The title of this unit is *The Mouse and the Elephant*. It gets its title from the unit challenge. The unit challenge was two questions that we had to answer by the end of the unit. Those questions had to do with a mouse that stood six centimeters tall and an elephant that stood 240 centimeters tall. The questions were: “How many mouse coats are needed to sew a coat for the elephant?” and, “How many mice are needed on the scales to balance the elephant?” We learned a lot of mathematics before we were able to answer those questions.

The first thing we learned about was area and perimeter. We were given square tiles that represented small tables that sat 4 people. We could put the small tables together to make banquet tables. (See the diagrams.) The number of tables is the area and the number of people it seats is the perimeter. So the first example has an area of one square unit and a perimeter of 4 units, while the second table has an area of two square units and a perimeter of six units.

Our class also came up with a shortcut for calculating the area and perimeter so we wouldn’t have to count each time. Those formulas are area -- $A = l \times w$ and perimeter -- $P = (l + w) \times 2$ or $P = 2 \times l + 2 \times w$. An example would be this banquet table with a length of 4 and a width of 3. The area is $3 \times 4 = 12$ units, while the perimeter can be calculated with two different formulas $(l + w) \times 2 = (4 + 3) \times 2 = 7 \times 2 = 14$ or $2 \times l + 2 \times w = 2 \times 4 + 2 \times 3 = 8 + 6 = 14$. Both ways give you 14 square units so you can use whichever formula you like.

We also learned that if we wanted to use only a certain number of tables to make a banquet table, we could seat a different number of people at the table depending upon the shape we made with the small tables. Both of these
examples use four small tables, but a different number of people can be seated at the banquet table. In other words, the area is the same, but the perimeter is different. We found this to be true for no matter how many tiles we used. We found out another interesting fact. Example 1 seats the minimum number of people while example 2 seats the maximum. You see, the more square like the shape the smaller the perimeter and the more elongated the shape is the larger the perimeter is. Yet, they will have the same area!

Then we explored what would happen if we kept the perimeter the same and changed the areas. It was harder to keep the perimeter the same then it was to keep the area the same. We had to keep putting tiles in and out of the shape to get the right perimeter. But we discovered that a shape that was elongated had a smaller area then the one that was square-like and yet they both had the same perimeter. For example, one day we made sure all our rectangles had a perimeter of 24 units. Then we found the maximum area was found in a 6 X 6 rectangle, while

![Rectangle Diagram]

the minimum area was in a 1 X 11 rectangle. By the example you can see both rectangles have a perimeter of 24 units but their areas are different!!

Next we used cubes to represent food for travel in space. Each cube was one day’s supply of food for the space shuttle. But, we had to cover them with space armor jackets to protect them. And the space armor jackets cost $1 per square. Each day’s supply of food was the volume of the rectangular prisms we made with the cubes and the cost of the space armor jackets was the surface area. My team figured out a shortcut for calculating the volume. It was $V = l \times w \times h$. Another team found a shortcut for the surface area.

$$SA = [(l \times w) + (l \times h) + (w \times h)] \times 2.$$  

Here’s an example of how to calculate

![Cuboid Diagram]
both. So, there are four cubes in this example or a four-day’s supply of food. The surface area is 16 square units, so it would take 16 squares of space armor jackets to cover all sides of this shape.

In order to minimize the cost of the space armor jackets we needed to find a way of putting the cubes together that would have the minimum surface area. We found that if the cubes were put together to be the most cube-like, it would have the smallest surface area, while if they were the most elongated the surface area would be at its highest. The following examples show the minimum and maximum for 12 cubes.

By this time we had a lot of knowledge and we applied it to being economical. You see, if we went into space with a 14-day supply of food, the cheapest way you could cover it is in a 1 X 2 X 7 rectangular prism. This would cost you $46. Well, that means you are paying $3.28 per day for the food. How you calculate this is (total cost of package)/(number of days supply). \((46/14 = \$3.28)\) This, put mathematically, is \(SA/V\). Well, we could package 27 cubes in a 3 X 3 X 3 arrangement. It would cost $54 (\(V = 27\) cubic units, \(SA = 54\) square units), but the per day cost (\(SA/V\)) would be $2.00. It’s the cheapest per day cost above 14 days. So, if the astronauts were needed in space for 14 days, it would be better for NASA to combine it with another mission and have the astronauts up there for 27 days. This would save the taxpayers a lot of money!

Then we learned about growing squares. We learned about one-year old squares, two-year old squares, etc. Here is an example. As a square gets older, its edge gets bigger. One unit for each year! But if the edge gets bigger so does the area. So the area of a one-year old is 1

\[
\begin{align*}
\text{Ex 1} & \quad V = 3 \times 2 \times 2 = 12 \\
& \quad SA = [(3 \times 2) + (3 \times 2) + (2 \times 2)] \times 2 \\
& \quad = [6 + 6 + 4] \times 2 = 16 \times 2 = 32 \\
\end{align*}
\]

\[
\begin{align*}
\text{Ex 2} & \quad V = 12 \times 1 \times 1 = 12 \\
& \quad SA = [(12 \times 1) + (12 \times 1) + (1 \times 1)] \times 2 \\
& \quad = [12 + 12 + 1] \times 2 = 25 \times 2 = 50 \\
\end{align*}
\]
square unit while a two-year old’s area is 4 square units and a three-year old’s area is 9 square units. We then learned that if you want to find the area of a square you take its age and multiply it by itself. In math terms, you take its edge and square it. The formula is \( A = e^2 \). If I were a square my edge would be 12 units since I’m 12. My area would be 144 square units since \( A = e^2 = 12^2 = 12 \times 12 = 144! \)

We then did the same thing for cubes. But, instead of finding area for them, we found the volume, as they got older. We then found new formulas for volume and surface area for when you are working with cubes. \( V = e^3 \) and \( SA = e^2 \times 6 \). In a one-year old \( V = 1^3 = 1 \times 1 \times 1 = 1 \) cubic unit, \( SA = 1^2 \times 6 = 1 \times 1 \times 6 = 6 \) square units, and in a two-year old \( V = 2^3 = 2 \times 2 \times 2 = 8 \) cubic units, \( SA = 2^2 \times 6 = 2 \times 2 \times 6 = 24 \) square units, and in a three-year old \( V = 3^3 = 3 \times 3 \times 3 = 27 \) cubic units, \( SA = 3^2 \times 6 = 3 \times 3 \times 6 = 54 \) square units.

Now we were ready to solve the unit challenge. If we make a one-year old cube represent a one-year-old mouse and a two-year old cube represent a two-year old mouse, then it will take 8 one-year old mice to balance a two-year old mouse on the scale. So we can write a rule that a
n-year old mouse will be balanced by \( n^3 \) one-year old mice. A ten-year old mouse will be balanced by \( 10^3 = 1,000 \) one-year old mice. Well, the elephant is like a 40-year-old mouse. This is because the mouse is 6 cm high and the elephant is 240 cm high and it will take 40 mice standing on top of each other to equal the height of the elephant \( (240/6 = 40) \). So, to balance the elephant, we will need \( 40^3 = 40 \times 40 \times 40 = 64,000 \) one-year old mice!

If a one-year old cube is a mouse, then the cube’s jacket is a mouse coat. Hence, a one-year old mouse’s mouse coat would have a surface area of 6 square units. If you were to use these jackets to make coats for the older cubes, a two-year old cube would require four jackets because a two-year old cube has a SA = 24 \( (24/6 = 4) \). Hence, if you take four mouse coats and sew them together you’ll have a coat for a two-year old. Here’s a table we made. We found a rule from this table for how many mouse coats would be needed. If you had a n-year old mouse you would need \( n^2 \) one-year old mouse coats. Well, the elephant is the same as a forty-year old mouse. So you will need \( 40^2 = 40 \times 40 = 1,600 \) one-year old mice.

So, to answer the unit challenge. You will need 1,600 mice coats to make a coat for the elephant. And you will need 64,000 mice to balance the elephant on a scale!

<table>
<thead>
<tr>
<th>Edge or Age</th>
<th># of mouse coats</th>
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<td>( n^2 )</td>
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Problem Section

Strength

My strength in this unit is finding the area of a rectangle. I think it is my strength because of all the areas we had to calculate in this unit and in years past. I've been doing areas since third grade. And the area is just multiplication. If you know your multiplication table, area is easy and you won't need a calculator. Here is an example of area using the formula: \( A = l \times w \). In this example the area is 12 square units. We can verify this because we can count that it takes 12 squares to make this rectangle. To use the formula you count how many squares are along the length and how many squares are along the width and you multiply these together. In this case \( 4 \times 3 = 12 \) square units. It’s square units because it takes 12 squares to cover the rectangle. If we said 12 units, that’s only a line or length. That doesn’t have the two dimensions of this shape.

Weakness

My weakness in this unit is calculating the SA/V ratio. It’s not that hard for me, it’s just complicated because you have to calculate the surface area and the volume. Then you have to divide the volume into the surface area. \( \text{SA}/V \). Sometimes I get mixed up and divide surface area into volume, \( V/\text{SA} \) and this in wrong! Here’s an example. So once you’ve calculated the volume and surface area you can find the \( \text{SA}/V \) ratio which would be four for this example because \( \text{SA}/V = 16/4 = 4 \).
Reflection Section

This unit was fun and I learned a lot. I didn’t realize I had learned so much until I wrote my summary. It was fun because of being able to use all the tiles and blocks and working with my team. I had a great team! We got along well and our Task Manager always made sure that the work was evenly delegated so no one person was overloaded. We worked hard during class but it paid off because we didn’t get stuck with a lot of homework. That’s what happened in my last group. One member, who I won’t name here, would do nothing and we’d have to do her work. We would spend so much time arguing with her that we wouldn’t get all of our work done. In this group, we each did what we could. Jorge always did the hard stuff because he understood it better and then he’d explain it to us afterwards. This was a good group!