Adding and Subtracting Fractions (Unlike Denominators)

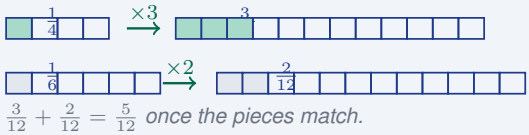
Name: _____	Date: _____	Score: _____ / 17

Here is the trick: you cannot combine fractions until the pieces are the same size, so unlike denominators must first become a **common denominator**—usually the **least common denominator** (LCD). Once both fractions are speaking the same "language," you simply add or subtract the numerators and keep that shared denominator. It takes a little practice to find the LCD quickly, but once you have that skill down, *any* pair of fractions is fair game. Master this topic and the rest of fraction arithmetic will feel much smoother!

Key Concepts & Quick Review

Steps: **1.** Find the LCD of the denominators. **2.** Rewrite each fraction as an equivalent fraction with the LCD. **3.** Add or subtract numerators; keep the LCD; simplify.

Example: $\frac{1}{4}+\frac{1}{6}$: LCD$=12$; $\frac{3}{12}+\frac{2}{12}=\frac{5}{12}$ **LCD tip:** list multiples of each denominator and find the first common one.



$\frac{3}{12}+\frac{2}{12}=\frac{5}{12}$ *once the pieces match.*

Examples

① Find $\frac{5}{6}-\frac{3}{4}$. Simplify your answer.

Think It Through: The denominators are different, so the pieces are not the same size yet. We need a common denominator first. The least common denominator of 6 and 4 is 12. Now rewrite both fractions: $\frac{5}{6}=\frac{10}{12}$ and $\frac{3}{4}=\frac{9}{12}$. Once the pieces match, subtract the numerators: $\frac{10}{12}-\frac{9}{12}=\frac{1}{12}$. It is already simplified. The big idea is that you must make the denominators match before you add or subtract.

Answer: $\frac{1}{12}$

② A container holds $\frac{3}{4}\ gal$ of juice. After $\frac{1}{3}$ gallon is poured out, how much juice remains?

Think It Through: Start with the subtraction $\frac{3}{4}-\frac{1}{3}$. Since the denominators 4 and 3 are different, find the LCD, which is 12. Rewrite the fractions as equivalent fractions: $\frac{3}{4}=\frac{9}{12}$ and $\frac{1}{3}=\frac{4}{12}$. Now subtract: $\frac{9}{12}-\frac{4}{12}=\frac{5}{12}$. A smaller answer makes sense here, because some juice was poured out, so the amount left should be less than the amount we started with.

Answer: $\frac{5}{12}\ gal$

Practice Problems

Add or subtract. Find the LCD first, then simplify each answer.

1. $\frac{1}{2}+\frac{1}{3}=$ _____
2. $\frac{3}{4}-\frac{1}{6}=$ _____
3. $\frac{2}{3}+\frac{1}{4}=$ _____
4. $\frac{5}{6}-\frac{1}{4}=$ _____
5. $\frac{1}{3}+\frac{3}{8}=$ _____
6. $\frac{3}{4}+\frac{2}{5}=$ _____
7. $\frac{7}{8}-\frac{2}{3}=$ _____
8. $\frac{5}{6}+\frac{3}{4}=$ _____
9. $\frac{2}{3}-\frac{1}{5}=$ _____
10. $\frac{3}{8}+\frac{5}{12}=$ _____
11. $\frac{4}{5}-\frac{3}{7}=$ _____
12. $-\frac{1}{3}+\frac{5}{6}=$ _____
13. $\frac{7}{10}-\left(-\frac{3}{4}\right)=$ _____
14. $-\frac{2}{3}+\left(-\frac{3}{4}\right)=$ _____
15. $\frac{5}{9}+\frac{2}{3}=$ _____

Study Tips

- Always find the **LCD** before adding or subtracting — never work with unlike denominators directly.
- Quick LCD trick: if one denominator is a multiple of the other, the larger one *is* the LCD (e.g., LCD of 3 and 9 is 9).
- After finding the LCD, multiply both top and bottom by the same number to build equivalent fractions: $\frac{2}{3}\times\frac{4}{4}=\frac{8}{12}$.

Word Problems

16. A recipe calls for $\frac{2}{3}$ cup of brown sugar and $\frac{3}{8}$ cup of white sugar. Sofia wants to make $1\frac{1}{2}$ times the recipe but only has $1\frac{1}{2}$ cups of sugar total. First find the total sugar needed for the original recipe. Then determine whether Sofia has enough sugar to make the larger batch and by how much she is over or short. _____

17. During a science project, a student fills a graduated cylinder to $\frac{5}{6}$ of its capacity with water. She then adds vinegar until the total liquid level reaches $1\frac{1}{4}$ of the cylinder's capacity, causing the mixture to overflow. How much vinegar was added? If the cylinder can hold $\frac{3}{4}$ liter, how many milliliters of vinegar were poured in? _____

Answer Keys

1) $\frac{5}{6}$
2) $\frac{7}{12}$
3) $\frac{11}{12}$
4) $\frac{7}{12}$
5) $\frac{17}{24}$
6) $\frac{23}{20}$
7) $\frac{5}{24}$
8) $\frac{19}{12}$
9) $\frac{7}{15}$
10) $\frac{19}{24}$
11) $\frac{13}{35}$
12) $\frac{1}{2}$
13) $\frac{29}{20}$
14) $-\frac{17}{12}$
15) $\frac{11}{9}$
16) $\frac{25}{24}$ cup; batch needs $\frac{25}{16}$ cup; short by $\frac{1}{16}$ cup.
17) $\frac{5}{12}$ capacity; $312.5\,mL$

Step-by-Step Explanations

Strategy: For Adding and Subtracting Fractions (Unlike Denominators), find a common denominator before combining unlike fractions; once the parts share a denominator, the numerator work is straightforward. The best unlike-denominator work shows the common denominator before any numerators are combined.

Practice 1: $\frac{1}{2}+\frac{1}{3}=$ **Answer:** $\frac{5}{6}$

In the opening example, rename the fractions with a common denominator, combine the numerators, and simplify.

Practice 15: $\frac{5}{9}+\frac{2}{3}=$ **Answer:** $\frac{11}{9}$

For the end-of-set item, rename the fractions with a common denominator, combine the numerators, and simplify.

Word-problem notes:

16. Answer: Original: $\frac{2}{3}+\frac{3}{8}=\frac{25}{24}$ cup; batch needs $\frac{25}{16}$ cup; short by $\frac{1}{16}$ cup.

First find the sugar in one recipe: $\frac{2}{3}+\frac{3}{8}$. The LCD of 3 and 8 is 24, so $\frac{2}{3}=\frac{16}{24}$ and $\frac{3}{8}=\frac{9}{24}$. Add to get $\frac{25}{24}$ cup. Sofia wants $1\frac{1}{2}$ times the recipe, so multiply by $\frac{3}{2}$: $\frac{3}{2}\times\frac{25}{24}=\frac{75}{48}=\frac{25}{16}$. She has $1\frac{1}{2}=\frac{3}{2}=\frac{24}{16}$ cups, so she is short by $\frac{1}{16}$ cup. This is a good example of a word problem using both addition and multiplication.

17. Answer: Vinegar $=1\frac{1}{4}-\frac{5}{6}=\frac{5}{12}$ capacity; $=312.5\,mL$.

The amount of vinegar added is the difference between the final level and the starting level: $\frac{5}{4}-\frac{5}{6}$. Use denominator 12: $\frac{5}{4}=\frac{15}{12}$ and $\frac{5}{6}=\frac{10}{12}$, so the difference is $\frac{5}{12}$ of the cylinder's capacity. The cylinder holds $\frac{3}{4}$ liter, so the vinegar amount is $\frac{5}{12}\times\frac{3}{4}=\frac{15}{48}=\frac{5}{16}$ liter. Since $\frac{5}{16}=0.3125$, that is $312.5\,mL$. The word "overflow" is a clue that the final level is more than one full container.

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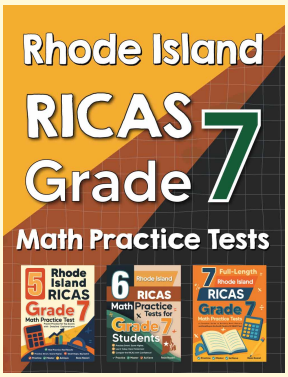

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