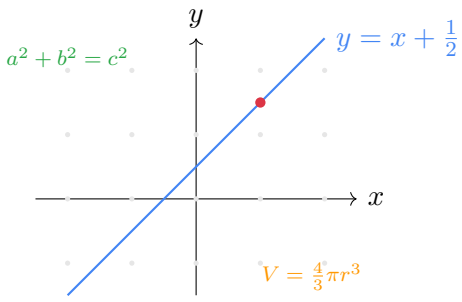
District of Columbia DC CAPE

8th Grade Math Workbook

Comprehensive Practice, Challenging Exercises, and Strategic Guidance for Complete Test-Day Confidence



Reza Nazari

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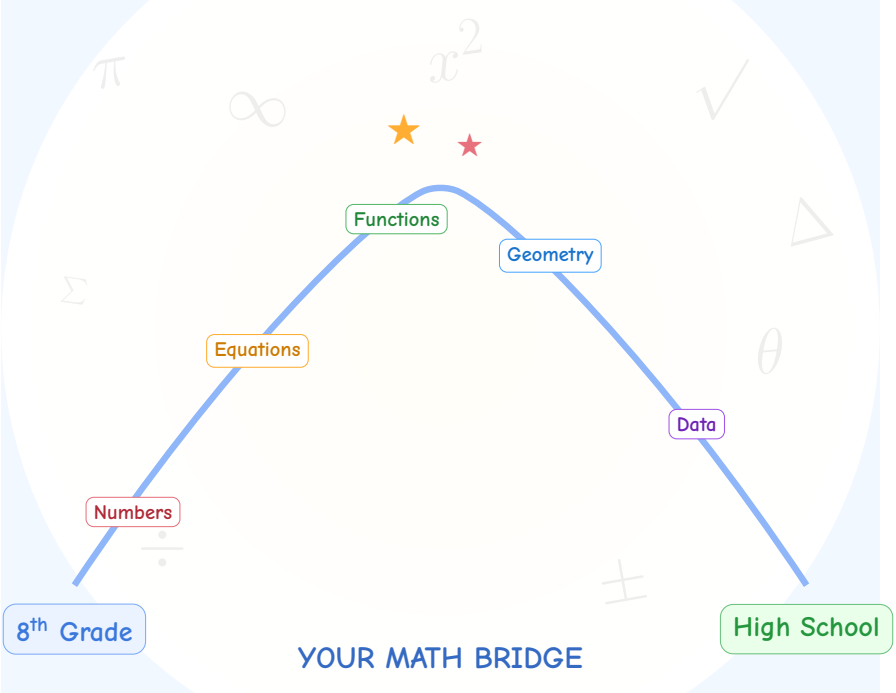
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Welcome, 8th Grader!

The Bridge Between Middle School and High School Starts Here



Dear Eighth Grader,

Welcome! This is *your* year. Everything you have built so far — working with fractions, decimals, ratios, and basic geometry — has been preparing you for this moment. Eighth-grade math is where all of those skills come together and open the door to high school and beyond.

8.G.1 Verify experimentally the properties of rotations, reflections, and translations:

8.G.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them

8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates

8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them

8.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles

8.G.6 Explain a proof of the Pythagorean Theorem and its converse

8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions

8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system

8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems

8.NS | The Number System

Understand and apply concepts of rational and irrational numbers

8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number

8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2)

8.SP | Statistics and Probability

Investigate patterns of association in bivariate data

8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association

8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept

8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables

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1.4 Understanding Scientific Notation

8.EE.3, 8.EE.4

Quick Review and Helpful Hints

Standard form: $a \times 10^n$, where $1 \leq a < 10$, $n \in \mathbb{Z}$

Large number → sci. notation: Count places the decimal moves *left*; exponent is positive.

$93{,}000{,}000 = 9.3 \times 10^7$

Small number → sci. notation: Count places the decimal moves *right*; exponent is negative.

$0.000045 = 4.5 \times 10^{-5}$

Example: Write $0.000\,000\,73$ in scientific notation.

The decimal must move *right* until the leading digit is just before the decimal: 7.3. Count the moves: $0.0000007\underbrace{3}$ → 7.3 takes 7 places. Moving right means a *negative* exponent. So $0.000\,000\,73 = 7.3 \times 10^{-7}$.

Answer: 7.3×10^{-7}

Practice Problems

Convert between standard form and scientific notation.

1. $5{,}200{,}000 =$ _____ $\times 10^{\square}$ _____
2. $0.0039 =$ _____ $\times 10^{\square}$ _____
3. $72{,}000 =$ _____ $\times 10^{\square}$ _____
4. $0.000\,000\,8 =$ _____ $\times 10^{\square}$ _____
5. $3.15 \times 10^4 =$ _____
6. $9.2 \times 10^{-3} =$ _____
7. $1.07 \times 10^6 =$ _____
8. $6.4 \times 10^{-5} =$ _____
9. Is 12×10^3 in proper sci. notation? _____
10. Write 12×10^3 properly: _____
11. $314{,}000{,}000 =$ _____ $\times 10^{\square}$ _____
12. $0.000\,000\,000\,5 =$ _____ $\times 10^{\square}$ _____

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Word Problems

13. Earth's population is approximately 8×10^9 people and the population of Canada is approximately 4×10^7 people. How many times larger is Earth's population than Canada's? Write your answer as a whole number. _____

14. A bacterium is about 2×10^{-6} m wide and a virus is about 3×10^{-8} m wide. How many times wider is the bacterium than the virus? Express the answer in standard form. _____

15. The national debt of a country is approximately $\$3.1 \times 10^{13}$. The country has about 3.3×10^8 citizens. (a) Write each number in standard form. (b) Estimate the debt per citizen by dividing. Express your answer in both scientific notation and standard form. _____

16. A human hair is about 7×10^{-5} m wide. A red blood cell is about 7×10^{-6} m wide. (a) How many times wider is a hair than a red blood cell? (b) If you lined up red blood cells side by side across a 1-cm-wide microscope slide, about how many would fit? _____

17. A computer can perform 4.8×10^9 calculations per second. A weather simulation requires 8.64×10^{14} calculations. (a) How many seconds will the simulation take? Give the answer in scientific notation. (b) Convert that time to hours. (c) Is this more or less than one full day? _____

★ Chapter 1 Answer Key ★

Number Systems & Exponents

Topic 1 • Rational and Irrational Numbers

1) 3
2) 7
3) -12
4) Rational
5) Irrational
6) Irrational
7) Rational
8) Irrational
9) Rational
10) Irrational
11) Irrational
12) 13
13) Irrational
14) Yes
15) Irrational
16) No
17) Rational; 8 ft
18) 4 rational
19) False

Topic 7 • Properties of Integer Exponents

1) 128
2) 125
3) 729
4) $\frac{1}{4}$
5) 1
6) 1
7) $\frac{1}{9}$
8) 8
9) $\frac{1}{4}$
10) $\frac{1}{36}$
11) $\frac{1}{25}$
12) $\frac{16}{9}$
13) 16
14) $\frac{1}{12}$
15) 3
16) 128
17) $\frac{1}{144}$
18) 1
19) $2^{15} = 32{,}768$ bytes
20) $3^3 = 27$; Ava is correct
21) $2^{25} \div 2^{10} = 2^{15} = 32{,}768\ \mu s \approx 0.033$ s
22) $6^{3+(-5)-(-4)} = 6^2 = 36$
23) Colony A $= 3^8$, Colony B $= 3^7$; A is 3 times larger

Topic 8 • Square Roots and Cube Roots

1) 5
2) 9
3) 2
4) 3
5) -10
6) -4
7) 5
8) 13
9) ± 7
10) 10
11) ± 11
12) -3
13) -5
14) 15
15) $\pm \frac{1}{2}$
16) $\frac{1}{2}$
17) 56 m
18) No; side $= \sqrt[3]{1029} \approx 10.1$ cm
19) Bed A side = 15 ft, Bed B side = 12 ft; combined perimeter = 84 ft
20) Side $= \sqrt[3]{512} = 8$ in; new volume $= 16^3 = 4096$ in^3; 8 times more
21) Side A = 3 ft, side B = 5 ft; floor area $= 9 + 25 = 34$ ft^2; height diff = 2 ft

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