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| **Multiplication and Division** | |
| **Enrichment Investigation #1** | |
| Common Core State Standard(s):  3.OA.3  3.OA.5 | Standard(s) for Mathematical Practice:   1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Model with mathematics   6. Attend to precision  7. Look for and make use of structure  8. Look for and express regularity in  repeated reasoning |
| Materials Needed:   * Blackline Masters:   + *Designing Multiplication Arrays*   + *Multiplication Array Problem 1- 4 and Challenge Problem* * Optional: Graph paper | |
| Instructions:  Students will practice multiplication of whole numbers through arrays.   1. Students read through the information sheet on how to split up a multiplication problem and arrays into easier problems to find the answer. *Teacher might want to read through information with the students.* 2. Students attempt several problems on their own. 3. Challenge problem is optional. | |
| Sources:   * Teacher created | |

Designing Multiplication Arrays

Mission: To demonstrate how you can make easy multiplication problems out of hard ones to find the product! But first, let’s practice a few problems before we begin our mission.

I was multiplying 4X6 and decided that multiplying by 2’s was much easier then by 4’s. So I broke up the number 4 into two sets of 2. Is 4 X 6 the same thing as 2X6 + 2X6?

Let’s see what 4 X 6 looks like as an array:

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There are 6 columns and 4 rows. There is a total of **24.** So, 4 X 6 = 24.

What if I split up the 4 into two groups of 2?

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Well, that is still 4 X 6 because there are 6 columns and 4 rows but it is much easier for me to multiply 2 X 6 and 2 X 6. Then I add the two products together:

2 X 6= 12

2 x 6= 12

12 + 12 = **24**

That is the same answer!

So all I had to do was break up one of the numbers into smaller numbers that were easier to multiply!

Another example:

Problem: 7 X 3

I think if I broke up the 7 into a group of 4 and a group of 3, it would be much easier to solve.

So, my new problem would look like this: 4 X 3 + 3 X 3 (I must remember to multiply before I add)

Let’s see if it works:

7 X 3 = 21

|  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |

Or I could do

4 X 3 + 3 X 3

|  |  |  |  |
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Well, 4 X 3= 12 and 3 X 3= 9 and 12 + 9 = 21.

That is the same answer!!

These are simple examples of how you could split up a multiplication problem into easier problems to find the answer.

Here is an example of how to do it with harder numbers:

Problem: 16 X 8

Another way to solve: 10 X 8 + 4 X 8 + 2 X 8 (I broke apart the 16 to make an easier problem: 10 + 4 + 2= 16)

10 X 8= 80

4 X 8= 32

2 X 8 = 16

80 + 32 + 16 = **128**

See if you can do it with harder ones too!

Directions:

Read the problem and draw an array. *You might want to use graph paper.*

Determine how you could split it up into easier problems to solve.

Rewrite the problem using the easier multiplication problems.

Draw new arrays.

Solve!

Designing Multiplication Arrays: Problem 1

Problem: 15 X 4

Array:

An easier way to solve:

Array:

Answer:

Designing Multiplication Arrays: Problem 2

Problem: 12 X 7

Array:

An easier way to solve:

Array:

Answer:

Designing Multiplication Arrays: Problem 3

Problem: 9 X 12

Array:

An easier way to solve:

Array:

Answer:

Designing Multiplication Arrays: Problem 4

Problem: 13 X 8

Array:

An easier way to solve:

Array:

Answer:

Designing Multiplication Arrays: Challenge

Problem: 15 X 15

Array:

An easier way to solve:

Array:

Answer:

|  |  |
| --- | --- |
| **Multiplication and Division** | |
| **Enrichment Investigation #2** | |
| Common Core State Standard(s):  3.OA.3  3.OA.5  3.OA.7 | Standard(s) for Mathematical Practice:   1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Model with mathematics   6. Attend to precision  7. Look for and make use of structure |
| Materials Needed:   * Blackline Masters:   + *Multiplication Equality Graphs Directions*   + *Example of Multiplication Equality Graph*   + *Multiplication Equality Graph: 24, 30*   + *Multiplication Equality Graph Challenge: 60* | |
| Instructions:   1. Students may work independently or in pairs. 2. Provide student(s) with the needed blackline masters 3. Students design number sentences to equal target number. They must include a combination of addition, subtraction, multiplication and division 4. Have students check each others’ number sentences | |
| Sources:   * Teacher created | |

Multiplication Equality Graphs- Directions

Today you are going to create your own multiplication equality graphs. You will use the center number as your target number or your product. The bubbles that are coming from the center are the number sentences you can create that equal your target number.

Rules:

1. Remember anything in parenthesis must be completed first!
2. Multiplication must be completed first
   1. Example: 2+ 4 X 3. You must multiply 4 X 3 and then add 2. So, 4 X 3= 12 plus 2= 14.
3. You may not have any number sentences that use the commutative property of multiplication.
4. You must use division, multiplication, addition, and subtraction in the graph. Each bubble might only use one or two (for example, you might only use addition and multiplication in one bubble and division in another) but you must have at least one example of each throughout the graph.
5. Be creative! Try to think of number sentences that no one else would think of for their bubbles!

Example of a Multiplication Equality Graph:

/ means division

Challenge!!

|  |  |
| --- | --- |
| **Multiplication and Division** | |
| **Enrichment Investigation #3** | |
| Common Core State Standard(s):  3.OA.3  3.OA.8 | Standard(s) for Mathematical Practice:   1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics   6. Attend to precision |
| Materials Needed:   * Blackline Masters:   + *Cell Phone Multiplication* | |
| Instructions:   1. Students may work independently or in pairs. 2. Students use the information about cell phone plans to determine which plan each customer should purchase. 3. Students need to make a recommendation based on their math | |
| Sources:   * Teacher created | |

Cell Phone Multiplication

Wake Wireless Phone Company just announced new prices for cell phones. Help these customers figure out the best plan for their needs using your knowledge of multiplication and addition.

New Plans and Prices (any minutes not used in a month cannot be carried over to the next month):

|  |  |  |  |
| --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Charge for Extra Minutes |
| A | 400 | $30 | $0.40 |
| B | 600 | $40 | $0.35 |
| C | 1000 | $75 | $0.30 |

Directions:

Pretend you work at Wake Wireless Phone Company.

Determine how much each plan would cost the customer based on the number of minutes they spend talking on the phone. Recommend to the customer which plan would be the best. **You will need a calculator!**

Example: Fran usually talks 440 minutes a month on her cell phone. Which plan would be the best for her?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 | 40 X 40 | 1600 cents ($16) | $46 |
| B | 600 | $40 | 0 X 35 (she did not go over the 600 minutes) | $0 | $40 |
| C | 1000 | $75 | 0 X 30 (she did not go over the 1000 minutes) | $0 | $75 |

Recommendation: If Fran choose Plan A she would have to pay for the minutes that she talked on her phone over the amount given (40 extra minutes). It would cost her an extra $16 a month plus the $30 fee for a total of $46. Plan C is expensive and has more minutes than she needs a month. Plan B would be the perfect amount since it is less than Plan A costs more money. Plan B would also give Fran extra minutes a month if she needed them.

Customer 1:

George loves to talk on the phone. He normally talks 900 minutes a month. Which plan should he get?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 |  |  |  |
| B | 600 | $40 |  |  |  |
| C | 1000 | $75 |  |  |  |

Recommendation:

Customer 2: Samantha has a busy job. Every other month she has to travel to California for her job. The months that she is not traveling, she talks 600 minutes a month. The months that she is traveling she talks 700 minutes a month. You might want to figure out how much it would cost her for the months of 600 minutes and the months it is 700 minutes. Would it be better for her to choose Plan B or Plan C?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 |  |  |  |
| B | 600 | $40 |  |  |  |
| C | 1000 | $75 |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 |  |  |  |
| B | 600 | $40 |  |  |  |
| C | 1000 | $75 |  |  |  |

Recommendation:

Customer 3: Hank and his mom decide to share minutes. They each get a phone but they have to share the minutes that are listed in the plan. If Hank talks 275 minutes a month and his mom talks twice as much, which plan is the best for them?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 |  |  |  |
| B | 600 | $40 |  |  |  |
| C | 1000 | $75 |  |  |  |

Recommendation:

Answer Key: George loves to talk on the phone. He normally talks 900 minutes a month. Which plan should he get?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 | 40 X 500 | 20,000 cents= $200.00 | $230.00 |
| B | 600 | $40 | 35 X 300 | 10,500 cents= $105.00 | $145.00 |
| C | 1000 | $75 | 30 X 0 | $0 | $75 |

Customer 2: Samantha *The student may have different charts depending on how they choose to answer the problem.*

*600 minutes:*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 | 40 X 200 | 6000 cents= $60 | $100 |
| B | 600 | $40 | 35 X 0 | $0 | $40 |
| C | 1000 | $75 | 30 X 0 | $0 | $75 |

*700 minutes:*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 | 40 X 300 = 12,000 | 12,000 cents = $120.00 | $150 |
| B | 600 | $40 | 35 X 100 | 3,500 cents = $35 | $75 |
| C | 1000 | $75 | 30 X 0 | $0 | $75 |

Recommendation: She should choose plan B because it is enough minutes for the months she only talks 600 minutes. The months that she talks 700 minutes the charge is the same as plan c. If she choose plan B, she would pay an extra $35 a month for the months she only talked 600 minutes and she would not need that many minutes that are in plan C.

Customer 3: Hank and his mom decide to share minutes. They each get a phone but they have to share the minutes that are listed in the plan. If Hank talks 275 minutes a month and his mom talks twice as much, which plan is the best for them?

*Hank talks 275 minutes and his mom talks 550 minutes for a total of 825 minutes.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plan | Minutes included in Plan | Monthly Fee | Multiplication sentence for determining cost of extra minutes | Total cost for extra minutes | Total (Monthly fee + Extra Minutes) |
| A | 400 | $30 | 40 X 425 | 17,000 cents= $170.00 | $200 |
| B | 600 | $40 | 35 X 225 | 7,875 cents= $78.75 | $118.75 |
| C | 1000 | $75 | 0 X 30 | 0 | $75 |

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| **Multiplication and Division** | |
| **Enrichment Investigation #4** | |
| Common Core State Standard(s):  3.OA.3  3.OA.7 | Standard(s) for Mathematical Practice:   1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Model with mathematics   6. Attend to precision |
| Materials Needed:   * Blackline Masters:   + *Super Multiplication Problems* | |
| Instructions:   1. Students work on multiplication factors to answer the questions. | |
| Sources:   * Adapted from: <http://www2.ups.edu/faculty/woodward/Multiplication%20and%20Division%20Word%20Problems.pdf> | |

**Super Multiplication Problems**

Directions: Read the problem and record your answer in the bubbles

Think of all the combinations of numbers that multiply together to equal 24. Which set has the smallest sum?

Think of all the combinations of numbers that multiply together to equal 30. Which set has the largest30 sum?

Think of all the combinations of numbers that multiply together to equal 60. Which set has the Smallest Difference?

Think of all the combinations of numbers that multiply together to equal 40. Which set has the smallest difference?

Think of all the combinations of numbers that multiply together to equal 80. Which set has the Largest Sum (not 1)?

Think of all the combinations of numbers that multiply together to equal 48. Which set with an odd number has the smallest difference?

Answer Key:

1. 4, 6
2. 30, 1
3. 10, 6
4. 8, 5
5. 40, 2
6. 3, 16

|  |  |
| --- | --- |
| **Multiplication and Division** | |
| **Enrichment Investigation #5** | |
| Common Core State Standard(s):  3.OA.1  3.OA.3  3.OA.7  3.OA.8 | Standard(s) for Mathematical Practice:   1. Make sense of problems and persevere in solving them.   2. Reason abstractly and quantitatively  4. Model with mathematics.  6. Attend to precision**.** |
| Materials Needed:   * Optional: Calculators * Blackline Masters:   + *Class Fundraiser* | |
| Instructions:   1. Students work through the three fundraiser problems to determine if a class has made enough money for new computers. 2. Optional: Students might need calculators for the last fundraiser problem. | |
| Sources:   * Teacher created | |

**Class Fundraiser**

Mrs. Jose’s class is raising money to buy some new computers for her classroom. Can you help them determine if they have enough money?

Fundraising Goal: $1,000

First Fundraiser: Cookie Dough

*The first one has been done for you.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Amount of money made on each container | How many containers sold | Multiplication sentence used to solve | Total amount made |
| Chocolate Chip | $4 | 12 | 4 X 12 | 48 |
| Pecan | $3 | 9 |  |  |
| Mint | $5 | 8 |  |  |
| Lemon | $2 | 14 |  |  |
| Sugar | $6 | 9 |  |  |
| Total Made on the Cookie Dough |  |  |  |  |

Second Fundraiser: Wrapping Paper

Read the clues to fill out the chart.

1. They sold three times as many rolls of blue paper as red.
2. If you add 2 to the amount of red rolls and multiply that by 2 you will equal the amount of rolls of green wrapping papers sold.
3. 4 more rolls of blue wrapping paper than green were sold.
4. They sold 2 rolls of striped wrapping paper.
5. Half the amount o green wrapping paper sold would equal the amount of stars wrapping paper.
6. 4 times more red paper was sold than stripped paper.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Amount of money made on each roll of paper | How many rolls of paper sold | Multiplication sentence used to solve | Total amount made |
| Red | $5 |  |  |  |
| Green | $3 |  |  |  |
| Blue | $2 |  |  |  |
| Striped | $3 |  |  |  |
| Stars | $8 |  |  |  |
| Total Made on the Wrapping Paper |  |  |  |  |

Third Fundraiser: Coupon Books

Read the clues to figure out how much the class made during the week of selling coupon books.

1. On Monday the class sold 10 times the amount they sold on Wednesday.
2. The class sold 5 books on Friday.
3. Tuesday they sold 10 more books than Wednesday.
4. Monday they sold 8 times more books than they did on Friday.
5. They sold a total of 88 coupon books.
6. Each coupon book was $5 (you can use a calculator to figure out the total amount made).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Monday | Tuesday | Wednesday | Thursday | Friday |
|  |  |  |  |  |

Total made from third fundraiser: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

After the three fundraisers, did the class make enough money for the computers? How much more or less did they make than $1,000?

Answer Key

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Amount of money made on each container | How many containers sold | Multiplication sentence used to solve | Total amount made |
| Chocolate Chip | $4 | 12 | 4 X 12 | $48 |
| Pecan | $3 | 9 | 3 X 9 | $27 |
| Mint | $5 | 8 | 8 X 5 | $40 |
| Lemon | $2 | 14 | 2 X 14 | $28 |
| Sugar | $6 | 9 | 9 X 6 | $54 |
| Total Made on the Cookie Dough |  |  |  | $197 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Amount of money made on each roll of paper | How many rolls of paper sold | Multiplication sentence used to solve | Total amount made |
| Red | $5 | 8 | 8 X 5 | $40 |
| Green | $3 | 24 | 3 X 24 | $72 |
| Blue | $2 | 20 | 2 X 20 | $40 |
| Striped | $3 | 2 | 3 X 2 | $6 |
| Stars | $8 | 10 | 8 X 10 | $80 |
| Total Made on the Wrapping Paper |  |  |  | $238 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Monday | Tuesday | Wednesday | Thursday | Friday |
| 40 | 14 | 4 | 25 | 5 |

Total Made: $440

Did they make enough? No, only made $825- needed $125 more.