OPERATIONS WITH DECIMAL NUMBERS

A COLUMN ADDITION AND SUBTRACTION

Method Column addition and subtraction

1. **Step 1: Line up the decimal points.** Write the numbers one under the other so their decimal points are in a vertical line.

2. **Step 2: Fill in the gaps.** Add zeros to the end of the numbers so they all have the same length after the decimal point.

3. **Step 3: Add or subtract.** Work from right to left, column by column, as you would with whole numbers.

4. **Step 4: Place the decimal point.** Bring the decimal point straight down into your answer.

Ex: Calculate $3.83 + 2.7$.

Answer:

- **Line up the decimal points and add a zero**:

$$
\begin{array}{r}
3.8\ 3 \\
+\ 2.7\ 0 \\
\hline
\end{array}
$$

- **Add column by column from right to left**, carrying over when needed.
    - Hundredths: $3 + 0 = 3$
    - Tenths: $8 + 7 = 15$. Write down 5, carry over 1.
    - Ones: $1 + 3 + 2 = 6$.
- **Bring down the decimal point.**

$$
\begin{array}{r}
{}^{1}\ \ \ \\
3.8\ 3 \\
+\ 2.7\ 0 \\
\hline
6.5\ 3
\end{array}
$$

The answer is 6.53.

Ex: Calculate $3.8 - 2.9$.

Answer:

- **Line up the decimal points**. No zeros are needed.

- **Subtract from right to left**, borrowing when needed.
    - Tenths: We can't do $8 - 9$. Borrow 1 from the ones place, changing the 3 to a 2 and the 8 to an 18. Now, $18 - 9 = 9$.
    - Ones: $2 - 2 = 0$.
- **Bring down the decimal point.**

$$
\begin{array}{r}
3.8 \\
-\ 2.9 \\
\hline
0.9
\end{array}
$$

The answer is 0.9.

B COLUMN MULTIPLICATION

> **Method Column multiplication**
>
> 1. **Step 1: Ignore the decimals.** Write the calculation as if the numbers were whole numbers. You do not need to line up the decimal points.
>
> 2. **Step 2: Multiply.** Perform the multiplication as you would with whole numbers.
>
> 3. **Step 3: Count the decimal places.** Count the total number of digits after the decimal point in the original numbers.
>
> 4. **Step 4: Place the decimal point.** In your answer, place the decimal point so it has the same number of decimal places you counted in Step 3.

Ex: Calculate 3.48×2.9.

Answer:

1. **Multiply as whole numbers** (348×29).

$$
\begin{array}{r}
3\ 4\ 8 \\
\times\ \ \ \ 2\ 9 \\
\hline
3\ 1\ 3\ 2 \\
6\ 9\ 6\ \ \ \\
\hline
1\ 0\ 0\ 9\ 2 \\
\end{array}
$$

2. **Count the decimal places** in the original numbers.

   - 3.48 has 2 decimal places.
   - 2.9 has 1 decimal place.
   - Total: $2 + 1 = 3$ decimal places.

3. **Place the decimal point** in the answer (10092) so it has 3 decimal places.

$$10.092$$

So, $3.48 \times 2.9 = 10.092$.

C LONG DIVISION

> **Method Long Division by a Whole Number**
>
> 1. **Step 1: Set up the division.** Write the problem in the long division format.
>
> 2. **Step 2: Pop the decimal up.** Place the decimal point in the answer space, directly above the decimal point in the number being divided.
>
> 3. **Step 3: Divide from left to right.** Divide as you would with whole numbers, ignoring the decimal point now.

Ex: Calculate $34.4 \div 4$.

Answer:

1. **Set up and pop the decimal up**.

$$4\,\overline{\smash{)}\,34.4}$$

2. **Divide**.

   - How many 4s in 34? **8**. $(8 \times 4 = 32)$
   - Subtract: $34 - 32 = 2$.
   - Bring down the 4 to make 24.
   - How many 4s in 24? **6**. $(6 \times 4 = 24)$

- Subtract: $24 - 24 = 0$. The division is complete.

$$\begin{array}{r} 8.6 \\ 4\overline{)34.4} \\ 32 \\ \hline 2.4 \\ 2.4 \\ \hline 0 \end{array}$$

So, $34.4 \div 4 = 8.6$.

> **Method Long Division by a Decimal Number**
>
> In long division, first convert the divisor to a whole.
>
> 1. **Step 1: Make the divisor whole.** Move the decimal point in the divisor all the way to the right. Count how many places you moved it.
>
> 2. **Step 2: Move the other decimal.** Move the decimal point in the dividend the **same number of places** to the right.
>
> 3. **Step 3: Divide.** Now the problem is a "division by a whole number" problem. Follow the steps from the method above.

Ex: Calculate $4.56 \div 1.2$.

Answer:

1. **Make the divisor (1.2) whole.** Move the decimal point one place right to make it 12.

2. **Move the other decimal.** We must also move the decimal in 4.56 one place right. It becomes 45.6.

3. The new problem is $45.6 \div 12$.

4. **Divide.**

$$12\overline{)45.6}$$

So, $4.56 \div 1.2 = 3.8$.