FRACTIONS

Unit Fractions across the K-12 Curriculum

Within the *Fractions Learning Pathways*, six cells specify the foundational actions that support student understanding of unit fractions. This support document is intended to provide a K-12 perspective on the role of unit fractions in students' learning.

A unit fraction is any fraction with a numerator of 1. For example, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{23}$ are all unit fractions.

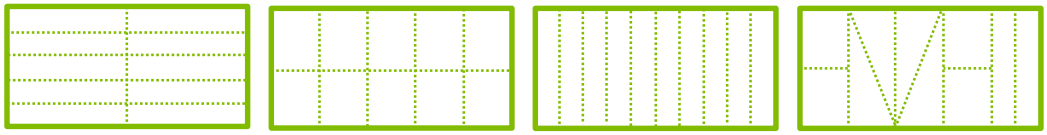
Partitioning

Partitioning a model involves determining and creating a unit fraction. When students construct fractions by partitioning, they develop fractional number sense.

Partitioning can be accomplished through paper folding, cutting with scissors and/or drawing lines.

E.g., The exercise, "Partition this rectangle into tenths."

may yield the following correct responses.

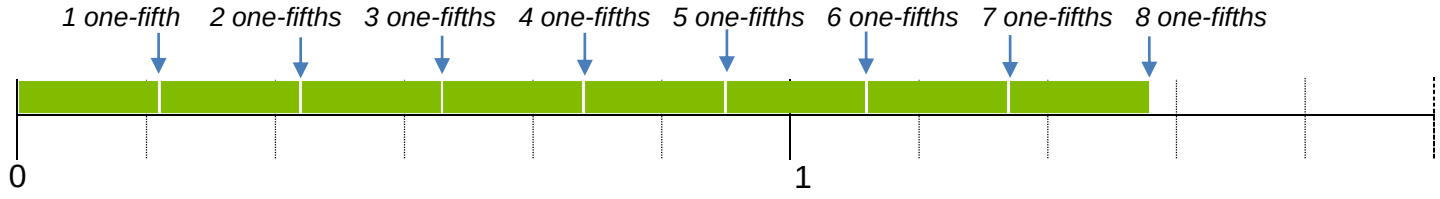


This type of exercise supports student understanding that each of the tenths have the same area even though they look different. If we ask students to re-partition this rectangle into smaller units, such as twelfths, they will see that as the digit in the denominator increases, the size of the area decreases.

What does this look like in the Ontario Mathematics Curriculum (Specific Expectations)?
Students will:
Grade 3: divide whole objects into parts and identify the parts using fractional names.
Grade 5: determine and explain, through investigation using concrete materials, drawings, and calculators, the relationship between fractions and their equivalent decimal forms.
Grade 10: develop the formula for the midpoint of a line segment, and use this formula to solve problems. (MPM 2D; also in MPM 1D and related concepts in MAP 4C)

Counting and Naming Unit Fractions

Counting by unit fractions helps students recognize that fractions are numbers. In addition to building on their intuitive understanding of fractions, counting by unit fractions allows students to connect their understanding of whole numbers and whole number properties (such as one-to-one correspondence and quantity) to fractions. Naming the unit fraction when counting using concrete materials, such as a number line, helps students see the relationship between each part of the fraction and the whole. This also helps to solidify the meaning of the numerator and denominator. Counting beyond one whole, as in the example below, helps students understand that fractions also represent quantities greater than one.



In later grades, students work with fractions that relate to variable and unknown wholes. For example, when students encounter algebraic expressions, the whole may be *n*, in which case the unit fractions would be 1 one-fifth *n*, 2 one-fifths *n*, 3 one-fifths *n*. Having students count in such a manner aids them in connecting their prior knowledge to expressions such as $\frac{3n}{5}$ and recognize this as '3 one-fifths *n*'.

What does this look like in the Ontario Mathematics Curriculum (Specific Expectations)?
Students will:
Grade 1: divide whole objects into parts and identify and describe, through investigation, equal-sized parts of the whole, using fractional names.
Grade 4: count forward by halves, thirds, fourths, and tenths to beyond one whole, using concrete materials and number lines.
Grade 10: use the imperial system when solving measurement problems (MFM 2P; also MBF 3C, MAP 4C; MEL 4E)

Composing and Decomposing Fractions

As students count by unit fractions, they are composing fractions. Every fractional quantity can also be decomposed into unit fractions. For example, $\frac{3}{4}$ is 3 one-fourth units (so one fourth is the unit fraction and we are thinking about 3 of them). This is an example of iterating (creating a larger amount by repeating a smaller amount). As with whole numbers and geometric figures, students build flexible understanding by composing and decomposing fractions.

E.g., The exercise, "If  represents one-seventh of a whole, what might the whole look like?" may yield the following correct responses:

In secondary mathematics, if students create area representations of *x*, they can apply their experience with unit fractions and composing/decomposing to represent different fractions of *x*, such as:

Notice that counting unit fractions as well as composing and decomposing fractions are related to addition and subtraction. For example, composing 6 one-fourth units is the same as adding 6 one-fourth units together to make one and one half.

What does this look like in the Ontario Mathematics Curriculum (Specific Expectations)?
Students will:
Grade 2: regroup fractional parts into wholes, using concrete materials.
Grade 6: represent …fractional amounts …using a variety of tools.
Grade 8: use estimation when solving problems involving operations with …fractions, to help judge the reasonableness of a solution.
Grade 11: determine, through investigation using a variety of tools and strategies, the value of a power with a rational exponent. (MCR 3U; also in MCF 3M, MAP 4C and related concepts in MCT 4C)

For further information, visit *fractionsteaching.ca*

- *Math Teaching for Learning: Building Understanding of Equivalence*
- *Fractions Learning Pathways* (unit fractions tasks and supporting documents)
- *Paying Attention to K-12 Fractions*