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STEAM: M is for Mathematics

Manipulating Shapes: Tangrams

Have you ever heard of a **Tangram**? A tangram is simple a puzzle that is made up of seven specific shapes: two big triangles, one medium triangle, two small triangles, one square, and one parallelogram. From these shapes you can make over 6,500 pictures!

Tangrams are ancient puzzles that were invented in China thousands of years ago. They were made from wood, shell, glass and porcelain. However, they weren't known to the rest of the world until the early 1800's when the British began to trade with China and bring these puzzles home.

So, how do Tangrams work? Well, you are given a specific picture or outline that you have to fit all seven shapes inside. You can turn and flip the pieces to make them fit as much you like. The only rule is that you must use them all and the shapes cannot overlap one another or leave gaps!

What's more, tangrams are more than just a game, they are all about shape manipulation and **spatial awareness**. Spatial awareness is what we use to judge distance and space around us. It is how we understand where our body fits in regards to objects or other people, and how to move as the space changes and people and objects move. Puzzles like tangrams teach that if something is moved in a set space, everything else must move to accommodate that one movement.

Did you know that tangrams were extremely popular in World War I and that some famous people known to love tangrams were Lewis Carroll, Thomas Edison, and Napoleon?

Now that you're a tangram expert, why not try it for yourself!

Experiment

Step One:

Print off the square of seven shapes and the puzzle sheet. Cut out your seven shapes.

Step Two:

Without looking at the coloured version that has the answers, see if you can figure out how to make the images from the outlines alone.

Step Three:

If you can do all the images easily, there are a number of more advanced outlines online, or better yet, make your own pictures and puzzles and see if someone else can figure them out!

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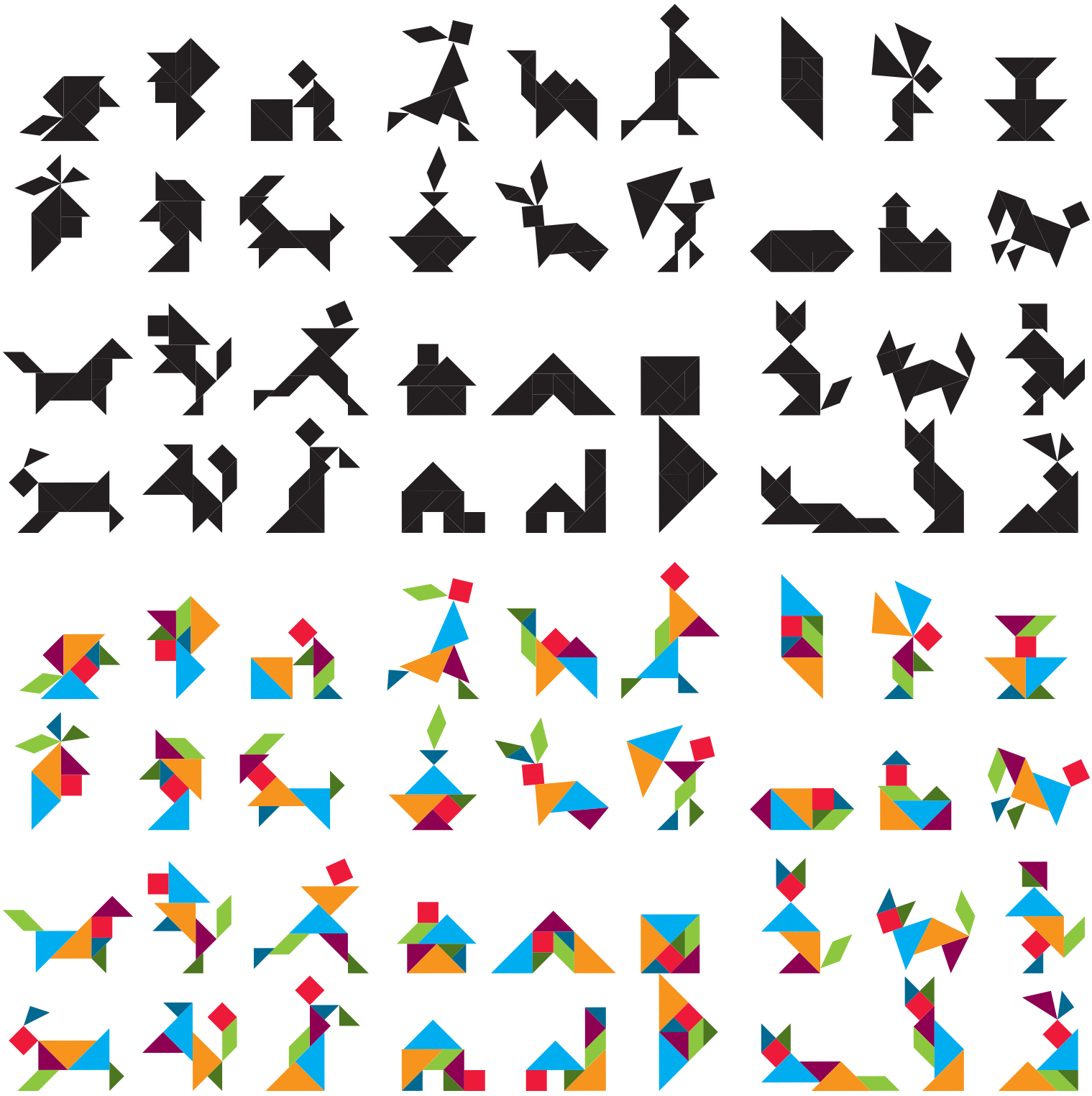
Tanagrams



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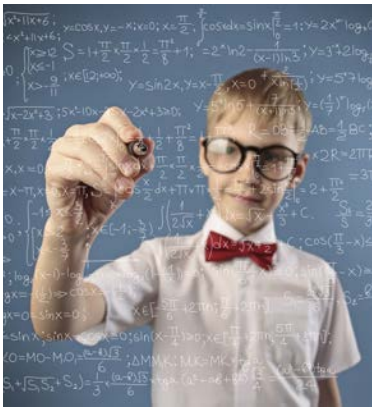

Math Games: Cards and Spin the Wheel

Math and our Brains

Did you know that you are born to do maths and that your brain is specially wired to understand and configure numbers? Crazy right?

At its core, maths is all about finding patterns and making connections. However, just like when we exercise and build our muscle strength, the same goes for our brain. The more we use it, the stronger it gets.

So how does math exercise our brain? Well, by understanding patterns and connections we develop **neural** pathways (nerves and nervous systems) that strengthen our brains. Maths teaches us how to problem solve, how to reach logical, possible, and accurate conclusions, and it also teaches the brain how to work through unfamiliar tasks. All pretty good reasons to pay attention in maths class!

Did you know:

- Ancient markings and drawings have been found that suggest humans have been doing maths since 30,000BC!
- Forty is the only number that is spelt with letters arranged in alphabetical order.
- You can cut a cake into eight equal pieces with just three straight cuts. Figure that one out!

Great, so now that you know why maths is important for your brain, let's do some fun maths games that will flex those brain muscles!

Materials

- A deck of cards
- Dice/or homemade spinner (a pen or pencil will work well for this)
- Template of math wheel

Experiment One – Number Race

Get your deck of cards and remove all picture cards (note the Aces stay and are valued at 1). The first game is called **Race to 27** and will need at least 2 players.

Step One:

Deal out all of the cards to the players. Players keep the cards in a pile face down. The first player turns over the top card and places it in the centre. The next player turns over their top card and does the same. This player adds the value of the two cards and tells everyone the total.

The next player does the same adding the value of their card to the previous total.

Step Two:

Play continues until the total reaches 27 or over. The player who puts down the card that takes the total to 27 or over takes all of the cards in this pile and shuffles them into their pile.

Step Three:

The game continues until one player has no cards left and the winner is the person with the most cards. If this is too easy, try racing to 100!

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Experiment Two – Maths Spin

For this you will need the template above of the wheel and your spinner or dice. (When using dice, simply roll on your turn and move around the wheel with the number you roll. For spinners, spin your pen/pencil in the centre of the wheel). You will need 2 or more players.

Step One:

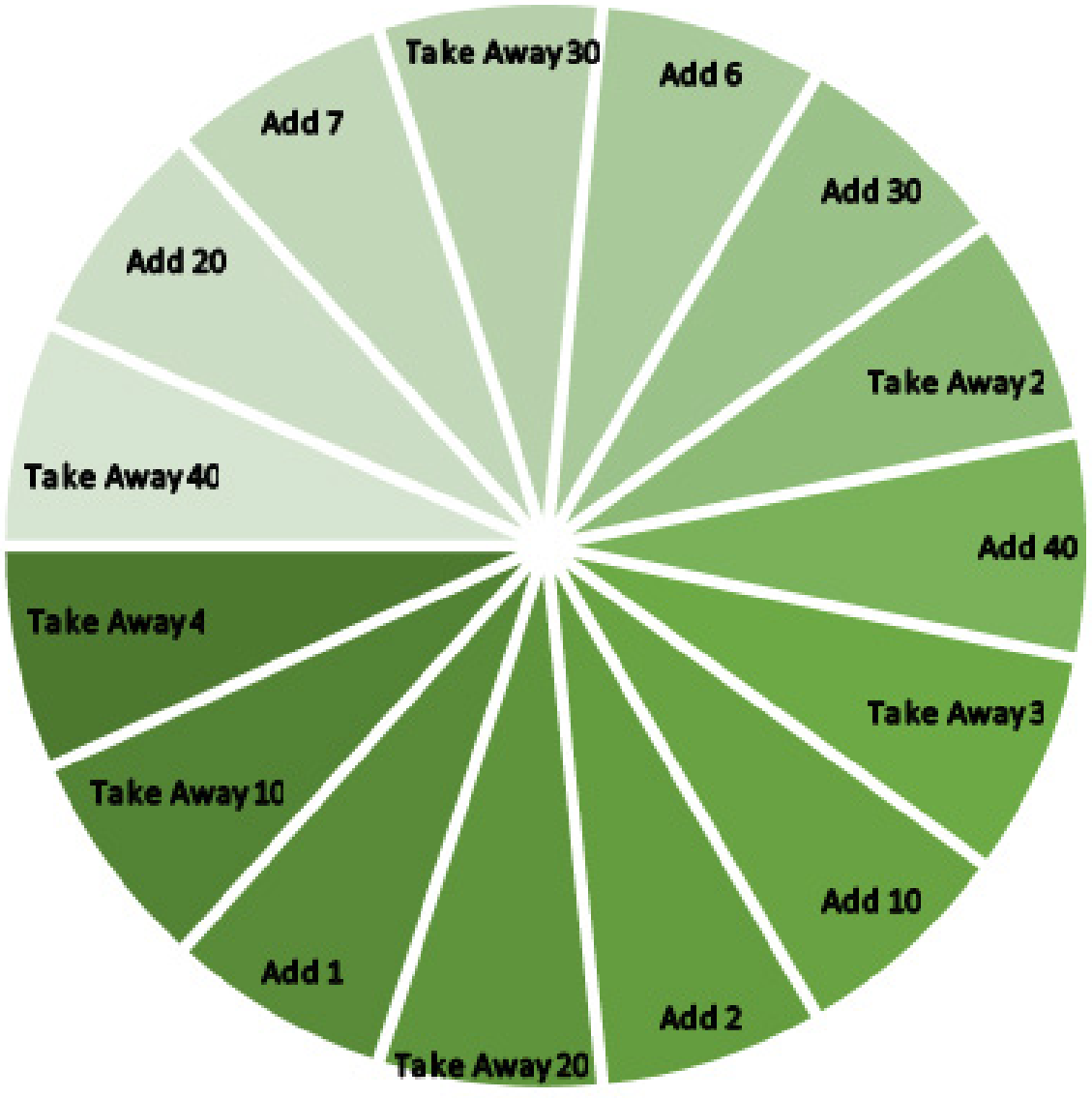
Player one spins or rolls the dice. They must land on an add space in order to start. Make sure you have a pen and paper to work out the totals and to keep score.

Step Two:

Taking turns, players must race to reach 100. If you fall past 0, you must stay on this until you land on an add.

Step Three:

You do not need exactly 100 in order to win, just 100 or higher is fine. Another way of playing this game is to have a wheel for each player. The first to 100 wins the game.



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Tessellations

Have you ever heard of **tessellations**? Maybe not, but chances are you see them every day!

A tessellation is a group of shapes or figures that connect together to completely cover a surface. These figures do not overlap or leave any gaps. Without even knowing it you will see tessellations everywhere. Brick houses and vinyl floors are all made with tessellations, even in nature we see them in honeycombs, fish scales, and the outside of a pineapple! I bet you're now starting to realise that we are completely surrounded by tessellations.

The word tessellation comes from the Latin word **tessellare**, which means 'to pave' or **tessella**, which means a small, square stone. Tessellations themselves are not a new concept either. Did you know that they have been traced back to 4000BC where the Sumerian civilizations used them in their buildings?

Not only are tessellations used in architecture and nature, but they are also used to create art. One of the first and most famous artists to use tessellations was **M.C. Escher**. Escher often used mathematics in his art creations and created his first true tessellations in the 1920's. You can view his art work on his website M.C. Escher Art.

You can make your own simple tessellation art with squares, rectangles, triangles and hexagons. All these shapes tessellate. Or you can attempt a more complicated design. See these printable templates: Tessellation Templates

All right, let's get started and try this experiment for ourselves

Materials

- Cardboard
- Scissors
- Ruler
- Chalk or Felts

Experiment

Step One:

With your piece of cardboard rule up a triangle or hexagon and cut this out. This will be your tessellation template.

Step Two:

Using your chalk, draw a large square on the pavement. Using your cut out template, trace your shape as many times as it takes to fill the square. Remember the shapes cannot overlap and must remain inside your square, and there should be no gaps. If you do not have chalk, you can do this with a large piece of paper and felts.

Step Three:

Great, now you have your tessellation, you can colour it in with multiple colours to make a piece of mathematical art. If you think you're a pro, you can even try a more complicated shape. Check out this one

Homemade Tessellation