total area = ______

   c) 2 m
       5 m
       9 m
       Area of Rectangle 1 = ______
       Area of Rectangle 2 = ______
       Total area = ______
3. a) A building is 8 storeys high. The wing is 5 storeys high. How many storeys high is the tower?

- The tower is ______ storeys high.
- The wing is ______ m wide.

b) The tower of a building is 10 m wide. The base is 50 m wide. How wide is the wing?

- The wing is ______ m wide.

4. Find the missing side lengths. Divide the polygon into two rectangles and find their areas. Then find the total area of the polygon.

a) 

- Area of Rectangle 1 = ______
- Area of Rectangle 2 = ______
- Total area = ______

b) 

- Area of Rectangle 1 = ______
- Area of Rectangle 2 = ______
- Total area = ______

5. The picture shows plans for two flower beds. Find the area and the perimeter of each flower bed.

a) Flower Bed A

- Area = ______
- Perimeter = ______

b) Which flower bed has greater area? ______

c) Which has greater perimeter? ______

6. The picture shows plans for two parks. Find the area and the perimeter of each park.

- Area = ______
- Perimeter = ______

7. On grid paper, draw two different shapes made from rectangles that have the same perimeter and area.
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 = ____ : ____
   b) 3 : 5 = ____ : ____ = ____ : ____
   c) 5 : 8 = ____ : ____ = ____ : ____
   d) 3 : 10 = ____ : ____ = ____ : ____
   e) 5 : 4 = ____ : ____ = ____ : ____
   f) 4 : 9 = ____ : ____ = ____ : ____

4. Find the missing term(s).
   a) 3 : 7 = ____ : 14
   b) 5 : 6 = 10 : ____ = ____ : 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.

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

There are 8 red marbles in the jar.

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?
Introduction to Ratio Tables

1. The column was made by skip counting by a number. Complete the column.

   a)  4  b)  5  c)  3  d)  2  e)  7  f)  
   8   10  9   8  21  12  
  12  
  24

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.

   a)  4 : 1  b)  1 : 2  c)  3 : 1  d)  1 : 7  e)  2 : 3  f)  5 : 2  g)  6 : 4  h)  3 : 5
   4  1  1  2  3  1  1  7
   8  2  2  4  3
  12  3  
  16  4

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

   a)  2 : 7  b)  4 : 1  c)  3 : 2  **BONUS**  6 : ____
   2  7  4  1  3  2
   4  14  8  2  9
   6  12  10
   18  15
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>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>21</td>
<td>9</td>
<td>12</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>28</td>
<td>12</td>
<td>16</td>
<td>16</td>
<td>24</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>
</tbody>
</table>


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) \(0.27 = \)  
   c) \(0.04 = \)

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) $\frac{72}{80}$
**NS6-65 Visual Representations of Percentages**

1. Fill in the chart.

<table>
<thead>
<tr>
<th>Picture</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraction</td>
<td>$\frac{23}{100}$</td>
<td>$\frac{100}{100}$</td>
<td>$\frac{45}{100}$</td>
</tr>
<tr>
<td>Decimal</td>
<td>0.23</td>
<td>0.</td>
<td>0.</td>
</tr>
<tr>
<td>Percentage</td>
<td>23%</td>
<td>63%</td>
<td></td>
</tr>
</tbody>
</table>

Use a ruler for Questions 2 to 4.

2. Shade 50% of the shape.
   - a) 
   - b) 
   - c) 

3. Shade 25% of the box.
   - a) 
   - b) 
   - c) 

4. Colour 50% of the rectangle blue, 40% red, and 10% green.

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></th>
<th></th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>0%</td>
<td></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) ![Mark] 25% 50% 75%

b) ![Mark] 25% 50% 75%

c) ![Mark] 25% 50% 75%

d) ![Mark] 25% 50% 75%

e) ![Mark] 25% 50% 75%

f) ![Mark] 25% 50% 75%

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

a) ![Mark] 0% 100%

b) ![Mark] 0% 100%

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?
NS6-66 Comparing Decimals, Fractions, and Percentages

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)  \( \boxed{0.4} \)  
   b) 7  \( \boxed{0.7} \)  
   c) 32  \( \boxed{3.2} \)  
   d) 120  \( \boxed{12.0} \)  
   e) 3.8  \( \boxed{0.38} \)  
   f) 2.5  \( \boxed{0.25} \)  

2. 10% is short for \( \frac{1}{10} \). Find 10% of the number.
   a) 9  \( \boxed{0.9} \)  
   b) 5.7  \( \boxed{0.57} \)  
   c) 4.05  \( \boxed{0.405} \)  
   d) 6.35  \( \boxed{0.635} \)  
   e) 0.06  \( \boxed{0.006} \)  
   f) 21.1  \( \boxed{2.11} \)  

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 \quad 30\% \text{ of } 21 = 6.3

3. Find the percentage using the method above.
   a) 40% of 15  
   i) 10% of 15 = \( \boxed{1.5} \)  
   ii) \( \boxed{0.4} \) \times \boxed{15} = \boxed{6.0}  
   b) 60% of 25  
   i) 10% of \boxed{2.5} = \boxed{0.25}  
   ii) \boxed{4} \times \boxed{2.5} = \boxed{10.0}  
   c) 90% of 31  
   i) 10% of \boxed{3.1} = \boxed{0.31}  
   ii) \boxed{9} \times \boxed{3.1} = \boxed{27.9}  

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?
1. Find the percentage of the stamp collection that comes from “other” countries. 
   Hint: Change all fractions to percentages.
   a) Anne’s collection:
      
<table>
<thead>
<tr>
<th>USA</th>
<th>Canada</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>1/2</td>
<td>50%</td>
</tr>
<tr>
<td>40%</td>
<td>50%</td>
<td>10%</td>
</tr>
</tbody>
</table>

   b) Braden’s collection:
      
<table>
<thead>
<tr>
<th>Canada</th>
<th>England</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>80%</td>
<td>1/10</td>
<td>10%</td>
</tr>
</tbody>
</table>

   c) Jun’s collection:
      
<table>
<thead>
<tr>
<th>Mexico</th>
<th>Canada</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>40%</td>
<td>10%</td>
</tr>
</tbody>
</table>

   d) Lela’s collection:
      
<table>
<thead>
<tr>
<th>Canada</th>
<th>Nigeria</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>22%</td>
<td>3/5</td>
<td>15%</td>
</tr>
</tbody>
</table>

   e) Grace’s collection:
      
<table>
<thead>
<tr>
<th>Jamaica</th>
<th>Canada</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4</td>
<td>15%</td>
<td>10%</td>
</tr>
</tbody>
</table>

   f) Carl’s collection:
      
<table>
<thead>
<tr>
<th>France</th>
<th>Italy</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>

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>50%</td>
</tr>
<tr>
<td>Canvas</td>
<td></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?

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

<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></td>
<td>15</td>
</tr>
<tr>
<td>Science</td>
<td>1/20</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>French</td>
<td></td>
<td>0.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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?
NS6-70 Fractions, Ratios, and Percentages

There are only blue (b) and red (r) crayons in each bag.

1. Write the number of blue crayons (b), red crayons (r), and total crayons (c) in the bag.
   a) There are 8 blue crayons and 5 red crayons in the bag. b: 8 r: 5 c: 13
   b) There are 4 blue crayons and 7 red crayons in the bag. b: ___ r: ___ c: ___
   c) There are 12 blue crayons and 15 red crayons in the bag. b: ___ r: ___ c: ___
   d) There are 9 red crayons in the bag of 20 crayons. b: ___ r: ___ c: ___
   e) There are 7 blue crayons in the bag of 10 crayons. b: ___ r: ___ c: ___

2. Write the number of blue crayons, red crayons, and total crayons in the bag. Then write the fraction of crayons that are blue and the fraction that are red.
   a) There are 5 blue crayons and 6 red crayons in the bag. b: 5, 5 11 r: 6, c: ___
   b) There are 15 crayons in the bag. 8 are blue. b: ___, r: ___, c: ___

3. Write the fraction of crayons in the bag that are blue and the fraction that are red.
   a) There are 5 blue crayons and 17 crayons in total in the bag. b: 5/17 r:
   b) There are 3 blue crayons and 2 red crayons in the bag. b: r: 
   c) There are 9 red crayons and 20 crayons in total in the bag. b: r: 
   d) The ratio of blue crayons to red crayons in the bag is 5 : 9. b: r: 
   e) The ratio of red crayons to blue crayons in the bag is 7 : 8. b: r: 
   f) The ratio of blue crayons to red crayons in the bag is 10 : 11. b: r: 
   g) The ratio of blue crayons to total crayons in the bag is 11 : 23. b: r: 
   h) The ratio of total crayons to red crayons in the bag is 25 : 13. b: r:
4. Fill in the missing numbers for the bag of crayons.

<table>
<thead>
<tr>
<th>Ratio</th>
<th>What Fraction ...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>red to total</td>
</tr>
<tr>
<td>a)</td>
<td>2 : 5</td>
</tr>
<tr>
<td>b)</td>
<td>4 : 7</td>
</tr>
<tr>
<td>c)</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>23 : 50</td>
</tr>
<tr>
<td>e)</td>
<td></td>
</tr>
<tr>
<td>f)</td>
<td></td>
</tr>
<tr>
<td>g)</td>
<td></td>
</tr>
<tr>
<td>h)</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td></td>
</tr>
</tbody>
</table>

5. Fill in the missing numbers for the bag of crayons.

<table>
<thead>
<tr>
<th>Percentage That Are Red</th>
<th>Percentage That Are Blue</th>
<th>Fraction That Are Red</th>
<th>Fraction That Are Blue</th>
<th>Ratio of Red to Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 40%</td>
<td>60%</td>
<td>$\frac{40}{100}$</td>
<td>$\frac{60}{100}$</td>
<td>40 : 60</td>
</tr>
<tr>
<td>b) 35%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td></td>
<td></td>
<td>$\frac{3}{4}$</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td></td>
<td></td>
<td></td>
<td>10 : 15</td>
</tr>
<tr>
<td>e) $\frac{1}{2}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) 65%</td>
<td></td>
<td></td>
<td></td>
<td>23 : 27</td>
</tr>
<tr>
<td>g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
There are 3 canoes for every 2 kayaks in a marina of 20 boats. How many canoes are in the marina?

**Method 1:** Jack writes a sequence of equivalent ratios.

\[
\begin{align*}
3 \text{ canoes} : 2 \text{ kayaks} &= 6 \text{ canoes} : 4 \text{ kayaks} = 9 \text{ canoes} : 6 \text{ kayaks} = 12 \text{ canoes} : 8 \text{ kayaks} \\
\text{There are 12 canoes in the marina.}
\end{align*}
\]

**Method 2:** Sally uses different equivalent ratios to find the answer.

There are 3 canoes for every 5 boats in the marina.

\[
\begin{align*}
3 \text{ canoes} : 5 \text{ boats} &= 6 \text{ canoes} : 10 \text{ boats} = 9 \text{ canoes} : 15 \text{ boats} = 12 \text{ canoes} : 20 \text{ boats} \\
\text{There are 12 canoes in the marina.}
\end{align*}
\]

**Method 3:** Ken uses fractions. The ratio of canoes to kayaks is 3 : 2. So the fraction of canoes in the marina is \(\frac{3}{5}\).

\[
\frac{3}{5} \times 20 = 3 \times (20 \div 5) = 12.
\]

So there are 12 canoes in the marina.

---

6. From the information given, determine the number of kayaks and canoes in the marina.

a) There are 20 boats. \(\frac{2}{5}\) are canoes.

b) There are 42 boats. \(\frac{3}{7}\) are kayaks.

c) There are 15 boats. The ratio of kayaks to canoes is 3 : 2.

6. From the information given, determine the number of kayaks and canoes in the marina.

c) There are 15 boats. The ratio of kayaks to canoes is 3 : 2.

6. From the information given, determine the number of kayaks and canoes in the marina.

c) There are 15 boats. The ratio of kayaks to canoes is 3 : 2.

7. Which marina has more kayaks?

a) In Marina A, there are 40 boats. 60% are kayaks.

   In Marina B, there are 36 boats. The ratio of canoes to kayaks is 5 : 4.

b) In Marina A, there are 28 boats. The ratio of canoes to kayaks is 5 : 2.

   In Marina B, there are 30 boats. \(\frac{3}{5}\) of the boats are canoes.

8. Look at the word “Whitehorse.”

   a) What is the ratio of vowels to consonants?

   b) What fraction of the letters are vowels?

   c) What percentage of the letters are consonants?

9. Write the amounts in order from least to greatest: 20%, \(\frac{1}{20}\), 0.2. Show your work.

10. Karen has 360 hockey cards. Thirty percent are Montreal Canadiens cards and half are Detroit Red Wings cards. The rest are Edmonton Oilers cards. How many cards from each team does Karen have?