

1. RATIONAL NUMBERS

Basics of Rational Numbers

EXERCISE 1.1

POINTS TO REMEMBER

- ✓ Rational numbers are the numbers of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.
- ✓ If $\frac{p}{q}$ is a rational number and $m \neq 0$, then $\frac{p}{q} = \frac{p \times m}{q \times m}$.
- ✓ Similarly, if $\frac{p}{q}$ is a rational number and m is a common divisor of both p and q , then $\frac{p}{q} = \frac{p \div m}{q \div m}$.
- ✓ A rational number $\frac{p}{q}$ is said to be in standard form if p and q have no common divisor other than 1 and q is positive.

1. Express the following rational numbers with denominator 40:

- a. $\frac{1}{-2}$ _____ b. $\frac{-8}{5}$ _____ c. $\frac{1}{10}$ _____
 d. $\frac{1}{20}$ _____ e. $\frac{20}{1}$ _____ f. $\frac{1}{-8}$ _____

2.

Compare using $<$, $>$, or $=$.

- a. -20 _____ $\frac{1}{20}$ b. $\frac{4}{5}$ _____ $\frac{-4}{5}$ c. -1 _____ $\frac{-4}{4}$
 d. $\frac{-4}{12}$ _____ $\frac{-4}{3}$ e. 0 _____ $\frac{0}{1}$ f. 8 _____ $\frac{40}{5}$

3. Arrange in ascending order:

- a. $\frac{-4}{3}, \frac{-4}{9}, \frac{-4}{6}, \frac{-4}{5}, \frac{-4}{1}$ _____
 b. $\frac{-4}{7}, \frac{4}{3}, \frac{-6}{21}, \frac{4}{21}, \frac{-9}{7}, 2\frac{1}{3}$ _____

c. $\frac{-4}{-9}, \frac{4}{3}, \frac{5}{9}, \frac{1}{3}, \frac{5}{-6}, \frac{-1}{6}, \frac{7}{9}$ _____

4. Arrange in descending order:

a. $\frac{-11}{3}, \frac{-11}{9}, \frac{-4}{3}, \frac{-4}{9}, \frac{-8}{9}$ _____

b. $\frac{-3}{8}, \frac{4}{3}, \frac{-5}{24}, \frac{2}{3}, \frac{-9}{8}, 2\frac{1}{3}$ _____


c. $\frac{-4}{-5}, \frac{-4}{15}, \frac{5}{10}, \frac{1}{5}, \frac{5}{-10}, \frac{-1}{15}, \frac{3}{10}$ _____

5. Write each of the following in standard form:

a. $\frac{-144}{108}$ _____

b. $\frac{-240}{-300}$ _____

c. $\frac{2100}{-120}$ _____

 d. $\frac{192}{-168}$ _____

e. $\frac{-150}{-455}$ _____

f. $\frac{100}{-80}$ _____

6. Express $\frac{-5}{-11}$ as a rational number with numerator as given below:


a. 20 _____

b. 60 _____

c. -100 _____

7. Find the value of x :


a. $\frac{1}{5} = \frac{3}{x}, x =$ _____

 b. $\frac{3}{7} = \frac{x}{42}, x =$ _____

c. $\frac{4}{-5} = \frac{x}{-10}, x =$ _____

8. Solve the puzzles:

a. I am a rational number with denominator 121. My standard form is $\frac{-5}{11}$. Who am I? _____

 b. I am a rational number with denominator 15. My standard form has numerator 1 and is 2 less than the denominator. Who am I? _____

Properties of Rational Numbers

EXERCISE 1.2

POINTS TO REMEMBER

✓ **Closure Property:** If $\frac{p}{q}$ and $\frac{l}{m}$ are rational numbers, then $\left(\frac{p}{q} + \frac{l}{m}\right), \left(\frac{p}{q} - \frac{l}{m}\right)$ and $\left(\frac{p}{q} \times \frac{l}{m}\right)$ are also a rational numbers.

Note that rational numbers are not closed under division.

- ✓ **Commutative Property:** If $\frac{p}{q}$ and $\frac{l}{m}$ are rational numbers, then

$$\left(\frac{p}{q} + \frac{l}{m} = \frac{l}{m} + \frac{p}{q}\right) \text{ and } \left(\frac{p}{q} \times \frac{l}{m} = \frac{l}{m} \times \frac{p}{q}\right).$$

Note that subtraction and division are not commutative for rational numbers.

- ✓ **Associative Property:** If $\frac{p}{q}$, $\frac{l}{m}$ and $\frac{r}{t}$ are rational numbers, then

$$\frac{p}{q} + \left(\frac{l}{m} + \frac{r}{t}\right) = \left(\frac{p}{q} + \frac{l}{m}\right) + \frac{r}{t} \text{ and } \left(\frac{p}{q} \times \frac{l}{m}\right) \times \frac{r}{t} = \frac{p}{q} \times \left(\frac{l}{m} \times \frac{r}{t}\right).$$

Note that subtraction and division are not associative for rational numbers.

- ✓ **Zero is the additive identity for rational numbers.**

- ✓ **The additive inverse of $\frac{p}{q}$ is $\left(\frac{-p}{q}\right)$.**

- ✓ **One is the multiplicative identity for rational numbers.**

- ✓ **The multiplicative inverse of $\frac{p}{q}$ is $\left(\frac{q}{p}\right)$.**

1. Find the additive and multiplicative inverse of the following:

a. $\frac{1}{2}$ _____, _____ b. $\frac{-2}{5}$ _____, _____ c. $\frac{12}{7}$ _____, _____ d. $\frac{-1}{10}$ _____, _____

2. Add the following:

a. $-1\frac{1}{5}$ and -2 _____ b. $\frac{-21}{56}$ and $\frac{21}{56}$ _____ c. -1 , $-\frac{1}{2}$ and $\frac{1}{4}$ _____
 d. $\frac{1}{2}$, $\frac{-2}{-8}$ and $\frac{3}{4}$ _____ e. 1 , $1\frac{1}{5}$ and $\frac{-3}{5}$ _____ f. $\frac{-8}{-15}$ and $\frac{-2}{10}$ _____

3. Subtract the following:

a. $-1\frac{1}{5}$ from 7 _____ b. $\frac{-21}{56}$ from $\frac{11}{56}$ _____ c. $-\frac{1}{2}$ from $\frac{1}{4}$ _____
 d. $\frac{-2}{-8}$ from $\frac{3}{4}$ _____ e. $1\frac{1}{5}$ from $\frac{-2}{10}$ _____ f. $\frac{-3}{-10}$ from $\frac{-2}{10}$ _____

4. Verify the following in your notebook:

a. $\frac{2}{5} + \frac{-3}{4} = \frac{-3}{4} + \frac{2}{5}$ b. $\frac{2}{7} \times \frac{-8}{13} = \frac{-8}{13} \times \frac{2}{7}$ c. $\frac{5}{7} + \left(\frac{1}{3} + \frac{-1}{2}\right) = \left(\frac{5}{7} + \frac{1}{3}\right) + \frac{-1}{2}$

