0.2

Pre-Algebra - Fractions

Objective: Reduce, add, subtract, multiply, and divide with fractions.

Working with fractions is a very important foundation to algebra. Here we will briefly review reducing, multiplying, dividing, adding, and subtracting fractions. As this is a review, concepts will not be explained in detail as other lessons are.

World View Note: The earliest known use of fraction comes from the Middle Kingdom of Egypt around 2000 BC!

We always like our final answers when working with fractions to be reduced. Reducing fractions is simply done by dividing both the numerator and denominator by the same number. This is shown in the following example

Example 1.

$$\frac{36}{84}$$ Both numerator and denominator are divisible by 4

$$\frac{36 \div 4}{84 \div 4} = \frac{9}{21}$$ Both numerator and denominator are still divisible by 3

$$\frac{9 \div 3}{21 \div 3} = \frac{3}{7}$$ Our Soultion

The previous example could have been done in one step by dividing both numerator and denominator by 12. We also could have divided by 2 twice and then divided by 3 once (in any order). It is not important which method we use as long as we continue reducing our fraction until it cannot be reduced any further.

The easiest operation with fractions is multiplication. We can multiply fractions by multiplying straight across, multiplying numerators together and denominators together.

Example 2.

$$\frac{6}{7} \cdot \frac{3}{5}$$ Multiply numerators across and denominators across

$$\frac{18}{35}$$ Our Solution

When multiplying we can reduce our fractions before we multiply. We can either reduce vertically with a single fraction, or diagonally with several fractions, as long as we use one number from the numerator and one number from the denominator.

Example 3.

$$\frac{25}{24} \cdot \frac{32}{55}$$ Reduce 25 and 55 by dividing by 5. Reduce 32 and 24 by dividing by 8

$$\frac{5}{3} \cdot \frac{4}{11}$$ Multiply numerators across and denominators across

$$\frac{20}{33}$$ Our Solution

Dividing fractions is very similar to multiplying with one extra step. Dividing fractions requires us to first take the reciprocal of the second fraction and multiply. Once we do this, the multiplication problem solves just as the previous problem.

Example 4.

$\frac{21}{16} \div \frac{28}{6}$ Multiply by the reciprocal

$\frac{21}{16} \cdot \frac{6}{28}$ Reduce 21 and 28 by dividing by 7. Reduce 6 and 16 by dividing by 2

$\frac{3}{8} \cdot \frac{3}{4}$ Multiply numerators across and denominators across

$\frac{9}{32}$ Our Soultion

To add and subtract fractions we will first have to find the least common denominator (LCD). There are several ways to find an LCD. One way is to find the smallest multiple of the largest denominator that you can also divide the small denomiator by.

Example 5.

Find the LCD of 8 and 12 Test multiples of 12

$12? \frac{12}{8}$ Can$'t$ divide 12 by 8

$24? \frac{24}{8} = 3$ Yes! We can divide 24 by 8!

24 Our Soultion

Adding and subtracting fractions is identical in process. If both fractions already have a common denominator we just add or subtract the numerators and keep the denominator.

Example 6.

$\frac{7}{8} + \frac{3}{8}$ Same denominator, add numerators $7 + 3$

$\frac{10}{8}$ Reduce answer, dividing by 2

$\frac{5}{4}$ Our Solution

While $\frac{5}{4}$ can be written as the mixed number $1\frac{1}{4}$, in algebra we will almost never use mixed numbers. For this reason we will always use the improper fraction, not the mixed number.

Example 7.

$$\frac{13}{6}-\frac{9}{6}$$ Same denominator, subtract numerators $13-9$

$$\frac{4}{6}$$ Reduce answer, dividing by 2

$$\frac{2}{3}$$ Our Solution

If the denominators do not match we will first have to identify the LCD and build up each fraction by multiplying the numerators and denominators by the same number so the denominator is built up to the LCD.

Example 8.

$$\frac{5}{6}+\frac{4}{9}$$ LCD is 18.

$$\frac{\mathbf{3}\cdot 5}{\mathbf{3}\cdot 6}+\frac{4\cdot \mathbf{2}}{9\cdot \mathbf{2}}$$ Multiply first fraction by 3 and the second by 2

$$\frac{15}{18}+\frac{8}{18}$$ Same denominator, add numerators, $15+8$

$$\frac{23}{18}$$ Our Solution

Example 9.

$$\frac{2}{3}-\frac{1}{6}$$ LCD is 6

$$\frac{2\cdot 2}{2\cdot 3}-\frac{1}{6}$$ Multiply first fraction by 2, the second already has *a* denominator of 6

$$\frac{4}{6}-\frac{1}{6}$$ Same denominator, subtract numerators, $4-1$

$$\frac{3}{6}$$ Reduce answer, dividing by 3

$$\frac{1}{2}$$ Our Solution

0.2 Practice - Fractions

Simplify each. Leave your answer as an improper fraction.

1) $\frac{42}{12}$

2) $\frac{25}{20}$

3) $\frac{35}{25}$

4) $\frac{24}{9}$

5) $\frac{54}{36}$

6) $\frac{30}{24}$

7) $\frac{45}{36}$

8) $\frac{36}{27}$

9) $\frac{27}{18}$

10) $\frac{48}{18}$

11) $\frac{40}{16}$

12) $\frac{48}{42}$

13) $\frac{63}{18}$

14) $\frac{16}{12}$

15) $\frac{80}{60}$

16) $\frac{72}{48}$

17) $\frac{72}{60}$

18) $\frac{126}{108}$

19) $\frac{36}{24}$

20) $\frac{160}{140}$

Find each product.

21) $(9)(\frac{8}{9})$

22) $(-2)(-\frac{5}{6})$

23) $(2)(-\frac{2}{9})$

24) $(-2)(\frac{1}{3})$

25) $(-2)(\frac{13}{8})$

26) $(\frac{3}{2})(\frac{1}{2})$

27) $(-\frac{6}{5})(-\frac{11}{8})$

28) $(-\frac{3}{7})(-\frac{11}{8})$

29) $(8)(\frac{1}{2})$

30) $(-2)(-\frac{9}{7})$

31) $(\frac{2}{3})(\frac{3}{4})$

32) $(-\frac{17}{9})(-\frac{3}{5})$

33 $(2)(\frac{3}{2})$

34) $(\frac{17}{9})(-\frac{3}{5})$

35) $(\frac{1}{2})(-\frac{7}{5})$

36) $(\frac{1}{2})(\frac{5}{7})$

Find each quotient.

37) $-2 \div \frac{7}{4}$

38) $\frac{-12}{7} \div \frac{-9}{5}$

39) $\frac{-1}{9} \div \frac{-1}{2}$

40) $-2 \div \frac{-3}{2}$

41) $\frac{-3}{2} \div \frac{13}{7}$

42) $\frac{5}{3} \div \frac{7}{5}$

43) $-1 \div \frac{2}{3}$

44) $\frac{10}{9} \div -6$

45) $\frac{8}{9} \div \frac{1}{5}$

46) $\frac{1}{6} \div \frac{-5}{3}$

47) $\frac{-9}{7} \div \frac{1}{5}$

48) $\frac{-13}{8} \div \frac{-15}{8}$

49) $\frac{-2}{9} \div \frac{-3}{2}$

50) $\frac{-4}{5} \div \frac{-13}{8}$

51) $\frac{1}{10} \div \frac{3}{2}$

52) $\frac{5}{3} \div \frac{5}{3}$

Evaluate each expression.

53) $\frac{1}{3} + (-\frac{4}{3})$

54) $\frac{1}{7} + (-\frac{11}{7})$

55) $\frac{3}{7} - \frac{1}{7}$

56) $\frac{1}{3} + \frac{5}{3}$

57) $\frac{11}{6} + \frac{7}{6}$

58) $(-2) + (-\frac{15}{8})$

59) $\frac{3}{5} + \frac{5}{4}$

60) $(-1) - \frac{2}{3}$

61) $\frac{2}{5} + \frac{5}{4}$

62) $\frac{12}{7} - \frac{9}{7}$

63) $\frac{9}{8} + (-\frac{2}{7})$

64) $(-2) + \frac{5}{6}$

65) $1 + (-\frac{1}{3})$

66) $\frac{1}{2} - \frac{11}{6}$

67) $(-\frac{1}{2}) + \frac{3}{2}$

68) $\frac{11}{8} - \frac{1}{2}$

69) $\frac{1}{5} + \frac{3}{4}$

70) $\frac{6}{5} - \frac{8}{5}$

71) $(-\frac{5}{7}) - \frac{15}{8}$

72) $(-\frac{1}{3}) + (-\frac{8}{5})$

73) $6 - \frac{8}{7}$

74) $(-6) + (-\frac{5}{3})$

75) $\frac{3}{2} - \frac{15}{8}$

76) $(-1) - (-\frac{1}{3})$

77) $(-\frac{15}{8}) + \frac{5}{3}$

78) $\frac{3}{2} + \frac{9}{7}$

79) $(-1) - (-\frac{1}{6})$

80) $(-\frac{1}{2}) - (-\frac{3}{5})$

81) $\frac{5}{3} - (-\frac{1}{3})$

82) $\frac{9}{7} - (-\frac{5}{3})$

Answers - Fractions

1) $\frac{7}{2}$
2) $\frac{5}{4}$
3) $\frac{7}{5}$
4) $\frac{8}{3}$
5) $\frac{3}{2}$
6) $\frac{5}{4}$
7) $\frac{5}{4}$
8) $\frac{4}{3}$
9) $\frac{3}{2}$
10) $\frac{8}{3}$
11) $\frac{5}{2}$
12) $\frac{8}{7}$
13) $\frac{7}{2}$
14) $\frac{4}{3}$
15) $\frac{4}{3}$
16) $\frac{3}{2}$
17) $\frac{6}{5}$
18) $\frac{7}{6}$
19) $\frac{3}{2}$
20) $\frac{8}{7}$
21) 8
22) $\frac{5}{3}$
23) $-\frac{4}{9}$
24) $-\frac{2}{3}$
25) $-\frac{13}{4}$
26) $\frac{3}{4}$
27) $\frac{33}{20}$
28) $\frac{33}{56}$
29) 4
30) $\frac{18}{7}$
31) $\frac{1}{2}$
32) $-\frac{19}{20}$
33) 3
34) $-\frac{17}{15}$
35) $-\frac{7}{10}$
36) $\frac{5}{14}$
37) $-\frac{8}{7}$
38) $\frac{20}{21}$
39) $\frac{2}{9}$
40) $\frac{4}{3}$
41) $-\frac{21}{26}$
42) $\frac{25}{21}$
43) $-\frac{3}{2}$
44) $-\frac{5}{27}$
45) $\frac{40}{9}$
46) $-\frac{1}{10}$
47) $-\frac{45}{7}$
48) $\frac{13}{15}$
49) $\frac{4}{27}$
50) $\frac{32}{65}$
51) $\frac{1}{15}$
52) 1
53) -1
54) $-\frac{10}{7}$
55) $\frac{2}{7}$
56) 2
57) 3
58) $-\frac{31}{8}$
59) $\frac{37}{20}$
60) $-\frac{5}{3}$
61) $\frac{33}{20}$
62) $\frac{3}{7}$
63) $\frac{47}{56}$
64) $-\frac{7}{6}$
65) $\frac{2}{3}$
66) $-\frac{4}{3}$
67) 1
68) $\frac{7}{8}$
69) $\frac{19}{20}$
70) $-\frac{2}{5}$
71) $-\frac{145}{56}$
72) $-\frac{29}{15}$
73) $\frac{34}{7}$
74) $-\frac{23}{3}$
75) $-\frac{3}{8}$
76) $-\frac{2}{3}$

77) $-\frac{5}{24}$

78) $\frac{39}{14}$

79) $-\frac{5}{6}$

80) $\frac{1}{10}$

81) 2

82) $\frac{62}{21}$