Module 3 Decimal Notation - Quick Notes ①

Assignment 1, Section 3.1

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Ex: Write 2.27 in fractional notation.

$$2.27 \rightarrow \frac{2.27}{1} \rightarrow \frac{2.27}{100} \rightarrow \boxed{\frac{227}{100}}$$

Ex: Write $\frac{80}{100}$ in decimal notation.

$$\frac{80}{100} \rightarrow \frac{80.}{100.} \rightarrow \frac{80}{100} \rightarrow \frac{0.80}{1} \rightarrow \boxed{0.80}$$

Ex: Write $\frac{56}{10,000} \rightarrow \frac{0056}{10,000} \rightarrow \frac{0.0056}{1} \rightarrow \boxed{0.0056}$

Ex: which number is larger? 0.754 or 0.76

0.754 or 0.76

same, go to next #

0.754 or 0.76

same, go to next #   cont.

0.754 or 0.76

6 is bigger than 5 so $\boxed{0.76}$ is larger

Ex: Round to nearest thousandth.

$$3.64981 \rightarrow 3.64\underline{9}81 \rightarrow \boxed{3.650}$$

Must keep the zero here because problem said to round to thousandth. Normally drop zeros on right.

Assignment 2, Section 3.2

Ex: Add. $32 + 7.985$

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  32.000
+  7.985
_____
```

For addition and subtraction, **must** line up decimal points.

Ex: Add. $0.65 + 4.7 + 0.293 + 123$

```
     0.650
+    4.700
     0.293
   123.000
_____
```

Line up decimal points. Fill blank spots with zeros.

Ex: Multiply

$$
\begin{array}{r}
\overset{2}{8}\,\overset{.}{3}.\,1 \\
\times \quad 2.9\,4 \\
\hline
,\,3\,3\,2\,4 \\
.\,7\,4\,7\,9\,0 \\
+\ \ 1\,6\,6\,2\,0\,0 \\
\hline
2\,4\,4\,3\,1\,4 \\
\end{array}
$$

← Line up digits, not decimal points.

Multiply as usual.

$$244.314$$

At end, count the total number of digits that are to the right of the decimal place. Here 3.

In the answer, beginning from right, move 3 decimal places to left.

Ex: Multiply. 1000 × 123.45678   ④

※ Use quicker method to multiply.

Prerequisite for quicker method:
One of the two numbers must have
one "1" and the rest 0's.

The goal is to get the 1000 to
become a "1" by moving the
decimal place in whatever direction
it takes to make it into a "1".

So,

    1,000,   ×   123.45678

Move decimal   Move decimal ③
③ places to left   places to right
to make 1000   of other number.
into a "1".

Note: In multiplication, decimals move in
   opposite direction.

So we have   1   ×   123456.78

So answer is: | 123456.78 |

Ex: Multiply.   0.0001 × 123.4

* Use quicker method.

This problem qualifies for quicker method. Do you see why? If not, see previous problem.

Make the 0.0001 become a "1".

$$0.0001 \quad × \quad 0123.4$$

Move decimal ④ places to right to make 0.0001 into a "1".

Move decimal ④ places to left of other number. Fill in zeros in empty slots.

Note: In multiplication, decimals move in <u>opposite direction.</u>

So,   1   ×   0.01234   Added leading zero for presentation, although not required.

Answer is :   0.01234

Ex: Divide. (12)⟌79.56

Divisor → (12)

Dividend → 79.56

Quotient

When dividing with decimals:

1) Divisor **must** be a whole number (no decimal). If it has decimal, move it to the right as many places as you need to so that it becomes a whole number.

2) Dividend can be either a whole number or have a decimal point.

$$12 \overline{\smash{)}79!56}$$

Bring up decimal point from Dividend to Quotient.

Now divide as usual forgetting about the decimal point in Dividend (which went up to Quotient).

$$
\begin{array}{r}
6.63 \\
12 \overline{\smash{)}79.56} \\
-72 \downarrow \\
\hline
7\,5 \\
-7\,2 \\
\hline
3\,6 \\
-3\,6 \\
\hline
0
\end{array}
$$

Answer is: 6.63

Divide

Ex: $0.06 \overline{)4.86}$

Make Divisor into a whole number.

$0.\underset{\curvearrowright}{06} \overline{)4.\underset{\curvearrowright}{86}}$

But also move the decimal point in Dividend the same number of places as you moved it in the Divisor. Here 2 places. In division (unlike multiplication), move decimal points in the _same direction._

So, we have:

$$6 \overline{)\begin{array}{r} 81 \\ 486 \\ -48\downarrow \\ \hline 6 \\ -6 \\ \hline 0 \end{array}}$$

Divide as usual.

The decimal point for both numbers is to the right of the numbers. The decimal points are there but in "hidden" mode.

Answer: $\boxed{81}$

Ex: Divide. $1.2 \overline{)72}$

Make Divisor into a whole number by moving decimal point one place to the right. You must do the same for Dividend. Move decimal one place to right of

Dividend: $72. \rightarrow 72.0 \rightarrow 720$

Decimal place in "hidden" mode

So,

$$
\begin{array}{r}
60 \\
12 \overline{)720} \\
-72 \downarrow \\
\hline
0 \\
-0 \\
\hline
0
\end{array}
$$

Divide as usual.

Answer is $\boxed{60}$

Ex: Divide $4.6 \overline{)37.72}$ ⑨

So, $4.\underset{\curvearrowright}{6} \overline{)37.\underset{\curvearrowright}{72}} \rightarrow 46 \overline{)377.2}$

Divide as usual:

$$
\begin{array}{r}
8.2 \\
46 \overline{)377.2} \\
-368 \downarrow \\
\hline
92 \\
-92 \\
\hline
0
\end{array}
$$

Answer is: $\boxed{8.2}$

Note: For MAT 050, you will not go more than 3 digits to the right of the decimal point. The Quotient will have 3 or fewer digits to the right of decimal point (for this course).

If you're beyond 3 digits, you made a calculation error.

Ex: Divide. $8\overline{)5}$ ⑩

Can 8 divide into 5? No.

Place a decimal point to the right
of the 5 in the Dividend. Then
bring up decimal point to Quotient.

   $8\overline{)5.}$ → $8\overline{)5.}$ → $8\overline{)5.}$

So,
                    $8\overline{)\overset{0.}{5.0}}$ Put a "0" after
                                                            5 in Dividend so
8 does not   it becomes a 50.
divide into
5 so put
0 above 5.   Now divide as usual and
                         keep putting "0" in Dividend.

                              $\overset{0.625}{8\overline{)5.000}}$
                               $\underline{-48}$
                                  20
                                 $\underline{-16}$
                                    40
                                   $\underline{-40}$
                                      0

   Answer is: $\boxed{0.625}$

Ex: Divide. $$\frac{123.456}{100}$$

When the denominator has one "1" and the rest zeros, use quicker method to divide.

We need to make the denominator become a "1" by moving the decimal point over as many places as it takes. However, you must do the same for the numerator. In division, you move decimal point in the <u>same direction</u>.

So, $$\frac{1 \overset{\frown}{23.} 456}{100.} \rightarrow \frac{1.23456}{1}$$

Any number divided by 1 is that number so the answer is:

$$\boxed{1.23456}$$

Ex: Divide.

$$\frac{1.23}{100}$$

So,

Added leading "0" for presentation.

$$\frac{01.23}{100.} \rightarrow \frac{0.0123}{1}$$

Any number divided by "1" is that number so the answer is:

$$\boxed{0.0123}$$

Ex: Divide.

$$\frac{123.456}{0.001}$$

Use quicker method to divide since denominator has one "1" and the rest zeros.

So,

$$\frac{123.456.}{0.001.}$$

Make denominator become 1 by moving decimal place 3 places to right. Do the same for numerator.

$$\frac{123456}{1} \rightarrow \boxed{123456}$$

Ex: Divide.

$$\frac{12345.6}{0.001}$$

Make denominator become "1". Move decimal place in numerator the same number of places and fill in blank spaces with zeros.

$$\frac{1\ 2\ 3\ 4\ 5.600}{0.001}$$

So we have,

$$\frac{12345600}{1}$$

Answer is : $\boxed{12345600}$

Ex: Find decimal notation. $\dfrac{7}{20}$

Optional Method:

If denominator only has 2's and/or 5's as prime factors, use this method to make denominator become a power of 10, such as 10, 100, 1000. Then use quicker method to divide as was shown in previous examples.

So, $\dfrac{7}{2 \cdot 2 \cdot 5}$ ← Factors are only 2's and or 5's.

Next, $\dfrac{7}{20}$ Since the 20 in denominator is already more than 10, look to next power of 10 which is 100.

Think to yourself, what number times 20 is 100? That number is 5.

So,

Multiply by $\dfrac{n}{n}$ ↗ $\dfrac{5}{5} \cdot \dfrac{7}{20} \to \dfrac{35}{100}$ Then $\dfrac{35}{100} \to$ $\boxed{0.35}$

Ex: Find decimal notation: $\dfrac{7}{20}$

<u>Long Division Method:</u>   (compare to Optional Method)

change fraction to long division format.

$$\dfrac{7}{20} \rightarrow 20\overline{)7}$$

See previous problems for steps from here.

$$
\begin{array}{r}
0.35 \\
20\overline{)7.00} \\
-6\,0\downarrow \\
\hline
1\,0\,0 \\
-1\,0\,0 \\
\hline
0
\end{array}
$$

Note: The "Long Division Method" always works so if you're comfortable with long division, use this.

Ex: Find decimal notation. $\frac{7}{18}$

We can't use the "Optional Method."
Do you see why?

we must use the "Long Division Method."

So, $\frac{7}{18} \rightarrow 18 \overline{)7}$

Then,

$$
\begin{array}{r}
0.388 \\
18 \overline{)7.000} \\
-54 \\
\hline
160 \\
-144 \\
\hline
160 \\
-144 \\
\hline
16
\end{array}
$$

observe that the pattern will continue indefinitely.

To indicate a repeating pattern in decimals, put a bar over the part that repeats. Here the 8 repeats.

Answer: $0.3\overline{8}$

Ex: Find decimal notation. $\frac{11}{3}$

Use "Long Division Method."

So, $\frac{11}{3}$ → $3\overline{)11}$

Then,

$$
\begin{array}{r}
3.66 \\
3\overline{)11.00} \\
-9 \\
\hline
20 \\
-18 \\
\hline
20 \\
-18 \\
\hline
2
\end{array}
$$

The pattern continues indefinitely.

Indicate repeating pattern by putting a bar over the part that repeats. Here the 6 repeats.

Answer: $\boxed{3.\overline{6}}$