Factoring Composite Numbers
ID: 10892

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Activity Overview
*In this activity, students will work with composite numbers to find their prime factorizations in exponent form. They will create factor trees and use division as a means to finding prime factors. Then students will use the handheld's **Factor** command to quickly obtain the prime factorization in exponent form.*

Topic: From Arithmetic to Algebra
- *Prime factorization*
- *Factor tree and prime factors*
- *Prime factorization in exponent form*

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Teacher Preparation and Notes
- *If an interactive white board is available, create a number sort with a Venn diagram. For example, intersecting circles for Primes and Multiples of 8. The students would be given a list of a few numbers to place into the proper part of the diagram. In this case, there would be no intersection. For another example, use Primes and Numbers less than 40. There would be quite a few possibilities for numbers contained in the intersection. (Teaching Reading in Mathematics, M. Barton and C. Heiderma, 2000)*
- *To precede this activity, the class could perform Eratosthenes' Sieve to find the Prime numbers. A chart could be created to keep on the classroom wall.*
- *Students will need to press ⒸⓉⓇⓁ + ▶ to advance to the next page. They will need to press ⒸⓉⓇⓁ + ⓣⓐⓑ to move to a different application within the same page.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "10892" in the quick search box.***

Associated Materials
- *Factoring_Student.doc*
- *Factoring.tns*
- *Factoring_Soln.tns*

Suggested Related Activities
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Here's Looking at Euclid (TI-Nspire technology) — 8611*
- *The Factor Game (TI-Navigator) — 6674*
- *Factors Galore C: Prime Factorization (TI-73 Explorer) — 5574*

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Problem 1 – Exploring a factor tree for a composite number

On page 1.3, students see an example of a factor tree with the prime factors at the end of "branches" circled, the composite number rewritten as the product of the primes, and also rewritten in exponent notation.
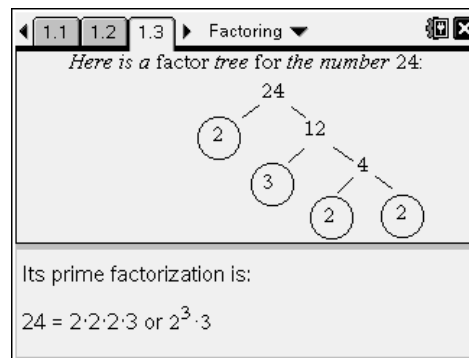
The students will answer questions on the next three pages. They should see that the number 24 is not a prime number and that the exponent for the factor 2 is three because there are three 2s.

Discussion Questions:

- *What if the factor tree starts out with two different factors than the ones shown? Will you still get the same answer?* Challenge students to change the factor tree on page 1.3 using two different starting factors. They can edit the number and move the circles and lines if needed. *Note:* To move a circle they must use the **Hide/Show** tool to show the center point first. Then drag the center point.

- *Does it matter in what order I list the final prime factors? Why might a teacher prefer that the numbers be listed in ascending order?*

- *Why is the exponent form used for the prime factorization?*

**Problem 2 – Exploring division to find prime factors**

On page 2.1, students observe the division that takes place from the composite number 30, down to 1. All prime factors have been found. Students are also shown the prime factorization. Note that there are no exponents in this example because there is only one of each factor.
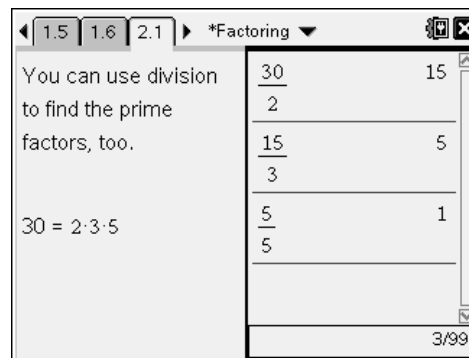
Students are asked to use the *Calculator* application to factor a composite number using basic division. They should complete a factor tree and the prime factorization on the worksheet.

To enter the fraction template, students can press $\text{ctrl} + \div$.

After making the factor tree, each student should assess how easy it was for them on page 2.3.
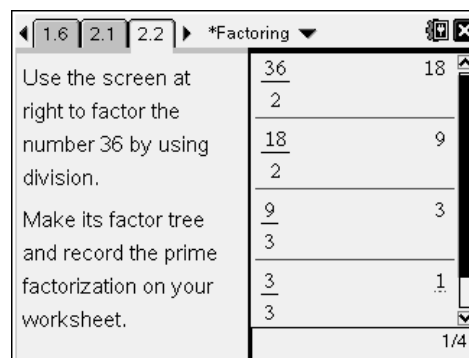
Things students can do after working through this problem:

- *How are prime factors used to create GCF and LCM? Demonstrate with an example.*

- *Explain how Eratosthenes' Sieve works to a younger student, to a peer, or to an adult.*

Problem 3 – Using the factor command

On page 3.1, students are shown how the **factor** command is used to obtain the prime factorization of a number in exponent form.

Students are to use the **factor** command to factor the composite number 100. They are told to use the green alpha keys on the keypad to access the letters to spell out "factor." An alternative to typing the word factor is to select **MENU > Number > Factor**.

On page 3.2, students complete the prime factorization of the numbers 27, 56, and 72 using both division and the **factor** command. They will also complete the factor tree of 72. Students should record their answers on the worksheet.
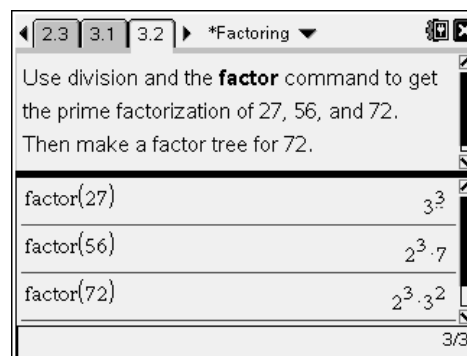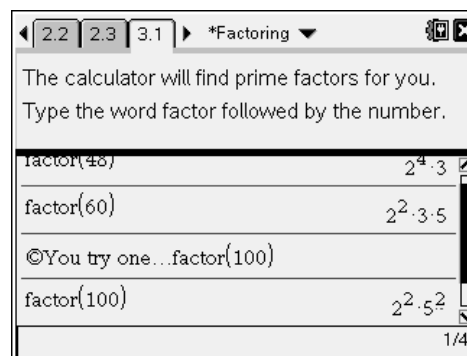
Problem 4 – Frayer Square for open-ended response

Directions are given to students on page 4.1 to complete the Frayer Square on the next page. The student is asked to think about the concept of Prime in several ways. The information garnered here can be used as Formative Assessment.

Though prompts are given to start students off in each quadrant, explain to students that they are adding words to the top half and adding numbers to the bottom half of the screen.

A similar Frayer Square could be used later as a more Summative Assessment, with Composite being the concept analyzed in the four squares.
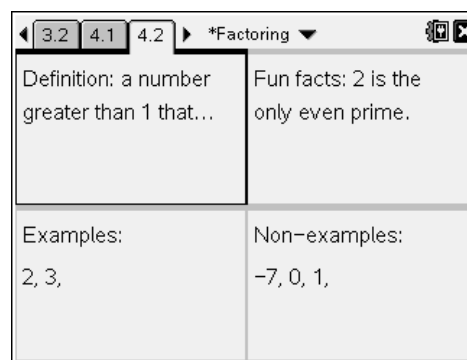
Possible Extension – Common Denominator

The students can demonstrate the use of prime factors in selecting a common denominator for fraction addition or subtraction problems.

They can use either method from the activity, factor tree or division, to find the prime factorization of each denominator. This can be checked by using the **factor** command.

Students can use the common denominator to simplify the expressions.
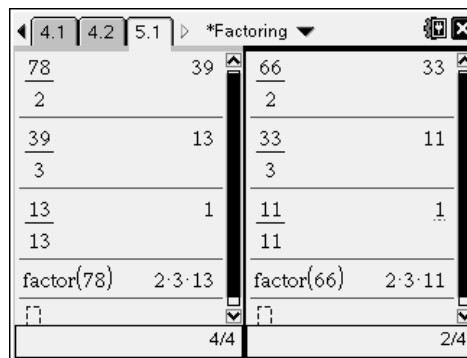
$$\frac{a}{126}+\frac{a}{84}$$

$$\frac{a}{2\cdot3\cdot3\cdot7}+\frac{a}{2\cdot2\cdot3\cdot7}$$

$$\left(\frac{2}{2}\right)\frac{a}{2\cdot3\cdot3\cdot7}+\left(\frac{3}{3}\right)\frac{a}{2\cdot2\cdot3\cdot7}$$

$$\frac{2a}{2\cdot2\cdot3\cdot3\cdot7}+\frac{3a}{2\cdot2\cdot3\cdot3\cdot7}$$

$$\frac{5a}{2\cdot2\cdot3\cdot3\cdot7}=\frac{5a}{252}$$

$$\frac{5x}{78}-\frac{x}{66}$$

$$\frac{5x}{2\cdot3\cdot13}-\frac{x}{2\cdot3\cdot11}$$

$$\left(\frac{11}{11}\right)\frac{5x}{2\cdot3\cdot13}-\left(\frac{13}{13}\right)\frac{x}{2\cdot3\cdot11}$$

$$\frac{55x}{2\cdot3\cdot11\cdot13}-\frac{13x}{2\cdot3\cdot11\cdot13}$$

$$\frac{42x}{2\cdot2\cdot11\cdot13}=\frac{42x}{858}=\frac{7x}{143}$$

$$\frac{n}{30}-\frac{n}{63}$$

$$\frac{n}{2\cdot3\cdot5}+\frac{n}{3\cdot3\cdot7}$$

$$\left(\frac{3\cdot7}{3\cdot7}\right)\frac{n}{2\cdot3\cdot5}+\left(\frac{2\cdot5}{2\cdot5}\right)\frac{n}{3\cdot3\cdot7}$$

$$\frac{21n}{2\cdot2\cdot3\cdot3\cdot7}+\frac{10n}{2\cdot2\cdot3\cdot3\cdot7}$$

$$\frac{31n}{2\cdot3\cdot3\cdot5\cdot7}=\frac{31n}{630}$$