## Bead Loom Questions

We are going to begin a study of beadwork. You will be able to create beadwork on the computer using the culturally situated design tools.

Read the first page and then click on continue which will enter you into the section on cultural background. Read through this section and answer the questions below.

## Cultural Background

## Four Fold Symmetry

Look at the four images of Native American designs under cultural background. The four designs represent different tribes throughout the United States. Symmetry was extremely important in the creation of art and artifacts made by the Native Americans.

Geometry is prevalent in Native American designs. The circle was very important to Native Americans representing the four directions and the Great Spirit. When looking at much of Native American art, the four directions and the circle will be present in many of the designs. Indians used geometric shapes such as triangles in designs. Rays and lines were also used and had many meanings in the art work.

Looking at the four examples in the tutorial, what geometric designs do you see?

Embroidery, Plains Indians: $\qquad$

Shoshone Beadwork: $\qquad$

Pawnee Buffalo Hide Drum: $\qquad$

Sand Paintings, Navajo: $\qquad$

What geometric features are common in all four examples?

Symmetry is a geometric term which means that there is a reflection over a line of symmetry. For example, look at the first example of embroidery work done by a Plains Indian. There are two lines of symmetry. If you draw a line vertically through the upper two triangles, what you have on one side of the line will match what you have on the other side of the line. Also, if you draw a horizontal line between the left two triangles, again you will have a line of symmetry where the upper half will be a reflection of the lower half.


Now look at examples two through 4 on the tutorial. How many lines of symmetry are there in each example?

Shoshone Beadwork: $\qquad$
Pawnee Drum: $\qquad$
Navajo Rug: $\qquad$

Another form of symmetry besides line symmetry that is found in these examples is rotational symmetry. Rotational symmetry is where we move a figure to a new location by turning it through a fixed angle about a fixed point and the figure or object looks the same. The motion is called a rotation or turn. The point about which the figure is rotated is called the center of rotation.

Do any of these designs have rotational symmetry? In other words, if you rotate it around the middle point, does the object look the same?

How many symmetrical rotations are there in each figure?
For example, look at the embroidery. If I place my pencil in the middle of the design and begin turning the figure, where does the figure look the same? If I turn 90 degrees, it will look the same. If I turn 180 degrees, and 270 degrees it will also look the same. So we can say this figure has three symmetrical rotations at 90, 180 and 270.

What about the other examples? Does it have rotational symmetry and if so how many rotations are there?

Beadwork: $\qquad$
Hide Drum: $\qquad$

Navajo Rug: $\qquad$
Continuing the tutorial, click on continue and read about reflection symmetry and four fold symmetry.

What is four fold symmetry?

In your previous classes, you have studied about graphing ordered pairs and the coordinate plane.

## Review of Coordinate Plane and Graphing

Before we can begin to graph lines and parabolas and all that fun stuff in Algebra, we must make sure we understand how to graph and name points in a plane. In the earlier $17^{\text {th }}$ century a French mathematician named Rene Descartes was sick in bed and noticed a fly on the ceiling. Since he was REALLY bored he wondered if there would be a way that he could describe to his nurse where the fly was located on the ceiling without using his finger. So the legend goes that he came up with the coordinate plane and the rest is history. ©

With the knowledge of the coordinate system, people began to figure out ways to show pictures of equations and represent lines and curves with algebraic equations!

Number Line:

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On a number line, each point is the graph of a number. So the number 4 would be represented with an X over the 4 on the number line.

On a plane each point is the graph of an ordered pair ( $\mathrm{X}, \mathrm{Y}$ )

Quadrant 2
(All x's are negative and all y's Are positive numbers)


We use two perpendicular number lines called axes, which divide the plane into four regions called Quadrants. The horizontal axis Is called the X axis and the vertical axis $\downarrow$ is called the Y axis.
The axes cross at a point called the origin. The numbers in an ordered pair are called coordinates. The X coordinate ALWAYS goes first like in the alphabet. If a point is labeled (5,6), this tells you that you start at the origin and you go right (towards the positive numbers) 5 units. Then you go up 6 units and that is where point $(5,6)$ is found.

Is the point $(5,6)$ the same as the point $(6,5)$ ? Why or why not?

What about $(5,6)$ and $(-5,6)$. Are these the same points? Why or why not?

Which quadrant is $(5,6)$ found in?
Which quadrant is $(-5,6)$ found in?

All the points on the X axis have what number for the Y coordinate? $\qquad$
All the points on the Y axis have what number for the X coordinate? $\qquad$

Continuing on in the tutorial, click on continue and read about Sand Paintings.
How are sand paintings similar to a Coordinate Plane?

Click continue
Why do you think it is important for the Yupik to have both sides of their parka look the same?

Click continue
How is the bead loom also like the Cartesian coordinate Plane system?

Describe the Great Chain beadwork?

Why did the Iroquois give it to the US Government in 1794 ?

How are beads placed on a bead loom?

## Tutorial: How to use the Bead Loom

You need to know how to use the coordinate system and plotting points of the system. Each point has an address called an ordered pair ( $\mathrm{X}, \mathrm{Y}$ ). The point $(3,4)$ tells us to go 3 units to the right and 4 units up on the coordinate plane. The point $(-3,2)$ tells up to go three units to the left from $(0,0)$ and 2 units up.

It is the same with the bead loom. The point tool places a single bead. So if you say $(4,-2)$, the program will place your bead at that address $(4,-2)$.

A line of beads has two endpoints. So if you use this feature and say $(0,3)$ and $(0,7)$, it will tell the computer to put a line of beads vertically from where $y=3$ to where $y=7$. You will have beads at $(0,3)$, $(0,4),(0,5)(0,6)$ and $(0,7)$.

The triangle and rectangle feature uses the vertices (corners) of the design and fills in the middle of the triangle or rectangle.

Iteration is a mathematical term meaning to build on the one previously built.
So for example, you could start with


In this pattern, you have one bead in three columns and then it builds on itself and the next three columns have a bead placed on each side of the "alone" bead making it a row of 3. After those three columns have been made, the next three columns will have five beads and so on.

## Look up Pascal's Triangle on the internet.

## What is it? Is it an iteration?

There are also tools for enlarging your grid and for bead color choices.

## Creating Your Bead Work on the Virtual Loom

At the bottom of the tutorial you will see the words Back to virtual bead loom overview. Click on them. Go to the last column, Take me to the latest version of the Virtual Bead Loom and click on those words. Now you will create your own beadwork.

Remember when you enter the coordinates, you must click on the tool to see the bead. For example, if I am placing one bead, I would use the point tool. I would enter my coordinates and then click on the word point. The bead should appear on the coordinate plane.

NOW COMES THE FUN! Create awesome beadworks.

