Smart Cookie Factors

Brief Overview:

In this unit, Smart Cookie Factors, students will be introduced to the concepts of factoring numbers in order to find the Greatest Common Factor. A variety of approaches to finding the greatest common factor will be introduced and practiced. The concept of prime and composite numbers will be introduced and/or reviewed.

NCTM Content Standard/National Science Education Standard:

Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

- Recognize equivalent representations for the same number and generate them by decomposing and composing numbers.

Grade/Level:

Grades 4-5

Duration/Length:

Three lessons – 60 minutes per lesson
Summative Assessment on Day 4

Student Outcomes:

- The student will identify or describe numbers as prime or composite.
- The student will identify and use rules of divisibility.
- The student will identify the greatest common factor.

Materials and Resources:

Day 1

- Pre-Assessment Worksheets (Student Resources 1 & 1A)
- The Doorbell Rang by Pat Hutchins ISBN 0-688-09234-9
- Laminated chocolate chip cookies (Teacher Resource 1) with tape loops or magnets on the back
- Factor definition and diagram definition (Teacher Resource 2)
- Pair of dice or deck of cards (face cards removed) per pair of students
- Sandwich sized zip lock bags filled with cookie Crisp cereal or student sized cookie cut outs (Student Resource 2)
- Game recording sheet (Student Resource 3)
- Teacher observation Sheet (Teacher Resource 3)

Day 2

- Common factor Pre-Assessment Worksheets (Student Resources 4 & 4A)
- Cookie Word Problems Sheet (Teacher Resource 4)
- Laminated chocolate chip cookies and sandwich cookies (Teacher Resource 5) with tape loops or magnets on the back
- Cookie word problem worksheet (Student Resource 5)
- Baggies of cookie crisp cereal and mini sandwich cookies or baggies with student sized cut-outs of chocolate chip cookies and sandwich cookie cut-outs (Student Resources 6 & 6A)
- Exit Ticket (Student Resources 7 &7A)

Day 3

- Pre-Assessment Worksheet (Student Resources 8 & 8A)
- Overhead transparency (Teacher Resource 6)
- Picture definition of "Prime" (Teacher Resource 7)
- Picture Definition of "Composite" (Teacher Resource 8)
- Student sized white boards and markers, if available (If not available use pencil and paper.)
- Cookie Numbers (Teacher Resource 9)
- Smart Cookie Game Board (Student Resource 9)
- Cookie Playing Cards (Student Resource 10) enough for pairs of students in class
- Game Pieces (Student Resource 11) one strip for each pair of students
- Prime or Composite Worksheet (Student Resources 12 &12A)

Day 4

- Summative Assessment (Student Resources 13 & 13A)

Development/Procedures:

Lesson 1

Focus on understanding factors.

Pre-assessment

Distribute worksheet (Student Resource 1) with questions on divisibility by 2, 3, 5, 9, and 10. Included on the worksheet will be the question: "What is a Factor?" Allow time for the students to complete the worksheet.

Launch

Read aloud the book The Doorbell Rang. Have the twelve laminated cookies (Teacher Resource 1) randomly placed on the board with tape loops or magnets. Stop each time the cookies are divided and have students go to the board to divide

the twelve cookies into the appropriate number of groups. Record the grouping on the board. (Example: 1 x 12)

Teacher Facilitation

After finishing the book, have the students observe the different ways the twelve cookies were grouped. Ask the students "What do these numbers have in common?"

Discuss that these numbers are all factors of 12. Have students work with a partner to write a definition of a factor. Have students share definitions to decide upon one thorough definition. See (Teacher Resource 2) for a complete definition and factor definition diagram. Have students record these definitions in their math journals.

Model finding the factors of 18, 24, etc. using additional laminated cookies with tape loops on the back.

Student Application

Divide students into pairs to practice finding factors by playing a game. Each student will roll dice or select two cards from the deck to make a two digit number. Give each student a sandwich bag filled with cookie crisp cereal to use as a manipulative to help students find the factors for their number. If food is not allowed, then use cookie cutouts (Student Resource 2). They will write this number on a recording sheet (Student Resource 3) and then find all of the factors for their number. The student with the most factors wins the round and earns one point. The student then records the number of factors as "the number of cookies in the jar." The student with the most cookies in the jar at the end of the twelve rounds wins.

Embedded Assessment

Teacher will circulate and informally assess the students understanding of factoring by recording findings on an observation sheet. (Teacher Resource 3)

Reteaching/Extension

Gather as a group to review the definition of factors and allow students to again model factoring on the board using the cookies, as time permits.

Lesson 2

Focus on finding and understanding Greatest Common Factor

Pre-assessment

Distribute worksheet (Student Resource 4) that instructs student to find the factors of two different numbers and then instructs them to circle the factors the two numbers have in common. Students are also asked to answer the question "What is the Greatest Common Factor?" Allow time for the students to finish the worksheet.

Launch

Read aloud a word problem involving making bags of cookies that contain equal amounts of two different types of cookies. (Teacher Resource 4) Find the greatest amount of bags of cookies that can be made using all of the cookies in equal amounts for each type of cookie in each bag. Discuss how using factors could help them to solve the problem.

Teacher Facilitation

With the students assistance, the teacher will model finding all of the factors of each type of cookie. Use the laminated cookies (from Teacher Resource 5) or real cookies to find all of the factors and record the factors on the board. Circle the factors that both amounts of cookies have in common. Ask: "What is the Greatest Common Factor for these two amounts of cookies? How will this help us find the amount of cookies that will go in each bag and how many bags we will need if we want the greatest amount of bags possible?"

Solve the problem. Answer any questions the students may have.

Student Application

Students will work with a partner to solve a cookie word problem (Student Resource 6). Students can model the problem with baggies of cookie crisp cereal and mini sandwich cookies or student sized chocolate chip and sandwich cookie cut-outs (Student Resource 5). Students will record their answers on the word problem worksheet.

Embedded Assessment

Exit ticket: Complete and turn-in cookie word problem worksheet (Student Resource 7) to be evaluated.

Reteaching/Extension

Write several groups of numbers on the board. Students will find the GCF using the cookie manipulatives.

Lesson 3

Focus on using prime factorization to find the Greatest Common Factor. Students will learn and/or review the meaning of prime and composite numbers.

Pre-assessment

Distribute (Student Resource 8) which shows a number at the beginning of a factor tree and a number at the beginning of a division ladder. Students should solve the problems and answer the questions "What is a prime number?" and "What is a composite number?"
Allow time for the students to finish the worksheet.

Launch

Play the concept attainment game, "Guess My Rule" by using an overhead transparency of Teacher Resource 6. The transparency will have a "Yes" column and a "No" column. Students will give numbers. Write the number in the "yes" column if it is composite and in the "no" column if it is prime. Have students guess the rule. Hint: The rule has to do with the number of factors the numbers have.

Teacher Facilitation

Once students have figured out the rule, work as a class to define prime and composite. Prime numbers have only the factors of one and itself while composite numbers have at least one more factor that one and itself. Students will write these definitions in their math journal along with the picture definitions. (Teacher Resources 7 and 8).

Explain how prime factorization can be used to find the greatest common factors of two or more numbers. Demonstrate prime factorization using factor trees and division ladders. Show how these prime factors are used to find the GCF.

Student Application

1) Pull out a single number cookie (Teacher Resource 9) and show the cookie to the students. Students will identify the number as prime or composite and explain their reasoning. Discuss with students if they agree or disagree and why. Students may use white boards or paper and pencil to help them determine if the number is prime or composite. Pick two or three cookies from (Teacher Resource 9) and find the GCF of these numbers. Use a factor tree to model how to find the GCF of one number and discuss the prime and composite numbers. Be sure to point out that your factor tree is completed when all numbers are prime. Then do the same with the other number but use a division ladder. If doing a third number, have the students choose one of the two methods and find the factors. Discuss the GCF of

all the numbers. Students can use white boards or paper and pencil to find the factors.

2) Play Smart Cookie Board Game in pairs. (Student Resource 9) The game consists of a game board , cookie cards with pairs of numbers on them (Student Resource 10) and 2 game pieces (Student Resource 11). Player one draws a card. Player one finds the GCF for the pair of numbers and advances that amount of spaces on the board. Player 2 repeats the process. The first player to reach the finish line wins. Students may use cookie manipulatives, white boards and markers or pencil and paper to assist them in finding the GCF for each number. Students can use the method for finding the GCF with which he/she feels most comfortable.

An alternative to this game is to use the cookie playing cards to play Greatest Common Factor War. Divide the cookie cards between the two players. Each player places one card face up. The card with the larger GCF wins the round. Play until one player has all of the cards or as time permits.

Embedded Assessment

Prime and Composite Worksheet (Student Resource 12): Students will complete a worksheet on prime and composite numbers as well as finding the GCF using a division ladder and a factor tree.

Reteaching/Extension

Student will use the computers to visit the following websites that have interactive games for finding the GCF using a factor tree and using a division ladder.

www.puplemath.com/moduels/fetnumq.html - division ladder

www.nlvm.usu.edu/en/nav/frames - factor tree

Summative Assessment

Student Resource 13: This assessment includes finding the divisibility of numbers, finding factors, finding the greatest common factor using the three different methods presented over the three day period, word problems, determining if a number is prime or composite and a short answer about the students preferred method for solving the greatest common factor.

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Name_____ Date_____

You're On Your Way to Being an Even SMARTER COOKIE

Smart cookies know about factors. Over the next three days you will learn about them. Let's see what you know to begin with. Do the best you can and show your work.

Under each number write if that number is divisible by 2,3, 5, 9 and/ or 10.

25	16	12	18

What is a factor?

What are all the factors of 12?

Answer Key

Name_____ Date_____

You're On Your Way to Being an Even SMARTER COOKIE

Smart cookies know about factors. Over the next three days you will learn about them. Let's see what you know to begin with. Do the best you can and show your work.

Under each number write if that number is divisible by 2,3, 5, 9 and/ or 10.

25	16	12	18
5	**2**	**2, 3**	**2, 9**

What is a factor?
A factor is a number that you multiply by another to get the original number.

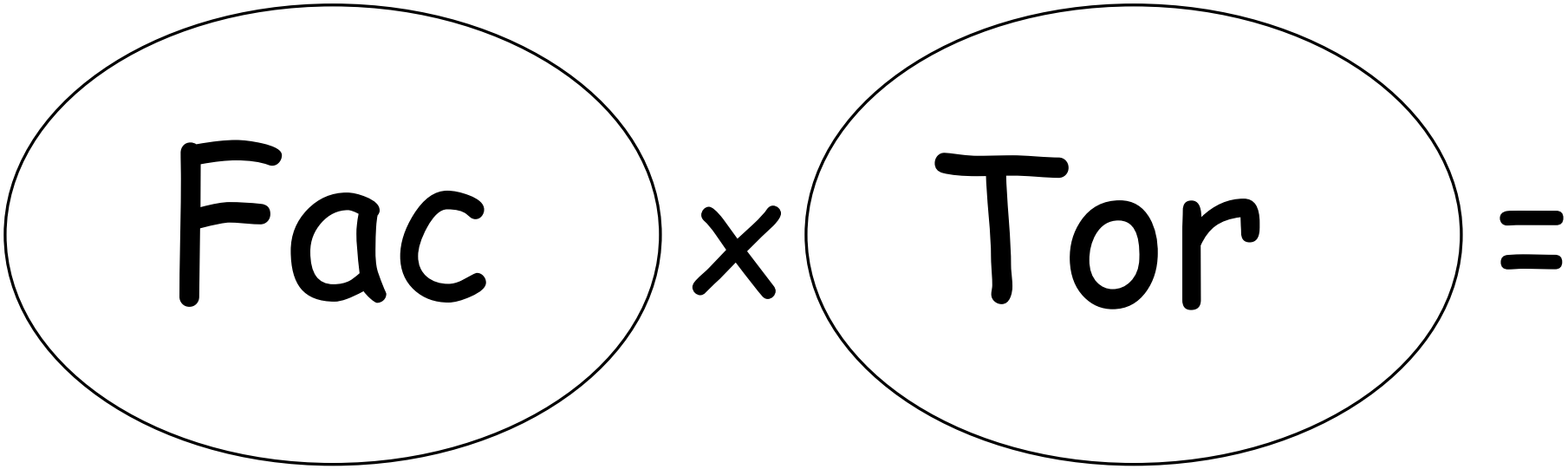
What are all the factors of 12?

1, 2, 3, 4, 6, 12

Teacher Resource 1- Copy 10 times



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Who has more cookies in the Cookie Jar?

Directions:

1) Player 1 rolls two dice or picks two number cards from a deck of cards.
2) Create a two-digit number from the numbers you rolled or picked.
3) Find all the factors for that number and record in the box.
4) The number of factors you found is the number of cookies you can put in the jar.
5) Player 2 then completes steps 1-4.
6) After 12 rounds add up all your cookies in the jar. The player with the most cookies WINS!!

Number Made	*Factors of that Number*	*Number of Cookies in the Jar*

Who has more cookies in the Cookie Jar? Teacher Observation Sheet			
Name of Student who is having trouble.	Trouble with what a factor is.	Trouble with finding factors or multiplication.	Other (write in own notes).

Name_____Date_____

You're On Your Way to Being an Even SMARTER COOKIE

Smart cookies know about Greatest Common Factors (GCF). Today you will learn about finding GCF's. Let's see what you know to begin with. Do the best you can and show your work.

Find the common factors of the two numbers below. Then circle all the factors that these numbers have in common.

36 48

What factors do these numbers have in common?

Write a definition of what you think greatest common factor means?

Student Resource 4A
Answer Key

Name_____Date_____

You're On Your Way to Being an Even SMARTER COOKIE

Smart cookies know about Greatest Common Factors (GCF). Today you will learn about finding GCF's. Let's see what you know to begin with. Do the best you can and show your work.

Find the common factors of the two numbers below. Then circle all the factors that these numbers have in common.

36	48

36: 1, 2, 3, 4, 6, 9, 12, 18, 36

48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

Circled Factors: 1, 2, 3, 4, 6, 12

What factors do these numbers have in common?

1, 2, 3, 4, 6, 12

Write a definition of what you think greatest common factor means?
The factor with the largest value that two or more numbers have in common.

Our class is going to put together bags of cookies for the Spring Fair. If we have 32 chocolate chip cookies and 40 sandwich cookies what is the largest amount of bags we can create so there are no cookies left over?











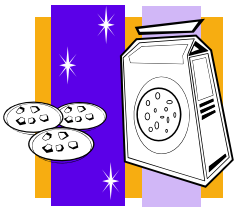








Name_____ Date_____



Bags of Cookies

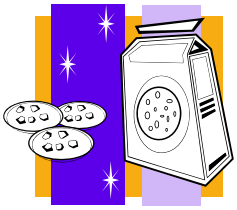
Now you are going to put together bags of cookies for the fair.

You have 42 chocolate chip cookies and 21 sandwich cookies. What is the greatest amount of cookie bags you can make with no cookies left over.

How many bags of cookies were you able to make?_____

What is the greatest common factor for 42 and 21? Show your work.

Name_____ Date_____



Bags of Cookies

Now you are going to put together bags of cookies for the fair.

You have 42 chocolate chip cookies and 21 sandwich cookies. What is the greatest amount of cookie bags you can make with no cookies left over?

How many bags of cookies were you able to make?_____7_____

What is the greatest common factor for 42 and 21? Show your work.
Students work will vary depending on their method to solving the problem.

Name_____ Date_____

Exit Ticket

Solve the following problem using what you learned about greatest common factors today. Be sure to show your work.

Beth is putting together baskets of soap for mother's day to sell at the fair. She has 54 vanilla scented soaps and 48 tropical fruit scented soaps. What is the greatest amount of baskets of soaps Beth can make without having any soap left over? Use words, pictures, and/or numbers to show how you found your answer.

Student Resource 7A
Answer Key

Name_____ Date_____

Exit Ticket

Solve the following problem using what you learned about greatest common factors today. Be sure to show your work.

Beth is putting together baskets of soap for mother's day to sell at the fair. She has 54 vanilla scented soaps and 48 tropical fruit scented soaps. What is the greatest amount of baskets of soaps Beth can make without having any soap left over? Use words, pictures, and/or numbers to show how you found your answer.

6 baskets with 9 vanilla scented soaps and 8 tropical fruit scented soaps

Name_____Date_____

You're On Your Way to Being an Even SMARTER COOKIE

Smart cookies know about prime and composite numbers. Today you will learn about these types of numbers. Let's see what you know to begin with. Do the best you can and show your work.

Find the Greatest Common Factor using a factor tree or a division ladder.

44

88

Student Resource 8A
Answer Key

Name_____Date_____

You're On Your Way to Being an Even SMARTER COOKIE

Smart cookies know about prime and composite numbers. Today you will learn about these types of numbers. Let's see what you know to begin with. Do the best you can and show your work.

Find the Greatest Common Factor using a factor tree or a division ladder.

44

88

GCF: 11

Guess My Rule

Yes	No

Prime x 1 = Prime

A prime number has only 2 factors, one and itself.

CO x OM x PO x SI x TE

A composite number has at least two more than two factors.


15


99


7


19


63


84


77


31


47


12

Who will get the cookies in the Cookie Jar?

Start					


28 & 47


33 & 68


28 & 74


86 & 95


57 & 42


12 & 43


83 & 82


90 & 38


14 & 21


9 & 3


75 & 12


18 & 34


75 & 32


84 & 58


12 & 9


66 & 77


49 & 56


92 & 16


27 & 58


25 & 9

Game Pieces








Name_____ Date_____

Prime or Composite Cookies

Directions: Sort the following numbers into prime and composite numbers.

45	71	21	82	63	37	53
7	9	64	27	11	89	50
32	2	99	33	58	84	28

Prime	Composite

What two numbers are neither prime nor composite? _____

Find the greatest common factor for the following numbers. 52 21
(show your work)

BCR: **Your teacher has asked you to help grade some math papers but the answer key was lost. Student needed to say if the number 37 was prime or composite. The paper you are grading says composite. Should you mark the answer as correct or incorrect? Use what you know about factors to explain your answer.**

Name_____ Date_____

Prime or Composite Cookies

Directions: Sort the following numbers into prime and composite numbers.

45	71	21	82	63	37	53
7	9	64	27	11	89	50
32	2	99	33	58	84	28

Prime	Composite
71	**45, 99**
37	**21, 33**
53	**82, 58**
7	**63, 84**
11	**9, 28**
89	**64**
2	**27**
	50
	32

What two numbers are neither prime nor composite? **1 and 0, one and zero**

Find the greatest common factor for the following numbers. 52 21

(show your work) **GCF: 1**

BCR: **Your teacher has asked you to help grade some math papers but the answer key was lost. Student needed to say if the number 37 was prime or composite. The paper you are grading says composite. Should you mark the answer as correct or incorrect? Use what you know about factors to explain your answer.**

The answer should be marked as incorrect. The number 37 is prime. The factors of 37 are 1 and 37. The definition of a prime numbers is its only factors are 1 and itself.

2	**Student states the answer is prime and give evidence such as 37 is only divisible by 1 and itself.**
1	**Student states the answer is prime but give no evidence for the answer or the evidence is incorrect.**
0	**Student states the answer is composite or no answer is given.**

Name _____ Date_____

Factor Assessment

Divisibility. Are the numbers divisible by 2, 3, 5, 9, 10?

36 _____ 45 _____

60 _____ 73 _____

Find all of the factors for each number.

63 _____

15 _____

48 _____

27 _____

Find the Greatest Common Factor for the following sets of numbers by <u>listing all of the factors</u> of each number.

54, 36 81, 63 15, 40

Find the Greatest Common Factor for the following sets of numbers by using <u>Factor trees</u>.

39, 26 28, 49 16, 32, 40

Find the Greatest Common Factor for the following sets of numbers by using <u>Division ladders</u>.

9,15, 27 64, 44 24, 40

Which method do you like best for finding the greatest Common Factor: Factor Trees, Division Ladders or Listing out all factors?

Why do you like this method? What are the Advantages/Disadvantages to this method?

You are making centerpieces for the Mother's Day Tea at School. You have 12 roses, 18 tulips, 24 daisies and 30 daffodils. What is the largest number of centerpieces you can make using all of the flowers and having an equal number of each type of flower in each centerpiece? How many of each type of flower will be in each centerpiece?

There are 45 members in the school band. How many different ways can you arrange the seating for the band at the school concert? List all of the possibilities for the number of rows and the number of band members in each row. Here is one to get you started.

3 rows of 15 band member

Student Resource 13A

Summative Assessment

Name_____**Answer Key**_____ **Date**_____

Divisibility. Are the numbers divisible by 2, 3, 5, 9, 10?

36: 2, 3, 9

45: 3, 5, 9

60: 2, 3, 5, 9, 10

73: none

Find all of the factors for each number.

63 : 1, 3, 7, 9, 21, 63

15 : 1, 3, 5, 15

48 : 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

27 : 1, 3, 9, 27

Find the Greatest Common Factor for the following sets of numbers by <u>listing all of the factors</u> of each number.

54, 36	**81, 63**	**15, 40**
GCF: 18	GCF: 9	GCF: 5

Find the Greatest Common Factor for the following sets of numbers by using <u>Factor trees</u>.

39, 26	**28, 49**	**16, 32, 40**
GCF: 13	GCF: 7	GCF: 8

Find the Greatest Common Factor for the following sets of numbers by using <u>Division ladders</u>.

9,15, 27	**64, 44**	**24, 40**
GCF: 3	GCF: 4	GCF: 8

Which method do you like best for finding the greatest Common Factor: Factor Trees, Division Ladders or Listing out all factors? Open Response, check students work to see if it makes sense

Why do you like this method? What are the Advantages/Disadvantages to this method? Open Response, check students work to see if it makes sense

You are making centerpieces for the Mother's Day Tea at School. You have 12 roses, 18 tulips, 24 daisies and 30 daffodils. What is the largest number of centerpieces you can make using all of the flowers and having an equal number of each type of flower in each centerpiece? How many of each type of flower will be in each centerpiece?

6 centerpieces each with 2 roses, 3 tulips, 4 daisies and 5 daffodils

There are 45 members in the school band. How many different ways can you arrange the seating for the band at the school concert? List all of the possibilities for the number of rows and the number of band members in each row. Here is one to get you started.

3 rows of 15 band member
1 row of 45 band members
5 rows of 9 band members
9 rows of 5 band members
15 rows of 3 band members
45 rows of one band member