Ch. 17: Multiplication of fractions

Def'n:

If \( \frac{m}{n} \) and \( \frac{k}{l} \) are fractions then,

\[
\frac{m}{n} \times \frac{k}{l} = \text{the area of a rectangle}
\]

with side lengths \( \frac{m}{n} \) and \( \frac{k}{l} \).

This agrees with our definition of whole # multiplication!*

Ex1. \( 3 \times 5 = 5 + 5 + 5 \)

Since whole #s are special case fractions.

Ex1. \( \frac{3}{1} \times \frac{5}{1} \) is the area of a 3x5 rectangle.

Ex1. \( \frac{1}{2} \times \frac{1}{2} \) is what?

Start with a 1x1 square:

Ex. \( \frac{2}{3} \times \frac{4}{5} \)

Start w/ 1x1 square

The total area of the black rectangle is \( \frac{1}{15} \)

\[
\frac{8}{15} \quad \text{or} \quad \frac{8 \times 4}{3 \times 5}
\]
Ex1 What is $\frac{19}{7} \times \frac{14}{3}$?

Since we don't immediately know how many $1x1$ squares to use, let's use a $\frac{1}{7} \times \frac{1}{3}$ rectangle first.

Building brick

\[
\frac{1}{7} \quad \frac{1}{3}
\]

19 bricks

\[
\frac{1}{7} \quad \frac{1}{3}
\]

14 bricks

Area of black rectangle?

The arc of each brick is $\frac{1}{37}$, so we are on the sequence of 31st's.

\[
\frac{19 \times 14}{7 \times 3} = \frac{272}{21}
\]

\[
\frac{1.254}{30.19} = \frac{1254}{1000} \times \frac{3019}{100} = \frac{1254 \times 3019}{1000 \times 100} = \frac{1254 \times 3019}{10^5}
\]

Multiply as if there isn't a decimal and add the decimal afterwards,

Exams

- Def'n of fraction
  - Ex1 Def'n of $\frac{3}{5}$: Start at 0 and take 7 steps of length $\frac{1}{5}$
    - or -
    - 7 steps on the sequence of 5ths.
- Def'n of decimal + decimal fraction
  - Ex1 30.19 is notation for $\frac{3019}{100}$
- The unit
- Equivalent fractions
- Adding & subtracting fractions & decimals
  - Ex1 $1.9 + \frac{1}{4}$
- Multiplication & division base 12.
Let's count with the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ◊, ◯. Here is a grid to help:

```
 0  1  2  3  4  5  6  7  8  9  ◊  ◯  2 3
 1  2  3  4  5  6  7  8  9 10  ◊  ◯
 2  3  4  5  6  7  8  9 10 11  ◊  ◯
 3  4  5  6  7  8  9 10 11 12  ◊  ◯
 4  5  6  7  8  9 10 11 12 13  ◊  ◯
 5  6  7  8  9 10 11 12 13 14  ◊  ◯
 6  7  8  9 10 11 12 13 14 15  ◊  ◯
 7  8  9 10 11 12 13 14 15 16  ◊  ◯
 8  9 10 11 12 13 14 15 16 17  ◊  ◯
 9 10 11 12 13 14 15 16 17 18  ◊  ◯
 ◊  ◯  ◊  ◯  ◊  ◯  ◊  ◯  ◊  ◯  ◊
```

Perform the long division

\[
\begin{array}{ccccccc}
\text{Multiples of 10:} & & & & & & \\
(1) 10 & & & & & & \\
(2) 30 & & & & & & \\
(3) 59 & & & & & & \\
(4) 78 & & & & & & \\
(5) 97 & & & & & & \\
(6) 06 & & & & & & \\
(7) 115 & & & & & & \\
(8) 134 & & & & & & \\
\end{array}
\]

\[
\begin{array}{ccccc}
\begin{array}{c}
0 5 8 6 7 3 1 \\
\hline
10 \quad \downarrow \\
\hline
- 9 7 \\
\hline
1 4 4 \\
\hline
- 1 3 9 \\
\hline
0 6 \\
\hline
1 1 0 \\
\hline
- 1 1 5 \\
\hline
5 0 \\
\hline
- 5 9 \\
\hline
2 0 \\
\hline
- 1 0 \\
\hline
\end{array}
\end{array}
\]

So, \( ◊47000 ◯ = 586731 \times 10 + ◯ \)