Section 1.1c – Adding and Subtracting Fractions

This booklet belongs to: _____ **Block:** _____

- The **Simplified Form** of a fraction is when it is **reduced down** so the numerator and denominator have **no common factors**
- The best way to understand this is to understand the **prime factors** of each number.

Example:

$$\frac{28}{54}$$ this is not simplified; the numerator and denominator have factors in common

Break both numbers down into **prime factors**.

- The Prime Factors of 28 are: $2, 2, and\ 7$
- The Prime Factors of 54 are: $2, 3, 3, 3,$

- This concept of division is where the idea of **cancelling out factors** comes from

What this means is we can rewrite: $\dfrac{28}{54}$ as $\dfrac{2 \cdot 2 \cdot 7}{2 \cdot 3 \cdot 3 \cdot 3}$

- ✓ Then when you have the same factor on the **top and the bottom**, they divide to give 1.
- ✓ And 1 multiplied by anything doesn't change it.
- ✓
- ✓ We can therefore say that when you have the **same factor on top and bottom they cancel out**.

$$\frac{2 \cdot 2 \cdot 7}{2 \cdot 3 \cdot 3 \cdot 3} = \frac{\cancel{2} \cdot 2 \cdot 7}{\cancel{2} \cdot 3 \cdot 3 \cdot 3} = \frac{2 \cdot 7}{3 \cdot 3 \cdot 3} = \frac{14}{27}$$

- The outcome of canceling out the factors is the same as the division of the common factors
- **Simplifying before you Multiply** is a concept that extends past number into more abstract concepts!
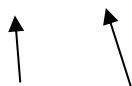
Adding and Subtracting Fractions

- In order to accurately **add or subtract fractions** what do we need?
- Remember, the **numerator: pieces we have** and **denominator: number of pieces in a whole.**

Naturally what is required is that **the pieces that make up the whole are the same size**

We need a **COMMON DENOMINATOR** (Same sized pieces), we get that using equivalent fractions

Let's do some examples:

Example: $\quad \dfrac{1}{3} + \dfrac{5}{7} = \quad \dfrac{1}{3} \cdot \dfrac{7}{7} + \dfrac{5}{7} \cdot \dfrac{3}{3} = \quad \dfrac{7}{21} + \dfrac{15}{21} = \quad \dfrac{22}{21}$

The Lowest Common Denominator in this case is the product of our two denominators,
so we just multiply the fractions by each others denominator as a fraction over itself

Example: $\quad \dfrac{6}{7} - \dfrac{3}{4} = \quad \dfrac{6}{7} \cdot \dfrac{4}{4} - \dfrac{3}{4} \cdot \dfrac{7}{7} = \quad \dfrac{24}{28} - \dfrac{21}{28} = \quad \dfrac{3}{28}$

Example: $\quad \dfrac{1}{2} + \dfrac{5}{6} = \quad \dfrac{1}{2} \cdot \dfrac{3}{3} + \dfrac{5}{6} = \quad \dfrac{3}{6} + \dfrac{5}{6} = \quad \dfrac{8}{6}$ but we can simplify that: $\quad \dfrac{8}{6} = \dfrac{\cancel{2} \cdot 2 \cdot 2}{\cancel{2} \cdot 3} = \dfrac{4}{3}$

The Lowest Common Denominator in this case is the denominator of
one of the two fractions, so we just multiply one of the fractions by
whatever multiple gets us the desired result

Example: $\quad \dfrac{3}{10} - \dfrac{1}{5} = \quad \dfrac{3}{10} - \dfrac{1}{5} \cdot \dfrac{2}{2} = \quad \dfrac{3}{10} - \dfrac{2}{10} = \quad \dfrac{1}{10}$

Adding and Subtracting Mixed Fractions

It is good form and will limit errors if you **always <u>CONVERT</u>** from Mixed to Improper Fractions before doing the operations.

<u>Example 1:</u> $2\frac{1}{3} - 1\frac{3}{4}$

<u>Solution 1:</u>

$$2\frac{1}{3} - 1\frac{3}{4} \quad \rightarrow \quad \frac{7}{3} - \frac{7}{4} \quad \rightarrow \quad \frac{7}{3} \cdot \frac{4}{4} - \frac{7}{4} \cdot \frac{3}{3} \quad \rightarrow \quad \frac{28}{12} - \frac{21}{12} \quad = \quad \frac{7}{12}$$

<u>Example 2:</u> $-5\frac{5}{6} + 2\frac{7}{8}$

<u>Solution 2:</u>

$$-5\frac{5}{6} + 2\frac{7}{8} \quad \rightarrow \quad -\frac{35}{6} + \frac{23}{8} \quad \rightarrow \quad \frac{-35}{6} \cdot \frac{4}{4} + \frac{23}{8} \cdot \frac{3}{3} \quad \rightarrow \quad \frac{-140}{24} + \frac{69}{24} = \quad -\frac{71}{24}$$

The Lowest Common Denominator in this case is 24, so multiply the fractions by whatever multiple gets us the desired result

<u>Example 3:</u> $1\frac{2}{3} + 3\frac{4}{5} - 4\frac{1}{2}$

<u>Solution 3:</u>

$$1\frac{2}{3} + 3\frac{4}{5} - 4\frac{1}{2} \quad \rightarrow \quad \frac{5}{3} + \frac{19}{5} - \frac{9}{2} \quad \rightarrow \quad \frac{5}{3} \cdot \frac{10}{10} + \frac{19}{5} \cdot \frac{6}{6} - \frac{9}{2} \cdot \frac{15}{15}$$

$$\rightarrow \quad \frac{50}{30} + \frac{114}{30} - \frac{135}{30} \quad = \quad \frac{29}{30}$$

Section 1.1c – Practice Problems

EMERGING LEVEL QUESTIONS

Simplify the following fractions, show a breakdown into factors and the cancelling process.

1. $\dfrac{12}{36} \rightarrow$

2. $\dfrac{24}{120} \rightarrow$

3. $\dfrac{234}{468} \rightarrow$

4. $\dfrac{36}{48} \rightarrow$

5. $-\dfrac{14}{21} \rightarrow$

6. $-\dfrac{10}{50} \rightarrow$

7. $\dfrac{18}{27} \rightarrow$

8. $\dfrac{11}{77} \rightarrow$

Add the following fractions, leave answers in simplified form

9. $\dfrac{1}{5} + \dfrac{2}{5}$

10. $\dfrac{3}{5} + \dfrac{2}{15}$

11. $\dfrac{2}{7} + \dfrac{8}{21}$

12. $-\dfrac{3}{4} + \dfrac{1}{4}$

13. $\dfrac{1}{3} + \dfrac{2}{5}$

14. $\dfrac{11}{12} + \dfrac{4}{7}$

15. $\dfrac{3}{4} + \dfrac{5}{6}$

16. $3\dfrac{2}{5} + 4\dfrac{1}{3}$

PROFICIENT LEVEL QUESITONS

17. $5\frac{4}{7} + 2\frac{2}{5}$

18. $-2\frac{3}{8} + 3\frac{5}{6}$

Subtract the following fractions, leave answers in simplified form

EMERGING LEVEL QUESTIONS

19. $\frac{3}{5} - \frac{2}{5}$

20. $\frac{1}{7} - \frac{3}{14}$

21. $\frac{7}{8} - \frac{9}{11}$

22. $-\frac{3}{17} - \frac{1}{2}$

PROFICIENT LEVEL QUESTIONS

23. $2\frac{3}{4} - \frac{5}{6}$

24. $3\frac{2}{7} - 4\frac{1}{3}$

25. $5\frac{4}{5} - 2\frac{2}{3}$

26. $-2\frac{3}{4} - 3\frac{5}{8}$

27. $-2\frac{1}{2} + 4\frac{1}{4}$

28. $8\frac{5}{6} - 9\frac{1}{4}$

EXTENDING LEVEL QUESTIONS

Perform the combined operations, leave answers as an improper fraction in simplified form

29. $\dfrac{3}{4} + \dfrac{5}{6} - \dfrac{2}{3}$

30. $2\dfrac{3}{5} + 4\dfrac{2}{3} - \left(-1\dfrac{2}{15}\right)$

31. $-5\dfrac{4}{8} + 2\dfrac{13}{26} - 4\dfrac{5}{10}$

32. $-3\dfrac{1}{4} + 1\dfrac{2}{3} - \left(-3\dfrac{5}{6}\right)$

Answer Key – Section 1.1c

1. $\dfrac{1}{3}$	2. $\dfrac{1}{5}$	3. $\dfrac{1}{2}$
4. $\dfrac{3}{4}$	5. $-\dfrac{2}{3}$	6. $-\dfrac{1}{5}$
7. $\dfrac{2}{3}$	8. $\dfrac{1}{7}$	9. $\dfrac{3}{5}$
10. $\dfrac{11}{15}$	11. $\dfrac{2}{3}$	12. $-\dfrac{1}{2}$
13. $\dfrac{11}{15}$	14. $\dfrac{125}{84}$ or $1\dfrac{41}{84}$	15. $\dfrac{19}{12}$ or $1\dfrac{7}{12}$
16. $\dfrac{116}{15}$ or $7\dfrac{11}{15}$	17. $\dfrac{279}{35}$ or $7\dfrac{34}{35}$	18. $\dfrac{35}{24}$ or $1\dfrac{11}{24}$
19. $\dfrac{1}{5}$	20. $-\dfrac{1}{14}$	21. $\dfrac{5}{88}$
22. $-\dfrac{23}{34}$	23. $1\dfrac{11}{12}$ or $\dfrac{23}{12}$	24. $-\dfrac{22}{21}$ or $-1\dfrac{1}{21}$
25. $\dfrac{47}{15}$ or $3\dfrac{2}{15}$	26. $-\dfrac{51}{8}$ or $-6\dfrac{3}{8}$	27. $\dfrac{7}{4}$ or $1\dfrac{3}{4}$
28. $-\dfrac{5}{12}$	29. $\dfrac{11}{12}-\dfrac{15}{2}$ or $-7\dfrac{1}{2}$	30. $\dfrac{42}{5}$ or $8\dfrac{2}{5}$
31. $-\dfrac{15}{2}$ or $-7\dfrac{1}{2}$	32. $\dfrac{9}{4}$ or $2\dfrac{1}{4}$	

Extra Work Space