Name: _____ Date: _____

Student Exploration: Pattern Flip

Vocabulary: least common multiple, multiple, pattern, sequence

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
Frances is making a charm bracelet. Her bracelet so far is shown below.

1. A **pattern** is a repeated group of objects or numbers. What pattern do you see on the charm bracelet? _____

   _____

2. If Frances continues the pattern, what should the next two charms be? _____ _____

3. Frances wants the bracelet to have 12 charms. What will the last charm be? _____

Gizmo Warm-up
Step right up and play the Pattern Flip Card Game! In the *Pattern Flip* Gizmo, the challenge is to find the pattern in the cards you see, and then figure out what's on the cards that are face down.

To see more cards, click and drag the string of cards left or right. Or use the arrow keys to scroll back and forth. To change the number of cards you see, click zoom out (−) or zoom in (+).

1. Check that pattern **A** is selected. What is the pattern? _____

2. What animal will be on card 8? _____ Card 9? _____ Card 23? _____

   To check your answers, flip the cards by clicking on the numbers below the cards. You can also click the **Show all** button to see all the cards.

3. Each pattern is a repeating **sequence**, or group, of cards. Turn on **Show groups**. For pattern **A**, how many cards are in each group? _____

Activity A: **Pattern predictions**	Get the Gizmo ready: • At the bottom of the Gizmo, select pattern **B**. • Turn off **Show groups**.	

If the cards follow a pattern, you should be able to predict what the next cards in the sequence will be. In fact, you can figure out *any* card in the sequence!

1. Look at pattern **B**. Write down the first 10 cards in spaces 1 through 10 below.

_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
1	2	3	4	5	6	7	8	9	10

2. Look at the numbers of the elephant cards. What do they all have in common? _____

   _____

3. Based on this, which of the cards listed below will have elephants? Circle your choices first.

   14 17 23 32 45 67 88 Check by clicking on each number.

4. For this pattern, how many cards long is the group that repeats? _____

   Check by turning on the **Show group** checkbox.

5. Look at the numbers of the cards with cows. Try to find a pattern in these numbers.

   A. What is the pattern? _____

   B. Where will you find the next three cows? ____ ____ ____ (Check your answers.)

6. Now try to find a pattern in the numbers of the bear cards.

   A. What is the pattern? _____

   B. Where will you find the next three bears? ____ ____ ____ (Check your answers.)

7. Predict which animal is on each card below. Check your answers by flipping the cards.

   Card 25 _____ Card 31 _____ Card 58 _____

Now that you have explored this pattern, you are ready to play a carnival game. Choose a game (**Name it** or **Flip it**) in the Gizmo. Follow the directions carefully, and play. Good luck!

Activity B: **Multiples**	Get the Gizmo ready: • If you are playing a game, finish and click **Done**. • At the bottom of the Gizmo, click **Edit**.	

You have been hired to produce a new **Pattern flip** game for a carnival. The carnival wants a pattern with a group that is three cards long, with a different animal on each of these cards.

1. After clicking **Edit** you are in the pattern editor. Create a pattern of three cards, each with a different animal. Which did you pick? _____ _____ _____

2. Click **Done** to view your pattern. Focus on the third animal in your pattern. At what numbers does this animal appear? _____

3. To find the **multiples** of a number, multiply that number by 1, 2, 3, 4, 5, and so on. For example, the multiples of 7 include 7, 14, 21, 28, 35, etc.
   A. Look at your list from question 2. All of these are multiples of what number? _____
   B. Which other cards will have this animal? _____ (Check answers.)

4. Now look at the second animal in your pattern.
   A. At what numbers does this animal appear? _____
   B. Which other cards will have this animal? _____ (Check answers.)

5. Notice that these numbers are not multiples of 3. But all of them *are* 1 less than a multiple of 3. Based on this fact, which of the following cards will look the same as the second card?
   Circle your choices: 36 23 41 56 28 65 (Check answers.)

6. Figure out the pattern for the animal on the first card. Which cards will have this animal?
   Circle your choices: 19 45 22 52 31 71 (Check answers.)

7. Predict which animal is on each card below. Check your answers by flipping the cards.
   Card 75 _____ Card 38 _____ Card 100 _____

Now that you have explored your pattern, play the **Name it** and **Flip it** games. Good luck!

Activity C: **Double patterns**	Get the Gizmo ready: • Select pattern **D**. • Turn off **Show groups**.	

At the Pattern Flip World Championship, the patterns are complex. Are you up to the challenge?

1. Look at pattern **D**. Focus on the crab on the top row, and the pig on the bottom row.
   A. At what numbers can you find a crab? ____ ____ ____ ____ ____ ____ ____
   B. At what numbers can you find a pig? ____ ____ ____ ____ ____ ____ ____
   C. At what numbers can you find a crab over a pig? ____ ____ ____ ____ ____

2. Based on your lists, fill in the blanks: The crab numbers are all multiples of _____. The pig numbers are all multiples of _____. The crab over pig numbers are all multiples of _____. The last number is called the **least common multiple**, or LCM, of the two other numbers.

3. Based on what you have discovered, at which of the following numbers would you expect to find a crab over a pig? 27 44 36 22 54 (Check your answers.)

4. Now try to figure out a rule of thumb for finding a lion over a bear.
   A. At what numbers do you see a lion over a bear? ____ ____ ____ ____ ____
   B. Describe the pattern. _____
   C. Based on your rule, at which of the following numbers would you see a lion over a bear? 25 29 37 43 51 (Check your answers.)

5. Challenge: Click **Custom** and click **Edit**. In the **Pattern editor**, click **Clear patterns** and turn on the **Two patterns** checkbox. Create a pattern that will have an elephant over a crab once every 10 cards. Then click **Done**. Describe your pattern below.

   Top row: _____

   Bottom row: _____

On your own, play the **Name it** and **Flip it** games for a double pattern. (You can use your custom pattern or pattern **D**.) Good luck!