Across the long side of a sheet of paper, students write the numbers 1 through 35. One by one, the class writes out the factors for each number. "What are the factors of two?" asks Rachel. "One and two—that's all," she writes these underneath the 2. How about the factors of three?" After modeling a few examples on the overhead projector, she has students get with their partner to complete the list. "Keep in mind that when you get to the number twelve, there are six factors!" reminds Rachel. She allows everyone time to finish—those students who reach 35 first are allowed to keep going until the entire class has caught up. "See if you can list all of the factors up to fifty," she tells one team.

Using the list they have produced, students can easily recognize the which numbers are prime. "Remember, prime numbers have only two distinct factors—one and itself," reiterates Rachel. She points to the number 2 on her transparency. "Two is a prime—it has one and itself," she says. "P for prime," she says, writing a P next to the 2. She does the same for the number three. "Four isn't a prime," Rachel acknowledges, "because it has three factors. It's made up of something besides one and itself. We call that a composite number." She writes C for composite.

"What about five?"

"Prime," the students tell her.

"What about six?"

"Composite."

Working as a class, they label each number on their list all the way up to thirty-five. "Now that we have all that, we are ready to do prime factorization," announces Rachel.

On a fresh transparency, she writes the number 12. "All composite numbers can be broken down into prime factors," Rachel explains. "We are going to prime factor twelve by making a factor tree."

Under the twelve she draws a two lines that branch out.



"It looks like a little tent," observes one student. "Oh, I like that!" says Rachel. "Everyone draw a little tent under your twelve."

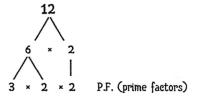
She explains, "When you do prime factorization, you have talk to yourself." To students' delight, Rachel strikes up a conversation with herself about the number twelve. "Self," she says, "is twelve prime?" "No," replies Rachel's self. "Then we need to pick any two factors of twelve," she tells herself, "but we can't pick twelve and one."

Rachel decides to write the factors 3 x 4 underneath the tent. Now she must have another chat with herself. "Is three prime?—yes." She draws

a single line down from the three and rewrites the three below it. "Is four prime?" she asks herself. "No." She draws a tent extending down from four and writes out the factors 2 x 2 underneath. Rachel has a discussion about each number at the base of the tree. "Is three prime? Yes. Is two prime? Yes. Is two prime? Yes."



"So the prime factors of twelve are three times two times two," concludes Rachel. She has the class write 12 again. This time, they choose the factors 6×2 .



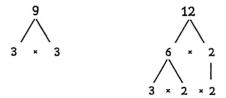
The prime factors are the same no matter which factors they start with. It is important that students connect a prime number down to the next line. "If you don't have them bring down that prime they will lose it." says Rachel.

Now she writes out a fraction the class was working with earlier:



Further down on the transparency, she and the students create a factor tree for 9, and another for 12.

"If we prime factor nine, what do we get?" she asks. "Three times three."



Rachel returns to the 9/12 at the top of the transparency and writes:

$$\frac{9}{12} = \frac{3 \times 3}{3 \times 2 \times 3}$$

"Notice that we have a three over a three," she points out. There are audible sounds of recognition from some students. "What is that?" Rachel asks. "One," they tell her.

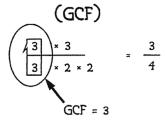
She draws the now-familiar outline of 1 around the 3/3.

$$\frac{9}{12} = \boxed{\frac{3 \times 3}{3 \times 2 \times 2}}$$

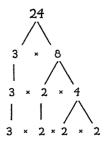
Finishing out the multiplication, they are left with the simplified fraction 3/4.

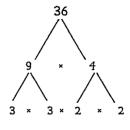
Pointing to the 3/3, Rachel explains, "Three is what we call the greatest common factor. That means that the biggest factor that nine and twelve have in common is three." On the overhead she writes:

Greatest Common Factor



Rachel selects another rational number to prime factor:





$$\frac{24}{36} = \frac{3 \times 2 \times 2 \times 2}{3 \times 3 \times 2 \times 2}$$

Simplified, the resulting equivalent fraction is 2/3.

Next, Rachel writes:

"Right away students can see that they don't need to prime factor five, because it is already prime, she says. "And thirty-five is simple to prime factor—most students don't have to bother drawing a factor tree."



Sometimes students will make this mistake when they write out the factors for five in the numerator:

$$\frac{5}{35} = \frac{5 \times 0}{5 \times 7}$$
 Ocops!

"It's not a zero, it's a one," corrects Rachel. "Every factor has a hidden one beside it. We don't usually write it, but it's there! It's important that you remember that there are secret ones hidden around all the time--beside that five there is a parenthesis with a one inside it," she explains.

"Zero cannot be one of five's factors--if you have zero as a factor, then the product must also be zero."

$$\frac{5}{35} = \frac{5}{5 \times 7}$$

$$\frac{5 \times (1)}{5 \times 7} = \frac{1}{7}$$

$$GCF = 5$$

Dazzling Venn Diagrams!

Using Venn diagrams is another fun approach to simplifying fractions. "Get with a partner," announces Rachel. "Turn to a fresh sheet in your notebook. I want each of you to make a list of your ten favorite foods."

She gives them a couple of minutes to write their list. Demonstrating on the overhead projector, Rachel instructs students to draw two large intersecting circles on their paper. Above one circle, the student writes his or her own name. Above the other circle, they write the name of their partner. "Now, I want you to talk to each other," Rachel tells them. The partners take turns sharing information from their list. For example:

Student 1: "I have pizza on my list—do you like pizza?"

Student 2: "Yes."

The partners both write pizza in the intersection of the two circles, and cross it off their lists.

Student 2: "Do you have mushrooms on your list?"

Student 1: "No."

Student 2 crosses mushrooms off her list, and each partner writes mushrooms inside Student 2's circle.

They continue to ask questions until they have crossed off all the items on their lists.

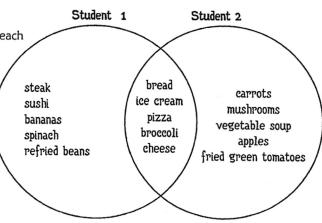
"Put your hand over the paper so that you can only see your circle," says Rachel. "You should have ten things in your circle."

On the overhead projector she writes 9/12. "Let's prime factor nine-twelfths again."



"Now we draw our intersecting circles," Rachel says. She labels one circle as 9 and the other circle as 12. "Nine and twelve are going to talk to each other," she explains. "Just like when you and your partner talked about your favorite foods."





She narrates the conversation with some help from the class. "Nine says to twelve, 'Do you have a three?' Twelve says, 'Yes.'" Rachel checks off 3 under each factor list and writes it in the intersection.

"Twelve says to nine, 'Do you have a two?' Nine says, 'No.'"

"Go fish," pipes one student.

Rachel crosses off a 2 and writes it inside the circle for 12.

"Nine says, 'Do you have another three?' Twelve says, 'No, go fish.'" Three is crossed out and goes into 9's circle.

"Twelve says, 'Do you have another two?' 'No,' says Nine." The last 2 is crossed off and written beside the other 2 in the 12 circle. Rachel writes a multiplication sign between them. "Two times two is four," she says.

Now they study the diagram. "What is left in nine's circle that isn't shared with twelve?" she asks the class.

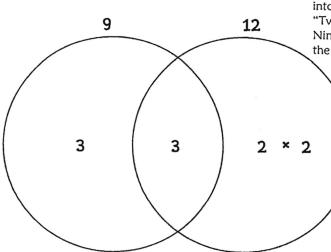
"Three."

"And what is left in twelve's circle that isn't shared with nine?"

"Four."

"Look, there's your answer—three-fourths!" says Rachel.

$$\frac{9}{12} = \frac{3}{4}$$



She asks, "What is in the intersection of nine and twelve?"

"Three."

"The intersection of nine and twelve gives us their greatest common factor—three." Rachel explains. She writes out:

$$9 - 12 = 3 (GCF)$$

"Let's simplify twenty-four-thirty-sixths."

 $\frac{24}{36}$

Prime Factors for 24:

Prime Factors for 36:

3 × 2 × 2 × 2

 $3 \times 3 \times 2 \times 2$

When there is more than one number in the intersection, students are instructed to put multiplication signs between them.

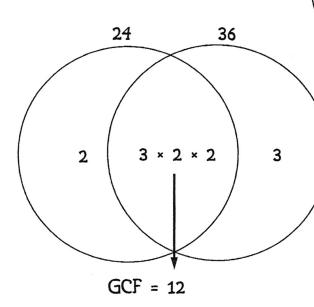
"What do twenty-four and thirty-six share?" asks Rachel.

"Two times two times three."

"What's do we have left?"

"Two-thirds."

"Now we are going to multiply what is in the intersection," says Rachel.



"The largest factor both of them share is twelve," she says.

Returning to the original fraction at the top of the page, she writes:

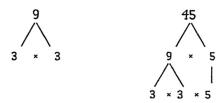
$$\frac{24}{36} = 12 \times 2$$

$$12 \times 3$$

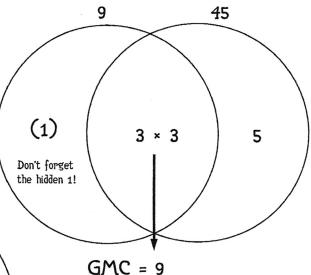
Simplified, the answer is:

$$\frac{24}{36} = \frac{2}{3}$$

Next, they prime factor 9/45:



"Let's draw out our Venn Diagram," says Rachel.



"It looks like nine doesn't have anything in it's circle," Rachel says. "but we know there is a secret what?"

"One," the class answers.

"That's right! If we have a product other than zero, then we know there is a secret one running around as a factor."

$$\frac{9}{45} = \boxed{\frac{9 \times 1}{9 \times 5}}$$

$$\frac{9}{45} = \frac{1}{5}$$

Now Rachel writes:

"Let's suppose I want to add these two fractions together," she suggests.. "We could prime factor eight and prime factor twelve."



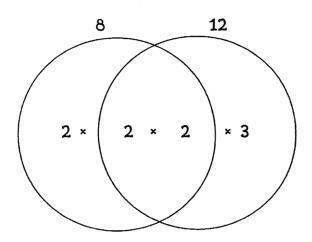


"Next, we draw our circles and label them," instructs Rachel. "What we need to find is the least common multiple, or LCM," she says, writing this out.

Least Common Multiple (LCM)

"In other words, if I wrote down the multiplication tables for eight and the multiplication tables for twelve, I want to know what is the smallest multiple they would share."

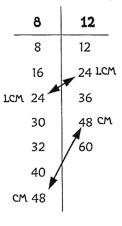
Inside the Venn diagram she writes multiplication signs between the all numbers contained within the circles in the right hand circle.



When multiplied out, the result is 24:

$$2 \times 2 \times 2 \times 3 = 24$$

"Now, let's look at something for a minute," Rachel says. Off to the side, she draws a T chart. With the help of the class, they fill in some multiples of 8 and some multiples of 12.



"We can see that twenty-four and forty-eight are common multiples," Rachel says. "If we kept writing our eights and twelves forever, we would find that they share an infinite number of common multiples. But twenty-four is the smallest."

"When we multiplied all the numbers in our Venn diagram, we found the least common multiple," she explains, writing:

$$8 \sim 12 = 24$$

"The union of eight and twelve equals twentyfour," Rachel reads. "And that is our the least common denominator."

24 = 1.CM

Returning to the original addition problem, she continues, "To get the least common denominator, we multiply seven-eighths by one in the form of three-thirds," she says. "And we multiply five-twelfths by one in the form of two over two."

$$\frac{7}{8} \times \left[\frac{3}{3} \right] =$$

$$\frac{5}{12} \times \left[\frac{2}{2} \right] =$$

Rachel calls the class' attention to Venn diagram. "Look at what is left in eight's circle, and what is left in twelve's circle. Notice that we are multiplying by two over two and three over three."

Finally, they complete the problem, leaving the answer in rational form:

$$\frac{7}{8} \times \left[\frac{3}{3}\right] = \frac{21}{24}$$
+ $\frac{5}{12} \times \left[\frac{2}{2}\right] = \frac{10}{24}$

31 24 Everything we needed to know is sitting here in our Venn diagrams!" Rachel smiles. "The intersection of sets gives us the greatest common factor, and in the union of sets we find the least common multiple."

Multiplication of Fractions

"Mathematics is the science of patterns," says Rachel. "Children inherently love to look for patterns, and inside their wonderful minds they draw conclusions."

For example, as students learn their multiplication tables, they discover that the product is always the same or greater than the two factors. They know that if they multiply 4×9 , the answer will be larger than four or nine.

"Students surmise that on their own," says Rachel. "They don't need to be told that when they multiply two whole numbers their answer always be bigger—they can see it for themselves." She pauses. "Then we teach them to multiply fractions."

Rachel writes:

$$\frac{1}{4} \times \frac{1}{2}$$

"We teach learners the algorithm—multiply the numerators, multiply the denominators:"

$$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

"One-eighth," she says thoughtfully. "One-eighth is less than one-half, and less than one-fourth. Students begin to notice that when they multiply two fractions, the product is less than it's factors."

Rachel provides the class with graph paper or geodot paper for their notebooks.

On the overhead, she draws a multiplication table.

"The multiplication of two numbers will always yield you a rectangle," Rachel explains. "Factor times factor equals product—both factors are linear measure. One factor is the length, the other factor is width. Their product is a rectangle—which is a square measure."

Above the chart she writes:

"In this case, three is our length and two is our width," she explains, drawing thick lines to indicate these measures on the chart.

0	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	4 8 12 16 20 24	30	36

Using her marker, Rachel draws two more lines to complete the rectangle, enclosing a total of six squares. "The area of the rectangle is six square units," she says.

 $3 \times 2 = 6$ square units

0	1	2	3	4	5	6
1			3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8				
5	5	10	15	20	25	30
6	6	12	18	24	30	36

She draws another chart, and writes above it:

"We go over five and come down four," she says, drawing. "When we complete the rectangle, we have enclosed twenty squares."

0	1		3		5	6
1	1	2 4 6 8	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Pointing to the 20 in the lower right hand corner," she explains, "That's the reason twenty is sitting down in this corner—the twenty means you have enclosed twenty square units. It makes sense."

She writes:

"If I drew this out, I would get a special kind of rectangle," Rachel confides.

"A square," says one student.

"That's right." agrees Rachel. "Now you can see why certain numbers are called square numbers."

0	1	2	3	4
1	1	2	3	4
2	2	4	6	8
3	3	6	9	12
4	4	8	12	16

"Now that we know something about rectangles," says Rachel, "We're going to put a magnifying glass on a one by one square."

At the top of a new transparency sheet, she writes:

$$\frac{1}{2} \times \frac{3}{4}$$

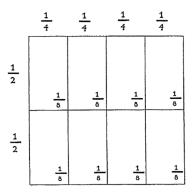
"Before we can make our rectangle, we have to mark off the fractions on our square," Rachel explains. "Across the top we divide the square in half," she says, drawing. "Along the side we divide the square into fourths."

When students have finished dividing up their own square, Rachel asks, "Now, how many little rectangles did we divide our little square into?"

"Eight," the students count.

"That's right," Rachel confirms. "We've divided our one by one square into eighths."

In the corner of each rectangle she writes 1/8. She checks to see that the students are also doing this in their notebooks. "I'm very picky about this," she informs them. "So we have eighteighths."



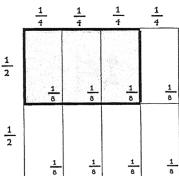
"Now we are ready to go," says Rachel. She draws a heavy line through ½... "Remember, that is one half of a line segment." Next she draws down ¾. "That is three-fourths of a line segment," she says. "Your factors are always linear measures."

Finally, Rachel draws two more lines to complete the rectangle and shades it in.

"How many rectangles have we enclosed?" she asks.

"Three-eighths."

"Right," says Rachel. "Three eighths of one whole square!"



$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$
 of one whole

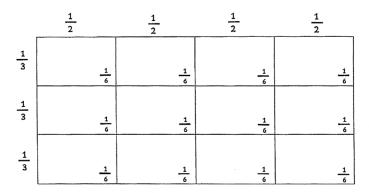
She writes another example on the overhead.

$$\overrightarrow{1}_{\frac{1}{2}} \times \frac{2}{3}$$

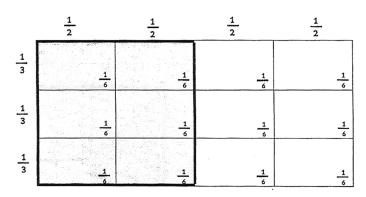
As they draw the set-up, Rachel reminds them, "We have to remember where our one whole square is—before we do anything else, we know how many parts we just divided the whole square into."

"Sixths," one student tells her.

"Sixths," repeats Rachel, "Not ninths!"

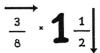


When they shade in the $1 \frac{1}{2} \times \frac{2}{3}$ rectangle, they discover they have enclosed six-sixths, or the equivalent of one whole square.



$$\frac{1}{2} \times \frac{2}{3} = \frac{6}{6}$$
 of one whole square

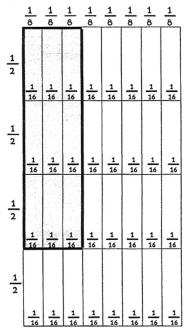
Rachel writes another problem on the overhead:



As with the previous problem, students must be aware of what makes up the original one by one square. "We've divided our squares into sixteenths," says Rachel. "Each of those rectangles is one-sixteenth. Now, we want to go over three-eighths, and come down one and one half."

They draw the outline and shade in a tall skinny rectangle made up of nine blocks.

$$\frac{3}{8} \times \frac{1}{2} = \frac{9}{16}$$



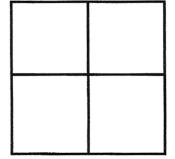
Using a slightly different approa-

Using a slightly different approach, Rachel draws a new whole square and writes:

$$\frac{1}{2}$$
 \times $\frac{3}{4}$

"This whole square is our One." she explains, adding, 'but we are looking at three-fourths today. We want to take a half of three-fourths."

Rachel sketches a new shape to better represent three-fourths.



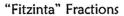
She draws a diagonal line across the upper left section, and shades in one half. The remaining shape is easily recognized by the students—it is looks like one of their fraction shape combinations.

"What do we have left?" Rachel asks.



"Yes," she agrees. "That means we have three-eighths of the original whole square."

$$\frac{1}{2}$$
 * $\frac{3}{4}$ = $\frac{3}{8}$ of one whole



"Most of the time when we teach division of fractions," Rachel quips, "We use the old Shakespearean method—'Ours is not to reason why, just invert and multiply."

Whenever she shares this adage with teachers in a workshop, it is met with the laughter of recognition. "This is how we were all taught to divide fractions—but no one really knows why we do it."

True to her teaching philosophy, Rachel begins by focusing on the language. "When we teach division of fractions, it is important to use the noun in our first examples," she says. "Remember, numbers are adjectives—fractions are qualitative, not quantitative. If I have a half, we also need to know who One is today."

On the overhead projector, Rachel draws a circle. "Suppose we have one cookie," she proposes, " and I want to cut it in half. What do I get? Two—but two what?" she asks insistently. She answers her own question, "Two half," she spells out the word to emphasize it, "H-A-L-F, cookies." She writes out the equation on the overhead:

$$1 \div \frac{1}{2}$$

"Invert and multiply":

$$1 \times \frac{2}{1} = 2$$

"Our answer is two, but no one ever teaches two WHAT. It is two half cookies--not two halves," she stresses. "Two half cookies."

Rachel draws out three more circles. "Now I have three cookies, and I want to divide them by one half," she says:

$$3 \div \frac{1}{2}$$

$$3 \times \frac{2}{1} = 6$$
 half cookies

"If I cut each cookie in half, I will have six half cookies."

"Division of fractions is a lot like trying on clothes," claims Rachel. "It's all a matter of 'fitzinta'—how much of me fitzinta my clothes."

She has invented compelling way of demonstrating this comparison for older students and teachers. "Sometimes when I go shopping for pants, I feel a little insecure" she confides, "because I think I've put on some weight over the holidays." It is a situation most adults in a teaching workshop can appreciate.

"I'm a normally a size sixteen," continues Rachel, "but I want to feel good about myself and I'm afraid! So I go right to the size twenty-two pants." She reveals a substantial pair of slacks. There are good-natured chuckles as Rachel holds the roomy garment up to herself.

"How many times do I fit in these pants?" she muses. "Oh, hey, one of me fitzinta, with room for more."

She writes:

"Sixteen will go into twenty-two once," she calculates, "with six-sixteenths left over. If I simplify, my answer is one and three-eighths."

$$\begin{array}{c|c}
1 & \frac{6}{16} & = 1 & \frac{3}{8} \\
16 & 22 & \\
 & -\frac{16}{6} & \\
\end{array}$$

"One and three-eighths what?" asks Rachel. "One and three-eighth Rachels," she explains. "All of me will fit into the size twenty-two pants, with room for another three-eighths of me."

Rachel writes:

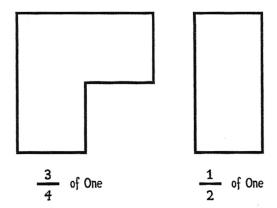
$$\frac{3}{4} \div \frac{1}{2}$$

She then rewrites it as:

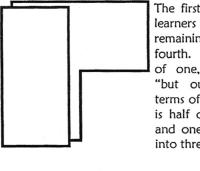
$$\frac{1}{2}$$
 $\frac{3}{4}$

"We want to know how many halves fit in three fourths," she says. "Right away, we can estimate that at least one one-half will fit into three-fourths.

She draws two squares on the overhead projector, and divides them up into the following shapes:



"If we lay the half on top of the three-fourths, we can see that one half fits inside three-fourths with a little chunk left over."



The first instinct of many learners is to see the remaining piece as one-fourth. "It is one-fourth of one," agrees Rachel, "but our answer is in terms of halfs—one fourth is half of one-half. One and one-half halfs will fit into three-fourths."

$$\frac{3}{4} \div \frac{1}{2} = 1 \frac{1}{2}$$
 half squares

"Sometimes when I go clothes shopping," Rachel reflects, "I feel really confident—I think I might have even lost some weight. In that case, I want to try on a smaller size."

She holds up a new pair of exceptionally small pants. The room erupts in laughter—it is quite evident that these new slacks will barely fit over her one leg. Rachel feigns ignorance. "Oh! Look at these pants," she says hopefully. "I wonder how much of me fitzinta this size six?"

Amid more peals of laughter, Rachel relates a story about the first time she did this demonstration in the classroom.. "There was an eighth-grade boy in the class who was just beside himself," she recalls, "and when I asked him what was so funny, he told me, 'I was just picturing what was hanging over.'

Well," she says wryly, "We can estimate—part of me fitzinta these slacks, with a lot hanging out."

She writes:

$$\frac{6}{16} = \frac{3}{8}$$

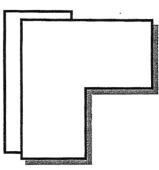
$$16 \boxed{6}$$

"Only three-eighths of me will fit into a size six," Rachel says goodnaturedly. "That isn't even a whole leg."

Going back to the fractional shapes she drew earlier, she writes:

$$\frac{1}{2} \div \frac{3}{4}$$

"We know how many times one-half fits into three-fourths," says Rachel, "but how many times does three fourths go into one half?" From the drawings, it is easy to estimate that only a part of 3/4 will fit inside 1/2.



"If we lay our threefourths over the onehalf, the whole thing does not fit," she observes. "What fractional part of threefourths fits into onehalf?"

The answer is twothirds. "We have to look at the three parts that make up threefourths," Rachel explains. "Two of the three will fit into one half. Two-thirds of three fourths."

$$\begin{array}{c|c}
2 & \text{of three-fourths} \\
\hline
1 & 3 & 4 & \\
\end{array}$$

"Mathematically, if we invert and multiply, we can see that it works out," says Rachel. "But now we know that it's one and a half halfs, and two-thirds of three-fourths.

WHY Invert and Multiply?

"In the world mathematics, there is one thing that all mathematicians try to avoid," says Rachel. "They do not like fractions in the denominator. Mathematicians always try to have a whole number in the denominator, because it makes estimation so easier," much she explains. "And they love it if that whole number can be One." She writes:

$$\frac{2/3}{3/4}$$

"Two-thirds divided by three fourths," reads

factor.

Rachel. "Remember, mathematicians hate the fact that 3/4 is in the denominator! They want a whole number in there!"

She writes:

"What can we multiply three-fourths by in order get One?" she says thoughtfully.

"Four-thirds."
She writes:

$$\frac{2/3}{3/4} \times \frac{4/3}{4/3} = \frac{2/3 \times 4/3}{12}$$

$$\frac{2/3}{3/4} = \frac{2/3 \times 4/3}{1}$$

"We've multiplied by one in the form of fourthirds over four-thirds," says Rachel with a smile.

"It's the wonderful number One!"

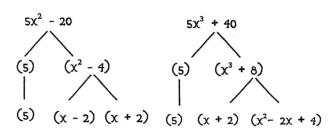
Amazing Algebra!

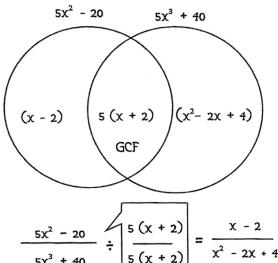
Here are a couple ways to apply some of this issue's activities to algebra!

Simplify:

$$\frac{5x^2 - 20}{5x^3 + 40}$$

Prime factor each part of the fraction:





Draw a Venn Diagram to find the greatest common

Add the following algebraic fractions!

$$\frac{x+3}{x^2+4x+4} + \frac{x+4}{x^2-4}$$

Or written as:

1) Prime factor the denominators (see right):

2) Set up equivalent fractions with LCM in the denominator.

$$\frac{x+3}{(x+2)(x+2)} = \frac{x+3}{(x+2)(x+2)(x-2)}$$

$$+ \frac{x+4}{(x-2)(x+2)} = \frac{x+4}{(x+2)(x+2)(x-2)}$$

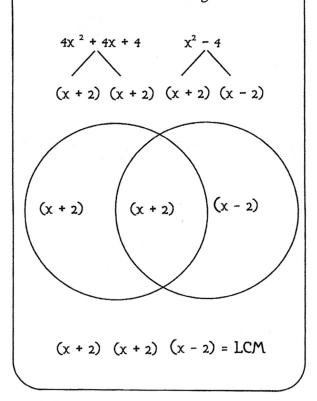
3) Multiply each fraction by one in the form of the missing factor:

$$\begin{array}{c|c}
x + 3 & \times & x - 2 \\
x + 2) & (x + 2) & x - 2
\end{array}$$

$$\begin{array}{c|c}
x + 4 & \times & x + 2 \\
(x - 2) & (x + 2) & x + 2
\end{array}$$

4)
$$\frac{x+3}{(x+2)(x+2)} = \frac{(x+3)(x-2)}{(x+2)(x+2)(x-2)}$$
+ $\frac{x+4}{(x-2)(x+2)} = \frac{(x+4)(x+2)}{(x+2)(x-2)}$

Prime factor denominators, then find LCM with Venn Diagram.



5) Multiply numerators of new equivalent fractions:

$$\frac{(x+3)(x-2)}{(x+2)(x+2)(x-2)} = \frac{x^2+1x-6}{(x+2)(x+2)(x-2)}$$

$$+\frac{(x+4)(x+2)}{(x+2)(x+2)(x-2)} = \frac{x^2+6x+8}{(x+2)(x+2)(x-2)}$$

6) Add the numerators. Or, as algebra teachers prefer to say: Combine similar terms and place them over the LCM.

$$\frac{x^{2} + 1x - 6 + x^{2} + 6x + 8}{(x + 2)(x + 2)(x - 2)}$$

(We're getting there...)

$$\frac{2 x^2 + 7x + 2}{(x + 2)^2 (x - 2)}$$

Yippee!