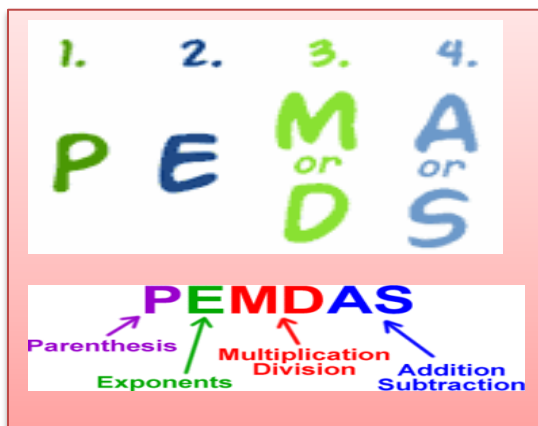| Order of Operations |
| --- |
| Enrichment Investigation #1 |

NC State Standard(s): NC.5.OA.2	Standard(s) for Mathematical Practice: 1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantifiably 3. Construct a viable argument and critique the reasoning of others. 5. Use appropriate tools strategically 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: *Challenging Operations, Ordering Twenty-Four* answer document
- Technology to access bit.ly
- Ti-15 calculators
- Google login needed to complete bit.ly (Make it True-google slides)

Instructions:
1. Teacher will provide students with blackline master, "Challenging Operations" to explain the activity. They will then use the "Ordering Twenty-Four" answer document to record their expressions.
2. Students will need time to work through possible expression using the guidelines provided. The teacher may have they work in pairs or have a partner review using calculators to check answers when complete.
3. Allow students to get a laptop or other device and go to the link shared. The *Make it True* google slide will have students use the operations symbols to make the equations true for further extension.

Sources:
- Teacher created
- http://bit.ly/1LgjStu

4C's Competencies:

Collaboration: • Working with peers evaluate your possible solutions to challenging equations and expressions.	Creativity: • Express you mathematical thinking through creative ways to solve problems.
Communication: • Have a partner to review and discuss your order of operations solutions.	Critical Thinking: • Working through challenges to solve complex expressions and equations

CHALLENGING OPERATIONS

Can you take operations into your own hands? Try to create solutions to the 24 problems so that the expression you create matches the answer given.

FOR EACH PROBLEM:

- You must use all the numbers 1,2,3 and 4.

- You may not repeat the 1,2,3 or 4.

- The numbers 1,2,3, and 4 do not need to be in consecutive order.

- You may use addition, subtraction, multiplication or division as many times as you would like.

- Parenthesis, exponents, square roots, and fraction bars are allowed.

THERE ARE MULTIPLE SOLUTIONS TO EACH PROBLEM!

Examples:

10 = 1 + 3 + 2 + 4

10 = (4x2) + (3-1)

10 = 32 + 14

ORDERING

TWENTY-FOUR

Find expressions to the following problems. Use the requirements to make sure each is correct.

1=	13=
2=	14=
3=	15=
4=	16=
5=	17=
6=	18=
7=	19=
8=	20=
9=	21=
10=	22=
11=	23=
12=	24=

Working with Multiplication, Models, and Data (Part #1)	
Enrichment Investigation #2	

NC State Standard(s):	Standard(s) for Mathematical Practice:
NC.5.NBT.5	1. Make sense of problems and persevere in solving them
	2. Reason abstractly and quantifiably
	3. Construct a viable argument and critique the reasoning of others.
	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:
- *Client Letter, Data Set Day 1, Super Store Super Problem, Weekly Expenses to Monthly Expenses*
- Student data chart and discussion questions
- Technology device Google Doc "Sample Response Letter"

Instructions:

1. Students receive Blackline Master, *"Client Letter 1 and Data Set 1"*. Have student's complete discussion questions on paper.
2. After students understand the task, separate the students into teams of approximately 3-4.
3. Have the students compute the Blackline Masters, *"Weekly Expenses to Monthly Expenses"* for each category and then add the Totals on the last column for each city.
4. Teachers can provide guidance using the reflective questions to help students determine the important factors and start thinking about how they can present their solution.
5. In teams, students work on the problem and respond to the client via Google Doc using the Sample Response Letter with the requested criteria.

Sources:
- Adapted from: http://www.cpalms.org

4C's Competencies:

Collaboration:	Creativity:
• Apply individual knowledge to team dilemma.	• Present sounds math and data findings creatively.
Communication:	**Critical Thinking:**
• Follow group working norms as problems are discussed in teams.	• Knowledge of multiplication and data to solve complex problems.

Big Big Super Store
Imagination Drive
Orlando, FL

Dear Students,

Big Big Super Store is an international home furnishing and décor company which is looking to open another branch within the United States. This is an important decision that will have a major impact on our employees since it will require relocating part of our management team to a new city. We have been able to narrow our choices down to four major cities in your state. However, we also need to consider the needs of our employees and this is where we need your assistance.

We are in the process of completing our monthly budget, therefore the first step is for you to take the data from the weekly expenses table that we have provided and do the appropriate calculations to complete the monthly expenses table.

The next step is to look over the data and then develop a procedure for ranking the cities from most desirable to least desirable. Think about where the best place for our employees would be when you consider the following: transportation, food, and temporary lodging expenses, as well as hotel ratings for a major hotel chain near our proposed location.

Please write us back and provide us with a clear and detailed procedure of how you arrived at this decision. Make sure that your team's procedure will work even if we decide to research and collect additional data. Thank you for your help!

Sincerely,

Brand Expansion/Relocation Department
Big Big Super Store

Super Store Super Problem

As a team you will need to assess the issue for your new client. Take time to brainstorm your ideas and thoughts before you look too deep into the data. *(review the letter from your client, have a team discussion, and answers the questions below.)*

1. What is the problem?

2. Who is the client?

3. What is the client asking your team to do?

4. What things do you need to include in your solution?

5. Do you think there is more than one correct answer to what the client is asking? Why or why not?

LOCATION CITIES FOR

BIG BIG SUPER STORE CORPORATION

WEEKLY EXPENSES

Directions: Calculate total weekly expenses using the information already provided. We will use this data to look at the monthly budget for each location. Think through this data and the other considerations to make a decision on what city should be selected.

City	Lodging **Weekly** Expenses	Reviews/ No. of Stars (1 to 5)	Transportation **Weekly** Expenses	Food **Weekly** Expenses (Family of 4)	Total **Weekly** Expenses
Greensboro, NC	**$1477**	**2 1/2**	**$36**	**$250**	
Raleigh, NC	**$1043**	**3**	**$29**	**$350**	
Cary, NC	**$616**	**4 1/2**	**$18**	**$275**	
Charlotte, NC	**$525**	**4 1/2**	**$25**	**$200**	

1. What math did you use to solve the problem?

2. Why did you use this kind of math?

3. What is the most important part of the data set when making your decision?

4. What difficulties did you have when making your choice?

RELOCATION CITIES FOR **BIG BIG SUPER STORE** CORPORATION

MONTHLY EXPENSES

Student Worksheet:

Name:_____   Date:_____

Directions: Calculate weekly expenses for the month (hint: how many weeks in a month on average?) On the last column, calculate the total monthly expenses for each city. Be sure to keep all your work to share when you finish your chart.

City	Lodging **Monthly** Expenses	Reviews/ No. of Stars	Transportation **Monthly** Expenses	Food **Monthly** Expenses (Family of 4)	Total **Monthly** Expenses
Greensboro, NC		2 1/2			
Raleigh, NC		3			
Cary, NC		4 1/2			
Charlotte, NC		4 1/2			

***Before your team can decide on a location, you must remember the company wants to weigh out costs and the needs of their employees. Here are some questions to consider with your team.

- How did you know to try that strategy/procedure?
- How do you know if you have an answer to the problem?
- Would your solution work in a different situation?
- When will this strategy or procedure not work?
- Could you use a different strategy?
- What are the most important things to consider in your procedure?
- What are the strengths and weaknesses of each factor?
- How is your answer like or different from another student's/team's?
- Do you agree or disagree with your classmates' ideas? Why or why not?

SAMPLE RESPONSE LETTER:

Your team should use a google doc to develop a response letter to the client. Here is a sample. You can add to this and be creative with how you display your findings.

Date: _____

    Dear Relocation Department:

    Our team, _____, has reviewed all of the data provided by you and we have created a list in which we have ranked the 4 cities so that you can make your final decisions based on this recommendation. Our findings are as follows:

    First:_____

    Second:_____

    Third:_____

    Fourth:_____

    The step-by-step procedure we used to determine the order was

    Sincerely,   Team:_____

Working with Multiplication, Models, and Data (Part #2)	
Enrichment Investigation #3	
NC State Standard(s): NC.5.NBT.5	**Standard(s) for Mathematical Practice:** 1. Make sense of problems and persevere in solving them 2.Reason abstractly and quantifiably 3.**Construct a viable argument and critique the reasoning of others.** 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:
  - *Client letter day 2 (response), Weekly Expenses*
- Data set day 2 and previous data
- Student data chart and discussion questions
- Technology device

Instructions:

1. Students receive the *Client Letter 2 and Data Set 2*, and along with their work from part 1.
2. Teams test, evaluate, and revise their first recommendation as necessary with the second data set and provide feedback as specified in the second letter. If teams finish early, they can begin preparing their presentations using google doc.
3. After all of the teams have completed their second letters to the client, the teams will present their results to the rest of the class in various ways,

Sources:
- Adapted from: http://www.cpalms.org

4C's Competencies:

Collaboration: • Hold mathematical discussions with teams around data.	**Creativity:** • Use technology and other creative ways to present information.
Communication: • Present findings and application of skills.	**Critical Thinking:** • Assess finding and revaluate based on new information.

Big Big Super Store
Imagination Drive
Orlando, FL

Dear Students,

Thank you for your thoughtful recommendation. It is evident that you put a lot of effort and thought into your decision. However, after speaking to our employees, we realized they were concerned about safety in addition to costs.

However, we are considering one additional city and have provided you with the additional data. We have also provided you with the crime statistics. Please note that these are not necessarily the crime rates for the entire city, just the particular area we are considering. Please look over the new data and provide us with a detailed description of how you ranked the cities and if you made any changes please explain why.

Sincerely,

Brand Expansion/Relocation Department
Big Big Super Store

RELOCATION CITIES FOR **BIG BIG SUPER STORE** CORPORATION

WEEKLY EXPENSES

City	Lodging Weekly Expenses	Reviews/ No. of Stars (1 to 5)	Transportation Weekly Expenses	Food Weekly Expenses (Family of 4)	Total Weekly Expenses	Crime Rate
Greensboro, NC	$1477	2 1/2	$36	$250	$1763	Medium
Raleigh, NC	$1043	3	$29	$350	$1422	High
Cary, NC	$616	4 1/2	$18	$275	$909	Medium
Charlotte, NC	$525	4 1/2	$25	$200	$750	Very High
Fayetteville, NC	$1326	2	$25	$300	$1657	High

*Family of 4

You should as a team review the new data, complete and new calculations for Monthly Expenses.

Monthly expenses for new additional city:

City	Lodging **Monthly** Expenses	Reviews/ No. of Stars	Transportation **Monthly** Expenses	Food **Monthly** Expenses (Family of 4)	Total **Monthly** Expenses
Fatetteville, NC		2			

You will need to send a final recommendation letter to you client. Hold a discussion as a team using the following questions to guide you thinking.

1. What is the most important section of Data Set 2?
2. What is the least important section of Data Set 2?
3. Did you change your procedure after receiving the new data set?
4. Why or why not? Did you change your choice after receiving the new information? Why or why not?
5. Do you think your ranking would change if you chose the Weekly Expenses vs. the Monthly Expenses data?

SAMPLE FINAL RESPONSE LETTER:

Your team should use a google doc or some form of technology to develop a response letter to the client. Here is a sample. You can add to this and be creative with how you display your findings.

Date: _____

Dear Relocation Department:

Our team, _____, has reviewed all of the data provided by you and we have created a list in which we have ranked the 4 cities so that you can make your final decisions based on this recommendation. Our findings are as follows:

First:_____

Second:_____

Third:_____

Fourth:_____

The changes we made
were:_____
_____
_____
_____
_____

We felt these changes were necessary
because:_____
_____
_____
_____

Sincerely,

Team:_____

Using Division to Solve Real-World Problems
Enrichment Investigation #4

NC State Standard(s):	**Standard(s) for Mathematical Practice:**
NC.5.NBT.6	1.Make sense of problems and persevere in solving them
	2.Reason abstractly and quantifiably
	3.**Construct a viable argument and critique the reasoning of others.**
	4. Model with mathematics
	5.Use appropriate tools strategically
	6.Attend to precision
	7. Look for and make use of structure
	8. L**ook for and express regularity in repeated reasoning**

Materials Needed:
- Blackline Masters:
    - *Math Division Menu*
    - *Division Depth and Complexity Frame* (2 copies)

Instructions:
1. Students will review menu options and select one main course and one dessert option to solve.
2. They will use the Division Depth and Complexity Frame to work through the problems and solve. (one for each problem they are completing)
3. Students will then develop a creative way to present their solutions and mathematical thinking. (paper or digital brochure, website, google slide, etc)
   you may determine students can complete more than one option

Sources:
- Teacher created

4C's Competencies:

Collaboration:	**Creativity:**
- Work with peers to problem solve complex word problems	- Use creative thinking to express the mathematical thinking process.
Communication:	**Critical Thinking:**
- Use clear academic math language through presentation and display.	- Use multiple strategies and schema to work through and solve complex math word problems.

Math Menu Division   _____

What to Include:

Be sure to circle the main course and dessert you selected to solve. You will need to complete the Division Depth and Complexity Frame before you start working on your final project you will the information!

Menu Problem Requirements:

Product Choices: Booklet/brochure (must be assembled and colored), or a Webpage template (complete and organized digitally). You must include the problem, all work, and written explanation as well as the strategy you used to solve. You will also include math vocabulary and tell why you performed each step.

MAIN COURSES

For Profit:

Twice Read Tales sells used books. The store bought Henry's collection of old Farm and Home magazines for $195.00. They sold the lot for $322.50, and this gave them a profit of $0.50 per magazine. How many magazines did Henry sell them?

$1000.00 in Dimes:

Ten dimes weigh an ounce. A roll of dimes is $5.00. How much does $1000 in dimes weigh?

Widgets:

A factory produces 10 widgets per second. How many hours does it take the factory to produce 90,000 widgets?

Chantelle's Hike:

Chantelle is going on an 8-day hike of 82.5 miles. She plans to hike 8.25 hours a day for each of those 8 days. How many miles will she cover each hour of her trip?

DESSERTS

Pumpkin:
A farmer needs to ship 71 pumpkins to a grocery store. If each crate can hold 19 pumpkins, how many crates will the farmer need?

Swim Lessons:
There are 165 children taking swimming lessons at the pool. If 10 children will be assigned to each instructor, how many instructors need to be hired?

Family Trip: A family leaves their house on Monday at 8:15 am for a 1530 mile trip. If they average 42 mph, on what day and at what time will they arrive at their destination?

Division Depth and Complexity Frame

What are the important details needed to solve the problem?

Think like a mathematician. What are some vocabulary you will use?

The Problem Title:

Solve as many ways as you can. Show your work!

Alter a piece of the problem and solve for a new answer. Explain what you change and how it affected the solutions.

Ordering Twenty-Four

Find expressions to the following problems. Use the requirements to make sure each is correct. Answers will vary. Check to confirm that each expression equals the number total in each box!

Super Store Super Problem

1. What is the problem? Will vary

2. Who is the client? Big Big Super Store

3. What is the client asking your team to do? Find the best location for their newest

4. What things do you need to include in your solution? Monthly expense, lodging, and rating, food and transportation expense, and desirable city. Other responses may vary

5. Do you think there is more than one correct answer to what the client is asking? Why or why not?

   Answers may vary.

LOCATION CITIES FOR BIG SUPER STORE CORPORATION WEEKLY EXPENSES

City	Lodging **Weekly** Expenses	Reviews/ No. of Stars (1 to 5)	Transportation **Weekly** Expenses	Food **Weekly** Expenses (Family of 4)	Total **Weekly** Expenses
Greensboro, NC	$1477	2 1/2	$36	$250	$1763
Raleigh, NC	$1043	3	$29	$350	$1422
Cary, NC	$616	4 1/2	$18	$275	$909
Charlotte, NC	$525	4 1/2	$25	$200	$750

1. What math did you use to solve the problem? Find the weekly expenses and compile them by adding for each city
2. Why did you use this kind of math? Add to get a total and then will need to multiply to get the monthly total
3. What is the most important part of the data set when making your decision? Answers will vary. EX: average total costs by week and quality of accommodations
4. What difficulties did you have when making your choice? Answers will vary. EX: deciding on city size and what each city has to offer for the price

RELOCATION CITIES FOR **BIG BIG SUPER STORE** CORPORATION MONTHLY EXPENSES

City	Lodging **Monthly** Expenses	Reviews/ No. of Stars	Transportation **Monthly** Expenses	Food **Monthly** Expenses (Family of 4)	Total **Monthly** Expenses
Greensboro, NC	$5908	2 1/2	$144	$1000	$7052
Raleigh, NC	$4172	3	$116	$1400	$5688
Cary, NC	$2464	4 1/2	$72	$1100	$3636
Charlotte, NC	$2100	4 1/2	$100	$800	$3000

*Multiply weekly expense by 4 to get monthly total

RELOCATION CITIES FOR **BIG BIG SUPER STORE** CORPORATION WEEKLY EXPENSES

City	Lodging Weekly Expenses	Reviews/ No. of Stars (1 to 5)	Transportation Weekly Expenses	Food Weekly Expenses (Family of 4)	Total Weekly Expenses	Crime Rate
Greensboro, NC	$1477	2 1/2	$36	$250	$1763	Medium
Raleigh, NC	$1043	3	$29	$350	$1422	High
Cary, NC	$616	4 1/2	$18	$275	$909	Medium
Charlotte, NC	$525	4 1/2	$25	$200	$750	Very High
Fayetteville, NC	$1326	2	$25	$300	$1657	High

Family of 4

You should as a team review the new data, complete and new calculations for Monthly Expenses.

Monthly expenses for new additional city:

City	Lodging **Monthly** Expenses	Reviews/ No. of Stars	Transportation **Monthly** Expenses	Food **Monthly** Expenses (Family of 4)	Total **Monthly** Expenses
Fatetteville, NC	**$5304**	2	$100	**$1200**	$6628

*Multiply by 4 to get totals

Math Division Menu (answer key)

For Profit: 322.50 - 195.00= 127.50

12750/50= 255

So, the answer should be 255 magazines.

Two-hundred fifty-five magazines were sold to the shop by Henry.

$1000.00 in Dimes: 1. I divided 1,000 (dollars in dimes) by 5.00 in dimes and got 20 rolls of dimes which equals 1,000 dollars in dimes.

2. I knew that 50 dimes equals $5.00 which equals 5 ounces.

3. Then since I knew 50 dimes equals 5 ounces and I also knew that there were a total of 20 rolls. So I multiplied 20 rolls of dimes by 5 ounces.

4. I got my final answer of 100 ounces.

The strategy I used is <u>reasoning</u>. I used this as I worked through my thinking of this problem.

Widgets: It would take the factory 2 hours and 30 minutes to produce 90,000 widgets.

1. I know that there are 60 seconds in an hour. I multiplied 60 by 60 and this equaled 3,600 seconds are in an hour.

2. Then I multiplied 3,600 by 10 because the factory produces 10 widgets per second.

3. Then i multiplied 36,000 by 2 to get 72,000 then that also multiplies the hour by 2 making the total hours 2 hours.
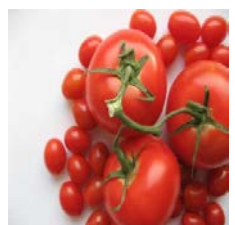
4. Then i knew that 18,000 was half of 36,000 and i needed 18,000 more to get to 90,000 widgets.

5. Since half an hour is 30 minutes and i divided 36,000 by 2 which equals half the answer came to be half an hour and 18,000 widgets.

6. I got my total answer of 2 hours and 30 minutes to produce the widgets.

The <u>strategy</u> I used is <u>reasoning</u>. I used this strategy by using my past knowledge of time to multiply 60 seconds in a minute and 60 minutes in an hour.

Chantelle's Hike: 1.25 miles Chantelle will hike 8.25 hours x 8 days = 66 hours of hiking. 82.5 miles ÷ 66 hours = 1.25 miles.

Pumpkin Pumpkin:

71 pumpkins ÷ 19 pumpkins = 3.74 crates.

You will need 4 creates total to ship the pumpkins.

5. Since 3 crates will be filled but there is a remainder, we will figure how many pumpkins are left over
6. Multiply 19 x 3 = 57 pumpkins in 3 crates
7. Subtract 71-57= 14 pumpkins left in the 4th crate.

Swim Lessons:

165 children ÷ 10 children per instructor = 16.5 instructors total

You will need 17 total instructors

1. Since 16 instructors will be needed and there is a remainder, we will figure out how many children are left.
2. Multiply 10 x 16 = 160 children for 16 instructors
3. That leave 5 children left so a 17th instructor will be needed.

Family Trip:

The family will arrive around 8:58pm on Tuesday night.

1. 1530 miles ÷ 42 mph = about 36.43 hours total trip
2. once you know the hours total you have figure out what day and time it will be once 36.43 hours have passed.
3. subract 36.43-24= 12.43 (which is Tuesday at 8:15am)
4. subtract 12.43-12= .43 (which gets you to Tuesday at 8:15 pm)
5. There are 43 minutes left so you can add 43 minutes to the 15 and get 58. Which makes the Day and Time Tuesday at 8:58 pm the family will arrive.