Core Knowledge® MATHEMATICS

Putting It All Together

Student Workbook

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Putting It All Together

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Putting It All Together

Student Workbook

Core Knowledge Mathematics™

Lesson 1: Find the Largest Product

- Let's look for patterns when we multiply multi-digit numbers.

Warm-up: Notice and Wonder: Digits

What do you notice? What do you wonder?

$$\begin{array}{r} 8\,4\,1 \\ \times\quad\;\; 6 \\ \hline \end{array} \qquad \begin{array}{r} 6\,4\,1 \\ \times\quad\;\; 8 \\ \hline \end{array}$$

1.1: Talk About it

1. Consider the statement below. Decide whether you agree, disagree, or are unsure. Be prepared to explain your reasoning.

	agree	disagree	unsure
Given the digits 7, 5, and 2, the largest product you can make is 75×2 because 75 is the largest number you can make.			
After round 1: Given the digits 7, 5, and 2, the largest product you can make is 75×2 because 75 is the largest number you can make.			

Write about something new that you learned from your group or something you still wonder about:

2. Use the digits 6, 3, and 1 to make the largest possible product. Be prepared to explain your reasoning.

1.2: More Digits

1. Use the digits 7, 3, 2, and 5 to make the greatest product.

2. Explain or show how you know you have made the greatest product.

Lesson 2: More Multiplication

- Let's practice using the multiplication algorithm.

Warm-up: Estimation Exploration: Large Product

$9{,}999 \times 896$

Record an estimate that is:

too low	about right	too high

2.1: Kiran's Work

1. Find the value of the product.

$$\begin{array}{r} 6\ 5\ 0 \\ \times\quad 2\ 7 \\ \hline \end{array}$$

2. Below is Kiran's work finding the value of the product 650×27. Is his answer reasonable? Explain your reasoning.

$$\begin{array}{r} {\scriptstyle 1\ \ \ } \\ {\scriptstyle 3\ \ \ } \\ 6\ 5\ 0 \\ \times\quad 2\ 7 \\ \hline 4,\ 5\ 5\ 0 \\ +\ 1,\ 3\ 0\ 0 \\ \hline 5,\ 8\ 5\ 0 \end{array}$$

3. What parts of the work do you agree with? Be prepared to explain your reasoning.

4. What parts of the work do you disagree with? Be prepared to explain your reasoning.

5. Look at your solution to problem 1. Is there anything you want to revise? Be prepared to explain.

2.2: Zero the Hero

Find the value of each product.

1.

$$\begin{array}{r} 260 \\ \times\ 35 \\ \hline \end{array}$$

2.

$$\begin{array}{r} 2,600 \\ \times\ 35 \\ \hline \end{array}$$

3.

$$\begin{array}{r} 670 \\ \times\ 89 \\ \hline \end{array}$$

4.

$$\begin{array}{r} 6,700 \\ \times\ 89 \\ \hline \end{array}$$

Lesson 3: Factors as a Factor in Our Strategy Choice

- Let's reason about strategies we use to multiply.

Warm-up: Number Talk: Increasing Factors

Find the value of each expression mentally.

- 230×10

- 230×12

- 230×15

- 232×15

3.1: Choose a Multiplication Strategy

Find the value of each expression. Explain or show your reasoning.

1. 14×3

2. 14×101

3. 14×25

4. 14×9

5. 14×136

3.2: Compare Strategies

Find the value of each expression.

1. 29×7

2. 12×45

3. 15×199

4. 24×154

Lesson 4: Dive Back Into Division

- Let's estimate and divide.

Warm-up: Notice and Wonder: Blank Spaces

What do you notice? What do you wonder?

$$_____ \div _____ = 136$$

4.1: Reasonable Estimates

1. Circle the most reasonable estimate. Show your reasoning.

a. $364 \div 13$

20

30

40

b. $540 \div 12$

40

50

60

c. $1{,}008 \div 14$

70

80

90

2. Find the value of each quotient.

a.

$13\overline{)364}$

b.

$12\overline{)540}$

c.

$14\overline{)1,008}$

4.2: Missing Dividends and Divisors

1. Write different numbers in the blanks that make the equations true.

$_____ \div _____ = 700$	$_____ \div _____ = 78$
$_____ \div _____ = 700$	$_____ \div _____ = 78$
$_____ \div _____ = 700$	$_____ \div _____ = 78$
$_____ \div _____ = 700$	$_____ \div _____ = 78$
$_____ \div _____ = 700$	$_____ \div _____ = 78$

2. What strategy did you use to choose numbers to write in the blanks?

Lesson 5: More Division

- Let's divide.

Warm-up: Estimation Exploration: Large Quotient

$9{,}953 \div 37$

Record an estimate that is:

too low	about right	too high

5.1: Elena's Work

1. Find the value of the quotient.

$$13\overline{)6,773}$$

2. Here is how Elena found the quotient. Is her answer reasonable?

   Explain or show your reasoning.

$$
\begin{array}{rl}
 & \boxed{53} \\
 & 1 \\
 & 2 \\
 & 50 \\
13\overline{)6773} & \\
-\ 650 & (50 \times 13) \\
\hline
 & 273 \\
-\ 26 & (2 \times 13) \\
\hline
 & 13 \\
-\ 13 & (1 \times 13) \\
\hline
 & 0
\end{array}
$$

3. What parts of the work do you agree with? Be prepared to explain your reasoning.

4. What parts of the work do you disagree with? Be prepared to explain your reasoning.

5. Look at your solution to problem 1. Is there anything you want to revise? Be prepared to explain.

5.2: Partial Quotients Practice

1. Use partial quotients to find the value of one of the quotients. Be prepared to explain how you found the quotient.

   Partner A:

   $37\overline{)2,516}$

   Partner B:

   $32\overline{)2,272}$

2. Explain to your partner how you found the quotient in your problem.

Section Summary

Section Summary

We investigated some different ways to find products and quotients, making sure to estimate the value before calculating. For example, the product 49×68 is about 50×70 or $3{,}500$. We looked at two different ways to show the newly composed units.

We also found quotients using partial products and saw that there are many different ways to do this.

```
   66
    6
   60
27 )1,782
 − 1,620
    162
 −  162
      0
```

```
   66
    1
    5
   30
   30
27 )1,782
 −  810
    972
 −  810
    162
 −  135
     27
 −   27
      0
```

The first calculation uses only 2 products but the products are more challenging to calculate. The second calculation uses 4 products but they are easier to calculate.

Lesson 6: Revisit Volume

- Let's solve problems about volume.

Warm-up: Estimation Exploration: Sugar Cubes

How many cubes are in the bowl?

Record an estimate that is:

too low	about right	too high

6.1: 126 Cubes

A company packages 126 sugar cubes in each box. The box is a rectangular prism.

1. What are some possible ways they could pack the cubes?

2. How would you choose to pack the cubes? Explain or show your reasoning.

3. The side lengths of the box are about $1\frac{7}{8}$ inches by $3\frac{3}{4}$ inches by $4\frac{3}{8}$ inches. What can we say about how the sugar cubes are packed?

6.2: Colossal Structures Old and New

1. The base of the Great Pyramid of Egypt is a square. One side length of the base is 230 meters. The pyramid is 140 meters tall. If the pyramid was shaped like a rectangular prism, what would the volume of the prism be?

2. The Empire State Building is in New York City. The base is 129 meters by 59 meters. The building is 373 meters tall. Estimate the volume of the Empire State Building.

3. Which do you think is larger, the Great Pyramid or the Empire State Building? Explain or show your reasoning.

Lesson 7: Estimating the Volume of the World's Largest Wagon

- Let's solve problems about volume.

Warm-up: Notice and Wonder: Radio Flyer

What do you notice? What do you wonder?

7.1: Anatomy of an Estimate

1. What measurements would you take of the wagon to accurately estimate its volume?

2. What units would you use to measure the wagon? Explain your reasoning.

3. Record an estimate for the volume of the wagon that is:

too low	about right	too high

4. What can you use in the picture to refine your estimate?

7.2: Estimating the Size of the Radio Flyer

1. Use the picture of the wagon to make a better estimate of the length, width, and height of the wagon bed.

   Make sure to:

   - explain how you estimated each measurement
   - include how accurate you think each estimate is

2. Then improve your estimate for the volume of the wagon.

Lesson 8: Filling up the World's Largest Wagon

- Let’s solve more problems about volume.

Warm-up: Notice and Wonder: Toy Boxes

What do you notice? What do you wonder?

8.1: Sand Wagon

The Radio Flyer wagon is 27 feet long, 13 feet wide, and 2 feet deep.

1. A 150-pound bag of sand will fill about 9 cubic feet. How many bags of sand will it take to fill the wagon with sand?

2. A 150-pound bag of sand costs about $12. About how much will it cost to fill the wagon with sand? Explain or show your reasoning.

3. How many pounds of sand does the Radio Flyer hold when it is full? Explain or show your reasoning.

8.2: More Boxes

The Radio Flyer wagon is 27 feet long 13 feet wide and 2 feet deep.

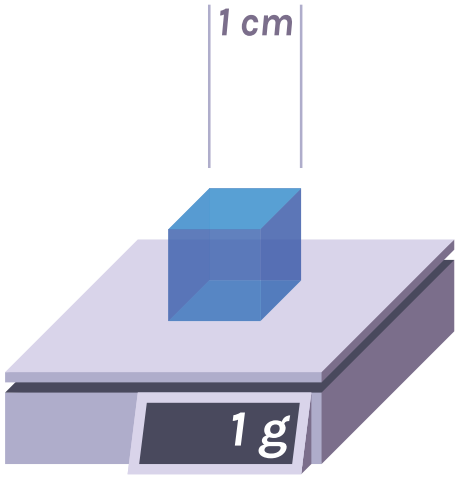
The wagon is being used to deliver 4,000 boxes that each have the side lengths 2 feet by 2 feet by 2 feet. How many trips will the wagon have to make? Explain or show your reasoning.

Lesson 9: Problem Solving with Volume: Water

- Let's solve problems about volume of water.

Warm-up: Notice and Wonder: Cubic Centimeters and Grams

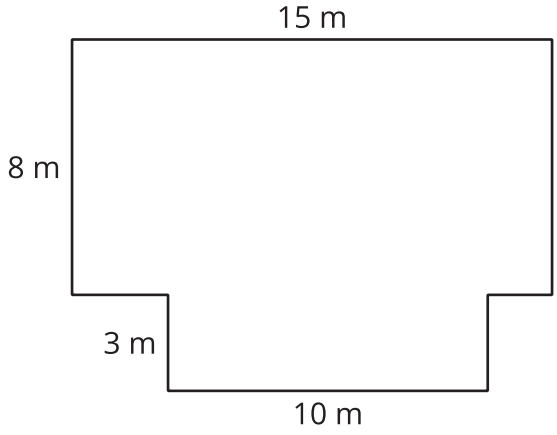
What do you notice? What do you wonder?



9.1: Catching Rainfall

Here is a diagram showing the roof of a house.

1. What is the area of the roof?



2. Each month an average of 5 cm of rain falls on the house. How many cubic cm of rain is that?

3. There are 1,000 cubic cm in 1 liter. How many liters of water fall on the house?

4. You want to build a reservoir to catch the rain that falls so you can use the water. What side lengths would you suggest for the reservoir? Explain or show your reasoning.

9.2: How Much Water?

1. What are some of the ways you use water at home?

2. Estimate how much water you use at your home in a month.

3. How much rain would need to fall on your home each month to supply all of your water needs?

4. What challenges might come up if you tried to use the rainwater that falls on the roof of your home? Do you think it makes sense to try to capture the rain that falls on your home?

Section Summary

Section Summary
We investigated several different complex volume questions. For the ancient pyramids of Egypt we gave an estimate of a couple million cubic meters. Since these pyramids are not rectangular prisms, an estimate is the best we could hope for. Then we estimated the volume of the world's largest wagon, using information from a photograph. Lastly, we investigated the amount of rain that falls on a house and the amount of water our families use in a year.

In each case, we could only make estimates because the situations are all complex. In the previous section we used estimation to check the reasonableness of calculations. In this section we saw that making reasoned estimates is a vital part of applying mathematics to many real world situations.

Lesson 10: Here Comes the Sum

- Let's play some games to practice adding fractions.

Warm-up: Number Talk: Adding Fractions

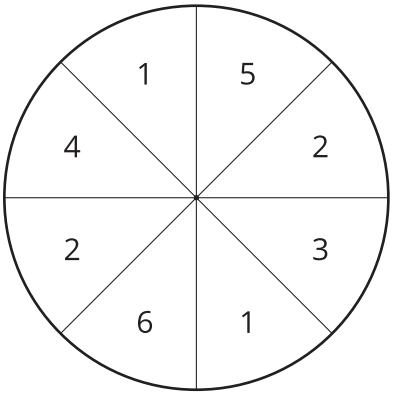
Find the value of each expression mentally.

- $\frac{2}{12} + \frac{1}{6}$
- $\frac{2}{6} + \frac{1}{2}$
- $\frac{1}{3} + \frac{1}{2}$
- $\frac{1}{3} + \frac{3}{2}$

10.1: Greatest Sum

Use the directions to play Greatest Sum with a partner.

1. Spin the spinner.
2. Each player writes the number that was spun in an empty box for Round 1. Be sure your partner cannot see your paper.
3. Once a number is written down, it cannot be changed.
4. Continue spinning and writing numbers in the empty boxes until all 4 boxes have been filled.
5. Find the sum.
6. The person with the greater sum wins the round.
7. After all 4 rounds, the player who won the most rounds wins the game.
8. If there is a tie, players add the sums from all 4 rounds and the highest total sum wins the game.



Round 1

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Round 2

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Round 3

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Round 4

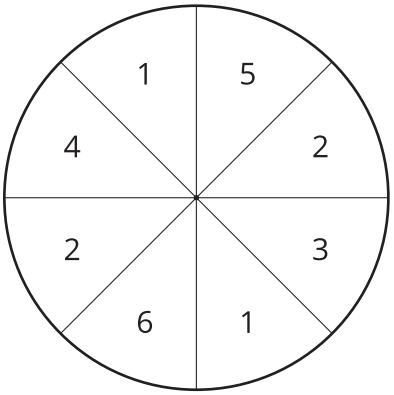
$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Total sum of all 4 rounds:

10.2: Smallest Sum

Use the directions to play Smallest Sum with a partner.

1. Spin the spinner.
2. Each player writes the number that was spun in an empty box for Round 1. Be sure your partner cannot see your paper.
3. Once a number is written down, it cannot be changed.
4. Continue spinning and writing numbers in the empty boxes until all 4 boxes have been filled.
5. Find the sum.
6. The person with the lesser sum wins the round.
7. After all 4 rounds, the player who won the most rounds wins the game.
8. If there is a tie, players add the sums from all 4 rounds and the lesser total sum wins the game.



Round 1

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Round 2

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Round 3

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Round 4

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Total sum of all 4 rounds:

Lesson 11: What's the Difference?

- Let's subtract fractions.

Warm-up: Number Talk: Subtracting Fractions

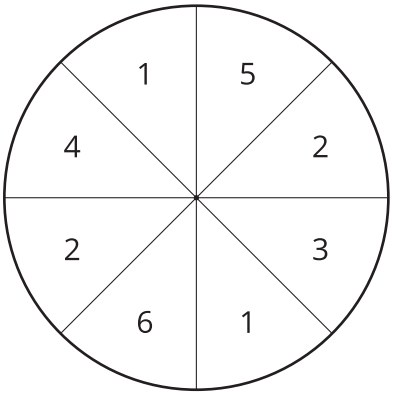
Find the value of each difference mentally.

- $\frac{2}{3} - \frac{1}{6}$
- $\frac{2}{3} - \frac{1}{2}$
- $\frac{2}{3} - \frac{4}{6}$
- $\frac{2}{3} - \frac{1}{4}$

11.1: Greatest Difference

Use the directions to play Greatest Difference with a partner.

1. Spin the spinner.
2. Each player writes the number that was spun in an empty box for Round 1. Be sure your partner cannot see your paper.
3. Once a number is written down, it cannot be changed.
4. Continue spinning and writing numbers in the empty boxes until all 4 boxes have been filled.
5. Find the difference.
6. The person with the greatest difference wins the round.
7. After all 4 rounds, the player who won the most rounds, wins the game.
8. If there is a tie, players add the differences from all 4 rounds and the highest total wins the game.



Round 1

$\frac{\square}{\square} - \frac{\square}{\square} =$

Round 2

$\frac{\square}{\square} - \frac{\square}{\square} =$

Round 3

$\frac{\square}{\square} - \frac{\square}{\square} =$

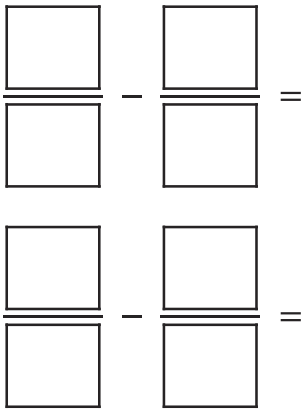
Round 4

$\frac{\square}{\square} - \frac{\square}{\square} =$

11.2: What is the Smallest Difference?

Use the numbers below to fill in the squares. Find each difference. Add the 2 differences together.

1 1 2 2 3 4 5 6



Lesson 12: Decimal Game Day

- Let's play some games and practice adding and subtracting decimals.

Warm-up: True or False: Adding Decimals

Decide if each statement true or false. Be prepared to explain your reasoning.

- $0.99 + 0.1 = 0.9 + 0.1 + 0.09$

- $0.99 + 0.01 = 0.9 + 0.1$

- $0.99 + 0.1 = 1.99$

12.1: Race to One or One Tenth

Use the directions to play Race to One or One Tenth with your partner. If there is time, play both versions of the game.

Race to One

1. Roll the number cube.
2. Decide if you want the number to represent tenths or hundredths.
3. Add the number to the last sum on your score sheet. If it is your first turn, you will add the number you roll to zero.
4. Take turns continuing to roll the number cube, decide the value, and add the number to your previous sum.
5. The first player to reach exactly 1 is the winner.
6. If you go over one, you lose your turn. For example, if your last sum was .95 and you roll a 6, you cannot go.
7. You may not need to use all the blank spaces on your score sheet or you may need to write more spaces.

	number rolled	0.1	0.01	equation to represent the total
1				
2				
3				
4				
5				
6				

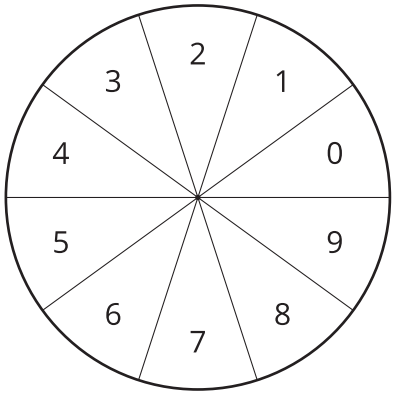
Race to One Tenth

1. Roll the number cube.
2. Decide if you want the number to represent hundredths or thousandths.
3. Add the number to the last sum on your score sheet. If it is your first turn, you will add the number you roll to zero.
4. Take turns continuing to roll the number cube, decide the value, and add the number to your previous sum.
5. The first player to reach exactly 0.1 is the winner.
6. If you go over 0.1, you lose your turn. For example, if your last sum was .095 and you roll a 6, you cannot go.
7. You may not need to use all the blank spaces on your score sheet or you may need to write more spaces.

	number rolled	0.01	0.001	equation to represent the total
1				
2				
3				
4				
5				
6				

12.2: Decimal Race to 500

Use the directions to play Decimal Race to 500 with a partner.



1. Spin the spinner three times.
2. Arrange the digits to make a decimal number that follows this rule:
    - Odd numbers can only be used in the tenths, hundredths, or thousandths place.
    - Even numbers can only be used in the ones, tens, and hundreds places.

      For example, if you spin the numbers 2, 3, and 9, these are some of the possible numbers you could make: 2.39 or 2.93.
3. Add your number to your previous sum. If it is your first turn, you will add your number to zero.
4. Continue taking turns until one person has reached 500 or more.

Lesson 13: Multiply Fractions Game Day

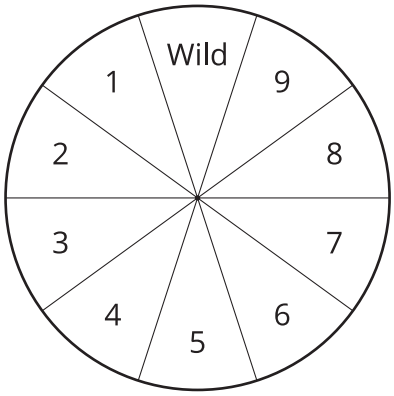
- Let's multiply a fraction or whole number by a fraction.

Warm-up: Number Talk: Multiply One Third

Find the value of each expression mentally.

- $\frac{1}{3} \times 3$
- $\frac{1}{3} \times 4$
- $\frac{1}{3} \times \frac{6}{3}$
- $\frac{1}{3} \times \frac{1}{4}$

13.1: Fraction Multiplication Compare



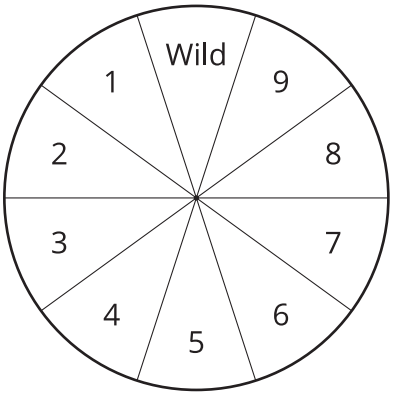
1. Use the directions to play Fraction Multiplication Compare with your partner.
    - Spin the spinner.
    - Write the number you spun in one of the empty blank boxes. Once you write a number, you cannot change it.
    - Player two spins and writes the number on their game board.
    - Continue taking turns until all four blank boxes are filled.
    - Multiply your fractions.
    - The player with the greatest product wins.
    - Play again.

Round 1 $\frac{\square}{\square} \times \frac{\square}{\square} = \underline{\quad\quad}$

Round 2 $\frac{\square}{\square} \times \frac{\square}{\square} = \underline{\quad\quad}$

2. What strategy do you use to decide where to write the numbers?

13.2: Fraction Multiplication Compare Round 2



1. Use the directions to play Fraction Multiplication Compare with your partner.
    - Spin the spinner.
    - Write the number you spun in one of the four blank boxes.
    - Player two spins and writes the number on their game board.
    - Continue taking turns until all four blank boxes are filled.
    - Multiply your fractions.
    - The player with the smallest product wins.
    - Play again.

Round 1 $\frac{\square}{\square} \times \frac{\square}{\square} = \underline{\quad\quad}$

Round 2 $\frac{\square}{\square} \times \frac{\square}{\square} = \underline{\quad\quad}$

2. What strategy did you use to choose where to write the numbers?

Section Summary

Section Summary
We played games with fractions and decimals, trying to make the largest or smallest number with given digits. Let's use the numbers 1, 3, 5, and 6. What is the smallest sum of two fractions we can make with these numbers? We want to use the smaller numbers, 1 and 3, for the numerators and the larger numbers, 5 and 6, for the denominators. This gives two possibilities, $\frac{1}{6} + \frac{3}{5}$ and $\frac{1}{5} + \frac{3}{6}$. The expression $\frac{1}{5} + \frac{3}{6}$ has the smaller value which makes sense since we want the larger numerator, which means more equal pieces, to go with the larger denominator which makes those pieces smaller.

The smallest difference we can make with these numbers is $\frac{3}{6} - \frac{1}{5}$ which is a little smaller than $\frac{3}{5} - \frac{1}{6}$. Finally, the largest product we can make is $\frac{6}{3} \times \frac{5}{1}$ or $\frac{5}{1} \times \frac{6}{3}$ which both have the value $\frac{30}{3}$ or 10.

Lesson 14: Notice and Wonder

- Let’s create a Notice and Wonder.

Warm-up: Notice and Wonder: Sharing Bread

What do you notice? What do you wonder?

14.1: Design Your Notice and Wonder

1. Find an image that would encourage your classmates to notice and wonder about sharing and interpreting the result as a fraction.

2. Fill in the possible things students might notice and wonder about your image.

Students may notice:

-
-
-

Students may wonder:

-
-
-

14.2: Facilitate Your Notice and Wonder

1. Display your image for your classmates.
2. Ask them, “What do you notice? What do you wonder?”
3. Give them a minute to discuss together.
4. Have them share what they notice and wonder.
5. Record their ideas.

14.3: Design Your Notice and Wonder, Part 2

1. Find an image that you find interesting and would encourage your classmates to notice and wonder about a mathematical topic you have learned this year.

2. Fill in the possible things students might notice and wonder about your image.

Students may notice:

-
-
-

Students may wonder:

-
-
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Lesson 15: Estimation Exploration

- Let's create an Estimation Exploration.

Warm-up: Estimation Exploration: Umbrellas

How many umbrellas are there?

Record an estimate that is:

too low	about right	too high

15.1: Design Your Estimation Exploration

1. Find an image that would encourage your classmates to estimate the total number of an item using strategies for multi-digit multiplication.

2. Fill in the possible estimates students might make.
   Record an estimate that is:

too low	about right	too high

15.2: Facilitate Your Estimation Exploration

1. Display your image for your classmates.
2. Ask them, “What is an estimate that’s too high?” “Too low?” “About right?”
3. Give them a minute of quiet think time.
4. Give them a minute to discuss together.
5. Have them share estimates.
6. Record their ideas.

Lesson 16: Number Talk

- Let’s create a Number Talk.

Warm-up: Number Talk: Division

Find the value of each expression mentally.

- $28 \div 14$

- $70 \div 14$

- $98 \div 14$

- $350 \div 14$

16.1: Number Talk: Design 1

Write an expression to complete the number talk. Be prepared to explain how you chose the last expression.

- $30 \div 15$
- $45 \div 15$
- $300 \div 15$
- _____

16.2: Number Talk: Design 2

Choose one of the number talks to complete. Be prepared to share your reasoning for the expressions you chose.

Option 1:

- $220 \div 22$
- $66 \div 22$
- _____
- _____

Option 2:

- $260 \div 26$
- $260 \div 13$
- _____
- _____

16.3: Number Talk: Design 3

Write expressions to complete the Number Talk. Be prepared to share your reasoning for the expressions.

- $430 \div 43$
- _____
- _____
- _____

Lesson 17: True or False?

- Let's create a True or False.

Warm-up: True or False: Fraction Addition

Decide if each statement is true or false. Be prepared to explain your reasoning.

- $\frac{3}{4} + \frac{3}{8} = \frac{3}{8} + \frac{3}{8}$

- $\frac{7}{5} + \frac{2}{3} = \frac{21}{15} + \frac{8}{15}$

- $\frac{8}{9} + \frac{5}{12} = \frac{32}{36} + \frac{15}{36}$

17.1: True or False: Design 1

Write an equation to complete the True and False task. Be prepared to share your reasoning for the last equation.

- $\frac{5}{6} - \frac{4}{9} = \frac{45}{54} - \frac{24}{54}$

- $\frac{5}{6} - \frac{4}{9} = \frac{15}{36}$

- _____

17.2: Design 2

Write two equations to complete the True or False task. Be prepared to share your reasoning for the equations.

- $\frac{8}{14} + \frac{3}{7} = \frac{4}{7} + \frac{3}{7}$

- _____

- _____

17.3: Design 3

Write three equations to complete the True or False task. Be prepared to share your reasoning for the equations.

- _____
- _____
- _____

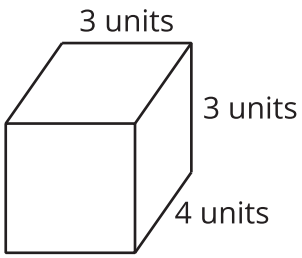
Lesson 18: Which One Doesn't Belong?

- Let's create a Which One Doesn't Belong.

Warm-up: Which One Doesn't Belong? Volume

Which one doesn't belong?

A



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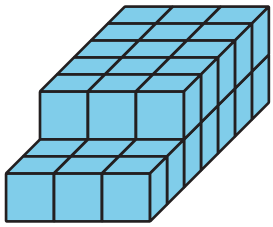
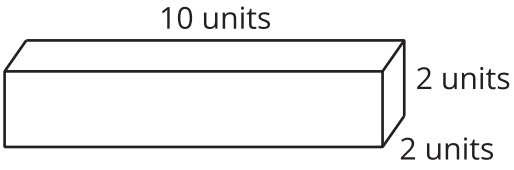


C



D

18.1: Which One Doesn't Belong? Design 1

1. Choose 3 shapes from the set of cards.
2. Draw a fourth shape to complete the Which One Doesn’t Belong.
3. For each shape, discuss one reason why it does not belong.

Which one doesn’t belong?

A

B

C

D

18.2: Which One Doesn't Belong? Design 2

1. Choose 2 shapes from the set of cards.
2. Draw a third and fourth shape to complete the Which One Doesn’t Belong.
3. For each shape, discuss one reason why it does not belong.

Which one doesn’t belong?

A

B

C

D

18.3: Which One Doesn't Belong? Design 3

Create your own Which One Doesn’t Belong about any mathematical idea you want others to notice.

Which one doesn't belong?

A

B

C

D

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