



SUNY ECC

ACCUPLACER Preparation Workshop

Numeric Skills

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Exponential Notation and Order of Operations

$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 3^5$ Three is the base, 5 is the exponent

Write the following in exponential notation:

Ex.) $5 \cdot 5 \cdot 5 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 5^3 \cdot 7^4$

Ex.) $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \cdot 5 = 2^3 \cdot 3^2 \cdot 5^4$

Simplify:

Ex.) $2^3 \cdot 3^2 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 8 \cdot 9 = 72$

Ex.) $5^3 \cdot 7^2 = 5 \cdot 5 \cdot 5 \cdot 7 \cdot 7 = 125 \cdot 49 = 6125$

Order of Operations

Use “Please excuse my dear Aunt Sally” to help you remember the correct order of operations.

Please: The P stands for parentheses – work on what is inside these first

Excuse: The E stands for exponents – simplify these next

My: M stands for multiplication

Dear: D stands for division: Perform **both** multiplication and division in order *from Left to Right*

Aunt: A stands for addition

Sally: S stands for subtraction: Perform **both** addition and subtraction in order *from Left to Right*

Examples:

Ex.) $4^2 + 6(3-1)$

$4^2 + 6(2)$

$16 + 6(2)$

$16 + 12$

28

Ex.) $9 - 6 + 6 \cdot 2 \div 3$

$9 - 6 + 12 \div 3$

$9 - 6 + 4$

$3 + 4$

7

Ex.) $16 + (8-3) \cdot 2$

$16 + (5) \cdot 2$

$16 + 10$

26

Ex.) $8 - (8 - 2) \div 3$

$8 - (6) \div 3$

$8 - 2$

6

Ex.) $20 - 4 \div 2 \cdot (3-1)^3$

$20 - 4 \div 2 \cdot (2)^3$

$20 - 4 \div 2 \cdot 8$

$20 - 2 \cdot 8$

$20 - 16$

4

Order of Operations: Practice Questions:

1. $3 + 4 \cdot 2$

2. $12 \div 3 \cdot 2$

3. $16 \div 8 \cdot 2$

4. $2 + 3 \cdot 2 + 1$

5. $2 + (-5)(-3) - 4^2$

6. $(3^2 - 11)^3$

7. $2[(4 - 10) - 2]$

8. $4^2 \div (10 - 9 + 1)^3 \cdot 3 - 5$

9. $15 \div 3 \cdot 2 \div (10 - 8)$

10. $7 \cdot 2 - (12 + 0) \div 3 - (5 - 2)$

Solutions

1. 11 2. 8 3. 4 4. 9 5. 1 6. -8 7. -16 8. 1 9. 5 10. 7

Square Roots

Symbol: $\sqrt{\#}$ The # inside the radical is called the “radicand”

$\sqrt{100} = 10$ because $10 \cdot 10 = 100$

Other Perfect Squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, etc.

Square Roots of non-Perfect Squares:

Ex.) $\sqrt{13}$ is between what two integers?

$\sqrt{13}$ is between $\sqrt{9}$ and $\sqrt{16}$ so the value is between 3 and 4

Ex.) $\sqrt{56}$ is between $\sqrt{49}$ and $\sqrt{64}$ so the value is between 7 and 8

Ex.) $\sqrt{23}$ is between $\sqrt{16}$ and $\sqrt{25}$ so the value is between 4 and 5

Ex.) $\sqrt{75}$ is between $\sqrt{64}$ and $\sqrt{81}$ so the value is between 8 and 9

Square Roots Practice Questions

Simplify: 1. $\sqrt{16}$ 2. $\sqrt{64}$

State what values the following radicals lie between.

3. $\sqrt{12}$ 4. $\sqrt{90}$ 5. $\sqrt{57}$

Solutions

1. 4 2. 8 3. $\sqrt{12}$ is between $\sqrt{9}$ and $\sqrt{16}$ so the value is between 3 and 4.
4. $\sqrt{90}$ is between $\sqrt{81}$ and $\sqrt{100}$ so the value is between 9 and 10.
5. $\sqrt{57}$ is between $\sqrt{49}$ and $\sqrt{64}$ so the value is between 7 and 8.

Simplifying Square Roots

Product Rule for Multiplication: $\sqrt{a} \cdot \sqrt{b} = \sqrt{a \cdot b}$

Ex.) $\sqrt{5} \cdot \sqrt{6} = \sqrt{5 \cdot 6} = \sqrt{30}$ (Multiply the “insides” (radicands), keep the product “inside”.)

Use this rule in reverse order to simplify square roots:

Ex.) $\sqrt{45}$ ***Break into two factors, one of which is a Perfect Square.
 $\sqrt{9 \cdot 5}$
 $3\sqrt{5}$

Ex.) $\sqrt{28}$
 $\sqrt{4 \cdot 7}$
 $2\sqrt{7}$

Ex.) $\sqrt{180}$
 $\sqrt{36 \cdot 5}$
 $6\sqrt{5}$

Ex.) $\sqrt{300}$
 $\sqrt{100 \cdot 3}$
 $10\sqrt{3}$

Ex.) $\sqrt{128}$
 $\sqrt{64 \cdot 2}$
 $8\sqrt{2}$

Ex.) $\sqrt{490}$
 $\sqrt{49 \cdot 10}$
 $7\sqrt{10}$

Simplifying Square Roots Practice Questions:

1. $\sqrt{200}$ 2. $\sqrt{44}$ 3. $\sqrt{18}$ 4. $\sqrt{90}$ 5. $3\sqrt{25}$
6. $4\sqrt{68}$ 7. $\sqrt{0}$

Solutions

1. $10\sqrt{2}$ 2. $2\sqrt{11}$ 3. $3\sqrt{2}$ 4. $3\sqrt{10}$ 5. 15 6. $8\sqrt{17}$ 7. 0

Addition and Subtraction of Square Roots

****Add or subtract like radicals only. Add the coefficients, keep the radicals the same. Some radicals may need to be simplified first before combining.

$$\text{Ex.) } 3\sqrt{6} + 2\sqrt{6} \\ 5\sqrt{6}$$

$$\text{Ex.) } 12\sqrt{15} + 5\sqrt{15} \\ 17\sqrt{15}$$

$$\text{Ex.) } \sqrt{5} + 2\sqrt{5} \\ 3\sqrt{5}$$

$$\text{Ex.) } \sqrt{27} + \sqrt{45} \\ \sqrt{9 \cdot 3} + \sqrt{9 \cdot 5} \\ 3\sqrt{3} + 3\sqrt{5} \\ \text{Cannot be combined}$$

$$\text{Ex.) } \sqrt{75} + \sqrt{108} \\ \sqrt{25 \cdot 3} + \sqrt{36 \cdot 3} \\ 5\sqrt{3} + 6\sqrt{3} \\ 11\sqrt{3}$$

$$\text{Ex.) } \sqrt{60} - \sqrt{135} \\ \sqrt{4 \cdot 15} - \sqrt{9 \cdot 15} \\ 2\sqrt{15} - 3\sqrt{15} \\ -\sqrt{15}$$

$$\text{Ex.) } -4\sqrt{90} + 3\sqrt{40} + 2\sqrt{10} \\ -4\sqrt{9 \cdot 10} + 3\sqrt{4 \cdot 10} + 2\sqrt{10} \\ -4 \cdot 3\sqrt{10} + 3 \cdot 2\sqrt{10} + 2\sqrt{10} \\ -12\sqrt{10} + 6\sqrt{10} + 2\sqrt{10} \\ -4\sqrt{10}$$

$$\text{Ex.) } 4\sqrt{80} - \sqrt{75} \\ 4\sqrt{16 \cdot 5} - \sqrt{25 \cdot 3} \\ 4 \cdot 4\sqrt{5} - 5\sqrt{3} \\ 16\sqrt{5} - 5\sqrt{3} \\ \text{Cannot be combined}$$

Addition and Subtraction of Square Roots Practice Questions:

1. $9\sqrt{2} + 6\sqrt{2}$

2. $\sqrt{40} + \sqrt{18}$

3. $\sqrt{75} + \sqrt{108}$

4. $\sqrt{15} - \sqrt{60}$

5. $-4\sqrt{99} + 3\sqrt{44} + 7\sqrt{11}$

Solutions

1. $15\sqrt{2}$

2. $2\sqrt{10} + 3\sqrt{2}$

3. $11\sqrt{3}$

4. $-\sqrt{15}$

5. $\sqrt{11}$

Whole Number Operations

The set, or collection, of **Whole Numbers** is: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, ...

The set goes on indefinitely. There is no largest whole number, and the smallest whole number is 0.

Addition of Whole Numbers

To add whole numbers, add the ones digits first, then the tens, then the hundreds, then the thousands, and so on.

Make sure digits representing the same place value are lined up in columns.

Ex.) Add: $6878 + 4995$

$$\begin{array}{r} \\ 6878 \\ + 4995 \\ \hline 11,873 \end{array}$$

Ex.) Add: $356 + 4910$

$$\begin{array}{r} \\ 4910 \\ + 356 \\ \hline 5,266 \end{array}$$

Ex.) Add. $391 + 276 + 789 + 498$

$$\begin{array}{r} \\ 391 \\ 276 \\ 789 \\ + 498 \\ \hline 1954 \end{array}$$

Ex.) Add: $77,543 + 23,767$

$$\begin{array}{r} \\ 77,543 \\ + 23,767 \\ \hline 101,310 \end{array}$$

Addition of Whole Numbers Practice Questions:

1. $86 + 78$

2. $99,999 + 112$

3. $10,120 + 12,989 + 5,738$

Solutions

1. 164

2. 100,111

3. 28,847

Subtraction of Whole Numbers

To subtract whole numbers, subtract the ones digits first, then the tens, then the hundreds, then the thousands, and so on.

Make sure digits representing the same place value are lined up in columns.

When borrowing is necessary, borrow 1 from the digit to the left, and add 10 to the current digit.

Ex.) Subtract: $9768 - 4320$

$$\begin{array}{r} 9768 \\ - 4320 \\ \hline 5448 \end{array}$$

Ex.) Subtract: $49,512 - 1,401$

$$\begin{array}{r} 49,512 \\ - 1,401 \\ \hline 48,111 \end{array}$$

Ex.) Subtract: $348 - 165$

$$\begin{array}{r} \overset{2}{\cancel{3}}\overset{14}{4}8 \\ - 165 \\ \hline 183 \end{array}$$

Borrow as follows:
Borrow 1 from 3; add 10 to 4

Ex.) Subtract: $6000 - 3762$

$$\begin{array}{r} \overset{5}{\cancel{6}}\overset{9}{\cancel{0}}\overset{10}{\cancel{0}}0 \\ - 3762 \\ \hline 2238 \end{array}$$

Borrow as follows:
Borrow 1 (thousand) from 6, add 10 (hundreds) to 0
Borrow 1 (hundred) from 10, add 10 (tens) to 0
Borrow 1 (ten) from 10, add 10 (ones) to 0

Subtraction of Whole Numbers Practice Questions:

1. $526 - 323$

2. $4512 - 1734$

3. $9241 - 5643$

Solutions

1. 203

2. 2778

3. 3598

Multiplication of Whole Numbers

The numbers that are multiplied are called factors. The result of the multiplication is called the product.

Make sure digits representing the same place value are lined up in columns.

Ex.) Multiply: 5×734

$$\begin{array}{r} ^{12} \\ 734 \\ \times 5 \\ \hline 3670 \end{array}$$

Ex.) Multiply: 51×32

$$\begin{array}{r} ^1 \\ 51 \\ \times 32 \\ \hline 102 \\ \underline{1530} \\ 1632 \end{array}$$

Ex.) Multiply: 457×68

$$\begin{array}{r} ^3 ^1 \\ ^4 ^1 \\ ^5 ^2 \\ 683 \\ \times 457 \\ \hline 4,781 \\ 34,150 \\ \underline{273,200} \\ 312,131 \end{array}$$

Multiplication of Whole Numbers Practice Questions:

1. 823×6

2. 48×63

3. 746×62

4. 245×837

Solutions

1. 4938

2. 3024

3. 46,252

4. 205,065

Division of Whole Numbers

Any number divided by 1 is that same number: $a \div 1 = \frac{a}{1} = a$

Any non-zero number divided by itself is 1: $a \div a = \frac{a}{a} = 1, a \neq 0$

Zero divided by any non-zero number is 0: $0 \div a = \frac{0}{a} = 0, a \neq 0$

Ex.) Divide: $22 \div 6$

$$\begin{array}{r} 3 \\ 6 \overline{)22} \\ \underline{-18} \\ 4 \end{array}$$

Answer: 3 R 4

Ex.) Divide: $6341 \div 7$

$$\begin{array}{r} 905 \\ 7 \overline{)6341} \\ \underline{63} \\ 41 \\ \underline{35} \\ 6 \end{array}$$

Answer: 905 R 6

Ex.) Divide: $8904 \div 42$

$$\begin{array}{r} 212 \\ 42 \overline{)8904} \\ \underline{84} \\ 50 \\ \underline{42} \\ 84 \\ \underline{84} \\ 0 \end{array}$$

Answer: 212

Ex.) Divide: $8169 \div 34$

$$\begin{array}{r} 240 \\ 34 \overline{)8169} \\ \underline{68} \\ 136 \\ \underline{136} \\ 9 \\ \underline{0} \\ 9 \end{array}$$

Answer: 240 R 9

Division of Whole Numbers Practice Questions:

1. $864 \div 8$

2. $852 \div 21$

3. $2729 \div 54$

Solutions

1. 108

2. 40 R 12

3. 50 R 29

Writing Equivalent Fractions

To write equivalent fractions: Multiply the numerator and denominator by the same amount.

$$\text{Ex.) } \frac{2}{3} = \frac{?}{12}$$

$$\frac{2 \cdot 4}{3 \cdot 4} = \frac{8}{12}$$

$$\text{Ex.) } 6 = \frac{\quad}{18}$$

$$\frac{6 \cdot 18}{1 \cdot 18} = \frac{108}{18}$$

$$\text{Ex.) } \frac{3}{5} = \frac{\quad}{45}$$

$$\frac{3 \cdot 9}{5 \cdot 9} = \frac{27}{45}$$

$$\text{Ex.) } \frac{11}{18} = \frac{\quad}{54}$$

$$\frac{11 \cdot 3}{18 \cdot 3} = \frac{33}{54}$$

$$\text{Ex.) } \frac{9}{25} = \frac{\quad}{300}$$

$$\frac{9 \cdot 12}{25 \cdot 12} = \frac{108}{300}$$

$$\text{Ex.) } \frac{7}{12} = \frac{\quad}{96}$$

$$\frac{7 \cdot 8}{12 \cdot 8} = \frac{56}{96}$$

Writing Equivalent Fractions Practice Questions:

$$1. \frac{1}{2} = \frac{?}{10}$$

$$2. \frac{1}{6} = \frac{?}{12}$$

$$3. \frac{3}{8} = \frac{?}{48}$$

$$4. \frac{7}{1} = \frac{?}{5}$$

$$5. \frac{17}{18} = \frac{?}{54}$$

$$6. \frac{3}{-8} = \frac{?}{-40}$$

$$7. \frac{11}{5} = \frac{?}{15}$$

$$8. \frac{4}{9} = \frac{?}{27}$$

$$9. \frac{8}{11} = \frac{?}{55}$$

$$10. \frac{11}{16} = \frac{?}{256}$$

Solutions

$$1. \frac{5}{10}$$

$$2. \frac{2}{12}$$

$$3. \frac{18}{48}$$

$$4. \frac{35}{5}$$

$$5. \frac{51}{54}$$

$$6. \frac{15}{-40}$$

$$7. \frac{33}{15}$$

$$8. \frac{12}{27}$$

$$9. \frac{40}{55}$$

$$10. \frac{176}{256}$$

Simplifying Fractions

Simplifying Fractions: Divide the numerator and denominator (top and bottom) by the same number. Repeat until there are no more common factors.

$$\text{Ex.) } \frac{8}{22} \quad \frac{8 \div 2}{22 \div 2} = \frac{4}{11} \quad \text{Ex.) } \frac{12}{16} \quad \frac{12 \div 4}{16 \div 4} = \frac{3}{4} \quad \text{Ex.) } \frac{14}{35} \quad \frac{14 \div 7}{35 \div 7} = \frac{2}{5}$$

$$\text{Ex.) } \frac{32}{120} \quad \frac{32 \div 8}{120 \div 8} = \frac{4}{15} \quad \text{Ex.) } \frac{80}{45} \quad \frac{80 \div 5}{45 \div 5} = \frac{16}{9} = 1 \frac{7}{9} \quad \text{Ex.) } \frac{9}{90} \quad \frac{9 \div 9}{90 \div 9} = \frac{1}{10}$$

$$\text{Ex.) } \frac{24}{64} \quad \frac{24 \div 8}{64 \div 8} = \frac{3}{8} \quad \text{Ex.) } \frac{33}{110} \quad \frac{33 \div 11}{110 \div 11} = \frac{3}{10} \quad \text{Ex.) } \frac{85}{75} \quad \frac{85 \div 5}{75 \div 5} = \frac{17}{15} = 1 \frac{2}{15}$$

Simplifying Fractions Practice Questions:

1. $\frac{3}{6}$
2. $\frac{-9}{12}$
3. $\frac{10}{25}$
4. $\frac{27}{36}$
5. $\frac{16}{10}$
6. $-\frac{13}{26}$
7. $\frac{17}{51}$
8. $\frac{100}{20}$
9. $\frac{17}{18}$
10. $\frac{180}{240}$

Solutions

1. $\frac{1}{2}$
2. $\frac{-3}{4}$
3. $\frac{2}{5}$
4. $\frac{3}{4}$
5. $1 \frac{3}{5}$
6. $-\frac{1}{2}$
7. $\frac{1}{3}$
8. 5
9. $\frac{17}{18}$
10. $\frac{3}{4}$

Addition of Fractions and Mixed Numbers

Addition of Fractions and Mixed Numbers: ***There must be a common denominator to add fractions!

Add numerators, keep denominators the same, simplify.

$$\text{Ex.) } \frac{2}{9} + \frac{5}{9} = \frac{7}{9}$$

$$\text{Ex.) } \frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$$

$$\text{Ex.) } \frac{5}{7} + \frac{3}{7} + \frac{6}{7} = \frac{14}{7} = 2$$

$$\text{Ex.) } \frac{3}{8} + \frac{7}{8} = \frac{10}{8} = 1\frac{2}{8} = 1\frac{1}{4}$$

When fractions have unlike denominators, make them equivalent by using the LCD (least common denominator), which is the smallest number that both denominators divide into evenly.

$$\text{Ex.) } \frac{5}{12} + \frac{3}{8}$$

$$\text{Ex.) } \frac{3}{4} + \frac{1}{6}$$

$$\text{Ex.) } \frac{7}{15} + \frac{2}{9}$$

$$\frac{10}{24} + \frac{9}{24} = \frac{19}{24}$$

$$\frac{9}{12} + \frac{2}{12} = \frac{11}{12}$$

$$\frac{21}{45} + \frac{10}{45} = \frac{31}{45}$$

$$\text{Ex.) } \frac{3}{4} + \frac{4}{5} + \frac{5}{8}$$

$$\text{Ex.) } \frac{2}{3} + \frac{6}{19}$$

$$\text{Ex.) } \frac{2}{3} + \frac{5}{6} + \frac{7}{12}$$

$$\frac{30}{40} + \frac{32}{40} + \frac{25}{40} = \frac{87}{40} = 2\frac{7}{40}$$

$$\frac{38}{57} + \frac{18}{57} = \frac{56}{57}$$

$$\frac{8}{12} + \frac{10}{12} + \frac{7}{12} = \frac{25}{12} = 2\frac{1}{12}$$

$$\text{Ex.) } \frac{11}{12} + \frac{13}{24} + \frac{4}{15}$$

$$\text{Ex.) } 7 + \frac{6}{11}$$

$$\text{Ex.) } 17 \text{ increased by } 3\frac{3}{8}$$

$$= \frac{110}{120} + \frac{65}{120} + \frac{32}{120} = \frac{207}{120} = 1\frac{87}{120} = 1\frac{29}{40}$$

$$7\frac{6}{11}$$

$$20\frac{3}{8}$$

$$\text{Ex.) } 4\frac{5}{8} + 8\frac{1}{2} + 4\frac{7}{12}$$

$$= 4\frac{15}{24} + 8\frac{12}{24} + 4\frac{14}{24} = 16\frac{41}{24} = 17\frac{17}{24}$$

Addition of Fractions and Mixed Numbers Practice Questions:

1. $\frac{4}{9} + \frac{1}{9}$

2. $\frac{4}{7} + \frac{3}{7}$

3. $\frac{4}{5} + \frac{7}{10}$

4. $\frac{1}{8} + \frac{1}{6}$

5. $\frac{7}{12} + \frac{3}{8}$

6. $\frac{3}{20} + 4$

7. $\frac{3}{10} + \frac{5}{12} + \frac{8}{15}$

8. $2\frac{7}{8} + 6\frac{5}{8}$

9. $4\frac{1}{4} + 1\frac{1}{12}$

10. $4\frac{1}{12} + 5\frac{1}{6}$

Solutions

1. $\frac{5}{9}$

2. 1

3. $1\frac{1}{2}$

4. $\frac{7}{24}$

5. $\frac{23}{24}$

6. $4\frac{3}{20}$

7. $1\frac{1}{4}$

8. $9\frac{1}{2}$

9. $5\frac{1}{3}$

10. $9\frac{1}{4}$

Subtraction of Fractions and Mixed Numbers

Subtraction of Fractions and Mixed Numbers: There must be a common denominator!

Subtract the fractional part first (borrow if necessary).

Subtract the whole number part.

Simplify.

Ex.) $\frac{16}{27} - \frac{7}{27} = \frac{9}{27} = \frac{1}{3}$

Ex.) $\frac{11}{18} - \frac{5}{18} = \frac{6}{18} = \frac{1}{3}$

Ex.) $\frac{3}{4} - \frac{2}{5}$
 $\frac{15}{20} - \frac{8}{20} = \frac{7}{20}$

Ex.) $\frac{5}{6} - \frac{4}{15}$
 $\frac{25}{30} - \frac{8}{30} = \frac{17}{30}$

Ex.) $\frac{13}{18} - \frac{7}{24}$
 $\frac{52}{72} - \frac{21}{72} = \frac{31}{72}$

Ex.) $9\frac{19}{24} - 5\frac{11}{24} = 4\frac{8}{24} = 4\frac{1}{3}$

Ex.) $11 - 8\frac{16}{17}$

Ex.) $6\frac{7}{9} - 3\frac{5}{6}$

Ex.) $17\frac{5}{9} - 11\frac{5}{12}$

$10\frac{17}{17} - 8\frac{16}{17} = 2\frac{1}{17}$

$6\frac{14}{18} - 3\frac{15}{18}$

$17\frac{20}{36} - 11\frac{15}{36} = 6\frac{5}{36}$

In this problem, 1 is borrowed from 6
 $1 = \frac{18}{18}$ and $\frac{18}{18} + \frac{14}{18} = \frac{32}{18}$

$$5\frac{32}{18} - 3\frac{15}{18} = 2\frac{17}{18}$$

Ex.) $82\frac{4}{33} - 16\frac{5}{22}$ This problem also requires borrowing: $82\frac{8}{66}$ becomes $81\frac{74}{66}$ by adding 1 or $\frac{66}{66} + \frac{8}{66}$

$$81\frac{74}{66} - 16\frac{15}{66} = 65\frac{59}{66}$$

Subtraction of Fractions and Mixed Numbers Practice Questions:

1. $\frac{5}{6} - \frac{1}{6}$

2. $\frac{3}{4} - \frac{1}{20}$

3. $\frac{3}{4} - \frac{4}{16}$

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

5. $9\frac{4}{5} - 3\frac{1}{2}$

6. $13 - 9\frac{3}{8}$

7. $7\frac{1}{15} - 2\frac{1}{6}$

Solutions

1. $\frac{2}{3}$

2. $\frac{7}{10}$

3. $\frac{1}{2}$

4. $5\frac{1}{2}$

5. $6\frac{3}{10}$

6. $3\frac{5}{8}$

7. $4\frac{9}{10}$

Multiplication of Fractions and Mixed Numbers

No common denominator is needed!

If possible, simplify first (look for common factors of any numerator and any denominator).

Multiply numerators, multiply denominators, simplify.

Note: “of” means multiply

$$\text{Ex.) } \frac{3}{4} \cdot \frac{6}{7} = \frac{18}{28} = \frac{9}{14}$$

$$\text{Ex.) } \frac{7}{55} \cdot \frac{11}{35} = \frac{1}{5} \cdot \frac{1}{5} = \frac{1}{25}$$

$$\text{Ex.) } \frac{3}{5} \cdot \frac{7}{8} = \frac{21}{40}$$

$$\text{Ex.) } \frac{16}{5} \cdot \frac{15}{24} = \frac{2}{1} \cdot \frac{3}{3} = \frac{6}{3} = 2$$

$$\text{Ex.) } 5 \frac{1}{4} \cdot \frac{2}{7} = \frac{21}{4} \cdot \frac{2}{7} = \frac{3}{2} \cdot \frac{1}{1} = \frac{3}{2} = 1 \frac{1}{2}$$

$$\text{Ex.) } 6 \cdot 2 \frac{1}{3} = \frac{6}{1} \cdot \frac{7}{3} = \frac{2}{1} \cdot \frac{7}{1} = \frac{14}{1} = 14$$

$$\text{Ex.) } 5 \frac{2}{5} \cdot \frac{5}{9} = \frac{27}{5} \cdot \frac{5}{9} = \frac{3}{1} \cdot \frac{1}{1} = \frac{3}{1} = 3$$

$$\text{Ex.) } 3 \frac{2}{7} \cdot 6 = \frac{23}{7} \cdot \frac{6}{1} = \frac{138}{7} = 19 \frac{5}{7}$$

$$\text{Ex.) } 3 \frac{2}{25} \cdot 2 \frac{1}{2} = \frac{77}{25} \cdot \frac{5}{2} = \frac{77}{5} \cdot \frac{1}{2} = \frac{77}{10} = 7 \frac{7}{10}$$

Multiplication of Fractions and Mixed Numbers: Practice Questions:

1. $\frac{2}{5} \cdot \frac{2}{3}$

2. $\frac{2}{3} \cdot \frac{7}{13}$

3. $\frac{3}{5} \cdot \frac{10}{9}$

4. $\frac{16}{15} \cdot \frac{5}{4}$

5. $\frac{11}{24} \cdot \frac{3}{5}$

6. $21 \cdot \frac{1}{3}$

7. $6 \cdot 2 \frac{1}{2}$

8. $3 \frac{1}{2} \cdot \frac{3}{4}$

9. $2 \frac{1}{4} \cdot 5 \frac{2}{3}$

10. $3 \frac{1}{3} \cdot 2 \frac{1}{2}$

Solutions

1. $\frac{4}{15}$

2. $\frac{14}{39}$

3. $\frac{2}{3}$

4. $1 \frac{1}{3}$

5. $\frac{11}{40}$

6. 7

7. 15

8. $2 \frac{5}{8}$

9. $12 \frac{3}{4}$

10. $8 \frac{1}{3}$

Division of Fractions and Mixed Numbers

Division of Fractions and Mixed Numbers: To divide fractions, multiply by the reciprocal of the divisor. (To form the reciprocal, invert the fraction – flip it upside down).

Find the reciprocal: $\frac{2}{3}$ ans: $\frac{3}{2}$ 5 ans: $\frac{1}{5}$ $\frac{5}{7}$ ans: $\frac{7}{5}$

$$\text{Ex.) } \frac{2}{9} \div \frac{1}{3} = \frac{2}{9} \cdot \frac{3}{1} = \frac{2}{3} \cdot \frac{1}{1} = \frac{2}{3}$$

$$\text{Ex.) } \frac{3}{7} \div \frac{2}{3} = \frac{3}{7} \cdot \frac{3}{2} = \frac{9}{14}$$

$$\text{Ex.) } \frac{8}{18} \div \frac{4}{7} = \frac{8}{18} \cdot \frac{7}{4} = \frac{2}{18} \cdot \frac{7}{1} = \frac{14}{18} = \frac{7}{9}$$

Mixed numbers must be changed to improper fractions before multiplying by the reciprocal.

$$\text{Ex.) } \frac{5}{7} \div 5 = \frac{5}{7} \cdot \frac{1}{5} = \frac{1}{7}$$

$$\text{Ex.) } \frac{5}{6} \div 3\frac{3}{4} = \frac{5}{6} \div \frac{15}{4} = \frac{5}{6} \cdot \frac{4}{15} = \frac{2}{9}$$

$$\text{Ex.) } 6\frac{2}{3} \div 2\frac{1}{2} = \frac{20}{3} \div \frac{5}{2} = \frac{20}{3} \cdot \frac{2}{5} = \frac{8}{3} = 2\frac{2}{3}$$

$$\text{Ex.) } 2\frac{5}{6} \div 8\frac{1}{2} = \frac{17}{6} \div \frac{17}{2} = \frac{17}{6} \cdot \frac{2}{17} = \frac{1}{3}$$

$$\text{Ex.) } 6\frac{2}{5} \div 4 = \frac{32}{5} \cdot \frac{1}{4} = \frac{8}{5} = 1\frac{3}{5}$$

Division of Fractions and Mixed Numbers Practice Questions:

1. $20 \div 3\frac{1}{5}$

2. $5\frac{4}{5} \div 2\frac{1}{2}$

3. $3\frac{3}{8} \div 3$

4. $4\frac{1}{10} \div 2\frac{1}{10}$

Solutions

1. $6\frac{1}{4}$

2. $2\frac{8}{25}$

3. $1\frac{1}{8}$

4. $1\frac{20}{21}$

Fraction Applications

1. The course of a boat race is in the shape of a triangle with sides that measure $4\frac{3}{10}$ miles, $3\frac{7}{10}$ miles and $2\frac{1}{2}$ miles. Find the total length of the course.

Solution: "Total" indicates addition. Find a common denominator first.

$$4\frac{3}{10} + 3\frac{7}{10} + 2\frac{5}{10} = 9\frac{15}{10} = 10\frac{5}{10} = 10\frac{1}{2} \text{ miles}$$

2. A car used $12\frac{1}{2}$ gallons of gas on a 275 mile trip. How many miles can the car travel on 1 gallon of gas?

Solution: Divide the number of miles by the number of gallons.

$$275 \div 12\frac{1}{2} = 275 \div \frac{25}{2} = \frac{275}{1} \cdot \frac{2}{25} = \frac{11}{1} \cdot \frac{2}{1} = 22 \text{ miles}$$

3. Nicole can walk $3\frac{1}{2}$ miles in 1 hour. At this rate, how far can Nicole walk in $\frac{1}{3}$ hour?

Solution: Since there are 3 "thirds" in one hour, divide the number of miles by 3.

$$3\frac{1}{2} \div 3 = \frac{7}{2} \cdot \frac{1}{3} = \frac{7}{6} = 1\frac{1}{6} \text{ mile}$$

4. The area of a rectangle is equal to the product of its length and its width. What is the area of a rectangle that has a length of $3\frac{1}{8}$ feet and a width of $2\frac{4}{7}$ feet?

Solution: "Product" indicates multiplication. Multiply the length by the width.

$$3\frac{1}{8} \cdot 2\frac{4}{7} = \frac{25}{8} \cdot \frac{18}{7} = \frac{25}{4} \cdot \frac{9}{7} = \frac{225}{8} = 8\frac{1}{8} \text{ square feet}$$

5. If a box can hold $\frac{3}{4}$ ounce of sugar, how many boxes can be filled with 600 ounces of sugar?

Solution: Think of this question as "how many $\frac{3}{4}$ s are in 600?". So, divide 600 by $\frac{3}{4}$.

$$600 \div \frac{3}{4} = \frac{600}{1} \cdot \frac{4}{3} = \frac{200}{1} \cdot \frac{4}{1} = 800 \text{ boxes}$$

6. A 15-foot board is cut into pieces $3\frac{1}{2}$ feet long for a bookcase. What is the length of the piece remaining after as many shelves as possible have been cut?

Solution: First, divide 15 ft by $3\frac{1}{2}$ ft.

$$15 \div 3\frac{1}{2} = \frac{15}{1} \div \frac{7}{2} = \frac{15}{1} \cdot \frac{2}{7} = \frac{30}{7} = 4\frac{2}{7}$$

So 4 whole pieces can be cut. Now find the length of 4 whole pieces:

$$3\frac{1}{2} \cdot 4 = \frac{7}{2} \cdot \frac{4}{1} = 14 \text{ ft}$$

Now, subtract 14 ft from 15 ft to get 1 ft as the answer.

$$15 - 14 = 1 \text{ ft}$$

7. $\frac{5}{6}$ of a math class of 30 students have passing grades. $\frac{2}{5}$ of the students with passing grades received an A. How many students passed the class? How many students received an A?

Solution: "of" indicates multiplication so multiply $\frac{5}{6}$ by 30 to obtain the number of students with passing grades. Then multiply the answer by $\frac{2}{5}$ to obtain the number who received As.

$$\frac{5}{6} \cdot \frac{30}{1} = 25 \text{ passed} \qquad \frac{25}{1} \cdot \frac{2}{5} = 10 \text{ received As}$$

8. Two hikers plan a 3-day, $27\frac{1}{2}$ mile backpack trip. The hikers plan to travel $7\frac{3}{8}$ miles the first day and $10\frac{1}{3}$ miles the second day. How many miles will they travel during the first two days? How many miles will be left to travel on the third day?

Solution: Add miles from the first two days and then subtract from the total mileage for the trip.

$$7\frac{3}{8} + 10\frac{1}{3} = 7\frac{9}{24} + 10\frac{8}{24} = 17\frac{17}{24}$$

$$27\frac{1}{2} - 17\frac{17}{24} = 24\frac{12}{24} - 17\frac{17}{24} = 23\frac{36}{24} - 17\frac{17}{24} = 9\frac{19}{24} \text{ miles}$$

9. A $\frac{5}{8}$ -carat diamond was purchased for \$1200. What would a similar diamond weighing 1 carat cost?

Solution: Divide the cost by the number of carats.

$$1200 \div \frac{5}{8} = \frac{1200}{1} \cdot \frac{8}{5} = \frac{240}{1} \cdot \frac{8}{1} = \$1920$$

10. The perimeter of a square is equal to four times the length of a side of the square. Find the perimeter of a square whose side measures $15\frac{3}{4}$ inches.

Solution: Multiply the length of the side by 4 (there are 4 equal sides in a square).

$$\frac{4}{1} \cdot 15\frac{3}{4} = \frac{4}{1} \cdot \frac{63}{4} = \frac{1}{1} \cdot \frac{63}{1} = 63 \text{ inches}$$

11. A company purchased $9\frac{3}{4}$ acres for a project. One and one-half acres were set aside for green space. How many acres are available for housing? How many $\frac{1}{4}$ acre pieces can be sold after the green space is set aside?

Solution: First subtract $1\frac{1}{2}$ from $9\frac{3}{4}$ to find the number of acres available for housing.

$$9\frac{3}{4} - 1\frac{1}{2} = 9\frac{3}{4} - 1\frac{2}{4} = 8\frac{1}{4}$$

Next, divide $8\frac{1}{4}$ by $\frac{1}{4}$ to find the number of acre pieces that can be sold.

$$8\frac{1}{4} \div \frac{1}{4} = \frac{33}{4} \cdot \frac{4}{1} = 33 \text{ pieces}$$

Fraction Applications Practice Questions:

1. A caterer prepares a mixed berry salad with $\frac{7}{8}$ qt of strawberries, $\frac{3}{4}$ qt of raspberries, and $\frac{5}{16}$ qt of blueberries. What is the total amount of berries in the salad?
2. The length of a rectangular cornfield is $\frac{15}{16}$ mi. The width is $\frac{5}{8}$ mi. What is area of the cornfield?
3. The recipe for a tossed salad calls for $\frac{3}{4}$ cup of sliced almonds. How much is needed to make $\frac{1}{2}$ of the recipe?
4. Sherry and John are widening their existing $17\frac{1}{4}$ ft driveway by adding $5\frac{9}{10}$ ft on one side. What is the width of the new driveway?
5. There are $20\frac{1}{3}$ gal of water in a rainbarrel; $5\frac{3}{4}$ gal are poured out and $8\frac{2}{3}$ gal are returned after a heavy rainfall. How many gallons of water are then in the barrel?
6. Kyle's pickup truck travels on an interstate highway at 65 mph for $3\frac{1}{2}$ hr. How far does it travel?
7. Steve rode his bicycle $3\frac{1}{3}$ mi on Saturday and $2\frac{1}{2}$ mi on Sunday. How far did he ride on the weekend?

8. A car traveled 213 mi on $14\frac{2}{10}$ gal of gas. How many miles per gallon did the car get?
9. Nicholas is $73\frac{2}{3}$ in. tall and his daughter, Kendra, is $71\frac{5}{16}$ in. tall. How much shorter is Kendra?
10. Holly's minivan traveled 302 mi on $15\frac{1}{10}$ gal of gas. How many miles per gallon did it get?

Solutions

1. $1\frac{15}{16}$ qt 2. $\frac{75}{128}$ mi² 3. $\frac{3}{8}$ cup 4. $23\frac{3}{20}$ ft 5. $23\frac{1}{4}$ gal
6. $227\frac{1}{2}$ mi 7. $5\frac{5}{6}$ mi 8. 15 mpg 9. $2\frac{17}{48}$ in. 10. 20 mpg

Comparing Fractions, Exponents and Order of Operations

To compare fractions with the same denominators, compare the numerators only.

$$\frac{6}{4} > \frac{3}{4} \qquad \frac{5}{7} < \frac{11}{7}$$

To compare fractions with unlike denominators you can either:

Method 1: Create like denominators

Method 2: Use the cross products to compare

Method 1: $\frac{6}{11} \quad \frac{4}{7}$

$$\frac{42}{77} < \frac{44}{77}$$

Method 2: $\frac{6}{11} \quad \frac{4}{7}$

Cross products: $6 \cdot 7 \quad 4 \cdot 11$

$$44 < 42 \text{ Note: the products must be written in this order!}$$

Method 2 will be used for the following examples.

Ex.) $\frac{9}{14} \quad \frac{13}{21}$

$$189 > 182$$

Ex.) $\frac{13}{36} \quad \frac{19}{48}$

$$624 < 684$$

Comparing Fractions Practice Questions:

Place the correct symbol (<, >, or =) between the two numbers.

1. $\frac{4}{15}$ $\frac{12}{25}$

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

3. 0 $\frac{17}{18}$

Solutions

1. < 2. > 3. <

**Fractions
with
Exp**

ponents

Ex.) $(\frac{4}{9})^2$

Ex.) $(\frac{7}{11})^2(\frac{2}{7})$

Ex.) $(\frac{2}{3})^2(\frac{3}{4})$

Ex.) $(\frac{9}{16})(\frac{2}{3})^4(\frac{3}{5})^3$

$\frac{4}{9} \cdot \frac{4}{9} = \frac{16}{81}$

$\frac{49}{121} \cdot \frac{2}{7} = \frac{14}{121}$

$\frac{4}{9} \cdot \frac{3}{4} = \frac{1}{3}$

$\frac{9}{16} \cdot \frac{16}{81} \cdot \frac{27}{125} = \frac{3}{125}$

Fractions with Exponents: Practice Questions:

1. $(\frac{3}{7})^2$

2. $(\frac{4}{5})^2(\frac{2}{3})$

Challenge Question: 3. $(\frac{9}{16})(\frac{2}{3})^4(\frac{3}{5})^3$

Solutions

1. $\frac{9}{49}$ 2. $\frac{32}{75}$ Challenge Question Solution 3. $\frac{3}{125}$

Order of Operations

Order of Operations (Follow the same procedure already discussed.)

$$\begin{aligned}\text{Ex.) } \frac{7}{8} + \frac{1}{9} \div \frac{8}{9} \\ \frac{7}{8} + \frac{1}{9} \cdot \frac{9}{8} \\ \frac{7}{8} + \frac{1}{8} = \frac{8}{8} = 1\end{aligned}$$

$$\begin{aligned}\text{Ex.) } \left(\frac{1}{3}\right)^2 \left(\frac{4}{5} - \frac{1}{2}\right) \quad (\text{here you can work P and E at the same time}) \\ \frac{1}{9} \cdot \left(\frac{8}{10} - \frac{5}{10}\right) \\ \frac{1}{9} \cdot \frac{3}{10} = \frac{1}{30}\end{aligned}$$

$$\begin{aligned}\text{Ex.) } \left(\frac{1}{2}\right)^2 + \left(\frac{3}{5} - \frac{1}{2}\right) \div \frac{4}{15} \\ \frac{1}{4} + \left(\frac{6}{10} - \frac{5}{10}\right) \div \frac{4}{15} \\ \frac{1}{4} + \frac{1}{10} \cdot \frac{15}{4} \\ \frac{1}{4} + \frac{3}{8} = \frac{2}{8} + \frac{3}{8} = \frac{5}{8}\end{aligned}$$

$$\begin{aligned}\text{Ex.) } \frac{9}{10} \cdot \left(\frac{2}{3}\right)^3 + \frac{2}{3} \\ \frac{9}{10} \cdot \frac{8}{27} + \frac{2}{3} \\ \frac{4}{15} + \frac{2}{3} \\ \frac{4}{15} + \frac{10}{15} = \frac{14}{15}\end{aligned}$$

Order of Operations Practice Questions:

1. $\left(\frac{1}{3}\right)^2 \left(\frac{4}{5} - \frac{1}{2}\right)$

2. $\frac{9}{10} \cdot \left(\frac{2}{3}\right)^3 + \left(\frac{2}{3}\right)$

Solutions

1. $\frac{1}{30}$ 2. $\frac{14}{15}$

Decimals

Place value: Ex.) 358.252379

3	5	8	.	2	5	2	3	7	9
hundreds	tens	ones		tenths	hundredths	thousandths	Ten-thousandths	Hundred-thousandths	Millionths

Reading/Writing

In place of the decimal point say “and”.

Read the entire decimal part as if it were a whole number, saying the place value of the last digit.

Ex.) 23.62: *Twenty three and sixty-two hundredths*

Ex.) 0.0035: *Thirty five ten-thousandths*

Ex.) 6.053: *Six and fifty-three thousandths*

Ex.) Write: Forty-two thousand and two hundred seven millionths: (the last digit – 7 must be in the millionths place): *42,000.000207*

Ex.) Write: Four and nine hundred seven ten-thousandths: *4.0907*

Reading/Writing Decimals Practice Questions:

1. Write 120.05 in words
2. Write six hundred three and twenty-nine thousandths in standard form.

Solutions

1. One hundred twenty and five hundredths

2. 603.029

Rounding

Rounding: If the digit to the right of the place you are rounding to is 5 or greater, increase the digit (in the place you are rounding to) by 1, drop all digits to the right. If the digit to the right of the place you are rounding to is less than 5, keep the digit the same (in the place you are rounding to), drop all digits to the right.

Round the following numbers to the indicated place value:

Ex.) 0.074 (tenths)

Ans: 0.1

Ex.) 840.156 (hundredths)

Ans: 840.16

Ex.) 5.60032 (whole #)

Ans: 6

Ex.) 0.635457 (hundred-thousandths)

Ans: 0.63546

Rounding Practice Questions:

1. Round 0.064 to the nearest tenth.
2. Round 72.3846 to the nearest hundredth.

Solutions

1. 0.1

2. 72.38

Addition, Subtraction, Multiplication and Division of Decimals

Addition of Decimals: Line up the decimal points!

Add as if whole numbers, keeping the decimal point lined up in the answer.

Ex.) $3.514 + 22.6981 + 145.78$

$$\begin{array}{r} 3.514 \\ 22.6981 \\ +145.78 \\ \hline 171.9921 \end{array}$$

Ex.) $7.814 + 63.109 + 2 + 0.0099$

$$\begin{array}{r} 7.814 \\ 63.109 \\ 2 \\ + 0.0099 \\ \hline 72.9329 \end{array}$$

Ex.) $4.62 + 27.9 + 0.62054$

$$\begin{array}{r} 4.62 \\ 27.9 \\ + 0.62054 \\ \hline 33.14054 \end{array}$$

Ex.) $6.05 + 12 + 0.374$

$$\begin{array}{r} 6.05 \\ 12 \\ + 0.374 \\ \hline 18.424 \end{array}$$

Addition of Decimals Practice Questions:

1. $56.314 + 17.78$

2. $3.42 + 0.237 + 14.1$

Solutions

1. 74.094

2. 17.757

Subtraction of Decimals: Line up decimal points

Subtract as if whole numbers, borrowing and inserting zeros where necessary.

Ex.) $18.9174 - 8.82$

Ex.) $35 - 9.67$

$$\begin{array}{r} 18.9174 \\ - 8.82 \\ \hline 10.0974 \end{array}$$

$$\begin{array}{r} 35.00 \\ - 9.67 \\ \hline 25.33 \end{array}$$

Ex.) $29.843 - 12.76$

Ex.) $3.7 - 1.9715$

$$\begin{array}{r} 29.843 \\ - 12.760 \\ \hline 17.083 \end{array}$$

$$\begin{array}{r} 3.7 \\ - 1.9715 \\ \hline 1.7285 \end{array}$$

Subtraction of Decimals Practice Questions:

1. $45 - 0.999$

2. $10.05 - 0.392$

Solutions

1. 44.001 2. 9.658

Multiplication of Decimals: Multiply as if whole numbers.

Count the total number of decimal places in each factor, insert the decimal point in your answer so it contains the same number of decimal places.

Ex.) 0.76×0.31

Ex.) 0.00086×0.057

Ex.) 4.68×6.3

$$\begin{array}{r} 0.76 \text{ (2 decimal places)} \\ \times 0.31 \text{ (2 decimal places)} \\ \hline 076 \\ 2280 \\ \hline 0.2356 \text{ (4 decimal places)} \end{array}$$

$$\begin{array}{r} 0.00086 \\ \times 0.057 \\ \hline 602 \\ 4300 \\ \hline 0.00004902 \end{array}$$

$$\begin{array}{r} 4.68 \\ \times 6.3 \\ \hline 1404 \\ 28080 \\ \hline 29.484 \end{array}$$

Multiplication of Decimals Practice Questions:

1. 0.09×7.8

2. 0.00238×2.7

Solutions

1. 0.702 2. 0.006426

Division of Decimals: Make the divisor a whole number by moving the decimal point to the right. Move the decimal point in the dividend the same number of places. Divide as if whole numbers. If asked to round to a particular place value, go one place past that place, round.

Ex.) $36.597 \div 5.2$

$$5.2 \overline{)36.5970}$$

Move the decimal right one place:

$$\begin{array}{r} 7.037 \\ 52 \overline{)365.970} \\ \underline{364} \\ 19 \\ \underline{00} \\ 197 \\ \underline{156} \\ 410 \\ \underline{364} \\ 46 \end{array}$$

Rounded answer: 7.04

Ex.) $370.2 \div 5.09$ (round to the nearest tenth)

$$5.09 \overline{)370.2}$$

Move the decimal right two places:

$$\begin{array}{r} 72.73 \\ 509 \overline{)37020.00} \\ \underline{3563} \\ 1390 \\ \underline{1018} \\ 3720 \\ \underline{3563} \\ 1570 \\ \underline{1527} \\ 43 \end{array}$$

Rounded answer: 72.7

Ex.) $0.2307 \div 26.7$ (nearest thousandth)

$$26.7 \overline{)0.2307}$$

Move the decimal to the right one place:

$$\begin{array}{r} 0.0086 \\ 267 \overline{)2.3070} \\ \underline{2136} \\ 1710 \\ \underline{1602} \\ 108 \end{array}$$

Rounded answer: 0.009

Division of Decimals Practice Questions:

1. $39.06 \div 4.2$

2. $5.848 \div 8.6$

Solutions

1. 9.3 2. 0.68

**Con
verti
ng**

Fractions to Decimals

Converting Fractions to Decimals: Divide! (round all of these examples to the nearest thousandth)

Ex.) $\frac{4}{15}$

$$\begin{array}{r} 0.2666 \\ 15 \overline{) 4.0000} \\ \underline{30} \\ 100 \\ \underline{90} \\ 100 \\ \underline{90} \\ 100 \\ \underline{90} \\ 10 \end{array}$$

Rounded answer:
0.267

Ex.) $\frac{25}{6}$

$$\begin{array}{r} 4.1666 \\ 6 \overline{) 25.0000} \\ \underline{24} \\ 10 \\ \underline{6} \\ 40 \\ \underline{36} \\ 40 \\ \underline{36} \\ 40 \end{array}$$

Rounded answer:
4.167

Ex.) $7\frac{1}{4}$

You may know that
 $\frac{1}{4}$ is the same as 0.25
The answer is 7.25

Converting Fractions to Decimals Practice Questions:

1. $\frac{3}{20}$

2. $\frac{11}{8}$

3. $5\frac{3}{10}$

Solutions

1. 0.15 2. 1.375 3. 5.3

Converting Decimals to Fractions

Converting Decimals to Fractions: Read, Write, Reduce

$$\text{Ex.) } 0.56 = \frac{56}{100} = \frac{28}{50} = \frac{14}{25}$$

$$\text{Ex.) } 5.35 = 5 \frac{35}{100} = 5 \frac{7}{20}$$

$$\text{Ex.) } 0.6 = \frac{6}{10} = \frac{3}{5}$$

$$\text{Ex.) } 8.808 = 8 \frac{808}{1000} = 8 \frac{202}{250} = 8 \frac{101}{125}$$

$$\text{Ex.) } 0.17\frac{2}{3} = \frac{17\frac{2}{3}}{100} = 17\frac{2}{3} \div 100 = \frac{53}{3} \cdot \frac{1}{100} = \frac{53}{300}$$

Converting Decimals to Fractions Practice Questions:

1. 0.6

2. $0.12\frac{5}{9}$

Solutions

1. $\frac{3}{5}$

2. $\frac{113}{900}$

Comparing Decimals and Fractions

Comparing Decimals and Fractions: Change one number so that both are fractions OR both are decimals.

For decimals, compare each digit from left to right until one does not match.

For fractions: compare the cross products

Ex.) $0.39 < 0.7$

Ex.) $0.42 > \frac{5}{12}$

Ex.) $\frac{7}{9} > 0.76$

$$\frac{5}{12} \approx 0.41$$

$$0.42 > 0.41$$

$$\frac{7}{9} \quad \frac{76}{100}$$

Cross products: $700 > 694$

Comparing Decimals and Fractions Practice Questions:

1. 0.6 0.52

2. 0.12 $\frac{3}{12}$

3. $\frac{1}{5}$ 0.162

Solutions

1. $>$

2. $<$

3. $>$

Ratios and Proportions

Ratios and proportions: A proportion states that two ratios (or rates) are equal. To solve a proportion, cross multiply (find the cross products). Divide to find the missing number.

Solve the following proportions. If necessary, round to the nearest tenth.

$$\text{Ex.) } \frac{5}{7} = \frac{n}{20}$$

$$100 = 7n$$
$$14.3 = n$$

$$\text{Ex.) } \frac{3}{7} = \frac{n}{14}$$

$$7n = 42$$
$$n = 6$$

$$\text{Ex.) } \frac{15}{20} = \frac{12}{n}$$

$$15n = 240$$
$$n = 16$$

$$\text{Ex.) } \frac{12}{n} = \frac{7}{4}$$

$$7n = 48$$
$$6.9 = n$$

Solving Proportions Practice Questions:

$$1. \frac{x}{63} = \frac{2}{9}$$

$$2. \frac{8}{x} = \frac{5}{3}$$

$$3. \frac{2}{5} = \frac{12}{x}$$

Solutions

1. 14

2. 4.8

3. 30

Decimal and Proportion Applications

1. A taxi costs \$3.25 and \$0.25 for each $\frac{1}{8}$ mile driven. Find the cost of hiring a taxi to travel $5\frac{1}{2}$ miles.

Solution: First, find the number of eighths in $5\frac{1}{2}$ miles.: $5\frac{1}{2} \div \frac{1}{8} = 44$

Next, multiply 44 miles by the cost per eighth mile (\$0.25): $44 \times 0.25 = \$11$

Finally, add \$11 to \$3.25: \$14.25

2. Find the sales between 2 p.m. and 3 p.m. if at 2 p.m. the register tape reads \$967.54 and at 3 p.m. it reads \$1437.15.

Solution: Subtract $1437.15 - 967.54 = \$469.61$

3. A car with odometer reading of 17,814.2 used 12.4 gallons of gas to travel until the odometer reads 18,130.4. How many miles did the car travel on one gallon of gasoline?

Solution: Subtract $18130.4 - 17814.2$ to find the number of miles traveled (316.2).

Next, divide 316.2 gallons by 12.4 miles to find miles per gallon: 25.5mpg.

4. A recycling center will pay \$0.75 per pound of aluminum. Find the amount paid for 18.75 pounds.

Solution: Multiply price by number of pounds: $0.75 \times 18.75 = \$43.06$

5. How many complete shelves 3.4 feet long can be cut from a 12-foot board?

Solution: Divide the size of the board by the size of a shelf: $12 \div 3.4 \approx 3.529$ so the number of whole shelves is 3.

6. The perimeter of a triangle is the sum of the lengths of the three sides of the triangle. Find the perimeter of a triangle that has sides measuring 4.9 feet, 6.1 feet and 8.5 feet.

Solution: "Sum" means add so $4.9 + 6.1 + 8.5 = 19.5$ ft.

7. The price of gasoline is \$4.09 per gallon after the price rose \$0.07 one week and \$0.11 the next week. Find the price of gas before these increases.

*Solution: Subtract the amount of both increases from the new price: $0.07 + 0.11 = 0.18$
 $4.09 - 0.18 = \$3.91$*

8. The perimeter of a square is equal to four times the length of a side of the square. Find the perimeter of a square whose side measures 2.8 feet.

Solution: Multiply 2.8 by 4 = 11.2 ft.

9. Shannon owned 357.448 shares of a fund at the beginning of the year. At the end of the year, she owned 439.917 shares. What was the increase in the number of shares that she owned?

Solution: Subtract $439.917 - 357.448 = 82.469$ shares

10. A car travels 70.5 miles on 3 gallons of gas. Find the distance traveled on 14 gallons of gas.

*Solution: Write a proportion using the ratio $\frac{\text{miles}}{\text{gallons}}$: $\frac{70.5}{3} = \frac{n}{14}$
Cross multiply to obtain: $3n = 987$, divide by 3, $n = 329$ miles*

11. A nursery makes plant food by adding 1 gallon of water for each 2 ounces of plant food. At this rate, how many gallons of water are required for 25 ounces of plant food?

*Solution: Write a proportion using the ratio $\frac{\text{water (gal)}}{\text{ounces}}$: $\frac{1}{2} = \frac{n}{25}$
Cross multiply to obtain: $2n = 25$, divide by 2, $n = 12.5$ gallons*

12. A brick wall 20 feet in length contains 1040 bricks. At the same rate, how many bricks would it take to build a wall 48 feet in length?

*Solution: Write a proportion using the ratio $\frac{\text{feet}}{\text{\#bricks}}$: $\frac{20}{1040} = \frac{48}{n}$
Cross multiply to obtain: $20n = 49920$, divide by 20, $n = 2496$ bricks*

13. A manufacturer knows that in an average production of 2000 circuit boards, 60 will be defective. How many defective circuit boards can be expected from a run of 25,000 circuit boards?

Solution: Write a proportion using the ratio $\frac{\#produced}{\#defective}$: $\frac{2000}{60} = \frac{25000}{n}$

Cross multiply to obtain: $2000n = 1500000$, divide by 2000, $n = 750$ boards

14. The ratio of the size of a part on a model to the actual size of the part is 2:5. If a door is 1.5 feet long on the model, what is the actual length of the door?

Solution: Write a proportion using the ratio $\frac{model}{actual}$: $\frac{2}{5} = \frac{1.5}{n}$

Cross multiply to obtain: $2n = 7.5$, divide by 2, $n = 3.75$ ft.

Practice Questions Decimal and Proportion Applications:

1. The perimeter of a triangle is the sum of the lengths of the three sides of the triangle. Find the perimeter of a triangle that has sides measuring 4.9 feet, 6.1 feet and 8.5 feet.
2. The scale on a blueprint indicated "1 inch = 3 feet." Find the width of a room measuring 6 inches on the blueprint.
3. Donna drives her delivery van 800 mi in 3 days. At this rate, how far will she drive in 15 days?
4. To control a fever, a doctor suggests that a child who weighs 28 kg be given 320 mg of a liquid pain reliever. If the dosage is proportional to the child's weight, how much of the medication is recommended for a child who weighs 35 kg?

Solutions

1. 9.5 feet 2. 18 feet 3. 4000 mi 4. 400mg

Introduction to Percents

Introduction to Percents: Percent means “per hundred” or “parts of one hundred”

$$\text{So } 13\% = \frac{13}{100}$$

Converting Percents to Fractions: Write the percent over 100, simplify

Converting Percents to Decimals: Move the decimal point 2 places the left

$$\text{Ex.) } 72\% = 0.72 \qquad \frac{72}{100} = \frac{36}{50} = \frac{18}{25}$$

$$\text{Ex.) } 0.5\% = 0.005 \qquad \frac{.5}{100} = \frac{5}{1000} = \frac{1}{200}$$

(The first step above is to multiply both numerator and denominator by 10 to remove the decimal.)

$$\text{Ex.) } 15\frac{2}{3}\% = 0.15\frac{2}{3} \qquad \frac{15\frac{2}{3}}{100} = 15\frac{2}{3} \div 100 = \frac{47}{3} \cdot \frac{1}{100} = \frac{47}{300}$$

$$\text{Ex.) } 82.9\% = 0.829 \qquad \frac{82.9}{100} = \frac{829}{1000}$$

(The first step above is to multiply both numerator and denominator by 10 to remove the decimal.)

Converting Percents to Decimals Practice Questions:

1. 62%

2. 4.9%

3. $3\frac{3}{4}\%$

Solutions

1. 0.62

2. 0.049

3. 0.0375

Converting Decimals to Percents: Move the decimal point 2 places to the right.

Ex.) $0.16 = 16\%$

Ex.) $1.07 = 107\%$

Ex.) $0.003 = 0.3\%$

Ex.) $1.012 = 101.2\%$

Converting Decimals to Percents Practice Questions:

1. 0.01

2. 8.7

3. 16.8

Solutions

1. 1%

2. 870%

3. 1680%

Converting Fractions to Percents: Convert to a decimal first (divide), then to a percent.

Ex.) $\frac{5}{12}$

Dividing will produce 0.4166. Convert to a percent by moving two decimal places to the right: 41.66%. Round if necessary. Nearest tenth: 41.7%

Ex.) $3\frac{2}{7}$

Dividing will produce 3.2857 (rounded to four decimal places). Convert to a percent by moving two decimal places to the right: 328.57%. Round if necessary. Nearest tenth: 328.6%

Ex.) $\frac{1}{3}$

Dividing will produce 0.3333. Convert to a percent by moving two decimal places to the right: 33.33 %. Round if necessary. Nearest tenth: 33.3%. However, $\frac{1}{3}$ and $\frac{2}{3}$ are quite commonly converted to exact percentages of $33\frac{1}{3}\%$ and $66\frac{2}{3}\%$

Converting Fractions to Percents Practice Questions:

1. $\frac{36}{100}$

2. $\frac{1}{100}$

3. $2\frac{3}{8}$

Solutions		
1. 36%	2. 1%	3. 237.5%

**Per
cent
Prob
lems**

blems

Percent Problems: To solve percent problems, you can write an equation using the following substitutions:

“what number”: n (or any variable)

“is”: $=$

“of”: \times

***Convert percents to decimals or fractions

Note: The proportion method is discussed after the following examples.

Ex.) What is 45% of 80?

$$n = 0.45 \times 80$$

$$n = 36$$

Ex.) 7% of 50 is what?

$$0.07 \times 50 = n$$

$$3.5 = n$$

Ex.) Find 12% of 425

$$0.12 \times 425 = 51$$

Ex.) What is $66\frac{2}{3}\%$ of 891?

$$\frac{2}{3} \times \frac{891}{1} = 594$$

Ex.) 0.075% of 625 is what?

$$0.00075 \times 625 = n$$

$$0.46875 = n$$

Ex.) What is $5\frac{3}{4}\%$ of 6.5?

$$5.75\% \text{ of } 6.5$$

$$0.0575 \times 6.5 = 0.37375$$

Ex.) Approximately 40% of the 45 million people in the U.S. who do not have health insurance are between the ages of 18 and 24. How many people in the U.S. ages 18 to 24 do not have health insurance?

$$0.40 \times 45 = 18$$

Ex.) A sales tax of 8.75% was added to a car costing \$15,000. How much was the sales tax?
What is the total cost of the car?

$$0.0875 \times 15,000 = \$13,12.50_{\text{(sales tax)}} \quad \$15,000 + \$1,312.50 = \$16,312.50_{\text{(total cost)}}$$

Ex.) What percent of 80 is 25?

$$\begin{aligned} n \times 80 &= 25 \\ n &= 0.3125 = 31.25\% \end{aligned}$$

Ex.) 30 is what percent of 45?

$$\begin{aligned} 30 &= n \times 45 \\ \frac{30}{45} &= n \\ 0.6667 &= n \\ 66\frac{2}{3}\% &= n \end{aligned}$$

Ex.) In a survey, 1236 people were asked about their favorite food. 293 people responded “pizza”. What percent of those surveyed chose pizza? Round to the nearest tenth of a percent.

$$n \times 1236 = 293 \quad \text{Divide 293 by 1236 to obtain 0.2370 or 23.7\%}$$

Ex.) Florida recently grew 281.72 million pounds of the 572 million pounds of oranges in the U.S. What percent of the total amount of oranges were grown by Florida?

$$n \times 572 = 281.72 \quad \text{Divide 281.72 by 572 to obtain 0.4925 or 49.3\%}$$

Ex.) 10% of what number is 20?

$$0.10 \times n = 20 \quad \text{Divide 20 by 0.10 to obtain 200}$$

Ex.) The average deduction for medical expenses for income level A is \$4500. This is 26% of the medical expenses claimed by income level B. What are the medical expenses claimed by income level B?

$$4500 = 0.26 \times n \quad \text{Divide 4500 by 0.26 to obtain } \$17,000$$

Ex.) A 911 operator received 441 calls that were actually non-emergencies. These accounted for 42% of the actual calls received. How many calls were received?

$$441 = 0.42 \times n \quad \text{Divide 441 by 0.42 to obtain 1050}$$

Proportion Method

$$\frac{\text{percent}}{100} = \frac{\text{amount(is)}}{\text{base(of)}}$$

Cross multiply to finish solving.

Ex.) What is 28% of 950?

$$\frac{28}{100} = \frac{n}{950}$$

$$100n = 26600$$

$$n = 266$$

Ex.) 48 is what percent of 160?

$$\frac{n}{100} = \frac{48}{160}$$

$$160n = 4800$$

$$n = 30$$

Ex.) 90% of what is 63?

$$\frac{90}{100} = \frac{63}{n}$$

$$90n = 6300$$

$$n = 70$$

Percent Problems Practice Questions:

1. 7% of 50 is what?

2. What is $5\frac{3}{4}\%$ of 6.5?

3. A company currently employing 545 people needs to hire an additional 23% for the summer. What is the total number of employees needed?

4. 19 is what percent of 95?

5. 5.3 is what percent of 50?

6. In a safety test of automobiles, 3 of 200 cars tested did not meet safety requirements. What percent did meet safety requirements?

7. 7 is 14% of what number?

8. The average deduction for medical expenses for income level A is \$4,000. This is 25% of the medical expenses claimed by income level B. What are the medical expenses claimed by income level B?

9. A 911 operator received 332 calls that were non-emergencies. These accounted for 40% of the actual calls received. How many calls were received?

Solutions

1. 3.5 2. 0.37375 3. 125 employees 4. 20% 5. 10.6% 6. 1.5% 7. 50
8. \$16,000 9. 830

Percent Applications

Unit cost: the cost of one item. Divide the cost by the amount; round to the nearest cent (2 decimal places)

Ex.) 4 ounces of toothpaste cost \$2.29.
How much does 1 ounce cost?

*Divide 2.29 by 4 to obtain \$0.5725
Round: \$0.57*

Ex.) Find the most economical purchase:
Catsup: 32oz for \$1.98 or 18oz for \$1.15

*Divide 1.980 by 32 to obtain 0.061
Divide 1.15 by 18 to obtain 0.063
The better buy is 32 oz for \$1.98*

Percent Problems - Unit Cost Practice Questions:

1. 9 ounces of toothpaste cost \$2.52. How much does 1 ounce cost?
2. Find the most economical purchase: 12 ounces for \$3.12 or 18 ounces for \$4.50.

Solutions

1. \$0.28 2. 18 ounces for \$4.50 is most economical

Percent Increase

$$\begin{array}{l} \% \quad \times \quad \text{base} \quad = \quad \text{amount} \\ \% \text{ increase} \times \text{original value} \quad = \quad \text{amount of increase} \end{array}$$

OR $\frac{\text{percent}}{100} = \frac{\text{amount of increase}}{\text{original amount}}$ (Cross multiply to solve; no conversion needed if finding a percent)

Ex.) An automobile manufacturer increased the average mileage on a car from 17.5 miles per gallon to 18.2 miles per gallon. Find the percent increase in mileage.

$$\begin{array}{l} n \times 17.5 = 0.7 \\ n = 0.04 = 4\% \end{array} \quad \text{OR} \quad \begin{array}{l} \frac{n}{100} = \frac{0.7}{17.5} \\ 17.5n = 70 \\ n = 4\% \end{array}$$

Ex.) The number of medal events at the Olympics has increased from 14 to 78. Find the percent increase in the number of events.

The amount of increase is $78 - 14 = 64$

$$\begin{array}{l} n \times 14 = 64 \\ n \approx 4.57 \text{ or } 457\% \end{array} \quad \text{OR} \quad \begin{array}{l} \frac{n}{100} = \frac{64}{14} \\ 14n = 6400 \\ n \approx 457\% \end{array}$$

Ex.) The average price of gasoline rose from \$3.55 to \$4.23 in 5 months. What was the percent increase in the price of gasoline?

The amount of increase is $4.23 - 3.55 = 0.68$

$$\begin{array}{l} n \times 3.55 = 0.68 \\ n \approx 0.192 \text{ or } 19.2\% \end{array} \quad \text{OR} \quad \begin{array}{l} \frac{n}{100} = \frac{0.68}{3.55} \\ 3.55n = 68 \\ n \approx 19.2\% \end{array}$$

Percent Increase Practice Questions:

1. The average cost of movie tickets for a family of four was \$16.56 in 1993. The cost rose to \$30.00 in 2009. What was the percent increase in the cost for a family of four to attend a movie?

2. After attending a class entitled Improving Your SAT Scores, Jacob raised his total score from 1450 to 1600. What was the percent increase?

Solutions

1. Approximately 81.2%
2. Approximately 10.3%

Averages

Usually “*average*” is associated with the “*mean*” of a set of scores. To find the mean, add up the data values, divide by the number of data values.

Ex.) Test scores: 78, 82, 91, 87, 93. Find the average (mean) test score.

Add to find the sum: 431; divide this by 5 (the number of scores).

Answer: 86.2

Ex.) Amounts spent at a restaurant: \$6.26, \$8.37, \$7.94, \$5.12, \$6.52, \$7.04. Find the average (mean) amount spent.

Add to find the sum: 41.25; divide this by 6 (the number of scores); Round to the nearest cent.

Answer: \$6.88

Practice Questions for Averages:

1. Find the average (mean) test score for the following grades: 87, 77, 95, and 68.

2. The amounts spent at a restaurant include \$105.12, \$58.50, \$78.98 and \$100.04. Find the average (mean) amount spent.

Solutions

1. 81.75

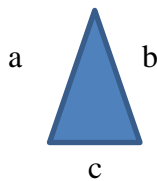
2. 85.66

Geometry

Perimeter: the distance around a figure. In general, add up the lengths of all the sides.

Formulas:

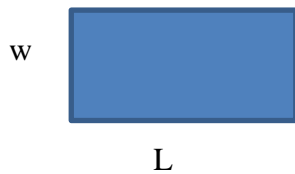
Triangle: $P = a + b + c$



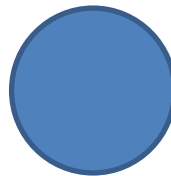
Square: $P = 4s$



Rectangle: $P = 2L + 2w$



Circle (circumference): $C = 2\pi r$



r = radius (distance from the center to the circle)

$\pi \approx 3.14$

Examples:

Ex.)

1.4m



5m

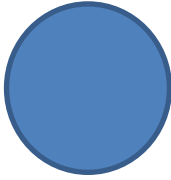
$$P = 2L + 2w$$

$$P = 2(5) + 2(1.4)$$

$$P = 10 + 2.8$$

$$P = 12.8\text{m}$$

Ex.)



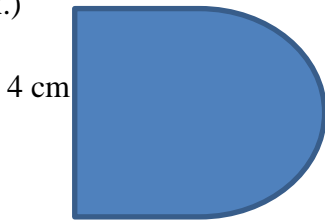
$r = 11\text{cm}$

$$C = 2\pi r$$

$$C = 2(3.14)(11)$$

$$C = 69.08\text{ cm}$$

Ex.)



2 cm

This shape is made up of a rectangle with length 4 cm and width 2cm.; plus a half circle with radius 2cm.

$$P = L + w + w + \frac{1}{2}\pi r$$

$$P = 4 + 2 + 2 + \frac{1}{2}(3.14)(2)$$

$$P = 4 + 2 + 2 + 3.14$$

$$P = 11.14\text{cm}$$

Area: the amount of surface in a region; measured in square units.

Formulas:

Triangle: $A = \frac{1}{2}bh$

Circle: $A = \pi r^2$

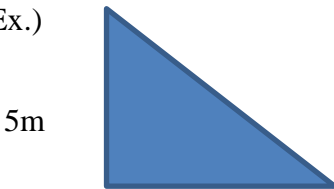
(the height is measured along a line perpendicular to the base)

Rectangle: $A = l \cdot w$

Square: $A = s^2$

Examples:

Ex.)



5m

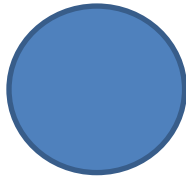
10m

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(10)(5)$$

$$A = 25\text{m}^2$$

Ex.)



$d = 10\text{cm}$

The length of the radius is half the length of the diameter.
 $r = 5\text{cm}$

$$A = \pi r^2$$

$$A = (3.14)(5^2)$$

$$A = 78.5\text{ cm}^2$$

Ex.)



3.2 m

6.8m

$$A = lw$$

$$A = (6.8)(3.2)$$

$$A = 21.76\text{m}^2$$

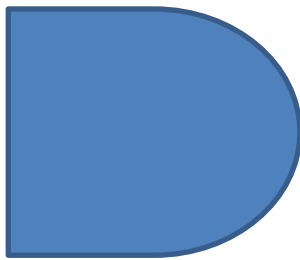
Ex.)



3 cm

$$A = s^2$$
$$A = 3^2$$
$$A = 9\text{cm}^2$$

Ex.)



10 in

6 in

This shape is a rectangle plus a half circle.

$$A = lw + \frac{1}{2}\pi r^2$$

$$A = 10(6) + \frac{1}{2}(3.14)(5^2)$$

$$A = 60 + 39.25$$

$$A = 99.25\text{in}^2$$

Volume: A measure of the amount of space inside a 3-dimensional solid.

Volume of a rectangular prism (box): $V = l \cdot w \cdot h$

(l = length; w = width; h = height)

Ex.) Find the volume of a rectangular solid with length 2.1m, width 1.3 m, and height 2.4 m.

Solution: $2.1 \times 1.3 \times 2.4 = 6.552$ cubic meters

Geometry Practice Questions:

1. The length of a rectangle is 15m and the width is 9m. Find the perimeter of the rectangle.
2. The length of the side of a square is 10cm. What is the area of the square?
3. Find the volume of a rectangular solid with a length of 2.2m, width of 1.4m, and height of 2.5m.
4. Find the area of a circle whose radius is 5in.

Solutions

1. 48m

2. 100cm^2

3. 7.7cm^3

4. 78.5in^2

Signed Numbers: Addition and Subtraction

Addition

If the numbers have the same signs: Add, keep the same sign.

If the numbers have different signs: Subtract (the absolute values); use the sign of the number with the larger absolute value.

$$\text{Ex.) } -9 + 4 = -5$$

$$\text{Ex.) } 5 + -2 = 3$$

$$\text{Ex.) } -2 + -1 = -3$$

$$\text{Ex.) } 3 + -4 = -1$$

$$\text{Ex.) } -44 + (-71) = -115$$

$$\text{Ex.) } -80 + 30 = -50$$

$$\text{Ex.) } 42 + -18 = 24$$

$$\text{Ex.) } -27 + (-42) + (-18) = -87$$

$$\text{Ex.) } -25 + (-31) + 24 + 19$$

$$-56 + 24 + 19$$

$$-32 + 19$$

$$-13$$

$$\text{Ex.) } -6 + (-8) + 13 + (-4)$$

$$-14 + 13 + (-4)$$

$$-1 + (-4)$$

$$-5$$

Addition Practice Questions:

$$1. -10 + 4$$

$$2. -7 + -4$$

$$3. 5 + -6$$

$$4. -80 + 71$$

5. $-27 + (-52) + (-22)$

Solutions

1. -6

2. -11

3. -1

4. -9

5. -101

Subtraction

Add the opposite. (Make two changes: first, change the subtraction sign to an addition sign; second, change the sign of the second number).

Ex.) $-4 - (-1)$
 $-4 + (+1) = -3$

Ex.) $-2 - (-3)$
 $-2 + (+3) = 1$

Ex.) $2 - 5$
 $2 + (-5) = -3$

Ex.) $-4 - 17$
 $-4 + (-17) = -21$

Ex.) $21 - (-19)$
 $21 + (+19) = 40$

Ex.) $-5 - 8 - (-10)$
 $-5 + (-8) + (+10) = -3$

Ex.) $42 - (-30) - 65 - (-11)$
 $42 + (+30) + (-65) + (+11)$
 $72 + (-65) + (+11)$
 $7 + (+11) = 18$

Ex.) Find -8 less than 14
 $14 - (-8)$
 $14 + (+8) = 22$

Subtraction Practice Questions:

1. $-6 - (-1)$

2. $2 - 8$

3. $-15 - (-26)$

4. Find -6 less than 10

5. $-2 - 5 - (-12)$

Solutions

1. -5

2. -6

3. 11

4. 16

5. 5

Signed Numbers: Multiplication and Division

Multiplication

Same signs: Answer is positive

Different signs: Answer is negative

Ex.) $-5(7) = -35$

Ex.) $-8(-12) = 96$

Ex.) $-10(-6)(7) = 420$

Ex.) $-8(-7)(-4) = -224$

Ex.) $(-6)(5)(7) = -210$

Ex.) $-9(-6)(11)(-2) = -1188$

***If there is an even number of negative signs the answer is positive

If there is an odd number of negative signs the answer is negative

Multiplication Practice Questions:

1. $(-2)(-4)$

2. $8(-10)$

3. $-8 \cdot 2(-3)$

4. $3 \cdot (-8) \cdot (-1)$

5. $(-5)(6)(-4)5$

Solutions

1. 8

2. -80

3. 48

4. 24

5. 600

Division

Use the same rules as for multiplication.

Ex.) $15 \div (-3) = -5$ Ex.) $(-280) \div 8 = -35$ Ex.) $-108 \div (-12) = 9$ Ex.) $(-98) \div (-7) = 14$

Ex.) $-8 \div 0$ undefined (division by zero cannot be done) Ex.) $196 \div (-7) = -28$

Division Practice Questions:

1. $36 \div (-6)$ 2. $24 \div (-12)$ 3. $-100 \div (-50)$ 4. $\frac{-16}{8}$

5. $\frac{-48}{-12}$

Solutions

1. -6

2. -2

3. 2

4. -2

5. 4

Signed Numbers: Order of Operations

Continue using the order of operations already discussed.

$$\begin{aligned}\text{Ex.) } & (-4)^2 - 8 + 9(3) \\ & 16 - 8 + 27 \\ & 8 + 27 \\ & 35\end{aligned}$$

$$\begin{aligned}\text{Ex.) } & 7(3 - 6) + 5 \\ & 7(-3) + 5 \\ & -21 + 5 \\ & -16\end{aligned}$$

$$\begin{aligned}\text{Ex.) } & (-6)^2 \times (6 - 4)^2 - (-12) \div 4 \\ & 36 \times 2^2 - (-3) \\ & 36 \times 4 + (+3) \\ & 144 + 3 \\ & 147\end{aligned}$$

$$\begin{aligned}\text{Ex.) } & 16 - 4 \times 8 + 4^2 - (-18) \div (-9) \\ & 16 - 32 + 16 - 2 \\ & -16 + 16 - 2 \\ & 0 - 2 \\ & -2\end{aligned}$$

$$\begin{aligned}\text{Ex.) } & 4 - 2 \times 7 - 3^2 \\ & 4 - 14 - 9 \\ & -10 - 9 \\ & -19\end{aligned}$$

$$\begin{aligned}\text{Ex.) } & 5 + 7(3 - 8)^2 \div (-14 + 9) \\ & 5 + 7(-5)^2 \div -5 \\ & 5 + 7(25) \div -5 \\ & 5 + 175 \div -5 \\ & 5 + (-35) \\ & -30\end{aligned}$$

Order of Operation Practice Questions:

1. $(8 - 2)(3 - 9)$

2. $16 \cdot -15 - (-26)$

3. $10 \cdot 20 - 15 \cdot 24$

4. $2^4 + 2^2 - 10$

Solutions

1. -36

2. -214

3. -160

4. 10