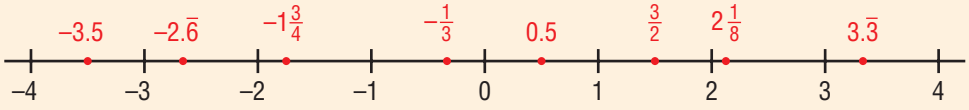
Study Guide

A rational number is any number that can be written in the form $\frac{m}{n}$, where m and n are integers and $n \neq 0$.
This number line illustrates some different forms of rational numbers:

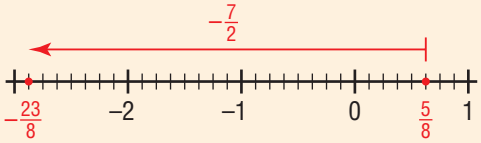


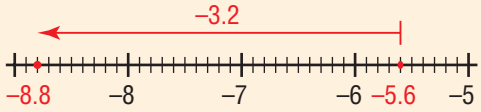
From least to greatest: $-3.5, -2.\overline{6}, -1\frac{3}{4}, -\frac{1}{3}, 0.5, \frac{3}{2}, 2\frac{1}{8}, 3.\overline{3}$

To operate with rational numbers, apply what you know about operating with fractions, decimals, and integers.

- To add rational numbers, visualize a number line.

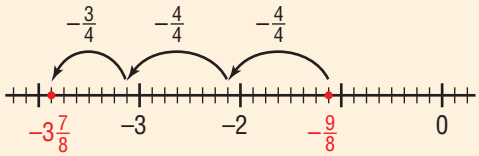
$\frac{5}{8} + \left(-\frac{7}{2}\right) = -\frac{23}{8}$ $\qquad$ $(-5.6) + (-3.2) = -8.8$

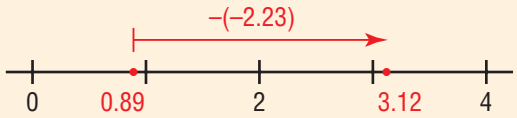




- To subtract rational numbers, visualize a number line.

$-\frac{9}{8} - \frac{11}{4} = -\frac{31}{8}$ $\qquad$ $0.89 - (-2.23) = 3.12$





- To multiply rational numbers, determine the sign of the product first.

$\left(\frac{3}{4}\right)\left(-\frac{5}{2}\right) = -\frac{15}{8}$ $\qquad$ and $\qquad$ $(-4.13)(-0.8) = 3.304$

- To divide rational numbers, determine the sign of the quotient first.

$\left(-\frac{3}{10}\right) \div \left(-\frac{12}{5}\right) = \frac{1}{8}$ $\qquad$ and $\qquad$ $76.63 \div (-7.5) = -10.217\overline{3}$

The order of operations with rational numbers is the same as the order for whole numbers, fractions, and integers:

- Do the operations in brackets first.
- Then evaluate the exponents.
- Then divide and multiply, in order, from left to right.
- Then add and subtract, in order, from left to right.

Review

3.1

1. Which of the following rational numbers are between -2.5 and $-\frac{11}{3}$?
How do you know?

a) -3.4 **b)** $-\frac{9}{4}$ **c)** $-\frac{19}{6}$ **d)** -4.2

2. Order the following rational numbers from least to greatest. Show them on a number line.
$3.12, -\frac{4}{3}, 0.9, -\frac{1}{2}, -0.4$

3. Write 3 rational numbers between each pair of numbers. Sketch number lines to show all the rational numbers.

a) $-3.5, -3.1$ **b)** $\frac{1}{5}, \frac{7}{10}$

c) $0.8, 0.9$ **d)** $-\frac{5}{2}, -\frac{3}{2}$

4. On one day, the prices of 5 stocks changed by the following amounts in dollars:
$-0.09, -0.51, +0.95, +0.54, -2.00$
Order the amounts from the greatest loss to the greatest gain.

3.2

5. Determine each sum.

a) $-1.2 + (-0.3)$
b) $134.89 + (-56.45)$
c) $-23.6 - 4.57$
d) $48.05 + 0.003$

6. A technician checked the temperature of a freezer and found that it was $-15.7°C$. She noted that the temperature had dropped $7.8°C$ from the day before.

a) What was the temperature the day before?
b) Show both temperatures on a vertical number line.

7. Determine each sum.

a) $\frac{3}{4} + \frac{7}{8}$ **b)** $-1\frac{1}{2} + 3\frac{1}{3}$

c) $-4\frac{5}{6} + \left(-1\frac{5}{12}\right)$ **d)** $\frac{11}{9} + \left(-\frac{17}{6}\right)$

3.3

8. Determine each difference.

a) $-3.4 - (-4.8)$
b) $-71.91 - 11.23$
c) $90.74 - 100.38$
d) $63.2 - 80.02$

9. At the end of a day, the price of a stock was \$21.60. During the day, the price of the stock had changed by $-\$0.75$.
What was the price of the stock at the beginning of the day? How do you know?

10. Determine each difference.

a) $\frac{4}{3} - \frac{11}{6}$ **b)** $-\frac{5}{8} - \left(-\frac{7}{5}\right)$

c) $3\frac{5}{7} - \left(-6\frac{9}{10}\right)$ **d)** $-\frac{23}{4} - \frac{23}{3}$

3.4

11. Predict which expressions have a value between -1 and 1. Calculate each product to check.

a) $(-1.4) \times (-0.8)$ **b)** $25.6 \times (-0.05)$

c) $\left(-\frac{3}{5}\right)\left(\frac{4}{3}\right)$ **d)** $\left(-\frac{5}{6}\right)\left(-\frac{2}{3}\right)$

12. The temperature in Richmond, BC, at 4:00 P.M. was 2°C. The temperature drops 1.3°C each hour. What will the temperature be at 11:00 P.M.?
Justify your answer.

13. Write 3 multiplication statements that have the same product as $\left(-\frac{4}{9}\right)\left(\frac{7}{5}\right)$.
How can you check your answers?

14. Determine each product.

a) $3.5 \times (-0.3)$ b) $(-4.1)(2.3)$

c) $\left(-\frac{4}{7}\right)\left(-\frac{2}{3}\right)$ d) $1\frac{3}{5} \times \left(-2\frac{1}{2}\right)$

15. A mountain climber descends from base camp at an average speed of 5.9 m/h. How far below base camp will the climber be after 3.75 h? Use a vertical number line with the base camp at 0 to illustrate the climber's descent.

3.5

16. Predict which expressions have a value between -1 and 1. Calculate each quotient to check.

a) $(-2.2) \div 0.4$ b) $10.6 \div (-9.2)$

c) $\frac{9}{10} \div \left(-\frac{3}{2}\right)$ d) $\left(-\frac{5}{12}\right) \div \left(-\frac{5}{4}\right)$

17. Write 3 division statements that have the same quotient as $\frac{3}{8} \div \left(-\frac{5}{11}\right)$.

18. Replace each $\square$ with a rational number to make each equation true. Explain the strategy you used.

a) $(-0.2) \times \square = 0.75$

b) $0.9 \times \square = -7.47$

c) $(-0.624) \div \square = -0.4$

19. Determine each quotient.

a) $8.4 \div (-1.2)$ b) $(-20.6) \div (-0.9)$

c) $\left(-\frac{9}{11}\right) \div \left(\frac{7}{5}\right)$ d) $\left(-1\frac{2}{3}\right) \div 3\frac{1}{2}$

3.6

20. a) Evaluate each expression. Do not use a calculator.

i) $-3.5 + 6.2 \times (-0.2)$

ii) $(-3.5 + 6.2) \times (-0.2)$

b) Are the answers in part a different? Explain.

21. Predict whether the value of each expression below is positive or negative. Explain how you predicted. Evaluate to check your prediction.

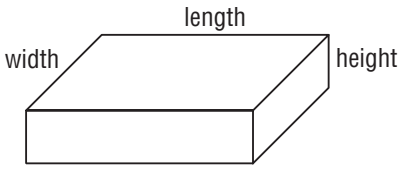
a) $-\frac{3}{5} + \left[\frac{1}{3} \times \left(-\frac{3}{4}\right)\right]$

b) $\left(-\frac{3}{5} + \frac{1}{3}\right) \times \left(-\frac{3}{4}\right)$

c) $-\left(-\frac{3}{5} + \frac{1}{3}\right) \times \left(-\frac{3}{4}\right)$

22. A formula for the surface area of a right rectangular prism is:

2(length $\times$ width + length $\times$ height + width $\times$ height)



a) Determine the surface area of a right rectangular prism with length 25.3 cm, width 15.2 cm, and height 9.7 cm.

b) Explain how you used the order of operations in part a.

23. Evaluate each expression. Show your work to illustrate the order of operations.

a) $-1.2 \div (0.6) - [6.3 + (-3.4)]$

b) $-\frac{5}{12} + \left(\frac{4}{3}\right)\left(\frac{4}{3}\right)$

c) $-\frac{4}{5} \div \left[\frac{1}{2} + \left(-\frac{1}{6}\right)\left(-\frac{1}{6}\right) \times \frac{1}{4}\right]$

d) $\left(-\frac{2}{3}\right)\left(-\frac{2}{3}\right) \div \frac{2}{9} - \left(-\frac{4}{5}\right)$

e) $-1\frac{3}{7} \times \frac{1}{2} + \left(-3\frac{1}{7}\right)$

f) $0.2 - (-1.2) \times 0.5 \div (-0.1)$

g) $(-0.2 + 0.9)^2 + 9.8 \div (-0.7)$

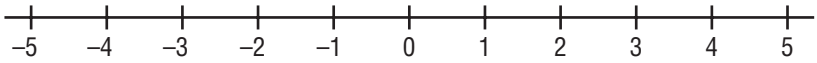
Practice Test

1. **a)** Identify a rational number between -0.5 and -0.6.

b) How do you know the number you identified in part a is a rational number?

2. **a)** Write the following rational numbers on a copy of the number line below:

$0.6,\ -0.\overline{3},\ -2.5,\ 3.\overline{6},\ 4\frac{1}{2},\ -1\frac{3}{10},\ -\frac{23}{5},\ \frac{11}{3}$



b) List the numbers in part a from greatest to least.

3. Evaluate.

a) $-7.4 - (-6.1)$ **b)** $\frac{4}{5} + \left(-\frac{3}{10}\right)$ **c)** $(-3.2)(-0.5)$ **d)** $\left(-\frac{3}{4}\right) \div \frac{1}{3}$

4. Sarah has a balance of $-\$2.34$ in her account.

Each time she makes a withdrawal, she is charged \$1.20.

a) What does "a balance of $-\$2.34$" mean?

b) Sarah makes three more withdrawals of \$20.50 each.

What is her balance now?

How can you use rational numbers to calculate it?

c) Sarah's overdraft limit is \$500.00. How many more \$20.50 withdrawals can she make? Justify your answer.

5. Evaluate. How could you check your answers?

a) $(-56.8)(-14.5)$ **b)** $\left(-3\frac{1}{3}\right)\left(-2\frac{3}{10}\right)$

c) $\left(-4\frac{2}{5}\right) \div \left(-1\frac{5}{7}\right)$ **d)** $45.8 \div (-12.2)$

6. **a)** A student evaluated the expression below and got the answer 1.

What is the correct answer? How do you know?

$\frac{1}{2} + \left(-\frac{3}{4}\right) \div \left(-\frac{1}{4}\right)$

b) What might the student have done wrong to get the answer 1?

7. Evaluate. Use a calculator when you need to.

a) $-3.1 + 4.5 \times (-2.9) - 7.2 \div (-3)$

b) $(-9.7) \times (-1.2) + 5.4^2 \div (-3.6)$