DESIGNER'S NOTEBOOK

COMPUTATIONAL THINKING *unplugged*

NAME: _____

BRAINSTORM – EXPLORE – CREATE

CELEBRATING OREGON STEM WEEK

MAY 6 – 10, 2024

Columbia Gorge STEM HUB

Science, Technology, Engineering, & Mathematics

STEM Oregon

COMPUTATIONAL THINKING *unplugged*

Computational Thinking is learning how people solve problems. It's all about looking at a difficult task and figuring out the small steps to solve it. It takes thinking, patience and a little creativity at times. Skills needed to solve math problems, plan a project or develop a piece of writing all involve computational thinking. Computers ***always*** use computational thinking to complete the tasks we input into them. But, humans use computational thinking skills **all the time**, too!

Computational Thinking skills include:

ALGORITHMS – DECOMPOSITION
LOGIC – PATTERNS – ABSTRACTION

For each day of the week during OR STEM Week, we will explore each of these skills with a challenge!

Unplugged **means we will learn about computational thinking without ever using a computer!**

MONDAY: ALGORITHM

What's it all about?

Algorithms are all around us! We follow them everyday! An **algorithm** is a set of directions that needs to be followed exactly to achieve something. Humans & computers use **algorithms** all the time! It's really important for **algorithms** to be just right, otherwise computers can't perform the tasks we need them to.

Activity 1:

MAKE A SANDWICH

Think about all the steps it takes to make your favorite sandwich.

Using the boxes, draw a picture or write words to show **each & every step** to making your favorite sandwich.

Then, give your directions to a friend. Have them pretend to make the sandwich.

Were they able to make the sandwich correctly, using the steps you gave? What steps did you leave out? What would you do differently next time you wrote the **algorithm** for making a sandwich?

Activity 2:

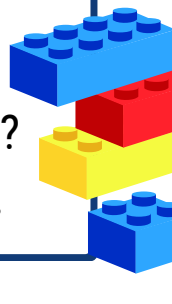
BUILD A MODEL

Using 6-10 Legos, create something from your imagination.

Using the boxes, draw a picture or write words that show the steps **(or algorithm)** someone would follow to rebuild your design. Be sure to include **each & every step.**

Then, hide your creation and give your **algorithm** to a friend. Ask them to follow your **algorithm** to see if they can correctly build your creation again!

Was your friend successful? Were there any parts of the **algorithm** that need to be fixed? Work to correct the **algorithm.**



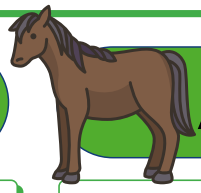
MONDAY: ALGORITHM

Plan: Draw or write out each & every step for someone else to follow. Use more paper, if needed.

TUESDAY: ABSTRACTION

What's it all about?

Abstraction is where detail is taken away so we only have the information we really need. **Abstraction** helps make things easier to understand. Computers use abstraction through a written program, often called a code. Computer coding includes only the necessary details needed to complete a task.



Activity 1:

ABSTRACT MAP

Using the graph paper, draw a map of your school, playground or neighborhood. But, instead of using a lot of details, think about how you can draw the map with the **least amount of details** as possible. A good trick to drawing an **abstract** map is to create a legend or key. Circles can represent houses or triangles represent trees. Roads could just be solid lines and sidewalks could be dotted lines.

Give the map to a friend and see if they can go from one place to another. Is the map easy to follow even though you used **abstraction** to create it?

Activity 2:

GUESS WHAT?

Using the graph paper, draw an animal or a plant. Make a list of the **most important details** of your plant or animal.

Next, start providing details (one at a time) to a friend and ask them to try to guess your animal or plant. Keep track of how many details you had to give them before they could get the answer! Use tally marks to keep track.

How many details were needed before your friend could guess your plant or animal? Were some of the details **most important or least important**? Try again with a new partner!

TUESDAY: ABSTRACTION

Plan – Draw your design

WEDNESDAY: DECOMPOSITION

What's it all about?

Decomposition means splitting things down into smaller parts to make them easier to deal with. Computer programmers work with hundreds of lines of code, to create computer programs we use everyday. When they discover a bug, they fix it using **decomposition**.

Activity:

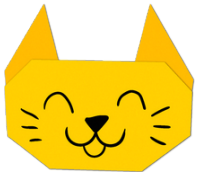
ORIGAMI

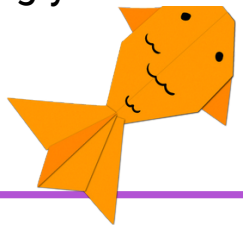
Making origami involves following the steps of an **algorithm**. By unfolding a finished origami figure, you can see the folds needed to build it. When we **decompose** the figure into smaller parts it makes the model easier to make!

STEP 1

Create an origami heart or pinwheel, by following the **algorithm** provided. Be sure to press the paper nice & hard to make creases.

Show your origami to a friend. Then, give them a paper square and challenge them to make the same model using yours as a guide.





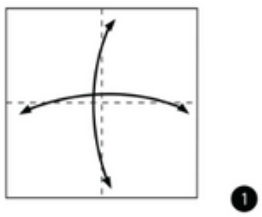
STEP 2

Let your friend try to work out the steps involved. You can give your friend a few clues, but let's see if they can recreate it on their own.

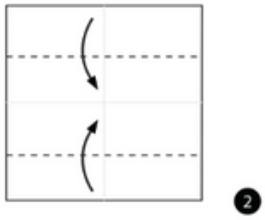
It's important to get things wrong and put them right! In computing, that's called **debugging**. It helps develop not only solutions to problems but persistence and resilience.

WEDNESDAY: DECOMPOSITION

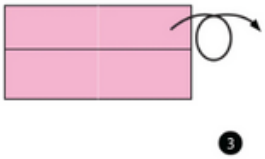
Origami Heart



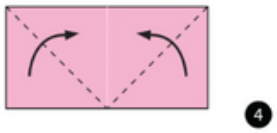
Step 1) Fold and unfold the paper in half both ways.



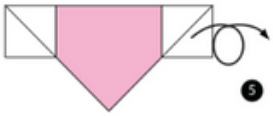
Step 2) Fold the top and bottom in to the centre.



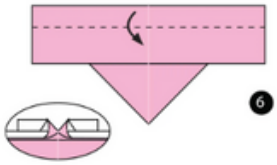
Step 3) Turn the paper over.



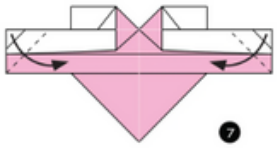
Step 4) Fold both sides up along the dotted lines.



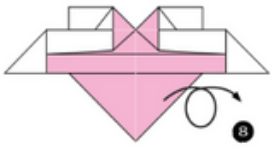
Step 5) Turn the paper over.



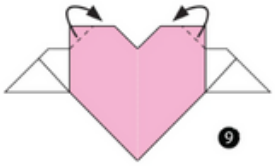
Step 6) Fold the top down and make Squash Folds on the flaps that open up. See the zoomed in part in the circle. Also take a look at the next step to see the final position of the folds.



Step 7) Fold both sides in along the dotted lines.



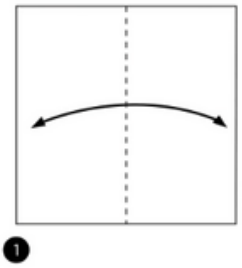
Step 8) Turn the paper over.



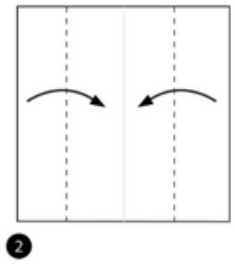
Step 9) Fold the tops in behind along the dotted lines to finish shaping the heart.

WEDNESDAY: DECOMPOSITION

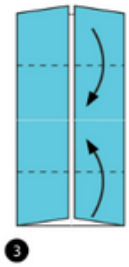
Origami Pinwheel



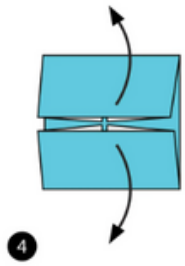
Step 1) Fold the paper in half and then unfold it.



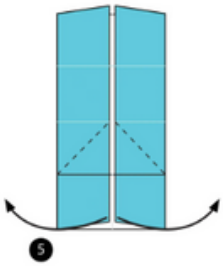
Step 2) Fold both sides in to the centre along the dotted lines.



Step 3) Fold the top and bottom in to the centre.

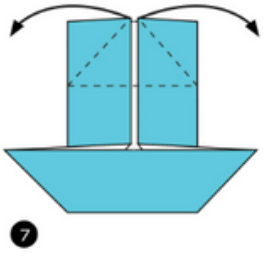


Step 4) Unfold the folds from the previous step.

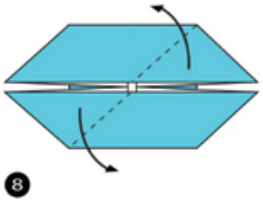


Step 5) Open up the paper along the dotted lines.

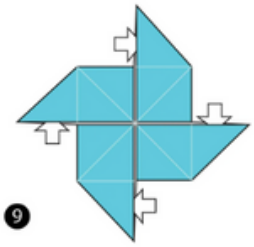
Step 6) Squash Fold the paper flat.



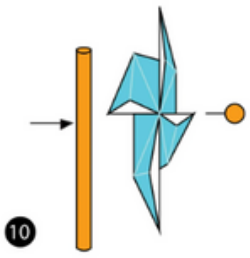
Step 7) Open up the paper at the top and Squash Fold it flat.



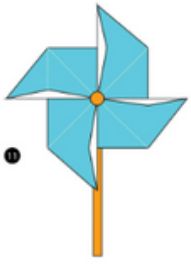
Step 8) Fold the paper out along the dotted lines.



Step 9) Open up each of the 4 flaps.



If you'd like to you can pin the windmill to a stick and blow into the pockets to make it spin.



The complete pinwheel or windmill

THURSDAY: PATTERN RECOGNITION

What's it all about?

We look for and use **patterns** to make sense of the world around us, and computers use **patterns** too! **Patterns** involve looking for similarities and differences between multiple images, symbols or ideas. Finding patterns helps us break down problems to come up with solutions.

Activity 1:

PATTERN PUZZLE

Identifying patterns can help you understand the rules that make them. Once you know the rules, you can predict the next image, symbol or number in the pattern sequence!

Create a pattern for a friend to solve. Ask your friend to identify the pattern and predict what comes next.

Talk with your friend about the patterns you've created.
What are the **rules** of this pattern?

Activity 2:

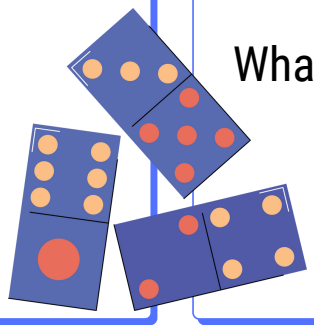
DOMINO PATTERNS

Cut your domino pieces out.

Then, use your dominoes to create your own pattern.When creating your pattern, think about the properties of dominoes and some **rules** you'll follow to create your pattern.

Show a friend your pattern and see if they can repeat it with their dominoes. Then, see if they can extend (or grow) your pattern.

Talk with your friend about the patterns you've created.
What are the **rules** of your pattern?



THURSDAY: PATTERN RECOGNITION

Plan your Pattern Puzzle: Draw or write out your patterns using numbers, symbols or pictures.

Kindergarten Example:

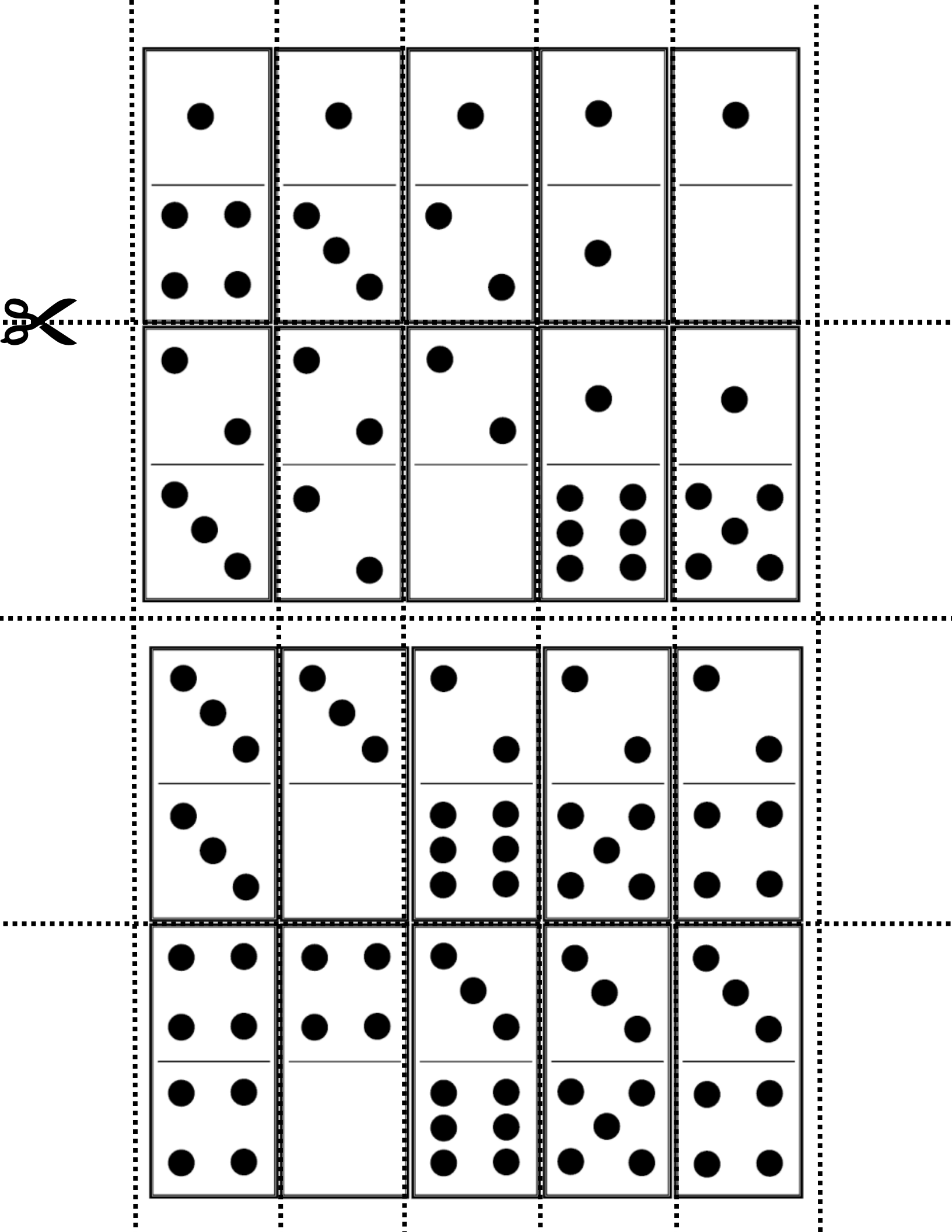
Grade 3 Example:

5, 7, 9, 11, 13 ___

Grade 5 Example:

In	Out
3	9
5	15
7	21
◯	◯

Create Your Own:



FRIDAY: LOGIC

What's it all about?

Logic is taking all the information you have to create an **"If...then..." rule** about the world around you. *For example*, **if** your pencil is broken, **then** you need a new one. Computers use logic too: **If** you press Caps Lock, **then** your letters will be capitalized. Can you come up with another **"If...then..." rule** for computers?

Activity 1:

SORTING LOGIC

Cut out all of the pictures. You can also make your own pictures too. Next, use **some** of the picture to create create a collection of objects. Your collection should follow a rule (color, shape, size, type). Keep the **rule** a secret.

Now ask a friend to choose an picture from the ones you have left over. If the object obeys your rule add it to your collection. If it does not obey your rule, set it aside. See if your friend can figure out the **rule** you created.

Can your friend tell you the **"If...then..." rule** for your collection?

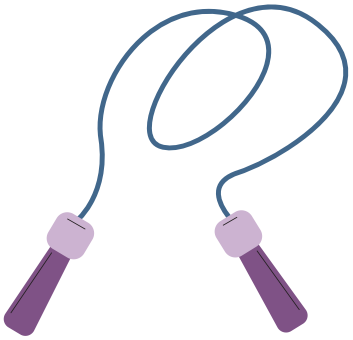
Activity 2:

PUZZLING PUZZLE

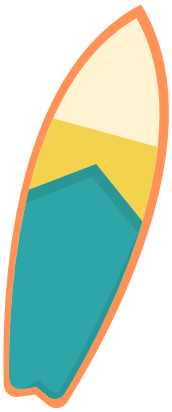
Lay out some toothpicks like the house below. Challenge a friend to move **only one** toothpick to make it look like the house points the other way. Now try moving only one toothpick to make the house look like two houses! Can your friend tell you any **"If...then..." rules**?

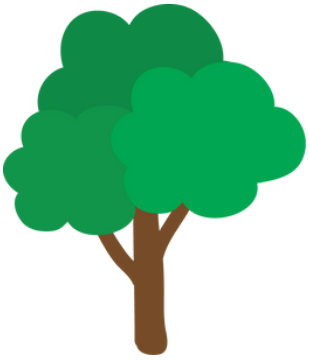
To complete these challenges, your friend has to think logically about each possible move then evaluate whether the action they take will be successful.

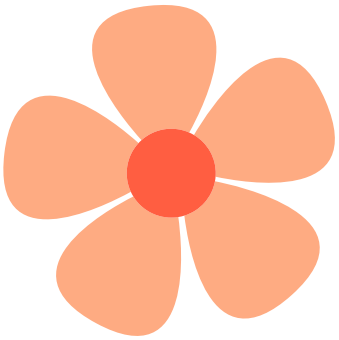
FRIDAY: LOGIC

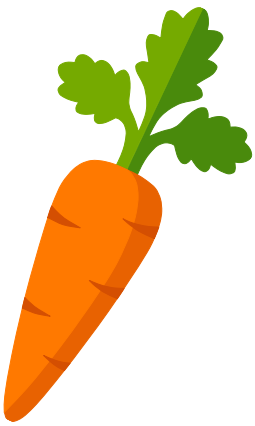


FRIDAY: LOGIC









FRIDAY: LOGIC

Create your own pictures for your collection.