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Integrating Art and STEM Education

ENGLISH VERSION

ArtSTEM Module: SCIENCE

Title: DNA

Target Group: High School Students

Coordinator: Wilhelmstadt Gymnasium (Germany)

Partners: Pangea (Germany), Art4Work (Poland), Wellnist Academy (Türkiye)

Prepared by: ArtSTEM Research Team

Date: 2025

Language: English

Confidentiality: Public (PU)

Project Reference: 2024-2-DE03-KA210-SCH-000285057



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Poster Template DNA Structure

Module: DNA – The Blueprint of Life

Use: Print-friendly or digital editing (Google Slides / Canva / Jamboard)

Title: “Our DNA Model”

- Draw or glue your DNA model here (pipe cleaners, paper strips, beads).
- Use color code for: Adenine (green), Thymine (red), Cytosine (blue), Guanine (yellow).
- Label base pairing rules.

DNA Component	Student Drawing Model Space	Notes Labels
Double Helix Shape		
Sugar-Phosphate Backbone		
Base Pairs (A-T, G-C)		

Comic Storyboard Template “DNA’s Diary”

Module: DNA – The Blueprint of Life

Use: Print-friendly or digital editing (Google Slides / Canva / Jamboard)

Title: “If DNA Could Talk...”

- Frame 1: DNA introduces itself.
- Frame 2: DNA replicates.
- Frame 3: DNA sends instructions (protein coding).
- Frame 4: DNA reflects on its importance for life.

Sketch Panel

Caption: _____

Sketch Panel

Caption: _____

Sketch Panel

Caption: _____

Sketch Panel

Caption: _____



Creative Writing Frame

“A Letter from DNA to Humanity”

Dear Humanity,
I am DNA, your _____. Every cell in your
body carries me, and I _____. Without me, you
would never _____. Sometimes, I can
_____, which makes you unique. Remember, we
all share _____.
Sincerely,
Your DNA



Poster Template DNA Structure

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Use: Print-friendly or digital editing (Google Slides / Canva / Jamboard)

Title: “Our DNA Model”

- Draw or glue your DNA model here (pipe cleaners, paper strips, beads).
- Use color code for: Adenine (green), Thymine (red), Cytosine (blue), Guanine (yellow).
- Label base pairing rules.

DNA Component	Student Drawing Model Space	Notes Labels
Double Helix Shape		
Sugar-Phosphate Backbone		
Base Pairs (A-T, G-C)		



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Integrating Art and STEM Education

ENGLISH VERSION

ArtSTEM Module: SCIENCE
Title: Climate Change & Carbon Cycle
Target Group: High School Students

Coordinator: Wilhelmstadt Gymnasium (Germany)

Partners: Pangea (Germany), Art4Work (Poland), Wellnist Academy (Türkiye)

Prepared by: ArtSTEM Research Team

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Poster Template

The Carbon Cycle: Before and After

Module: Climate Change & Carbon Cycle

Use: Print-friendly or digital editing (Google Slides / Canva / Jamboard)

Title: "The Carbon Cycle: Before and After"

- Students label key processes with arrows and icons.

Natural Carbon Cycle

Draw trees, oceans, animals

Show arrows: photosynthesis, respiration

Balanced flow of carbon

Human-Impacted Cycle

Draw factories, cars, deforestation

Add arrows: combustion, excess emissions

Excess CO₂ buildup in atmosphere




A tube of red paint is shown on the left side, with a red brushstroke extending from its tip across the top of the page.

Comic Storyboard Template “A Day in the Life of a Carbon Atom”

Module: Climate Change & Carbon Cycle

- Box 1: Carbon atom in a tree leaf
- Box 2: Moves into atmosphere (respiration/combustion)
- Box 3: Absorbed by ocean or another organism
- Box 4: Shows human impact (factory adds CO₂, imbalance)

A 2x2 grid of four empty rectangular boxes, each outlined in pink, intended for drawing the comic panels.An Erlenmeyer flask containing orange liquid with bubbles, located on the left side.A pair of orange-handled scissors, located on the left side.A blue molecular model with yellow spheres, located at the bottom left.

A tube of red paint is shown on the left side of the page, with a small amount of red paint squeezed out of the nozzle.

Comic Storyboard Template “Modeling the Carbon Cycle”

Create a carbon cycle diagram using arrows and symbols. Show at least:

- Photosynthesis
- Respiration
- Combustion (cars/factories)
- Ocean absorption
- Fossil fuel storage

Draw your model model below.

Question:

How does your model change when humans add more CO₂?



Creative Writing Frame

Write a short piece titled: “Letter from CO₂ to Humanity”

Example starter: “Dear Humans, I was once in balance, moving through trees, oceans, and skies. But now you have released too much of me by

_____.

I warm the Earth and cause _____.

I am not your enemy, but you must learn to _____.

Together, we can create a balance again.

Sincerely,
Your CO₂





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Integrating Art and STEM Education

ENGLISH VERSION

ArtSTEM Module: TECHNOLOGY
Title: Quantum Computing
Target Group: High School Students

Coordinator: Wilhelmstadt Gymnasium (Germany)

Partners: Pangea (Germany), Art4Work (Poland), Wellnist Academy (Türkiye)

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Application Poster Frame Detective

Module: Quantum Computing

Title: Quantum Solutions for Real Problems

Layout: A3 landscape – split into 3 parts

Section	Instruction
Problem Description	What challenge is hard for classical computers?
Why Quantum?	What makes this suitable for quantum computing (superposition, entanglement, etc.)?
Visual Sketch	Diagram or creative image to show the solution (e.g., molecule modeling, logistics map)

Simulate a Qubit

Module: Quantum Computing

Task 1 – The Classical Bit

Draw the circuit that shows a qubit in state $|1\rangle$:

(Draw gates or use a small box)

What is the probability of measuring a $|1\rangle$? _____ %

Task 2 – Superposition

Apply an H-gate to a $|0\rangle$ qubit.

Draw the circuit here:

Probabilities of measuring:

$|0\rangle \rightarrow$ _____ % $|1\rangle \rightarrow$ _____ %

What do these results mean in your own words?



Qubit Simulation Worksheet

Module: Quantum Computing

Title: "Qubit Playground" Qubit Simulation Worksheet (Complement to Student Sheet)

Classical Bit

Draw the circuit for $|0\rangle$ or $|1\rangle$.
Question: "What happens when you apply an X-gate?"

Superposition

Apply H-gate to $|0\rangle$.
Diagram: Bloch sphere showing 50/50 probability.
Prompt: "Explain why this is different from randomness."




A grey paint tube with red and white stripes is shown on the left side, with red paint dripping out of its nozzle.

Creative Thinking

Module: Quantum Computing

Title: My Quantum Application

Draw a sketch, simple diagram or mind map of a real-world problem quantum computers might solve:

A pair of orange-handled scissors is positioned on the left side of the page.

My application is in the field of: _____
It would help by:



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Ethical Consideration

Module: Quantum Computing

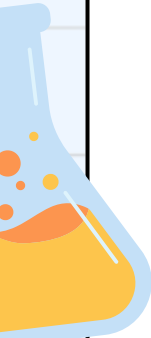
Read the scenario below:

“A large tech company has built the first powerful quantum computer and can now break most current internet encryption.”

List one potential benefit and one potential risk:

Benefit

Risk:



What is one question you would ask about who controls quantum computing?

Additional ethical scenarios:

- “Quantum AI replaces doctors for diagnosis.”
- “A company uses quantum computing to predict criminal behavior.”
- “All passwords become vulnerable in minutes.”



Prompt for students:

- What are the benefits?
- What is a risk?
- Who should decide how this is used?

A cartoon illustration of a red paint tube with a white cap, tilted and dripping red paint.

Homework

Module: Quantum Computing

Imagine you are applying for research funding.

Write a short grant proposal paragraph explaining your quantum project idea.

What is the problem?

Why can quantum computing help?

What is your goal?



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Integrating Art and STEM Education

ENGLISH VERSION

ArtSTEM Module: ENGINEERING
Title: Design the Future City
Target Group: High School Students

Coordinator: Wilhelmstadt Gymnasium (Germany)

Partners: Pangea (Germany), Art4Work (Poland), Wellnist Academy (Türkiye)

Prepared by: ArtSTEM Research Team

Date: 2025

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Poster Template Our Future City

Module: Design the Future City – Where Art Meets Sustainable Engineering

Title: “Our Future City”

- Sketch or attach a photo of your city model or digital layout
- Label key elements with sustainable or creative features
- Add arrows to show energy flow, water systems, or transport routes
- Bonus: Name your districts and include a city slogan!

City Element	Illustration Box	Description
Housing and Neighborhoods		
Public Art and Culture Zones		
Energy and Technology System		
Climate Resilience Features		

The title is centered on a purple brushstroke background. To the left of the title is an illustration of a tube of red paint with a red cap and a red brush tip.


Comic Storyboard Template

“If a City Could Talk...”

Module: Design the Future City – Where Art Meets Sustainable Engineering

Title: I Am a City!

- Imagine your city as a character
- Use humor, emotion, or future dreams
- Include STEAM concepts like smart energy, green art, safety zones
- Color and decorate using recycled materials or digital art tools

An illustration of a blue and yellow Erlenmeyer flask with orange and yellow liquid inside, positioned on the left side of the page.

I was built to...

My people use me for...

An illustration of a pair of orange-handled scissors, positioned on the left side of the page.

My proudest feature is...

One day, I dream to...

City Feature Match Cards Cut and Match Activity

Title: “Smart City Feature Match”

Use: Flashcard-style matching game for peer review or stations

Card Front	Card Back
Icon or Drawing e.g., solar panel sketch e.g., green wall e.g., mural	Feature Name e.g., Renewable Energy e.g., Urban Cooling e.g., Public Art & Culture

Feature List Suggestions:

- Renewable Energy
- Public Art
- Vertical Gardens
- Smart Transport
- Water Recycling
- Emergency Zones
- Digital Mapping

Suggested Activity:

- Shuffle and match icons to terms
- Add your own fun fact or function
- Use in small groups for a memory game or sorting challenge



Student Self-Reflection Sheet

Name: _____

Date: _____

1- *What was your city's main design goal (e.g., sustainability, safety, creativity)?*

2- *What STEAM element was most important in your design and why?*

3- *What role did you take in your group?*

Designer Builder Artist Researcher Presenter Other:

4- *One thing I'm proud of:*

5- *One idea I would improve or add next time:*



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Urban Design Plan

Key Features of Your City

Fill in with your city's features and creative ideas:

Feature	Description (Write or Draw)
Housing	
Green Spaces	
Energy Sources	
Transportation	
Public Art	
Climate Protection	

Challenges Your City Solves

What real-world problems does your design aim to fix?

Creative Touches

How is art used in your city (e.g. murals, light shows, sculptures)?



Sketch It Out!

Draw a top-down view or one important part of your city (e.g., a bridge, park, or building):

(Use the space below or attach on separate page)



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Homework: Letter from the Future

"Letter from a Future Citizen"

Write a short fictional letter as if you're living in your designed city in the year 2045. Start your letter like this:

Dear Friend from the Past,

I live in _____ (City Name), and life here is amazing because.....

(Describe how sustainability, art, and smart systems work in your city.)

Your friend,



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Integrating Art and STEM Education

ENGLISH VERSION

ArtSTEM Module: MATHEMATICS
Title: Logarithmic Beauty
Target Group: High School Students

Coordinator: Wilhelmstadt Gymnasium (Germany)

Partners: Pangea (Germany), Art4Work (Poland), Wellnist Academy (Türkiye)

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Poster Template Logarithmic Beauty

Module: Logarithmic Beauty

Use: Print-friendly or digital editing (Google Slides / Canva / Jamboard)

Title: "Our Logarithmic Spiral "

- Draw or glue your logarithmic model here (using graph paper, compass, ruler, or digital tools).
- Label each mathematical component with its corresponding function or description.
- Use color coding if needed for the spiral or exponential graphing elements.

Logarithmic Component	Student Drawing/Model Space	Notes/Labels
Logarithmic Spiral(e.g., nautilus shell, galaxy)	[Blank space for drawing or pasting image]	Equation: $r=ae^{b\theta}$ Real-world example: _____
Exponential Growth $y=a \cdot b^x$ $y=a \cdot bx$	[Graph space with x and y axes]	Initial value (a): _____ Growth factor (b): _____ Example: Population growth, compound interest
Logarithmic Scale $x=\log_b(y)$ $x=\log_b(ay)$	[Example: Richter scale, pH scale, decibel scale]	Base (b): _____ Application: _____ Why use logarithmic scale? _____

Comic Storyboard Template “Logarithmic Growth in Nature”

Module: Logarithmic Beauty – Exploring Patterns and Growth

Use: Print-friendly or digital editing (Google Slides / Canva / Jamboard)

Title: “The Hidden Spiral”

- Frame 1: Introduce a natural spiral (e.g., sunflower).
- Frame 2: Show the beginning of exponential growth (e.g., rapid seed expansion).
- Frame 3: Show how the spiral starts to slow as it grows.
- Frame 4: Depict logarithmic growth, with shrinking intervals.

Creat Logarithmic and Exponential Card Game

Module: Logarithmic Beauty – Exploring Patterns and Growth

Title: "The Growth Challenge

Use: Flashcards for review or group activity

Purpose: Reinforce the concepts of logarithmic and exponential growth through a strategic group game.

Card Type	Description
Exponential Growth Card	"Represents a process growing exponentially, like the doubling of bacteria or population over time."
Logarithmic Growth Card	"Represents growth that slows over time, like the intensity of light or the scaling of sound."
Function Card (Power Function)	"Describes repeated multiplication, such as $y=2^x$ "
Function Card (Logarithmic)	"Describes the inverse, such as $x=\log_b(y)$ "

How to Play:

Round 1: Pick a "function card" to represent the mathematical process.

Round 2: Use "growth cards" to compare how the growth happens in different scenarios (exponential vs logarithmic).

Round 3: Create scenarios with the "function" and "growth" cards, explaining the type of growth represented.



Creative Writing Frame

Title: *Design Your Own Logarithmic Artwork*

- *Students are tasked with designing an artwork that visually represents a mathematical pattern using logarithmic, exponential, or root functions.*

Activity Steps:

1. *Students brainstorm and sketch designs that involve growth, balance, and scaling using mathematical principles.*
2. *Students then explain how their artwork represents mathematical growth or scaling and which mathematical functions were used to create their design.*

Title of Artwork: _____

Equation/Pattern Used: _____

Explain How Your Design Represents Mathematical Growth:



Exponential Growth and Logarithmic Scaling Table

Title: Comparing Exponential Growth and Logarithmic Scaling

Instructions:

- Students will fill out a table comparing different examples of exponential growth and logarithmic scaling in nature, art, or real-world applications.

Type of Growth	Example	Explanation
Exponential Growth	Sunflower seed spiral	The number of seeds increases exponentially along the spiral
Logarithmic Growth	Earthquake intensity (Richter scale)	The Richter scale uses logarithmic scaling
Exponential Growth	Population increase	A rapidly increasing population over time
Logarithmic Scaling	Sound intensity (decibels)	The intensity of sound is measured logarithmically

Observation and Design

"Find the Logarithms in Real Life"

Think of situations where:

- Values grow quickly at first but slow down later, OR
- Equal steps lead to smaller and smaller increases.

Examples might include sound intensity, pH scale, earthquake magnitude, light dimming, etc.

List two situations that follow a logarithmic pattern:

Creative Expression

Design Your Own Logarithmic Artwork Use the space below (or attach a separate sheet) to sketch or describe your design.

Title of artwork:

Equation or mathematical pattern used (example: $y = \log_2 x$, $xy = \log_2 x$, Fibonacci spirals, scaling):

Explain how your design represents mathematical growth or scaling:

(Optional drawing space)



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Student Self-Reflection Sheet

Name: _____

Date: _____

1- Which type of function do you find most interesting — power, root, or logarithmic? Why?

2- How are these three functions connected to each other?

3- In your own words: How does a logarithmic function behave when numbers get larger?

4. Where have you seen similar patterns of growth or slowing change in real life?





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Integrating Art and STEM Education

ENGLISH VERSION

ArtSTEM Module: MATHEMATICS
Title: The Geometry of Motion
Target Group: High School Students

Coordinator: Wilhelmstadt Gymnasium (Germany)

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Poster Template Trigonometric Ratios

Module: The Geometry of Motion – Understanding Sine, Cosine and Tangent

Title: "Understanding Trigonometric Ratios"

- Draw or glue your triangle model here (using graph paper, compass, ruler, or digital tools).
- Label each side of the triangle with the corresponding trigonometric ratio (opposite, adjacent, hypotenuse).
- Use color coding for sine, cosine, and tangent functions for clarity.

Trigonometric Component	Illustration Box	Description
<p>Sine Function ($\sin \alpha$)</p>		
<p>Cosine Function ($\cos \alpha$)</p>		
<p>Tangent Function ($\tan \alpha$)</p>		

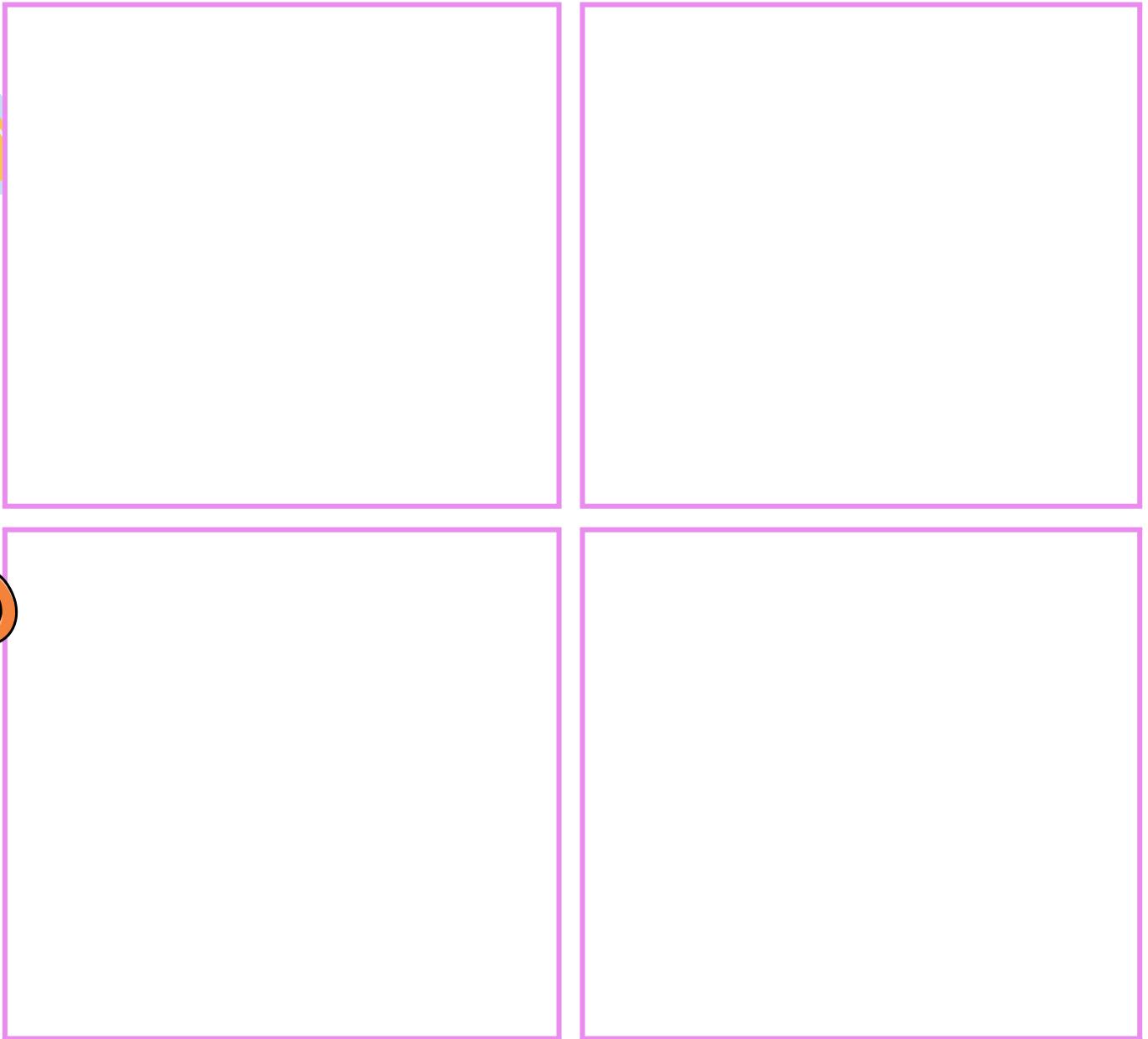


A tube of red paint with a white cap and a red band, tilted and dripping red paint.

Comic Storyboard Template “Trigonometric Ratios in Motion”

Module: Understanding Sine, Cosine and Tangent

Title: “Understanding Trigonometric Ratios”

- Frame 1: Illustrate sine as the vertical change in a right triangle.
- Frame 2: Illustrate cosine as the horizontal change.
- Frame 3: Represent tangent as a slope or ramp.
- Frame 4: Show complementary angles and their relationship to sine and cosine.

A 2x2 grid of four empty rectangular panels, each outlined with a thick purple border, intended for drawing comic panels.An Erlenmeyer flask containing orange liquid with bubbles.A pair of orange-handled scissors.



Creative Writing Frame

Trigonometric Art

Design Your Own Trigonometric Artwork

Students are tasked with designing an artwork that visually represents sine, cosine, or tangent using geometric shapes or motion-inspired imagery.

Activity Steps:

- a. Students brainstorm and sketch designs that involve movement, slopes, and angles.*
- b. Students explain how their artwork represents mathematical motion and the trigonometric ratios.*

Title of Artwork: _____

Equation/Pattern Used: _____

Explain How Your Design Represents Mathematical Motion:



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Observation and Design

Find the Logarithms in Real Life

Think of situations where:

- *Values grow quickly at first but slow down later, OR*
- *Equal steps lead to smaller and smaller increases.*

Examples might include sound intensity, pH scale, earthquake magnitude, light dimming, etc.

- *List two situations that follow a logarithmic pattern:*



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Creative Expression Trigonometric Art

Design Your Own Logarithmic Artwork

Use the space below (or attach a separate sheet) to sketch or describe your design.

Title of Artwork: _____

Equation or mathematical pattern used (example: $y=\log_2 x$, Fibonacci spirals, scaling): _____

Explain how your design represents mathematical growth or scaling: _____

(Optional drawing space below)



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