

3-2 Rational Numbers

Write each number as a fraction.

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

ANSWER:

$$\frac{15}{4}$$

2. -9

ANSWER:

$$-\frac{9}{1}$$

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

ANSWER:

$$-\frac{7}{4}$$

Write each decimal as a fraction or mixed number in simplest form.

4. 0.07

ANSWER:

$$\frac{7}{100}$$

5. $-3.\overline{85}$

ANSWER:

$$-3\frac{85}{99}$$

6. $0.\overline{78}$

ANSWER:

$$\frac{26}{33}$$

7. **MEASUREMENT** There are approximately 2.54 centimeters in 1 inch. Express 2.54 as a mixed number.

ANSWER:

$$2\frac{27}{50}$$

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Identify all sets to which each number belongs.

8. -632

ANSWER:

integer, rational

9. $0.\overline{56}$

ANSWER:

rational

10. 21

ANSWER:

natural, whole, integer, rational

Write each number as a fraction.

11. $1\frac{5}{6}$

ANSWER:

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

12. -12

ANSWER:

$$-\frac{12}{1}$$

13. $-10\frac{7}{8}$

ANSWER:

$$-\frac{87}{8}$$

14. 49

ANSWER:

$$\frac{49}{1}$$

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Write each decimal as a fraction or mixed number in simplest form.

15. 3.625

ANSWER:

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

16. 0.55

ANSWER:

$$\frac{11}{20}$$

17. -5.36

ANSWER:

$$-5\frac{9}{25}$$

18. -0.265

ANSWER:

$$-\frac{53}{200}$$

19. -1.3

ANSWER:

$$-1\frac{3}{10}$$

20. 0.9

ANSWER:

$$\frac{9}{10}$$

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21. **FINANCIAL LITERACY** Recently, one U.S. dollar was equal to 0.506 British pounds. Express 0.506 as a fraction.

ANSWER:

$$\frac{253}{500}$$

22. **POPULATION** The estimated portions for various age groups of the population for 2010 are shown in the table.

Age Group	Portion of Population
19 years and under	0.27
20 to 64 years	0.60
65 years and over	0.13

Source: United States Census Bureau

- Find the fraction of the population that is 19 years of age or younger.
- Find the fraction of the population that is 20 to 64 years of age.

ANSWER:

a. $\frac{27}{100}$

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

Write each decimal as a fraction or mixed number in simplest form.

23. $-2.\overline{5}$

ANSWER:

$$-2\frac{5}{9}$$

24. $0.\overline{36}$

ANSWER:

$$\frac{4}{11}$$

25. $0.161616\ldots$

ANSWER:

$$\frac{16}{99}$$

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26. $9.\overline{27}$

ANSWER:

$$9\frac{3}{11}$$

27. $-0.\overline{09}$

ANSWER:

$$-\frac{1}{11}$$

28. $-10.\overline{74}$

ANSWER:

$$-10\frac{74}{99}$$

Identify all sets to which each number belongs.

29. -8

ANSWER:

integer, rational

30. 14

ANSWER:

natural, whole, integer, rational

31. 9.23

ANSWER:

rational

32. $1\frac{5}{9}$

ANSWER:

rational

33. $0.323322333\dots$

ANSWER:

irrational

34. $3.141516\dots$

ANSWER:

irrational

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35. **JEWELRY** Maria has a bead that is 0.6 inch long. She wants to use the bead to fill a space that is $\frac{5}{8}$ inch long.

Will the bead fit? Explain.

ANSWER:

Yes; $\frac{5}{8} = 0.625$ and $0.625 > 0.6$, so the bead will fit.

36. **FOOD** All of the Calories in one cup of milk come from fat, protein, and carbohydrates. Use the table to find the fraction of Calories that comes from protein. Write the fraction in simplest form.

Nutrient	Decimal Part of Calories
Fat	0.03
Protein	■
Carbohydrates	0.53

Source: Nutrition Data

ANSWER:

$$\frac{11}{25}$$

Replace each _ with <, >, or = to make a true sentence.

37. -0.23 _ -0.3

ANSWER:

>

38. $\frac{8}{9}$ _ $0.888\ldots$

ANSWER:

=

39. 0.714 _ $\frac{5}{7}$

ANSWER:

<

40. $-1\frac{1}{11}$ _ -0.9

ANSWER:

<

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41. $4.\overline{63}$ $_$ $4\frac{5}{8}$

ANSWER:

$>$

42. $-5.\overline{3}$ $_$ $5.333\dots$

ANSWER:

$<$

Write each decimal as a fraction or mixed number in simplest form.

43. $0.\overline{652}$

ANSWER:

$$\frac{652}{999}$$

44. $0.\overline{18}$

ANSWER:

$$\frac{17}{90}$$

45. $0.\overline{724}$

ANSWER:

$$\frac{163}{225}$$

46. $3.\overline{596}$

ANSWER:

$$3\frac{197}{330}$$

47. $9.\overline{243}$

ANSWER:

$$9\frac{241}{990}$$

48. $0.\overline{2467}$

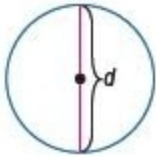
ANSWER:

$$\frac{2443}{9900}$$

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49. **MULTIPLE REPRESENTATIONS** Pi (π) is a nonrepeating, nonterminating decimal. Two common estimates for pi are 3.14 and $\frac{22}{7}$.

- a. Graphical** Use a calculator to find the value of π to seven decimal places. Then graph the three values on a number line.
- b. Symbolic** Write an inequality comparing the values.
- c. Verbal** To find the circumference of a circle, you multiply pi by the diameter d of the circle. Explain when you might use 3.14 to find the circumference and when you might use $\frac{22}{7}$ to find the circumference.



ANSWER:

- a.** 3.1415927



- b.** $3.14 < \pi < \frac{22}{7}$

- c.** Sample answer: If the diameter is a multiple of 7, use $\frac{22}{7}$. Otherwise, use 3.14.

50. **HISTORY** The mathematician Archimedes believed that π was between $3\frac{1}{7}$ and $3\frac{10}{71}$.

- a.** Express each mixed number as a decimal rounded to the nearest thousandth. Was Archimedes' theory correct? Explain.

- b.** The Rhind Papyrus records that the Egyptians used $\frac{256}{81}$ for π . Express the fraction as a decimal rounded to the nearest thousandth.

Which value is closer to the actual value of π , Archimedes' or the Egyptians' value?

ANSWER:

- a.** $3\frac{1}{7} \approx 3.143$, $3\frac{10}{71} \approx 3.141$; yes; Sample answer: Since $3.143 > 3.1415927... > 3.141$, pi is between the two values and his theory was correct.

- b.** $\frac{256}{81} \approx 3.160$; Archimedes' value is closer than the Egyptians.

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Order each set of rational numbers from least to greatest.

51. -3.4 , $3\frac{4}{11}$, $-3.\overline{42}$, 3.38

ANSWER:

$$-3.\overline{42}, -3.4, 3\frac{4}{11}, 3.38$$

52. $\frac{1}{3}$, $0.\overline{13}$, $\frac{5}{13}$, 0.32

ANSWER:

$$0.\overline{13}, 0.32, \frac{1}{3}, \frac{5}{13}$$

53. $-1\frac{13}{14}$, -1.9 , $-1\frac{9}{11}$, -1.95

ANSWER:

$$-1.95, -1\frac{13}{14}, -1.9, -1\frac{9}{11}$$

54. $9\frac{4}{5}$, $9.\overline{79}$, $9\frac{11}{13}$, 9.82

ANSWER:

$$9.\overline{79}, 9\frac{4}{5}, 9.82, 9\frac{11}{13}$$

55. **ANIMALS** A lion's speed is $\frac{5}{7}$ the speed of a cheetah. Find the least rational number with a denominator of 9 that is greater than $\frac{5}{7}$. Find the greatest rational number with a denominator of 8 that is less than $\frac{5}{7}$. Write an inequality comparing the three numbers.

ANSWER:

$$\frac{7}{9}; \frac{5}{8}; \frac{5}{8} < \frac{5}{7} < \frac{7}{9}$$

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56. **OPEN ENDED** Choose a repeating decimal in which three digits repeat. Write the number as a fraction or mixed number in simplest form.

ANSWER:

Sample answer: $0.231\ldots$

$$1000N = 231.231\ldots$$

$$\begin{array}{r} -N = -0.231 \\ \hline \end{array}$$

$$999N = 231$$

$$\frac{999N}{999} = \frac{231}{999}$$

$$N = \frac{231}{999}$$

57. **WRITING IN MATH** Explain why $0.\overline{76}$ is greater than 0.76.

ANSWER:

Sample answer: Since $0.\overline{76} = 0.76767676\ldots$ and $0.76 = 0.76000000\ldots$, $0.\overline{76}$ is greater than 0.76.

58. **CHALLENGE** Antonio stated that $0.\overline{9} = 1$. Show that he is correct.

ANSWER:

Let $N = 0.999\ldots$ so, $10N = 9.999\ldots$

$$10N = 9.999\ldots$$

$$\begin{array}{r} -N = 0.999\ldots \\ \hline \end{array}$$

$$9N = 9$$

$$\frac{9N}{9} = \frac{9}{9}$$

$$N = 1$$

59. **REASONING** Determine whether the following statements are *true* or *false*. If true, explain your reasoning. If false, give a counterexample.

- a. All integers are rational numbers.
- b. All whole numbers are integers.
- c. A rational number is always an integer.
- d. All natural numbers are rational.

ANSWER:

a. true; Sample answer: Integers include all whole numbers and their opposites. Therefore, they belong to the set of rational numbers.

b. true; Sample answer: All whole numbers and their opposites belong to the set of integers.

c. false: Sample answer: $\frac{1}{2}$ is not an integer

d. true: Sample answer: All natural numbers are rational because they can be expressed as fractions.

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60. **WRITING IN MATH** How do you compare and order fractions and decimals? Give an example to explain your reasoning.

ANSWER:

Sample answer: Convert all the numbers to fractions or decimals. Then use a number line to compare.

61. Which fraction is between 0.12 and 0.15?

A $\frac{3}{25}$

B $\frac{1}{8}$

C $\frac{3}{20}$

D $\frac{1}{5}$

ANSWER:

B

62. Which of the following is *not* a rational number?

F $\frac{4}{9}$

G $-4.\overline{27}$

H $0.\overline{62}$

J $-3.131131113\dots$

ANSWER:

J

63. Last football season, Jason made 0.85 of his field goal attempts. Write this decimal as a fraction in simplest form.

A $\frac{85}{100}$

B $\frac{20}{17}$

C $\frac{17}{20}$

D $\frac{100}{85}$

ANSWER:

C

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64. **EXTENDED RESPONSE** The table shows the results of a survey about how students get to school.

Method of Transportation	Portion of Students
bus	0.40
walk	0.18
car	0.36
bicycle	0.04
other	0.02

- Write each decimal in the table as a fraction.
- List the methods of transportation in order from least to greatest.
- Which method of transportation do most students use to get to school?

ANSWER:

a. bus: $\frac{2}{5}$; walk: $\frac{9}{50}$; car: $\frac{9}{25}$; bicycle: $\frac{1}{25}$; other: $\frac{1}{50}$

b. other, bicycle, walk, car, bus

c. bus

Write each fraction as a decimal. Use a bar to show a repeating decimal.

65. $-\frac{5}{8}$

ANSWER:

-0.625

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

ANSWER:

$0.\overline{16}$

67. $-\frac{2}{10}$

ANSWER:

-0.2

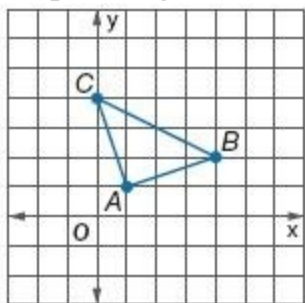
68. $\frac{4}{7}$

ANSWER:

$0.\overline{571428}$

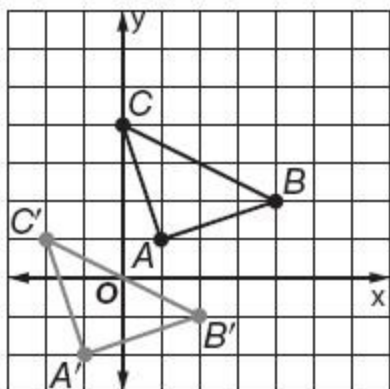
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Graph the figure below and its image after the transformation indicated.



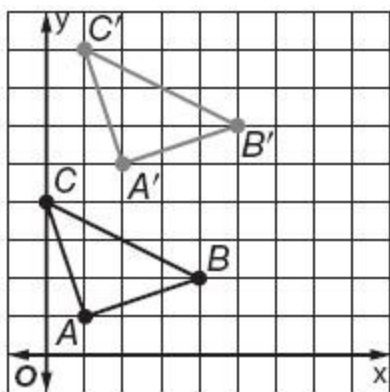
69. translation 3 units down and 2 units left

ANSWER:



70. translation 4 units up and 1 unit right

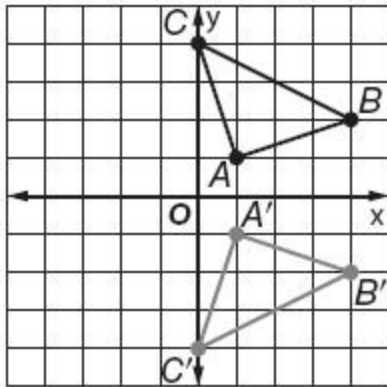
ANSWER:



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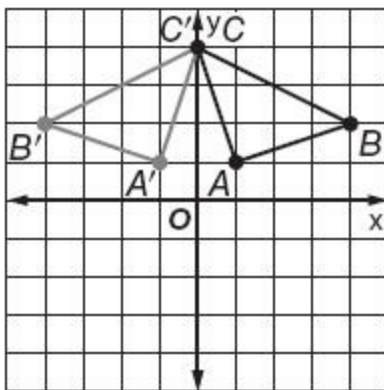
71. reflection across the x -axis

ANSWER:



72. reflection across the y -axis

ANSWER:



State the domain and range for each relation.

73. $\{(0, 0), (3, 2), (4, 6), (8, 12)\}$

ANSWER:

$$D = \{0, 3, 4, 8\}; R = \{0, 2, 6, 12\}$$

74. $\{(1, 2), (3, 4), (5, 6), (7, 8)\}$

ANSWER:

$$D = \{1, 3, 5, 7\}; R = \{2, 4, 6, 8\}$$

75. Mount Kilimanjaro's altitude is 5895 meters. Lake Assal's altitude is -155 meters. Find the difference between these altitudes.

ANSWER:

6050 m

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Find each product.

76. $-6(-12)$

ANSWER:

72

77. $15(-3)(-4)(0)$

ANSWER:

0

78. $-3(5)(-9)$

ANSWER:

135

79. $14(-20)$

ANSWER:

-280