## Prime Time

## Investigation 5: Factorizations
## Day 1

## Connections

| Prior Work | Current Big Idea | Future Work |
|---|---|---|
| • Find factors for given numbers. | • Search for factor strings for given numbers. | • Recognize that a number may have several different factorizations but, except for order, each number greater than 1 has exactly one factorization into a product of primes (the Fundamental Theorem of Arithmetic)<br>• Recognize primes as the building blocks of whole numbers. |

## Lesson Process

| **Steps** | **Student activity** | **Teacher Support** | **Comment/Evaluation** |
|---|---|---|---|
| **Launch**<br><br>10-15 minutes | • Work with teacher to find factor strings for 360. | • Launch the search for the factor string by helping student move from thinking about factor pairs to thinking about longer strings of factors.<br>• **"So far in this unit we have looked at factor pairs of given numbers. For example, we can express 30 as 1 x 30, 5 x 6, 2 x 15, or 3 x 10. Can you think of three numbers you can** | • The problem presents another opportunity for students to look at a less obvious fact about the Fundamental Theorem of Arithmetic. That is, regardless of how each student start off the factoring, the final factoring will be the |

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| | | **multiply to get a product of 30?"**<br>• Ask students to suggest different strings.<br>• **"Let's look at a larger number because it might be more interesting. How about 360? What numbers can you multiply to get a product of 360?"**<br>• Write the strings that student given you on the board, organizing them by the number of factors they contain.<br>• Urge students to search for longer and longer strings.<br>• Press students to find a strategy for lengthening the strings that are already on the board.<br>• **"How do you know when you have found the longest string possible?"**<br>• **"How do you know you cannot make a string for 360 with more numbers in it?"** | same for all students.<br>• Only some students will recognize that the longest string for 360 contains only prime numbers.<br>• It is not a good idea to push students to see this too soon.<br>• Let students make this observation on their own. |
| **Explore**<br><br>20-25 minutes | • Works alone on the puzzle. Then work in pairs to complete the puzzle. | • Ask students to go to the board and list a string they have found. | • You may want to put headings such as "2-factor strings" and "3-factor strings" on the board to organize the strings by the number of factors. |
| **Summarize**<br><br>10-15 minutes | • Discuss the factor strings on the board. | • Use the questions in Problem 5.1 Follow-Up for the number 360 as part of the discussion. | • Because primes cannot be broken down into smaller factor pairs, an all-prime string must be the longest possible string. |

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| | | | • This might be a good time to tell your students that this factorization has a special name: the *prime factorization* of the number.<br>• Do not push the terminology now. |
| **Homework** | • ACE questions 16, 17, 19. | | |

## Prime Time

## Investigation 5: Factorizations
## Day 2

## Connections

| Prior Work | Current Big Idea | Future Work |
|---|---|---|
| • Find factors for given numbers. | • Search for the longest factor strings for given numbers. | • Recognize that a number may have several different factorizations but, except for order, each number greater than 1 has exactly one factorization into a product of primes (the Fundamental Theorem of Arithmetic)<br>• Recognize primes as the building blocks of whole numbers. |

## Lesson Process

| **Steps** | **Student activity** | **Teacher Support** | **Comment/Evaluation** |
|---|---|---|---|
| **Launch**<br><br>10-20 minutes | • Work with teacher and class to make factor tree for the number 360. | • Launch the problem by referring to previous day's work.<br>• **"Yesterday we found the longest string of factors for 360. However, it would be difficult to explain how we did this to someone else because our method was not very orderly."**<br>• **"Making a factor tree is a systematic way of finding the longest factor** | |

| Steps | Student activity | Teacher Support | Comment/Evaluation |
|---|---|---|---|
| | | **string for a number."**<br>• **"Let's try some factor trees for 360. Can you tell me some factor pairs for 360?"**<br>• As students call out factor pairs, list them on the board.<br>• Demonstrate what a factor tree should look like. Write 360 at the top with branches leading to two factors.<br>• Have student begin their own factor trees using the factor pair they suggested or any other pair you listed on the board.<br>• An example might be<br>360<br>15 X 24<br>• **"Could anyone suggest what we might do now to move us toward finding the longest possible string of factors for 360?"**<br>• Use students' suggestions of "breaking apart" or "breaking down" factors that are made of other factor pairs to move towards finding the longest strings.<br>• If no such suggestions come from the group, ask more leading questions.<br>• Have student continue to work on their factorization of 360 until they have found the longest possible string.<br>• Show all the factor trees that students | • Students need to recognize that, no matter what pair of factors they begin with, they will get the same longest string, except for the order of |

| Steps | Student activity | Teacher Support | Comment/Evaluation |
|---|---|---|---|
| | | have completed on the board.<br>• **"Did everyone get the same factorization in the bottom row of their factor tree?"** | the factors. |
| **Explore**<br><br>15-20 minutes | • Complete Problem 5.2 and Problem 5.2 Follow-Up with partner. | • Continue to ask questions that lead students to work in a systematic way. | • Do not discourage students from developing other efficient ways to arrive at longest string.<br>• The longest string will soon be referred to as *prime factorizations*. |
| **Summarize**<br><br>10-15 minutes | • Present factor strings and strategies used in finding them. | • **"What observations can we make about the longest factor string for a number?"**<br>• Students should now begin to see that the longest factor string for a number consists entirely of prime numbers. | • Continue asking questions until students see that the longest factor string for a number consists entirely of prime numbers. |
| **Homework** | • ACE questions 1-21, 21, 22. | | |

## Prime Time

## Investigation 5: Factorizations
## Day 3

## Connections

| Prior Work | Current Big Idea | Future Work |
|---|---|---|
| • Find factors strings for given numbers. | • Use prime factorization. | • Recognize primes as the building blocks of whole numbers. |

## Lesson Process

| **Steps** | **Student activity** | **Teacher Support** | **Comment/Evaluation** |
|---|---|---|---|
| **Launch**<br><br>10-15 minutes | • Find the greatest common factor and the least common multiple for 24 and 60 using any method. | • Ask student to find the greatest common factor and the least common multiple for 24 and 60 using any strategy that is helpful.<br>• Refer students to Heidi's method of using prime factorization to find the greatest common factor and the least common multiple of two numbers.<br>• Have students try Heidi's method on 30 and 35. | |
| **Explore** | • Complete Problem 5.3 and Problem 5.3 Follow-Up questions 1 and 4. | • Ask students to explain their thinking about Problem 5.3 Follow-Up | |

| Steps | Student activity | Teacher Support | Comment/Evaluation |
|---|---|---|---|
| 20-25 minutes | | questions 1 and 4. | |
| **Summarize**<br><br>10-15 minutes | • Share results and explain strategies.<br>• Complete Mathematical Reflections. | • Have students share results and explain strategies.<br>• Assign Unit Project – My Special Number. | |
| **Homework** | ACE questions 13-15, 20, 23, 24. | | |