These connections are to be used as a resource to integrate and connect related concepts and skills that support and enrich the content standards.

Core Standard

3.1 Number and Operations: Develop an understanding of **fractions** and **fraction equivalence**.

Content Standards

3.1.1 Represent common fractions (e.g., halves, thirds, fourths, tenths) as equal parts of a whole, parts of a set, or points or distances on a number line.
3.1.2 Recognize and demonstrate that sizes of fractional parts are relative to the size of the whole.
3.1.3 Use fractions to represent numbers that are equal to, less than, or greater than one.
3.1.4 Solve problems that involve comparing and ordering fractions by using models, benchmarks (0, ½, 1), or common numerators or denominators.
3.1.5 Identify equivalent fractions using models, including the number line.
3.1.6 Add common fractions with like denominators.

Connections to the Standard

Key Connections to Prior Math Knowledge:

- In first grade students represent whole numbers on a number line—now students will begin learning about the fractional parts between the whole numbers. (1.1.2)
- They have modeled part-whole situations to understand addition and subtraction. Now the concept of part-whole will be applied to fractions of a whole and fractions of a set. (1.2.1)
- By decomposing and composing shapes, students have developed an understanding of part-whole relationships (e.g., ½ of a square may be a right triangle). (1.3.3)
- Knowing addition and subtraction concepts and facts to 20, students will now begin to add fractions. (2.2.1)
- In second grade students determined length by finding the total number of equal-length units and used rulers and other measurement tools to measure length in common units. Students will now use rulers to measure fractions of a unit. The ruler will help model equivalent fractions as well. (2.3.1, 2.3.5)

Key Connections to Future Math Knowledge:

- Strengthening the connection between fractions and multiplication/division will later assist students in changing improper fractions to mixed fractions and decimals, as well as finding least common denominators. (4.1.2, 4.1.4, 4.1.5)
- Decimals and fractions are very closely connected. Fractions have a decimal equivalent. Any decimal that terminates or repeats is a rational number and can be written as a fraction (e.g., 3/10 is the same as 0.3). (4.1.3)
- Teachers should help students to understand that as they progress through the grades they will learn how to add fractions with unlike denominators. (5.1.1)
- Fractions also connect to ratios and proportions. One way that two equal ratios such as ¾ and 6/8 can be written is as equal fractions. A proportion can be written as a fraction like 3/4 = 6/8. 6.2.1
- Fractions with a denominator of 100 are percents (e.g., 9/100 is the same as 9%). (6.2.1)

***Key Connection(s) to Current Grade Level Math Standards*:**

- Fraction reasoning is part of multiplicative reasoning. Students need to have many experiences to notice the relationships among the concepts of sets, parts of sets, and multiples (e.g., a plate with three cookies, a plate with three cookies shared equally among three children, and three plates of cookies with three cookies on each plate). Such experiences will help students generalize fractions as division of sets (e.g., 1/3 of 12) as well as parts of a whole. (3.1.1, 3.1.5, 3.2.3)
- To develop this reasoning, students should be able to demonstrate halves, thirds, fourths, and tenths numerically, concretely and using a number line simultaneously. One model will not suffice for students to generalize this concept. Consider multiple visual representations, including fraction strips and manipulatives, sets of items, and arrays. Arrays can help students see the connection between fractions and multiplication and division. (3.1.1, 3.2.3)
- They should understand that the numerator represents the quantity of (equal) parts of a whole. For example, the numerator 3 in ¾, identifies that there are three equal ¼ parts that are derived from 3/4. It is not sufficient for students to think of numerator as "the number on top." (3.1.1)
- The size of the fraction depends on the size of the whole. This is a difficult concept for students to master because they will tend to compare fractions in their absolute size. A half of a watermelon is not the same as half an apple. (3.1.2)
- Comparing and ordering fractions develops good number sense. Students will need to understand how to compare fractions with like numerators and denominators and unlike numerators and/or denominators. (3.1.2, 3.1.3, 3.1.4)
- Students should know how to model equivalent fractions in terms of the area models, parts of a set and distances on a number line. (A ruler might be an interesting number line application of this concept where ½ inch is the same is 2/4 of an inch, which is the same as 4/8 of an inch etc.) (3.1.3, 3.1.5)
- After students have had in depth instruction to develop fraction concepts, students should be able to model the addition of common fractions with like denominators. (3.1.1, 3.1.6)
- It is important for teachers to not set students up for future problems by teaching them an inaccurate generalization that they can only add fractions if the denominators are the same. (3.1.5, 3.1.6)
- Students should understand that adding equivalent fractions (1/3=2/6 and 2/3=4/6) such as 1/3 + 2/3 and 2/6 + 4/6 results in equivalent values. (3.1.5, 3.1.6)
- Students strengthen understanding of fractions as they explore **linear measurement**. They develop skills in measuring with fractional parts of linear units (e.g., half inch, millimeter, decimeter). (3.1.1, 3.1.4)
- They will tell **time** to the nearest minute (e.g. half past, quarter hour). 2.3.7 2.3.8 3.1.1
- They will make change for **money** amounts to $1.00 (e.g., a quarter is 25 cents or ¼ of a dollar). (2.2.5, 3.1.1, 4.1.1, 4.1.6)
- They can investigate fractional relationships as they describe the results of decomposing, combining, and transforming polygons to make other polygons (e.g., subdividing triangles, quadrilaterals, pentagons, hexagons, and octagons). (3.3.5)

Key Connection(s) to Other Content Areas

- Science—measure plant growth using the metric system to the nearest centimeter, relating fractions to decimals
- Social Sciences—timelines, half century, quarter hour, money systems
- Arts—music notes (quarter, half notes), beats in a measure (2/2 versus 4/4 time)
- Language Arts—literature connections e.g., Holy Enchilada by Henry Winkler uses fractions in recipes, patterns in poetry (e.g., couplets, quatrains, haiku)

Key Connection(s) to Real World:
- Cooking—using fractions in a recipe
- Sewing—measuring fabric (e.g., 3-1/2 yards)
- Building—measuring lengths of wood, measuring dimensions
- Machinery—tools labeled with fractional parts

Vocabulary:

Common fraction	Improper fraction	Number line
Denominator	Linear	Part
Distance	Measurement	Perimeter
Estimating	Multiples	Represents
Equivalence	Money	Whole
Fractions	Numerator	Time

Language of Math:
- Half as many, one fourth as many, whole, fraction notation, ability to read fractions, of, represent as, parts of sets, parts of whole, twice as many, _____ times as many, 1/?th as many, as big, twice the size, twice as long, 1/?th the size

Common Mistakes and Associated Misconceptions:
- Students may draw representations with unequal regions.
  Possible misconception: Students don't understand the notion of fractional parts being equal-sized portions so teachers should stress this concept.
- Students add and subtract the numerators and denominator.
  Possible misconception: They don't truly understand the concept of the numerator and denominator. The numerator is the counting part of the fraction and the denominator names the equal parts.
- Students think that ¼ is smaller than 1/10, for example.
  Possible misconception: Students do not understand that the bigger the denominator, the smaller the fractional part.
- Students write 2/1 for one-half.
  Possible misconception: confuses part to whole relationship. They do not understand the meaning of the fraction bar as a comparison symbol as well as a division symbol.