

## Multiplying $a \times \frac{a}{b}$

An example of this type problem is  $14 \times \frac{14}{15}$ . There are two different types of these problems: one with a proper fraction and one with an improper fraction.

### 1 Proper Fraction

Follow this procedure to produce the result in mixed number form when  $a < b$ :

- Find the “difference”, denominator minus numerator.
  - The numerator of the fraction part of the mixed number is the difference squared.
  - The denominator of the fraction part of the mixed number is the same denominator you started with.
  - The integer part of the mixed number is the numerator minus the difference.
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EXAMPLE:

$$14 \times \frac{14}{15} = \text{_____}(\text{mixed number}).$$

- The difference is  $15 - 14 = 1$ .
- The numerator is  $1^2 = 1$ .
- The denominator is still 15.
- The integer part is  $14 - 1 = 13$ .

Thus,  $14 \times \frac{14}{15} = 13\frac{1}{15}$ .

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## 2 Improper Fraction

An example of this type problem is  $13 \times \frac{13}{11}$ . The method is the same as above with two slight changes. Follow this procedure when  $a > b$ .

- Find the “difference”, numerator minus denominator.
  - The numerator of the fraction part of the mixed number is the difference squared.
  - The denominator of the fraction part of the mixed number is the same denominator you started with.
  - The integer part of the mixed number is the numerator **plus** the difference.
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EXAMPLE:

$$13 \times \frac{13}{11} = \text{_____} \text{ (mixed number).}$$

- The difference is  $13 - 11 = 2$ .
- The numerator is  $2^2 = 4$ .
- The denominator is the same: 11.
- The integer part is  $13 + 2 = 15$ .

Therefore,  $13 \times \frac{13}{11} = 15\frac{4}{11}$ .

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## 3 Be careful!

This trick works great with most all problems. You will run into a problem if the difference between the numerator and denominator squared is greater than the original denominator. This will produce an improper fraction as part of a mixed number, which you cannot have. To avoid this problem, work the fraction part first always. If you happen to compute an improper fraction, you can adjust that fraction by subtracting the amount needed to bring it back to a proper fraction, and then add it as a carry into the integer part.