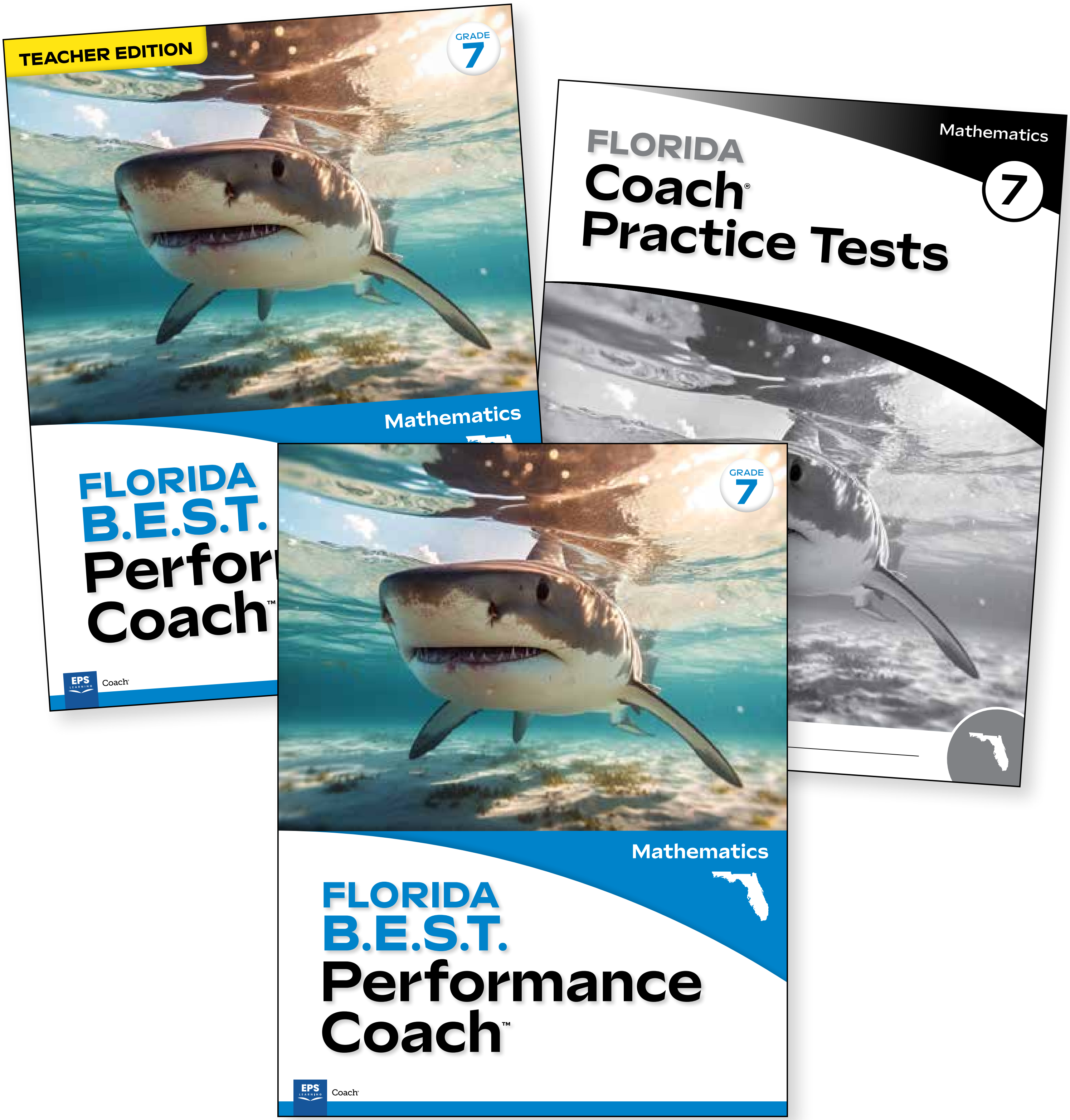
SAMPLER

Includes a Student Edition lesson and Practice Tests samples



CONTENTS

LESSON 4

Dividing Rational Numbers

1 GETTING THE IDEA

When you multiply rational numbers, you can use the signs of the factors to determine the product. You can use what you know about multiplication to help you understand the rules for dividing rational numbers.

Example 1

Find these quotients:

$20 \div 5$ $-20 \div -5$ $20 \div -5$ $-20 \div 5$

Strategy **Use multiplication facts to divide signed integers.**

Step 1 Divide $20 \div 5$.

Ask: What number times 5 equals 20?

Try positive 4: $4 \times 5 = 20$ ✓

So, $20 \div 5 = 4$.

Step 2 Divide $-20 \div -5$.

Ask: What number times -5 equals -20?

Try positive 4: $4 \times -5 = -20$ ✓

So, $-20 \div -5 = 4$.

Step 3 Divide $20 \div -5$

Ask: What number times -5 equals positive 20?

Try positive 4: $4 \times -5 = -20$ Not correct

Try negative 4: $-4 \times -5 = 20$ ✓

So, $20 \div -5 = -4$.

Step 4 Divide $-20 \div 5$.

Ask: What number times 5 equals -20?

Try positive 4: $4 \times 5 = 20$ Not correct

Try negative 4: $-4 \times 5 = -20$ ✓

So, $-20 \div 5 = -4$.

Solution **The first two quotients are positive: $20 \div 5 = 4$; $-20 \div -5 = 4$. The last two quotients are negative: $20 \div -5 = -4$; $-20 \div 5 = -4$.**

The examples above illustrate the rules for dividing rational numbers.

- If the numbers have the same sign, the quotient is positive.

  $(+) \div (+) = (+) \quad (-) \div (-) = (+)$

- If the numbers have different signs, the quotient is negative.

  $(+) \div (-) = (-) \quad (-) \div (+) = (-)$

Recall that the product of a number and its multiplicative inverse, or reciprocal, is 1.

One way to divide a rational number is to write it as a fraction or a complex fraction and simplify it. Another way is to multiply the dividend by the reciprocal of the divisor.

Example 2

Divide. $-\frac{3}{8} \div -\frac{9}{10}$

Strategy **Multiply the dividend by the reciprocal of the divisor.**

Step 1 Find the reciprocal of the divisor, $-\frac{9}{10}$.

$$-\frac{9}{10} \times -\frac{10}{9} = 1$$

So, the reciprocal of $-\frac{9}{10}$ is $-\frac{10}{9}$.

Step 2 Multiply by the reciprocal of the divisor.

$$-\frac{3}{8} \div -\frac{9}{10} = -\frac{3}{8} \cdot -\frac{10}{9}$$

$$= \frac{-3 \times -10}{8 \times 9}$$

$$= \frac{30}{72}$$

Simplify: $\frac{30}{72} = \frac{5}{12} \times \frac{6}{6} = \frac{5}{12}$

The dividend and the divisor have the same sign (−), so the quotient is positive.

Solution $-\frac{3}{8} \div -\frac{9}{10} = \frac{5}{12}$

Example 3

Find the quotient of $\left(-6\frac{3}{4} \div 4\frac{1}{2}\right) \div 1\frac{1}{2}$.

Strategy **Use the rules for dividing fractions.**

Step 1 Rewrite the expression with improper fractions.

Write each mixed number as a fraction.

$$-6\frac{3}{4} = -\frac{27}{4} \qquad 4\frac{1}{2} = \frac{9}{2} \qquad 1\frac{1}{2} = \frac{3}{2}$$

$$\left(-6\frac{3}{4} \div 4\frac{1}{2}\right) \div 1\frac{1}{2} = \left(-\frac{27}{4} \div \frac{9}{2}\right) \div \frac{3}{2}$$

Step 2 Divide the expression in parentheses.

$$-\frac{27}{4} \div \frac{9}{2} = -\frac{27}{4} \cdot \frac{2}{9}$$

$$= \frac{-27 \times 2}{4 \times 9}$$

$$= -\frac{54}{36}$$

So, $\left(\frac{-27}{4} \div \frac{9}{2}\right) \div \frac{3}{2} = -\frac{54}{36} \div \frac{3}{2}$.

Step 3 Divide the remaining numbers.

$$-\frac{54}{36} \div \frac{3}{2} = -\frac{54}{36} \times \frac{2}{3}$$

$$= \frac{-54 \times 2}{36 \times 3}$$

$$= \frac{-108}{108}$$

$$= -1$$

Solution **The quotient of $\left(-6\frac{3}{4} \div 4\frac{1}{2}\right) \div 1\frac{1}{2}$ is -1.**

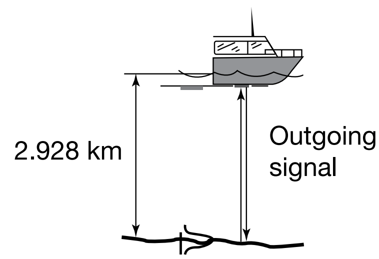
Example 4

Oceanographers found the depth of one area of the ocean to be 2.928 kilometers. To determine this depth, they sent out a signal and recorded the time it took for the signal to echo back. The speed of sound in water is approximately 1.5 kilometers per second. How many seconds did it take for the signal to echo back?

Strategy **Determine the steps needed to solve the problem.**

Step 1 Draw a diagram.

Label the diagram with the information you know.



The signal goes to the bottom of the ocean and echoes back. So the signal travels the depth of the ocean twice.

Step 2 Write an expression to find the time, t.

The signal travels at a rate, r, of 1.5 kilometers per second.

Since the signal travels to the bottom and back, the distance, d, is: 2×2.928.

Since $d = r \cdot t$, $t = \frac{d}{r}$.

The expression $\frac{2 \times 2.928}{1.5}$ represents this problem.

Step 3 Use the order of operations to find the time.

Multiply first. Then divide.

$$\frac{2 \times 2.928}{1.5} = \frac{5.856}{1.5} = 3.904$$

Solution **It took the signal approximately 3.904 seconds to echo back to the boat.**

2 COACHED EXAMPLE

Katie is conducting an experiment. She has a pan in her yard to collect rainwater. She leaves water in the pan after each storm so she can track how quickly it evaporates. Katie recorded the changes in the depth of water in the pan every week. What was the average change in water depth per week?

Week	Depth Change
0	0 in.
1	$+1\frac{1}{2}$ in.
2	$-\frac{1}{4}$ in.
3	$+3$ in.
4	$-2\frac{3}{4}$ in.

The table shows the change in the depth of the water over ________ weeks.

So, to find the average change in the depth of the water, add the depth changes.

Then ________ by the number of weeks.

Add the depth changes.

________ + ________ + ________ + ________ = ____________________________

Find the average change.

________ inches ÷ ________ weeks = ____________________________

The average change in water depth was ________ inch(es) per week.

1 What is $-17 \div 25$?

- A. -0.068
- B. -0.68
- C. 0.068
- D. 0.68

2 Ms. Ambrose paid $10 for 1.25 pounds of almonds. How much did the almonds cost per pound?

- A. $8.00
- B. $8.75
- C. $11.25
- D. $12.50

3 Which is **not** equivalent to $\left(\frac{1}{2} \div \frac{3}{4}\right) \div \left(-1\frac{1}{3}\right)$?

- A. $\frac{2}{3} \div \left(-1\frac{1}{3}\right)$
- B. $\left(\frac{1}{2} \times 1\frac{1}{3}\right) \div \left(-1\frac{1}{3}\right)$
- C. $\left(\frac{1}{2} \div \frac{3}{4}\right) \times \left(-\frac{4}{3}\right)$
- D. $-\frac{1}{2}$

4 Which of the following expressions has a value of 6.18?

- A. $-42.36 \div -7.2$
- B. $-21.012 \div -3.4$
- C. $-24.72 \div 4.8$
- D. $-37.08 \div 6$

5 What number makes the following equation true?

$$-\frac{3}{4} \div \square = \frac{3}{32}$$

- A. $-\frac{1}{8}$
- B. $-\frac{1}{4}$
- C. -4
- D. -8

6 Molly played an online game three times. Her scores were 5.5, −3.6, and 12.8. What was her average score for the three games?

- A. 4.9
- B. 6.1
- C. 7.3
- D. 14.7

7 Jasper is making mini picture frames. For each frame he needs four pieces of wood that are each $2\frac{3}{4}$ inches long. He has a wood board that is 6 feet long. How many frames can he make?

- A. 2
- B. 6
- C. 14
- D. 26

8 Check the boxes in the table to show whether each quotient is positive or negative.

Quotient	Positive	Negative
$518 \div (-45)$	○	○
$9.3 \div 0.04$	○	○
$-\frac{5}{7} \div \left(-2\frac{1}{4}\right)$	○	○
$3\frac{1}{9} \div \left(-6\frac{1}{5}\right)$	○	○
$-28.9 \div (-84)$	○	○
$-7\frac{3}{8} \div 1\frac{4}{5}$	○	○

9 Toby says the multiplicative inverse of $-2\frac{3}{8}$ is $-2\frac{8}{3}$. Sasha says the multiplicative inverse of $-2\frac{3}{8}$ is $\frac{8}{19}$. Who is correct—Toby, Sasha, neither or both? Explain your thinking.

10 Which expression has a quotient of −3.25? Mark all that apply.

- ○ **A.** $-1.46 \div 0.45$
- ○ **B.** $-22.1 \div 6.8$
- ○ **C.** $2.275 \div (-0.7)$
- ○ **D.** $-33.8 \div 10.4$
- ○ **E.** $8.75 \div (-2.7)$
- ○ **F.** $39 \div (-12)$

11 Is the following statement always true, sometimes true, or never true? Justify your answer.

The quotient of any two nonzero integers, *a* and *b*, is always a rational number.

12 The ABC Company has earned a total profit of −\$1,312.50 since it was founded 2.5 years ago.

Write and evaluate an expression to show the average annual profit for the ABC Company. What does the sign of the quotient indicate about the company's profits?

13 Ben needs $1\frac{3}{8}$ feet of fabric to make one banner. How many banners can he make from $4\frac{1}{2}$ yards of fabric? Justify your answer.

14 Show that this statement is true.

If a and b are integers and $b \neq 0$, then $-\left(\frac{a}{b}\right) = \frac{(-a)}{b} = \frac{a}{(-b)}$.

Part A

Choose two positive values for a and b. See if those values make the equation true.

Part B

Choose a negative value for a and a positive value for b. See if those values make the equation true.

Part C

Why must b be a nonzero integer? Could a be zero? Explain.

Florida B.E.S.T. Standards Correlation Chart

The following table matches the standards to the lessons in which they are addressed.

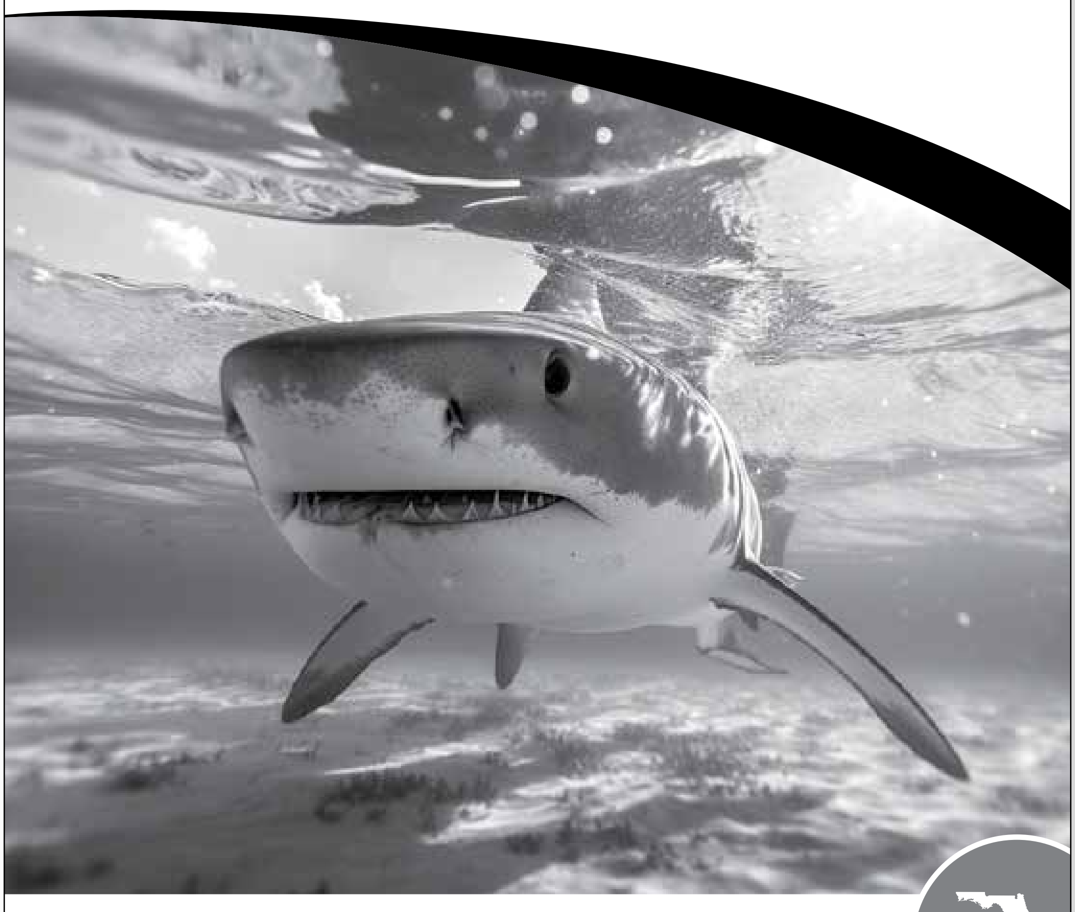
Standard	Grade 7	Lesson(s)
	Number Sense and Operations	
Rewrite numbers in equivalent forms.		
MA.7.NSO.1.1	Know and apply the Laws of Exponents to evaluate numerical expressions and generate equivalent numerical expressions, limited to whole-number exponents and rational number bases.	7
MA.7.NSO.1.2	Rewrite rational numbers in different but equivalent forms including fractions, mixed numbers, repeating decimals and percentages to solve mathematical and real-world problems.	5
Add, subtract, multiply and divide rational numbers.		
MA.7.NSO.2.1	Solve mathematical problems using multi-step order of operations with rational numbers including grouping symbols, whole-number exponents and absolute value.	8
MA.7.NSO.2.2	Add, subtract, multiply and divide rational numbers with procedural fluency.	1, 2, 3, 4
MA.7.NSO.2.3	Solve real-world problems involving any of the four operations with rational numbers.	6
	Algebraic Reasoning	
Rewrite algebraic expressions in equivalent forms.		
MA.7.AR.1.1	Apply properties of operations to add and subtract linear expressions with rational coefficients.	14
MA.7.AR.1.2	Determine whether two linear expressions are equivalent.	14
Write and solve equations and inequalities in one variable.		
MA.7.AR.2.1	Write and solve one-step inequalities in one variable within a mathematical context and represent solutions algebraically or graphically.	15
MA.7.AR.2.2	Write and solve two-step equations in one variable within a mathematical or real-world context, where all terms are rational numbers.	16
Use percentages and proportional reasoning to solve problems.		
MA.7.AR.3.1	Apply previous understanding of percentages and ratios to solve multi-step real-world percent problems.	13
MA.7.AR.3.2	Apply previous understanding of ratios to solve real-world problems involving proportions.	11
MA.7.AR.3.3	Solve mathematical and real-world problems involving the conversion of units across different measurement systems.	12
Analyze and represent two-variable proportional relationships.		
MA.7.AR.4.1	Determine whether two quantities have a proportional relationship by examining a table, graph or written description.	9, 10
MA.7.AR.4.2	Determine the constant of proportionality within a mathematical or real-world context given a table, graph or written description of a proportional relationship.	9, 10
MA.7.AR.4.3	Given a mathematical or real-world context, graph proportional relationships from a table, equation or a written description.	10
MA.7.AR.4.4	Given any representation of a proportional relationship, translate the representation to a written description, table or equation.	10
MA.7.AR.4.5	Solve real-world problems involving proportional relationships.	11

Standard	Grade 7	Lesson(s)
Geometric Reasoning		
Solve problems involving two-dimensional figures, including circles.		
MA.7.GR.1.1	Apply formulas to find the areas of trapezoids, parallelograms and rhombi.	17
MA.7.GR.1.2	Solve mathematical or real-world problems involving the area of polygons or composite figures by decomposing them into triangles or quadrilaterals.	17
MA.7.GR.1.3	Explore the proportional relationship between circumferences and diameters of circles. Apply a formula for the circumference of a circle to solve mathematical and real-world problems.	18
MA.7.GR.1.4	Explore and apply a formula to find the area of a circle to solve mathematical and real-world problems.	18
MA.7.GR.1.5	Solve mathematical and real-world problems involving dimensions and areas of geometric figures, including scale drawings and scale factors.	19
Solve problems involving three-dimensional figures, including right circular cylinders.		
MA.7.GR.2.1	Given a mathematical or real-world context, find the surface area of a right circular cylinder using the figure's net.	20
MA.7.GR.2.2	Solve real-world problems involving surface area of right circular cylinders.	20
MA.7.GR.2.3	Solve mathematical and real-world problems involving volume of right circular cylinders.	20
Data Analysis and Probability		
Represent and interpret numerical and categorical data.		
MA.7.DP.1.1	Determine an appropriate measure of center or measure of variation to summarize numerical data, represented numerically or graphically, taking into consideration the context and any outliers.	23
MA.7.DP.1.2	Given two numerical or graphical representations of data, use the measure(s) of center and measure(s) of variability to make comparisons, interpret results and draw conclusions about the two populations.	24
MA.7.DP.1.3	Given categorical data from a random sample, use proportional relationships to make predictions about a population.	21
MA.7.DP.1.4	Use proportional reasoning to construct, display and interpret data in circle graphs.	22
MA.7.DP.1.5	Given a real-world numerical or categorical data set, choose and create an appropriate graphical representation.	22
Develop an understanding of probability. Find and compare experimental and theoretical probabilities.		
MA.7.DP.2.1	Determine the sample space for a simple experiment.	25
MA.7.DP.2.2	Given the probability of a chance event, interpret the likelihood of it occurring. Compare the probabilities of chance events.	25
MA.7.DP.2.3	Find the theoretical probability of an event related to a simple experiment.	25
MA.7.DP.2.4	Use a simulation of a simple experiment to find experimental probabilities and compare them to theoretical probabilities.	25

Mathematics

FLORIDA Coach® Practice Tests

7



EPS LEARNING Coach

Name: ____________________

PRACTICE TESTS

SAMPLES

19. The cost of 4 museum tickets is \$9. Which equation represents the relationship between the price of a museum ticket, t, and the total cost for all tickets, C?

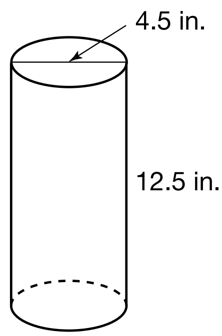
Ⓐ $C = 4t$

Ⓑ $C = 9t$

Ⓒ $C = 2.25t$

Ⓓ $C = 0.44t$

20. A cylinder with a height of 12.5 inches and a diameter of 4.5 inches is shown below.



Which is closest to the volume of the cylinder? (Use 3.14 for π.)

Ⓐ 177 in.^{3}

Ⓑ 199 in.^{3}

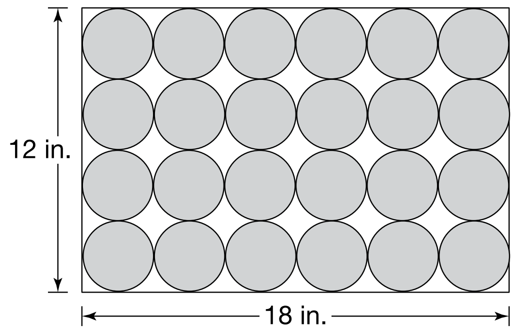
Ⓒ 795 in.^{3}

Ⓓ 2,208 in.^{3}

Practice Test 2

Go On

21. A cookie sheet that is 12 inches (in.) wide and 18 inches (in.) long has 24 cookies on it, packed tightly.



What is the area, in **square inches**, of each cookie? Use 3.14 for π.

Write your response in the shaded box below.

22. Letter cards for the phrase GEOMETRY ROCKS are placed into a bag. What is the sample space for choosing a card from this bag?

Ⓐ {C, E, E, G, K, M, O, O, R, R, S, T, Y}

Ⓑ {C, E, G, K, M, O, R, S, T, Y}

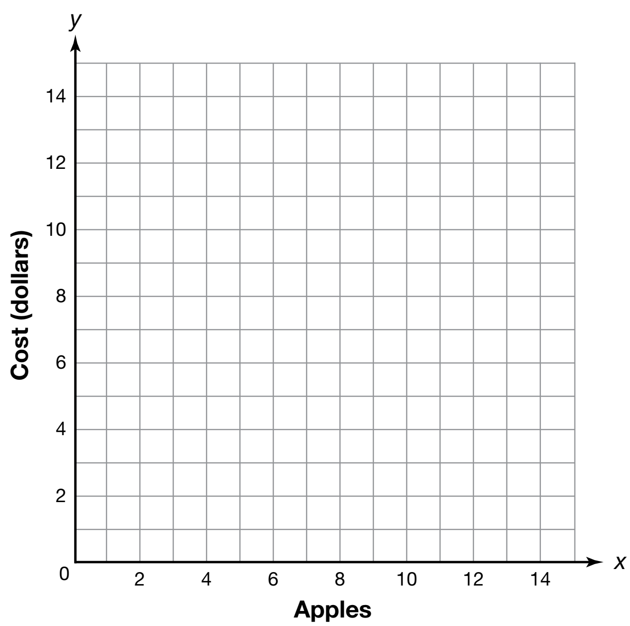
Ⓒ {C, G, K, M, R, S, T, Y}

Ⓓ {C, G, K, M, R, S, T}

Go On

23. The cost of 3 apples is $1.50.

Create a graph to represent the relationship between the number of apples and the cost.



24. Select all the expressions that are equivalent to the expression below.

$$1.5(2a + b) - 0.6(2a + b)$$

Ⓐ $0.9(2a + b)$

Ⓑ $3a + 1.5b - 1.2a + 0.6b$

Ⓒ $1.8a + 0.9b$

Ⓓ $3a + b - 1.2a - b$

Ⓔ $3a + 1.5b - 1.2a - 0.6b$

Go On

25. This question has **two** parts.

The table below shows the proportional relationship between the number of greeting cards Wyatt sold and the amount he collected.

GREETING CARD SALES

Number Sold (x)	Total Collected (in dollars) (y)
2	9.00
4	18.00
7	31.50
12	54.00

Part A

Which equation represents this relationship?

Ⓐ $y = 0.22x$

Ⓑ $y = 4.50x$

Ⓒ $y = 7.00x$

Ⓓ $y = 9.00x$

Part B

Wyatt sold 9 cards. How much money did he collect?

Ⓐ $9.00

Ⓑ $18.00

Ⓒ $40.50

Ⓓ $54.00

Go On

Mathematics

FLORIDA B.E.S.T. Performance Coach™

GRADES 3–8

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