Exhibit Guide - Table of Contents

MONEY

PA Standards

- Solve problems and make change involving money using a combination of coins and bills. CC.2.4.3.A.3
- **Key Words**:

  Penny = 1 cent
  Nickel = 5 cents
  Dime = 10 cents
  Quarter = 25 cents
  Dollar = 100 cents

- **Materials: Bar fractions:** 18" X 34" magnetic board. Magnetic currency: BILLS: 10 ones, 4 fives, 2 tens, 1 twenty. COINS: 20 pennies, 20 nickels, 20 dimes, 10 quarters. 3 display cards

Display Card

In the United States the official money is dollars and cents.

Penny

1 cent

One Hundred Pennies make a dollar. One cent can be written as 1¢ or $0.01

Nickel

5 cents

Twenty Nickels make a dollar. One nickel can be written as 5¢ or $0.05

Dime

10 cents

Ten Dimes makes a dollar. One dime can be written as 10¢ or $0.10

Quarter

25 cents

Four Quarters makes a dollar. One quarter can be written as 25¢ or $0.25

Dollar

One Dollar equals 100 pennies and is written as $1.00

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PLACE VALUE (1 MILLION)

PA Standard

- Students generalize their understanding of place value to 1 million. CC.2.1.4.B.1 (MO4.A.T.1.1.1)
- Apply place value concepts to show an understanding of multi-digit whole numbers. CC.2.1.4.B.1

Key Words:

One = 1
Ten = 10
One Hundred = 100
One Thousand = 1,000
Ten Thousand = 10,000
One Hundred Thousand = 100,000
One Million = 1,000,000

Materials: 6" X 24" clear plastic tube on base.
1 Display card.

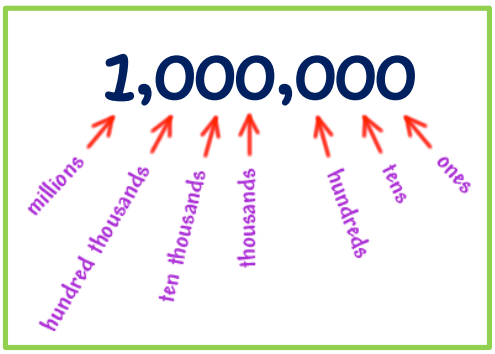
Display Card

The bottle contains one million beads. 1,000,000. Here is a list of how many beads there are of each color. Can you find the black bead?????

BEAD COLOR	NUMBER OF BEADS IN BOTTLE	PERCENTAGE OF TOTAL BEADS
Black	1	0.0001 %
Green	10	0.001 %
Pink	100	0.01 %
White	1,000	0.1 %
Red	10,000	1 %
Yellow	100,000	10 %

DID YOU KNOW???

Every time you add a zero to a number, it gets 10 times as big. If you add a zero to one million (1,000,000) it becomes ten million (10,000,000). And if you add three zeros to one million, it is a thousand times bigger and becomes one billion (1,000,000,000).



If you drive a car one million miles at 60 miles an hour, without stopping for gas or food, it will take you about ***two years***...that's a long drive!!

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TIME

PA Standard

- Tell and write time to the nearest five minutes using both digital and analog clocks. CC.2.4.2.A.2

Key Words:
Time, Hours, Minutes, Seconds
Analog Clock, Digital Clock

Materials: 12" X 24" exhibit with 5 clock faces. NOTE: Electricity required.
1 Display card.

Display Card

There are two clocks – an Analog Clock and a Digital Clock.

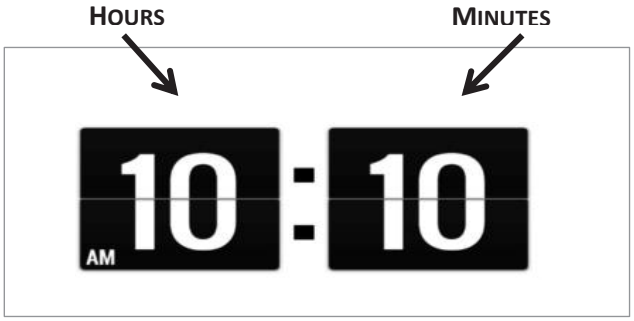
The ***analog clock*** has a round face with 12 numbers around the edge and is divided into 60 minutes. The short hand points to the hours, and the long hand points to the minutes.

Hours = short word…**short hand**
Minutes = long word…**long hand**

Some analog clocks also have a *'second hand'*, which counts 60 seconds in one trip around the clock each minute.

A ***digital clock*** shows numbers which indicate what time it is.

ANALOG CLOCK



DIGITAL CLOCK

WHAT TO DO -

Match the times of the analog clocks with the times on the digital clocks. When they are correct, the ***GREEN LIGHT*** will go on!

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MEASUREMENT

PA Standards

- Measure and estimate lengths in standard units using appropriate tools. CC.2.4.2.A.1
- Solve problems calculating time intervals. CC.2.4.3.A.2

Key Words Unit of Measure, Distance, Mile.

Materials: 24" X 22" map board. 2 strings. 1 Display card. 5 "Trip" cards. 1 Display card

Display Card

Miles are a unit of measure. A mile equals 5,280 feet. We use miles to measure large distances.

WHAT TO DO-

Use the string to measure distances from one place to another.

Step 1: Choose a place where you want to start your trip.

Step 2: Put the loop of the string around the post where you start.

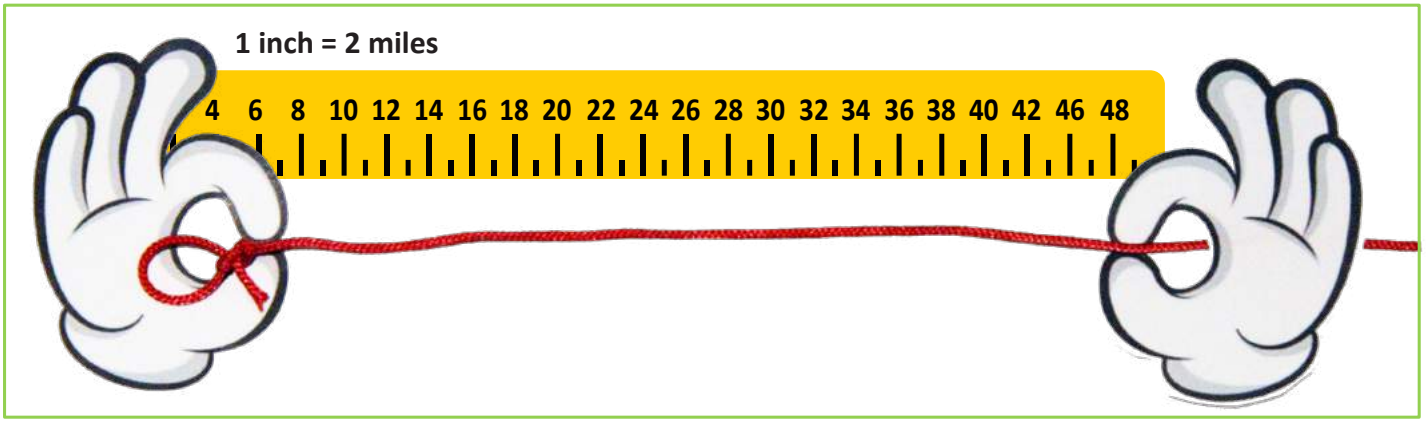
Step 3: Stretch the string to the place you want to go - until the string hits the peg.

Step 4: Keep holding the string and move the string down to the ruler.

Step 5: Measure how many miles you traveled.

Did You Know???

- The earth is about 25,000 miles around its circumference.
- It would take a commercial airplane around 51 hours to fly around the earth.
- The distance from the earth to the moon is 238,900 miles. It took the astronauts 3 days, 3 hours, and 49 minutes to get there!



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GEOMETRIC SHAPES

PA Standards

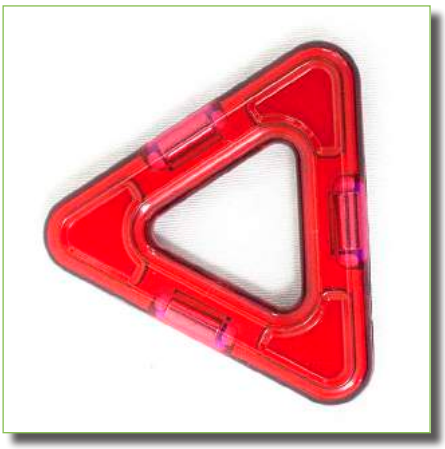
- Identify and describe two- and three-dimensional shapes. CC.2.3.K.A.1
- Identify, compare and classify shapes and their attributes. CC.2.3.3.A.1
- Compose and distinguish between two and three dimensional shapes. CC.2.3.1.A.1
- All Standards 2.3 Geometry.

Key words: Square, Triangle, Pentagon, Hexagon Two-dimensional shape. Three-dimensional shape.

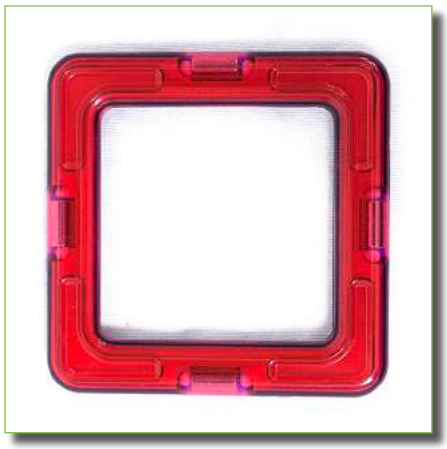
Materials: 72 each: Triangles, Squares, Pentagons, Hexagons, Trapezoids, Rhombus. 4 Display Cards.

Display Card

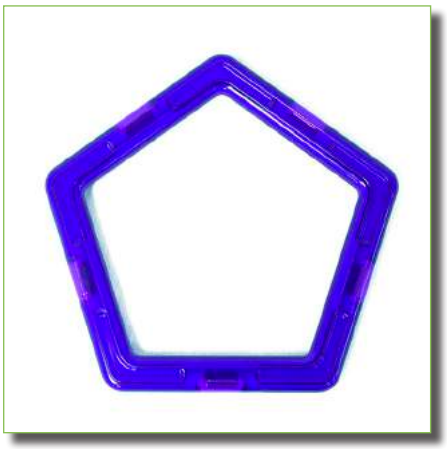
Use your imagination to create unique combinations & designs.



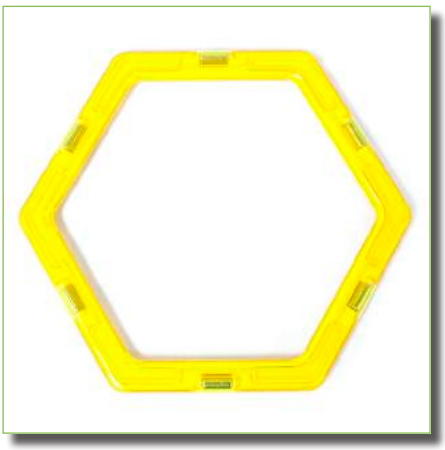
TRIANGLE
A triangle has three sides and three corners.



SQUARE
A square is a rectangle. All rectangles have 4 sides & 4 right angles, but only squares have 4 equal sides & 4 right angles.

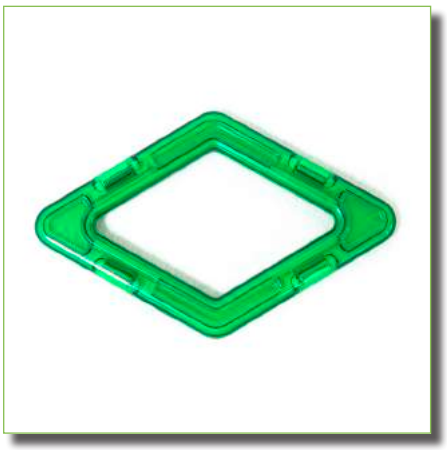


PENTAGON
A Pentagon is any five-sided flat shape



HEXAGON
A hexagon is any six-sided flat shape

TRAPEZOID
A trapezoid has 4 straight sides with 2 opposite sides parallel



RHOMBUS
A 4-sided shape where all have equal length, the opposite sides parallel & the opposite angles are equal

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GROUP 1 GROUP 2

VOLUME SANDBOX

PA Standards

- Describe and compare attributes of length, area, weight and capacity of everyday objects. CC.2.4.K.A.1
- Solve problems involving measurement of temperature, liquid volume, mass and length. CC.2.4.3.A.1
- Apply the concepts of volume of cylinders, cones and spheres to solve everyday problems. CC.2.3.8.A.1

Key words: Cylinder, Cone, Sphere, Volume, Capacity.

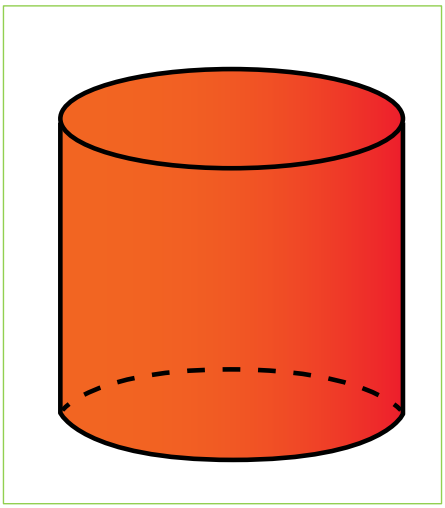
Materials: 24" X 18" Sandbox with cone, cylinder, sphere, cube, square cylinder, half-cube, scoop. Two sets available. 2 display cards.

Display Card

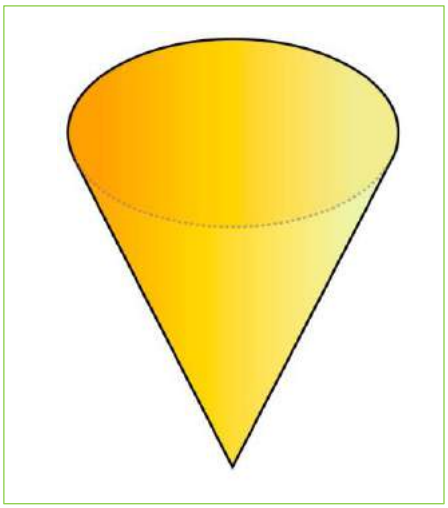
Volume is the amount of space inside an object or shape, like a bottle or a basketball.

WHAT TO DO:

Compare the volumes of a cylinder, a cone and a sphere by pouring sand from one shape to another.



CYLINDER



CONE

SPHERE

Do You Know????

- *How many cones does it take to fill the cylinder?*
- *How many cones does it take to fill the sphere?*
- *Does the sand in a sphere fill the cylinder?*

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GROUP 1 GROUP 2

TILING (TESSELLATION)

PA Standards

- Identify and describe two- and three-dimensional shapes. CC.2.3.K.A.1
- Identify, compare and classify shapes and their attributes. CC.2.3.3.A.1
- Compose and distinguish between two and three dimensional shapes. CC.2.3.1.A.1
- All Standards 2.3 Geometry

Key words: Hexagon, Pentagon, Square, Triangle, Trapezoid, Diamond, Tiling, Tessellation

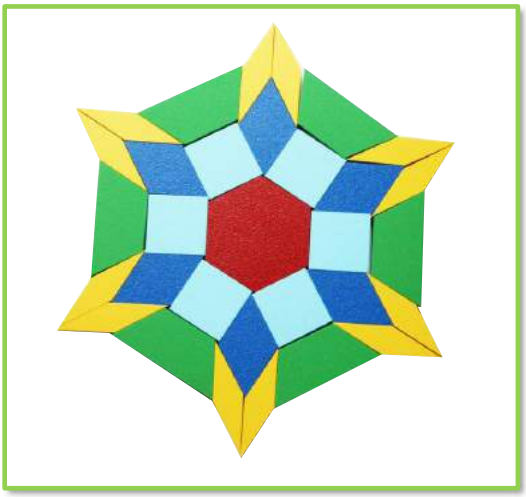
Materials: 24" X 24" Magnetic board. 12 each of: Rhombus, Trapezoid, Hexagon, Square, Triangle, Diamond. Two sets available. 1 display card.

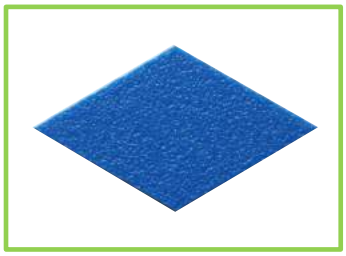
Display Card

Tessellation is when you create a solid pattern with tiles….
without overlaps or spaces between the tiles.

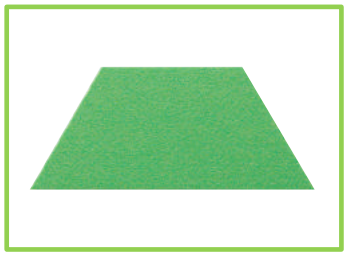
WHAT TO DO –

Use these flat geometric tile shapes to create your own Tessellation pattern!

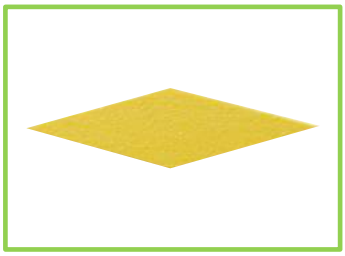




RHOMBUS
4-sided shape – all of equal length, opposite sides are parallel & opposite angles equal.

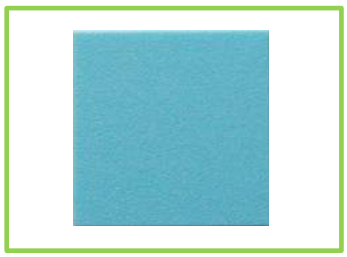


TRAPEZOID
A trapezoid has two straight sides with two opposite sides parallel



DIAMOND
A skinny rhombus with all sides equal length, opposite sides parallel & opposite angles equal

HEXAGON
A Hexagon is any 6-sided flat shape



SQUARE
A square is a rectangle, with 4 sides and 4 angles, only squares have 4 equal sides and 4 equal right angles.

TRIANGLE
A triangle has three sides and three corners

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GROUP 1 GROUP 2

FRACTIONS

PA Standard

- Explore and develop an understanding of fractions as numbers. CC.2.1.3.C.1
- Develop an understanding of fraction equivalence, addition and subtraction of fractions with like denominators. CC.2.1.4.C.2

Key Words: Fraction, Numerator, Denominator

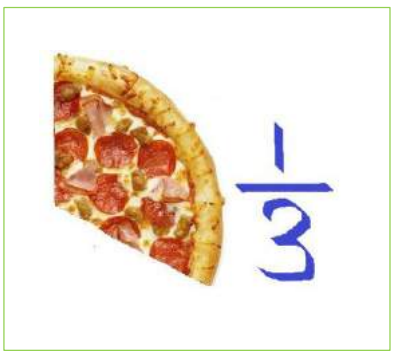
Materials: Bar fractions: 18" X 24" Fraction board, 18" X 8" fraction holder with fraction pieces. Pie fractions: 18" X 34" Fraction board, 18" X 6" fractions holder with fraction pieces. 1 Display Card.

Display Card

Fractions are parts of a whole. For example, say you have a whole pizza and you divide it into three equal parts, each part represents one-third of the whole pie. If you have one part, you have 1/3rd of the whole pizza.

Whole Pizza

Whole divided into thirds



1/3 of the Whole Pizza

In this fraction – the top number is called the **numerator** and the bottom number is called the **denominator**

NUMERATOR
(the number of parts you have)

$$\frac{1}{3}$$

DENOMINATOR
(total parts in the whole)

WHAT TO DO:

- Make a pie shape using 4 equal parts.
- Make a pie shape using at least three different fractions

- Make a complete bar using 6 equal parts.
- Make a complete bar using 1/8s and 1/4s
- Make a complete bar using at least three different fractions.

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VOLUME CUBES

PA Standards

- Describe and compare attributes of length, area, weight and capacity of everyday objects. CC.2.4.K.A.1
- Solve problems involving measurement of temperature, liquid volume, mass and length. CC.2.4.3.A.1

Key Words:

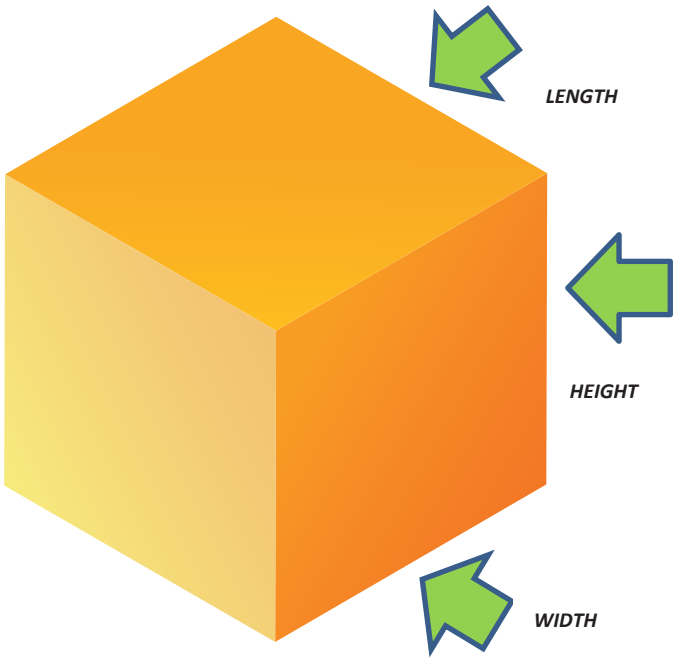
Cube, Volume, Capacity

Length, Width, Height, Three-dimensional shape

Materials: 24" X 14" board. All cubes 2" square. 2 yellow cubes, 29 white cubes. 2 display cards.

Display Card

A cube is a three-dimensional shape with six square sides. *All sides are the same length and all angles are 90 degree angles. When you increase the length of the sides you increase the volume inside the cube.*



WHAT TO DO -

Build a bigger cube. The yellow cube is 2 inches wide, 2 inches long and 2 inches high. Build a cube with *double the width*, *double the length*, and *double the height*.

- How many blocks did it take to build a bigger cube?
- What is the volume of the bigger cube compared to the yellow cube?

Now, build a cube with *three times* the *width*, *length* and *height* as the yellow cube.

- How many blocks did it take a build the cube?
- What is the volume of the bigger cube compared to the yellow cube?

ANSWERS:

When you ***DOUBLE*** the width, length and height of a cube, the volume of the bigger cube is ***8 times*** the volume of original cube.

When you ***TRIPLE*** the dimensions of a cube, the volume of the bigger cube is ***27 times*** the volume of the original cube.

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TANGRAMS

PA Standards

- Identify and describe two- and three- dimensional shapes. CC.2.3.K.A.1
- Analyze, compare, create, and compose shapes. CC.2.3.3.A.1
- Make sense of problems and persevere in solving them. Standards for Mathematical Practice #1.

Key Words

Triangle, Square, Diamond

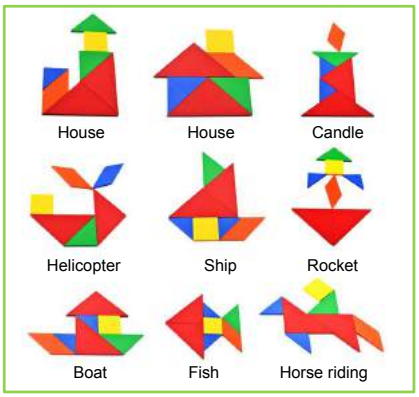
Materials: 24" x 24" board, 7 Tangrams shapes. 1 display card.

Display Card

A tangram is a puzzle consisting of seven flat pieces called tans, which are put together to form a shape. Tangrams originated in China in 700 AD. The objective of the puzzle is to form a specific shape using all seven pieces – the pieces may not overlap.

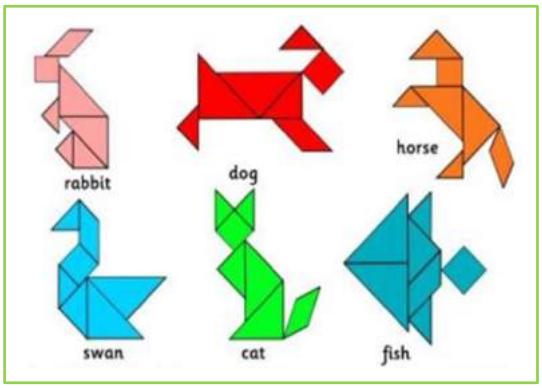
WHAT TO DO –

Use all seven pieces to fill the square →



OTHER SHAPES!!

You can use all seven pieces to create other fun shapes!!



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TRAPEZOIDS AND TRIANGLES

PA Standards

- and describe shapes. CC.2.3.PreK.A.1
- Analyze, compare, create, and compose shapes. CC.2.3.PreK.A.2
- Make sense of problems and persevere in solving them. Standards for Mathematical Practice #1.

Key Words

Trapezoid, Triangle

Materials: 24: X 24" board. 3 trapezoids. 1 display card.

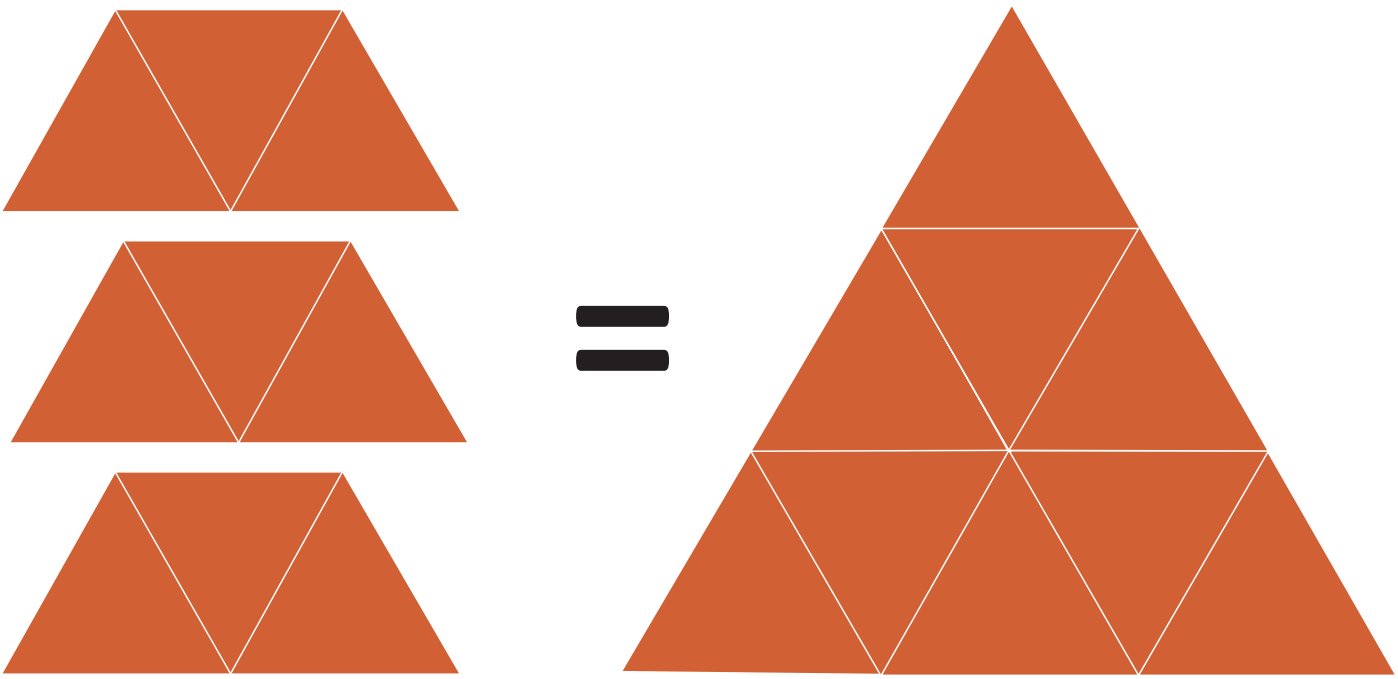
Display Card

Trapezoid: A four-sided shape with four corners and only two sides parallel

Triangle: A three-sided shape with three corners.

WHAT TO DO

Use the three identical trapezoids to form a triangle.



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PROBABILITY

PA Standards

Analyze patterns and relationships. CC.2.2.4.A.4
Develop a probability model by assigning equal probability to all outcomes. CC.2.4.7.B.3
Investigate chance processes and develop, use and evaluate probability models. CC.2.4.7.B.3

Key Words

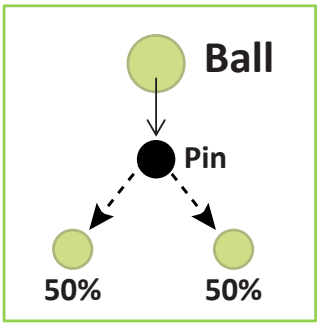
Probability, Bell Curve, Uniform Distribution.

Materials: 18" X 12" exhibit. 1 Display card.

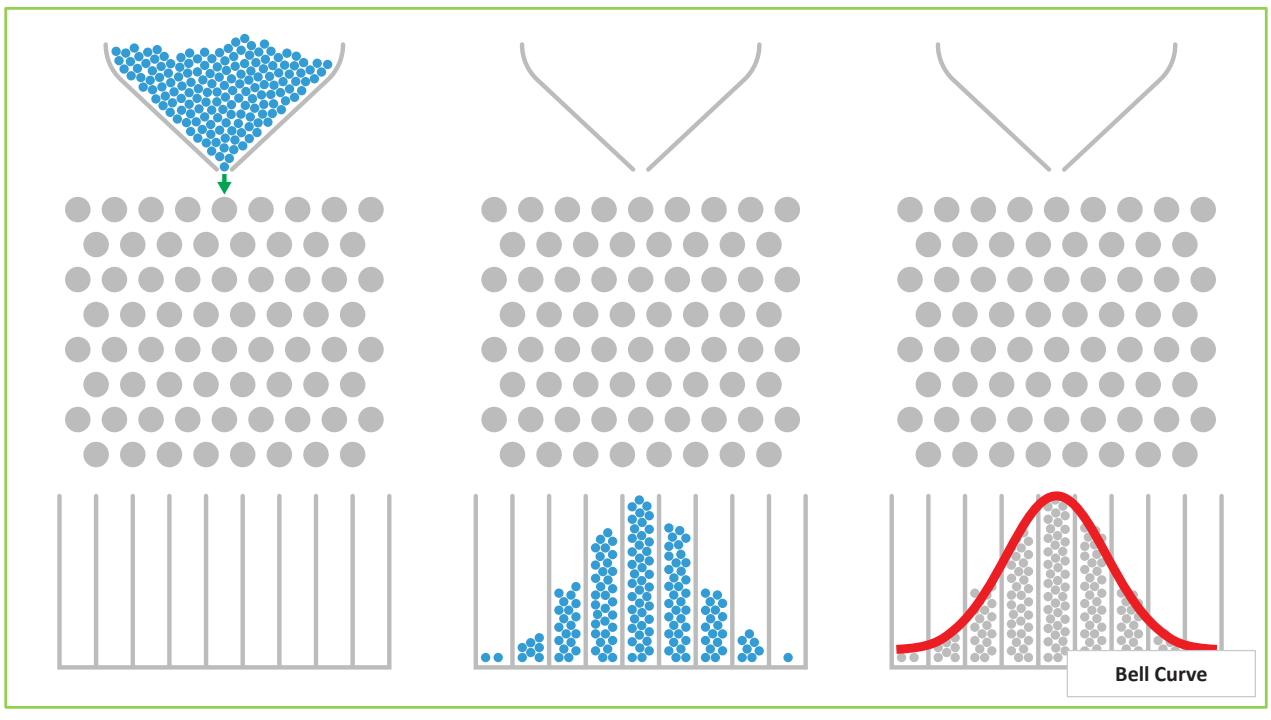
Display Card

Probability is the chance that something will happen. Sometimes you can measure probability with a number like "10% chance it will rain", which means there is a 1 out of 10 chance it will rain. Or, if you flip a coin, there is a 50% chance it will be heads and 50% chance it will be tails.

WHAT IS HAPPENING:



- When marbles are dropped into the top of the box they hit pins and bounce left or right…a **50%** chance of bouncing left and a **50%** chance of bouncing right!
- The marbles are then collected into bins at the bottom.
- After all the marbles reach the bins, they form a '***Bell Curve***'. When there is is a 50/50 chance of bouncing left or right, the marbles will always form a bell curve – called a ***'Uniform Distribution'***



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PI (CIRCUMFERENCE)

PA Standards.

- Solve real world and mathematical problems involving angle measurement, area, surface area, circumference and volume. CC.2.3.7.A.1

Key Words:

Pi, Diameter, Circumference, Radius

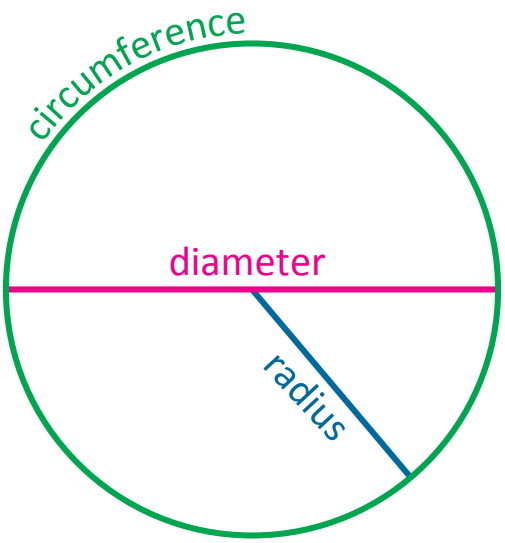
Materials: 36" X 18" board with 10" disc and ruler. 1 string. 1 Display card.

Display Card

Archimedes figured out how to calculate the circumference of a circle by using the number 3.14, which is also called 'Pi' and is represented by the symbol 'π' .

He found that if you multiply the diameter of a circle by 3.14 you get the circumference of the circle.

Pi is also found in many other calculations in geometry for circles, ellipses and spheres.



$$\frac{\text{Circumference}}{\text{Diameter}} = \pi = 3.14159...$$

WHAT TO DO:

***STEP 1*:** Hook the string on the peg and pull the string all the way around the yellow circle, and back to the peg.

STEP 2: Holding the length of string that went around the circle, measure the string on the ruler to find out the circumference of the circle.

QUESTIONS:

- *What is the circumference of the yellow circle?*
- *If you walked around a circle which has a diameter of 100 feet, how far have you walked?*
- *What is the radius of the yellow circle? (check diagram above)*

1. The circumference of the yellow circle is 31.4 inches (3.14 x 10 inches).
2. You would walk 314 feet (3.14 x 100 feet).
3. The radius is 5 inches.

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BINARY

PA Standards

- Generate a number or shape pattern that follows a given rule. CC.2.2.4.A.4
- Analyze patters and relationships. CC.2.2.5.A.4

Key Words.

Binary number system, Base 10 Number System

Materials: 24" X 12" Binary machine. NOTE: Electricity required. 1 Display card.

Display Card

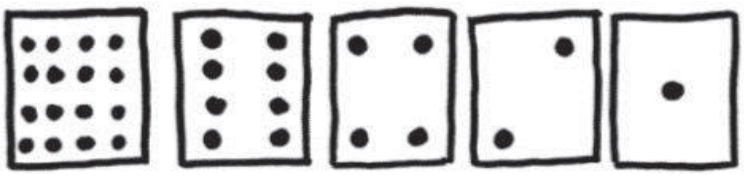
When we count and do everyday calculations, like adding and multiplying, we use the Base 10 Number System: 1, 2, 3, 4.

When computers count, calculate and process words, they use the Binary Number System: 110101.

All digital technology, such a mobile phones, computers and satellite communications use binary numbers. We now live in a digital world and the most important digits are 1 and 0.

WHAT TO DO -

- There are five number cards -



16 8 4 2 1

- Looking at the number cards, choose the numbers that add up to the number you want to create in binary.
- Move the *'YES' – 'NO'* switches under the number cards you choose, to create your number in binary.
- In the screen on the right, the machine will show your binary number as a base 10 number.

QUESTIONS:

- Create your age in Binary…check the base 10 number on the right to make sure you are correct.
- Count from 1 to 31 in Binary…watch the base 10 number on the right to make sure your counting from 1 to 31 is correct.
- What is the largest number you can create? *(The amazing thing about binary counting is that you can count to 31 with just five switches…you can count to 31 on one hand with just five fingers.)*

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MAGIC SQUARES

PA Standards

- Make sense of problems and persevere in solving them. Standards for Mathematical Practice. #1

Key Words

Magic Square

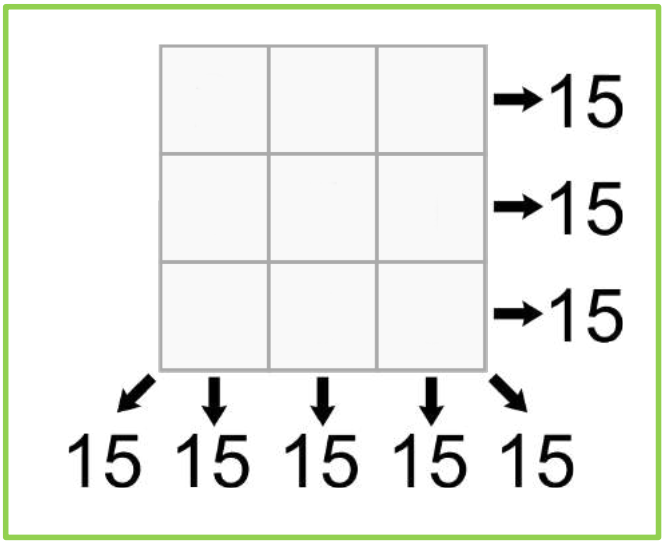
Materials: 18" X 18" board, 9 number blocks. 1 Display card.

Display Card

Magic Squares are a math puzzle. The objective is to arrange numbers in a square grid so each row, column and diagonal adds up to the same number.

When creating a Magic Square, you can only use a number once. For example, for a 3 x 3 magic square, you can use the numbers

1,2,3,4,5,6,7,8,9



WHAT TO DO –

Arrange the numbers so each row, column and diagonal adds up to 15

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

Here is a magic square using 4 x 4 grid. You can see that each number is used only once and the Magic Sum is ***34***.

Magic Squares were first created in China in 650BC. In 2014 China issued a series of stamps based on magic squares and above are shown some of the magic squares that were chosen.

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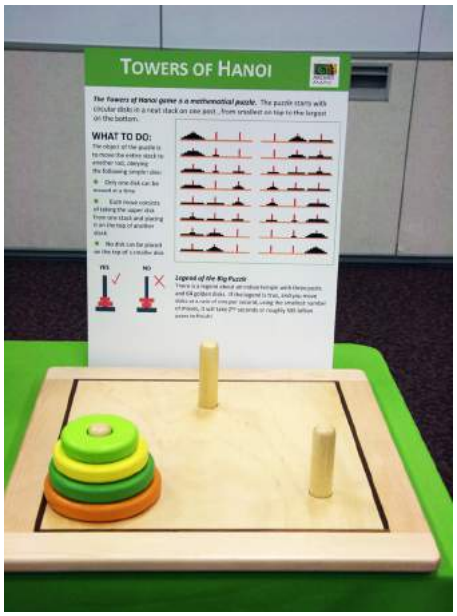


TOWERS OF HANOI

PA Standards

- Make sense of problems and persevere in solving them. Standards of Mathematical Practice #1.
- Develop a number or shape pattern that follows a given rule. CC.2.2.4.A.4

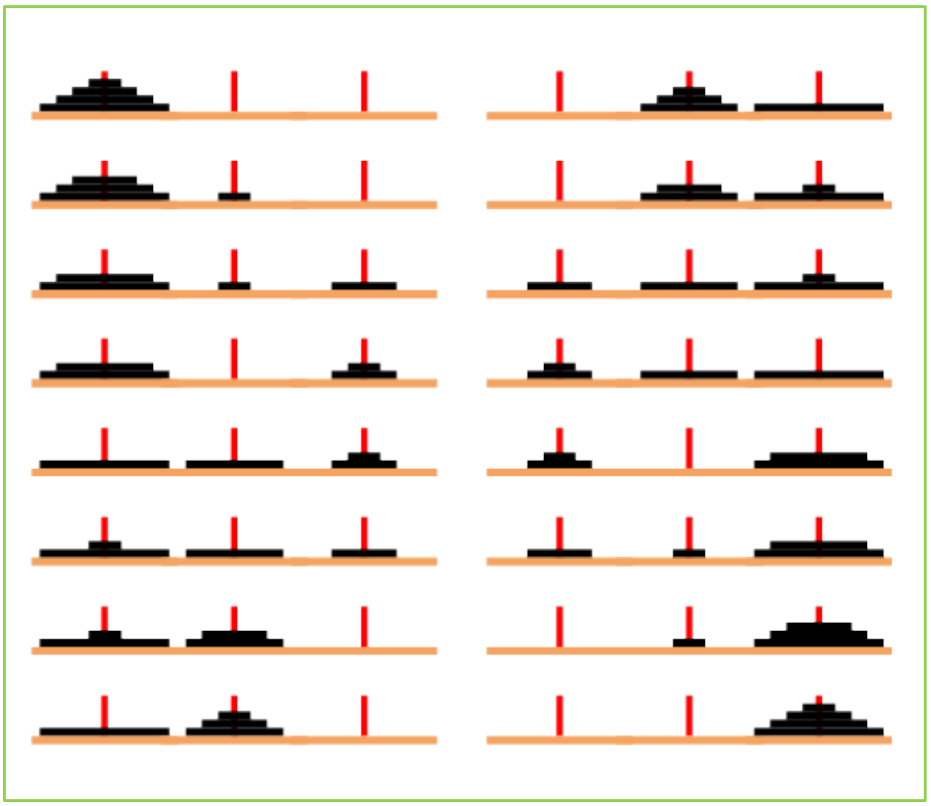
Key Words

Solution, Repeating Pattern

Materials: 18" X 18" board with pegs. 4 discs. 1 Display card.

Display Card

The Towers of Hanoi game is a mathematical puzzle. The puzzle starts with circular disks in a neat stack on one post…from smallest on top to the largest on the bottom.

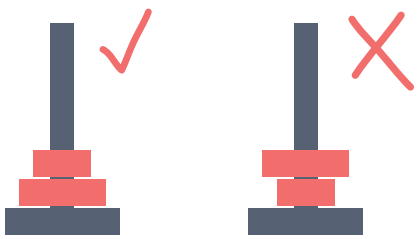


WHAT TO DO:

The object of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

- Only one disk can be moved at a time
- Each move consists of taking the upper disk from one stack and placing it on the top of another stack.
- No disk can be placed on the top of a smaller disk.

YES **NO**



Legend of the Big Puzzle

There is a legend about an Indian temple with three posts and 64 golden disks. If the legend is true, and you move disks at a rate of one per second, using the smallest number of moves, it will take 2^{64} seconds or roughly 585 billion years to finish!

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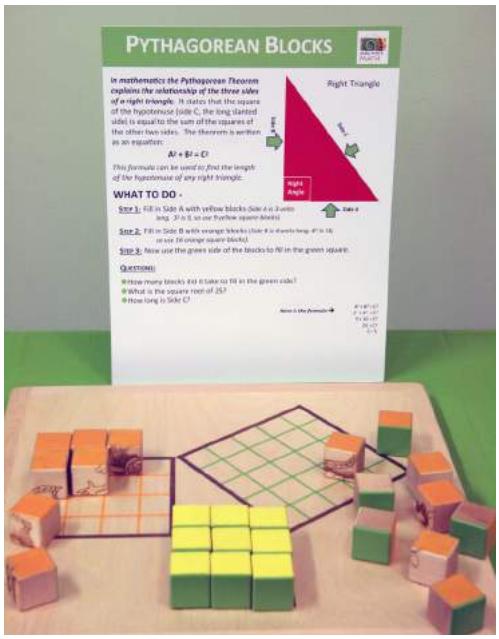


PYTHAGOREAN THEOREM

PA Standards

- Understand and apply the Pythagorean Theorem to solve problems. CC.2.3.8.A.3

Key Words

Pythagorean Theorem, Right Triangle, Hypotenuse, Squaring a number, Formula

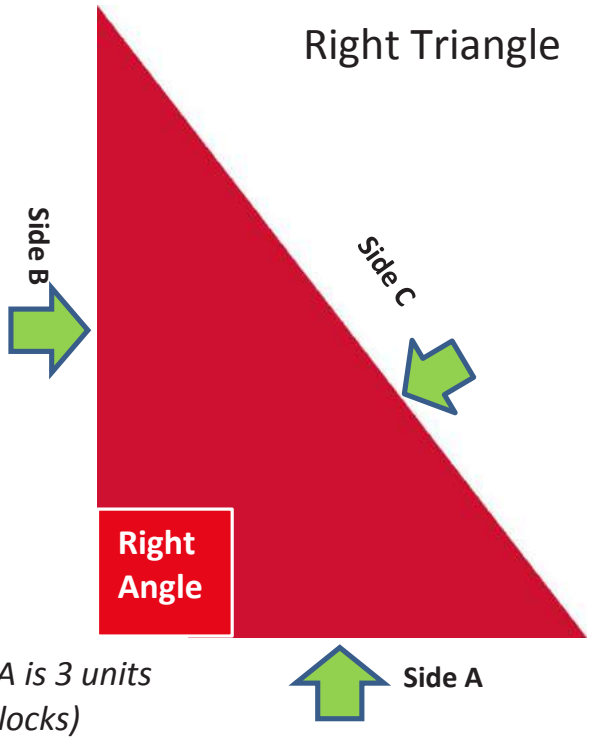
Materials: 18" X 18" board. 25 blocks. 1 Display card.

Display Card

In mathematics the Pythagorean Theorem explains the relationship of the three sides of a right triangle. It states that the square of the hypotenuse (side C, the long slanted side) is equal to the sum of the squares of the other two sides. The theorem is written as an equation:

$$A^2 + B^2 = C^2$$

This formula can be used to find the length of the hypotenuse of any right triangle.



WHAT TO DO -

STEP 1: Fill in Side A with yellow blocks (*Side A is 3 units long. 3^2 is 9, so use 9 yellow square blocks)*

STEP 2: Fill in Side B with orange blocks (*Side B is 4 units long. 4^2 is 16, so use 16 orange square blocks).*

STEP 3: Now use the green side of the blocks to fill in the green square.

QUESTIONS:

- How many blocks did it take to fill in the green side?
- What is the square root of 25?
- How long is Side C?

Here is the formula →

$A^2 + B^2 = C^2$
$3^2 + 4^2 = C^2$
$9 + 16 = C^2$
$25 = C^2$
$C = 5$

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FIBONACCI SEQUENCE

PA Standards

- Generate and analyze patterns using one rule. CC.2.2.4.A.4
- Make sense of problems ands persevere in solving them. Standards for Mathematical Practice #1.

Key Words

Fibonacci Sequence, Number pattern, Fibonacci Curve.

Materials: 26" X 20" board. 6 puzzle pieces. 2 Display cards.

Display Card

The Fibonacci Sequence

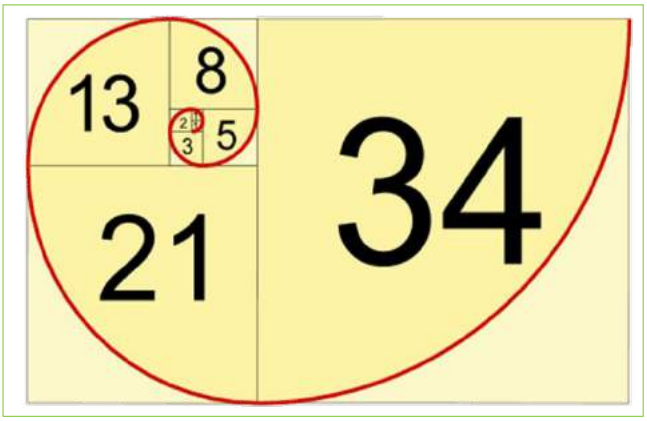
(pronounced 'fee-bow-notch-ee'). A number sequence is a list of numbers that follows a pattern. The next number in the fibonacci sequence is found by adding the two numbers before it:

0,1,1,2,3,5,8,13,21.....

0+1=1	2+3=5	8+13=21
1+1=2	3+5=8	13+21=34
1+2=3	5+8=13	21+34=55

WHAT TO DO:

Complete the puzzle to form a Fibonacci curve.



If you make squares with the sides of the square equal to the Fibonacci numbers, the squares look like this and you get a nice spiral often found in nature.

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