

VOLUME 1



enVision[®] Mathematics

SAVVAS











CONTENTS

TOPICS








- 1 Real Numbers
- 2 Analyze and Solve Linear Equations
- 3 Use Functions to Model Relationships
- 4 Investigate Bivariate Data
- 5 Analyze and Solve Systems of Linear Equations
- 6 Congruence and Similarity
- 7 Understand and Apply the Pythagorean Theorem
- 8 Solve Problems Involving Surface Area and Volume

Topic Opener	2
enVision® STEM Project	4
Review What You Know	5
Math Literacy Activity	6
Pick a Project	7
1-1 Rational Numbers as Decimals	9
1-2 Understand Irrational Numbers	15
1-3 Compare and Order Real Numbers	21
1-4 Evaluate Square Roots and Cube Roots	27
1-5 Solve Equations Using Square Roots and Cube Roots	33
Mid-Topic Checkpoint	39
Mid-Topic Performance Task	40
1-6 Use Properties of Integer Exponents	41
1-7 More Properties of Exponents	47
1-8 Use Powers of 10 to Estimate Quantities	53
1-9 Understand Scientific Notation	59
3-Act Mathematical Modeling: Hard-Working Organs	65
1-10 Operations with Numbers in Scientific Notation	69
Topic Review	75
Fluency Practice Activity	81

Analyze and Solve Linear Equations

Topic Opener	82
enVision® STEM Project	84
Review What You Know	85
Math Literacy Activity	86
Pick a Project	87
 2-1 Combine Like Terms to Solve Equations	89
 2-2 Solve Equations with Variables on Both Sides	95
 2-3 Solve Multistep Equations	101
 2-4 Equations with No Solutions or Infinitely Many Solutions	107
Mid-Topic Checkpoint	115
Mid-Topic Performance Task	116
 3-Act Mathematical Modeling: Powering Down	117
 2-5 Compare Proportional Relationships	121
 2-6 Connect Proportional Relationships and Slope	127
 2-7 Analyze Linear Equations: $y = mx$	133
 2-8 Understand the y -Intercept of a Line	139
 2-9 Analyze Linear Equations: $y = mx + b$	145
Topic Review	151
Fluency Practice Activity	157

Use Functions to Model Relationships

Topic Opener	158
enVision® STEM Project	160
Review What You Know	161
Math Literacy Activity	162
Pick a Project	163
 3-1 Understand Relations and Functions	165
 3-2 Connect Representations of Functions	171
 3-3 Compare Linear and Nonlinear Functions	177
Mid-Topic Checkpoint	183
Mid-Topic Performance Task	184
 3-Act Mathematical Modeling: Every Drop Counts	185
 3-4 Construct Functions to Model Linear Relationships	189
 3-5 Intervals of Increase and Decrease	195
 3-6 Sketch Functions From Verbal Descriptions	201
Topic Review	207
Fluency Practice Activity	211







Investigate Bivariate Data

Topic Opener	212
enVision® STEM Project	214
Review What You Know	215
Math Literacy Activity	216
Pick a Project	217
4-1 Construct and Interpret Scatter Plots	219
4-2 Analyze Linear Associations	225
4-3 Use Linear Models to Make Predictions	231
Mid-Topic Checkpoint	237
Mid-Topic Performance Task	238
4-4 Interpret Two-Way Frequency Tables	239
4-5 Interpret Two-Way Relative Frequency Tables	245
3-Act Mathematical Modeling: Reach Out	251
Topic Review	255
Fluency Practice Activity	259






Analyze and Solve Systems of Linear Equations

Topic Opener	260
enVision® STEM Project	262
Review What You Know	263
Math Literacy Activity	264
Pick a Project	265
5-1 Estimate Solutions by Inspection	267
5-2 Solve Systems by Graphing	273
Mid-Topic Checkpoint	279
Mid-Topic Performance Task	280
5-3 Solve Systems by Substitution	281
5-4 Solve Systems by Elimination	287
3-Act Mathematical Modeling: Ups and Downs	293
Topic Review	297
Fluency Practice Activity	301

Congruence and Similarity

Topic Opener	302
enVision® STEM Project	304
Review What You Know	305
Math Literacy Activity	306
Pick a Project	307
 6-1 Analyze Translations	309
 6-2 Analyze Reflections	315
 6-3 Analyze Rotations	321
 6-4 Compose Transformations	327
 3-Act Mathematical Modeling: Tricks of the Trade	333
 6-5 Understand Congruent Figures	337
Mid-Topic Checkpoint	343
Mid-Topic Performance Task	344
 6-6 Describe Dilations	345
 6-7 Understand Similar Figures	351
 6-8 Angles, Lines, and Transversals	357
 6-9 Interior and Exterior Angles of Triangles	365
 6-10 Angle-Angle Triangle Similarity	371
Topic Review	377
Fluency Practice Activity	383

Understand and Apply the Pythagorean Theorem

Topic Opener	384
enVision® STEM Project	386
Review What You Know	387
Math Literacy Activity	388
Pick a Project	389
 3-Act Mathematical Modeling: Go with the Flow	391
 Understand the Pythagorean Theorem	395
 Understand the Converse of the Pythagorean Theorem	401
Mid-Topic Checkpoint	407
Mid-Topic Performance Task	408
 Apply the Pythagorean Theorem to Solve Problems	409
 Find Distance in the Coordinate Plane	415
Topic Review	421
Fluency Practice Activity	425

Solve Problems Involving Surface Area and Volume

Topic Opener	426
enVision® STEM Project	428
Review What You Know	429
Math Literacy Activity	430
Pick a Project	431
8-1 Find Surface Area of Three-Dimensional Figures	433
8-2 Find Volume of Cylinders	439
Mid-Topic Checkpoint	445
Mid-Topic Performance Task	446
8-3 Find Volume of Cones	447
8-4 Find Volume of Spheres	453
3-Act Mathematical Modeling: Measure Up	459
Topic Review	463
Fluency Practice Activity	467

Essential Question How can you write repeating decimals as fractions?



EXAMPLE 1



Write Repeating Decimals as Fractions

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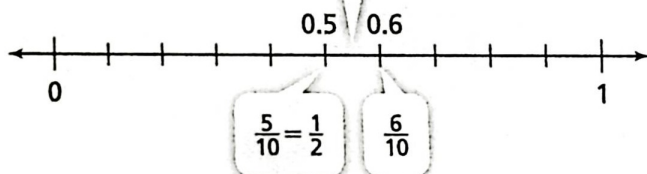
The Sluggers baseball team ended the season with the highest win percentage in their division. What is the Slugger's winning percentage written as a fraction?

Statistics are often rounded. Here, the decimal $0.555\ldots$ or $0.\overline{5}$ is rounded to the thousandths place.

	the record season	PCT
	Sluggers	.556
	Crushers	.512
	Bulldogs	.438
	Crusaders	.414
	Jaybirds	.389

Locate $0.555\ldots$ on a number line.

The decimal number $0.555\ldots$ is between 0.5 and 0.6; so it is between $\frac{1}{2}$, or $\frac{5}{10}$, and $\frac{6}{10}$.



Reasoning How do you know that the repeating decimal $0.555\ldots$ can be written as a fraction?

Write the repeating decimal as a fraction.

Assign a variable to represent the repeating decimal.

$$\text{Let } x = 0.\overline{5}.$$

$$10 \cdot x = 10 \cdot 0.\overline{5}$$

$$10x = 5.\overline{5}$$

$$10x - x = 5.\overline{5} - 0.\overline{5}$$

$$9x = 5$$

$$\frac{9x}{9} = \frac{5}{9}$$

$$x = \frac{5}{9}$$

Because $0.\overline{5}$ has 1 repeating digit, multiply each side of the equation by 10^1 , or 10.

Subtract $0.\overline{5}$ from each side of the equation, then solve for x . Because $x = 0.\overline{5}$, you can subtract x from one side and $0.\overline{5}$ from the other side.

The Sluggers won $\frac{5}{9}$ of their games.



Try It!

In another baseball division, one team had a winning percentage of $0.444\ldots$. What fraction of their games did this team win?

The team won of their games.

Convince Me! How do you know what power of ten to multiply by in the second step at the right?

$$\text{Let } x = 0.\overline{4}.$$

$$\boxed{} \cdot x = \boxed{} \cdot 0.\overline{4}$$

$$\boxed{} x = \boxed{}$$

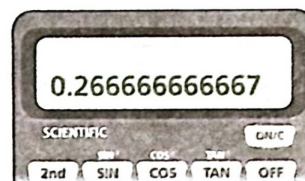
$$\boxed{} - x = \boxed{} - 0.\overline{4}$$

$$\boxed{} x = \boxed{}$$

$$x = \boxed{}$$

EXAMPLE 2**Write Repeating Decimals with Nonrepeating Digits as Fractions**

Sabine entered a division expression into her calculator. The quotient is shown on the calculator screen. What expression could Sabine have entered?



Let $x = 0.2\overline{6}$.

$$10x = 2.\overline{6}$$

Multiply by 10^1 , or 10, because the decimal has 1 repeating digit.

$$10x - x = 2.\overline{6} - 0.2\overline{6}$$

Subtract $0.2\overline{6}$ from each side of the equation, and then solve for x . Because $x = 0.2\overline{6}$, you can subtract x from one side and $0.2\overline{6}$ from the other side.

$$9x = 2.4$$

$$\frac{9x}{9} = \frac{2.4}{9}$$

$$x = \frac{24}{90}$$

Write an equivalent fraction so that the numerator and denominator are integers.

Sabine could have entered $24 \div 90$, or an equivalent expression such as $8 \div 30$.

Try It!

Write the repeating decimal $0.63333\ldots$ as a fraction.

EXAMPLE 3**Write Decimals with Multiple Repeating Digits as Fractions**

Write $2.\overline{09}$ as a mixed number.

Let $x = 2.\overline{09}$.

$$100 \cdot x = 100 \cdot 2.\overline{09}$$

$$100x - x = 209.\overline{09} - 2.\overline{09}$$

$$99x = 207$$

$$x = \frac{207}{99} \text{ or } 2\frac{1}{11}$$

The repeating decimal has 2 repeating digits, so multiply each side of the equation by 10^2 , or 100.

Subtract x from one side of the equation and its equivalent $2.\overline{09}$ from the other side of the equation.

Use Structure How do you know that subtracting x from one side of the equation and subtracting $2.\overline{09}$ from the other side results in an equivalent equation?

Try It!

Write the repeating decimal $4.1363636\ldots$ as a fraction.



Because repeating decimals are rational numbers, you can write them in fraction form.

STEP 1 Assign a variable to represent the repeating decimal.

STEP 2 Write an equation: *variable* = *decimal*.

STEP 3 Multiply each side of the equation by 10^d , where d is the number of repeating digits in the repeating decimal.

STEP 4 Subtract equivalent expressions of the variable and the repeating decimal from each side of the equation.

STEP 5 Solve for the variable. Write an equivalent fraction so that the numerator and denominator are integers, if necessary.

Do You Understand?

1. **Essential Question** How can you write repeating decimals as fractions?
2. **Use Structure** Why do you multiply by a power of 10 when writing a repeating decimal as a rational number?
3. **Be Precise** How do you decide by which power of 10 to multiply an equation when writing a decimal with repeating digits as a fraction?

Do You Know How?

4. A survey reported that $63.\overline{63}\%$ of moviegoers prefer action films. This percent represents a repeating decimal. Write it as a fraction.
5. A student estimates the weight of astronauts on the Moon by multiplying their weight by the decimal $0.16666\ldots$. What fraction can be used for the same estimation?
6. Write $2.3181818\ldots$ as a mixed number.



Practice & Problem Solving

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Leveled Practice In 7 and 8, write the decimal as a fraction or mixed number.

7. Write the number 0.21212121... as a fraction.

Let $x =$

$100x =$

$100x - x =$ $-$

$99x =$

$x =$

So 0.2121... is equal to .

8. Write 3.7 as a mixed number.

Let $x =$

$10x =$

$9x =$

$x =$

So $3.\overline{7}$ is equal to .

9. Write the number shown on the scale as a fraction.



10. Tomas asked 15 students whether summer break should be longer. He used his calculator to divide the number of students who said yes by the total number of students. His calculator showed the result as 0.9333....

a. Write this number as a fraction.

b. How many students said that summer break should be longer?

11. Write $0.\overline{87}$ as a fraction.

12. Write $0.\overline{8}$ as a fraction.