MONTH 4

Coordinates, Symmetry & Optimization

Monthly Learning Goals

Month 4 connects visual mathematics with algebraic reasoning. Students graph ordered pairs, complete symmetrical designs, model the surface area of three-dimensional objects, compare methods, and search for efficient solutions.

The activities range from accessible coordinate and symmetry practice to deeper challenges involving formulas, volume, surface area, and optimization, allowing students to engage at different levels.

WINTER SPECIAL OPTION

This packet can also be used as a fun holiday special during the winter months.

By the End of This Month, Students Should Be Able To:

- Plot ordered pairs accurately on a coordinate plane.
- Follow a sequence of coordinates to create a visual design.
- Complete figures using line symmetry.
- Represent surface-area relationships with formulas.
- Compare two methods and determine which is more efficient.
- Connect the volume and dimensions of a rectangular prism.
- Use algebra and testing to optimize a real-world design.

Skills We Will Practice

Coordinate Graphing
Plotting ordered pairs and interpreting position on a plane.

Symmetry
Reflecting visual information accurately across a line.

Geometric Modeling
Representing three-dimensional objects with two-dimensional diagrams.

Algebraic Reasoning
Writing and solving formulas that describe geometric relationships.

Optimization
Comparing possible designs to identify an efficient solution.

This Month's Activities

- Coordinate-graph mystery picture
- Coordinate-plane plotting
- Snowflake symmetry
- Wrapping-paper area models
- Surface-area formulas
- Cuboid optimization challenge

Connection to the Rest of the Year

Month 4 combines the pattern, logic, and spatial reasoning developed earlier in the program. These skills prepare students for later work with proportions, algebraic models, data visualization, and multi-step competition problems.

Candy Cane

Graph and connect each consecutive point until you reach the word STOP.
Then start a new line, continuing to connect each point until you reach STOP again.

(0.5, 2.5)
(1, 4)
(2.5, 7)
(2.5, 8.5)
(2, 9.5)
(0.5, 10.5)
(-1, 10)
(-2, 8.5)
(-3, 7.5)
(-4, 7.5)
(-4.5, 8)
(-5, 9)
(-5, 10)
(-4, 12)
(-3, 13)
(-1, 14)
(2, 14)
(4, 12.5)
(5, 11)
(5.5, 9)
(5.5, 8)
(5, 6)
(4.5, 5)
STOP

(1, -2)
(-2, -7)
(-4, -10)
(-6, -13)
(-6.5, -14)
(-8, -14)
(-9, -13)
(-9, -12)
(-8.5, -11)
(-7, -9)
(-5, -6)
(-3.5, -3.5)
(-1.5, -1)
STOP

(1.5, 2)
(0.5, 2.5)
(-0.5, 2.5)
(-1.5, 1.5)
(-1.5, -1)
(-0.5, -1)
(1, -2)
(0.5, -1)
(0.5, 1)
(1.5, 2)
(4.5, 5)
(6, 5.5)
(7, 5.5)
(8, 4.5)
(8.5, 3)
(8, 2)
STOP

(7.5, 3)
(9, 0)
(9, -2)
(8, -3.5)
(6, -4)
(5, -4)
(1.5, -1)
(0.5, -1)
STOP

(0.5, -0.5)
(1.5, -0.5)
(4, 1)
(6, 1.5)
(7, 1.5)
(8, 1)
(8.5, -1)
STOP

(8, 1)
(7.5, 0)
(7, -0.5)
(5, -0.5)
(3.5, 0.5)
STOP

(-0.5, 2.5)
(-1, 4)
(-2.5, 6)
(-4, 6.5)
(-5, 6)
(-5.5, 5)
(-8, 4)
(-9, 2.5)
(-9, 1.5)
(-8, -0.5)
(-5, -1)
(-1.5, -1)
STOP

(-9, 2.5)
(-7, 3.5)
(-6, 3.5)
(-4, 2)
(-3, 1)
(-1.5, 0)
STOP

(-6, 3.5)
(-5, 2)
(-3, 1)
STOP

(-3.5, -3.5)
(-4.5, -3)
(-5.5, -2)
(-5.5, -3.5)
(-7.5, -3.5)
(-5, -6)
STOP

(-2, -7)
(-1, -7.5)
(0.5, -7)
(1, -5)
(1, -2)
(2, -2.5)
(2.5, -5)
(2, -7)
(2, -8)
(3, -10)
(5, -10.5)
(6, -10.5)
(7.5, -10)
(8.5, -8.5)
(7, -8.5)
(6.5, -8)
(6, -6.5)
(5, -8)
(4, -8.5)
STOP

(5, -10.5)
(4.5, -10)
(4, -8.5)
(4, -6.5)
(4.5, -5)
(4, -3.5)
STOP

(-9, -12)
(-7.5, -11.5)
(-6.5, -12)
(-6, -13)
STOP

(-7, -9)
(-6, -9)
(-5, -9.5)
(-4.5, -10.5)
STOP

(-5.5, -6.5)
(-4, -6.5)
(-3, -7)
(-2.5, -8)
STOP

(-4, -4)
(-2, -4.5)
(-1, -5.5)
STOP

(-2.5, -2)
(-1.5, -2)
(0.5, -3)
STOP

(1, 4)
(2, 4)
(3, 3.5)
STOP

(2, 6)
(3, 6)
(4.5, 5)
STOP

(2.5, 7.5)
(3.5, 8)
(5.5, 8)
STOP

(2.5, 8.5)
(3, 9)
(4, 9.5)
(5.5, 9)
STOP

(2, 9.5)
(3 ,10.5)
(4, 12.5)
STOP

(0.5, 10.5)
(1.5, 11.5)
(1.5, 13)
(1, 14)
STOP

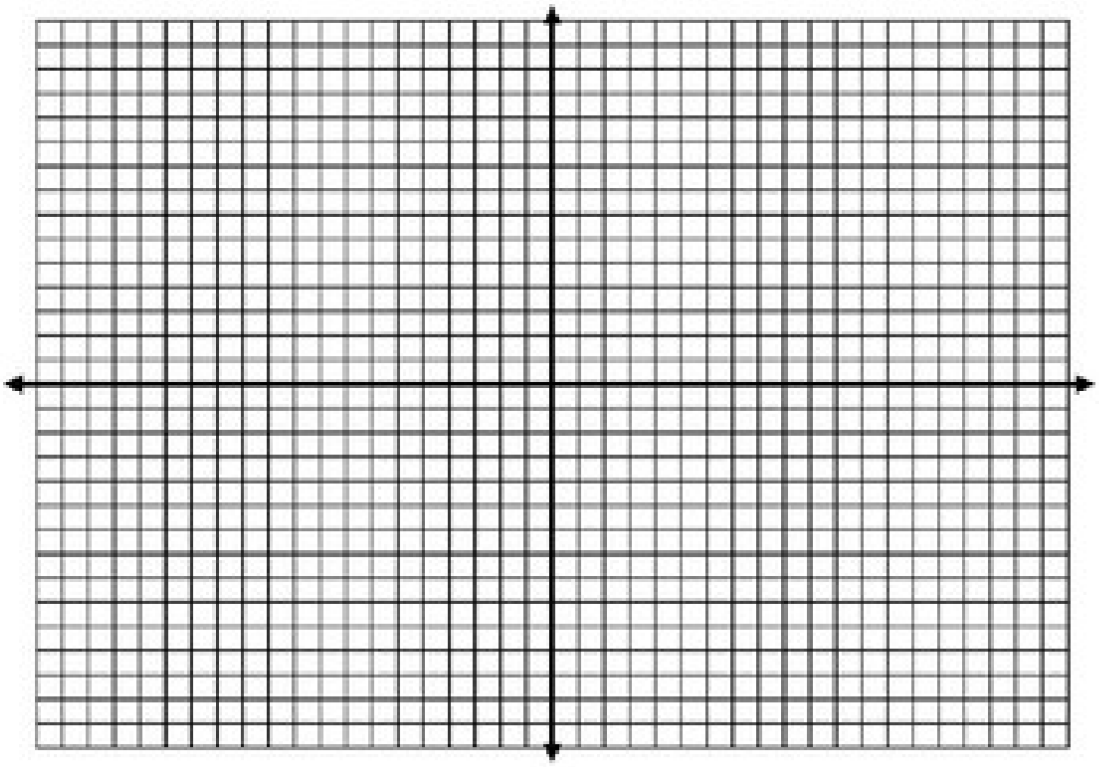
(-1, 10)
(-0.5, 12)
(-2, 13.5)
STOP

(-1.5, 9.5)
(-2, 10.5)
(-3, 11.5)
(-4, 12)
STOP

(-2.5, 8)
(-3, 9)
(-4, 10)
(-5, 10)
STOP

Don't forget to color the image!

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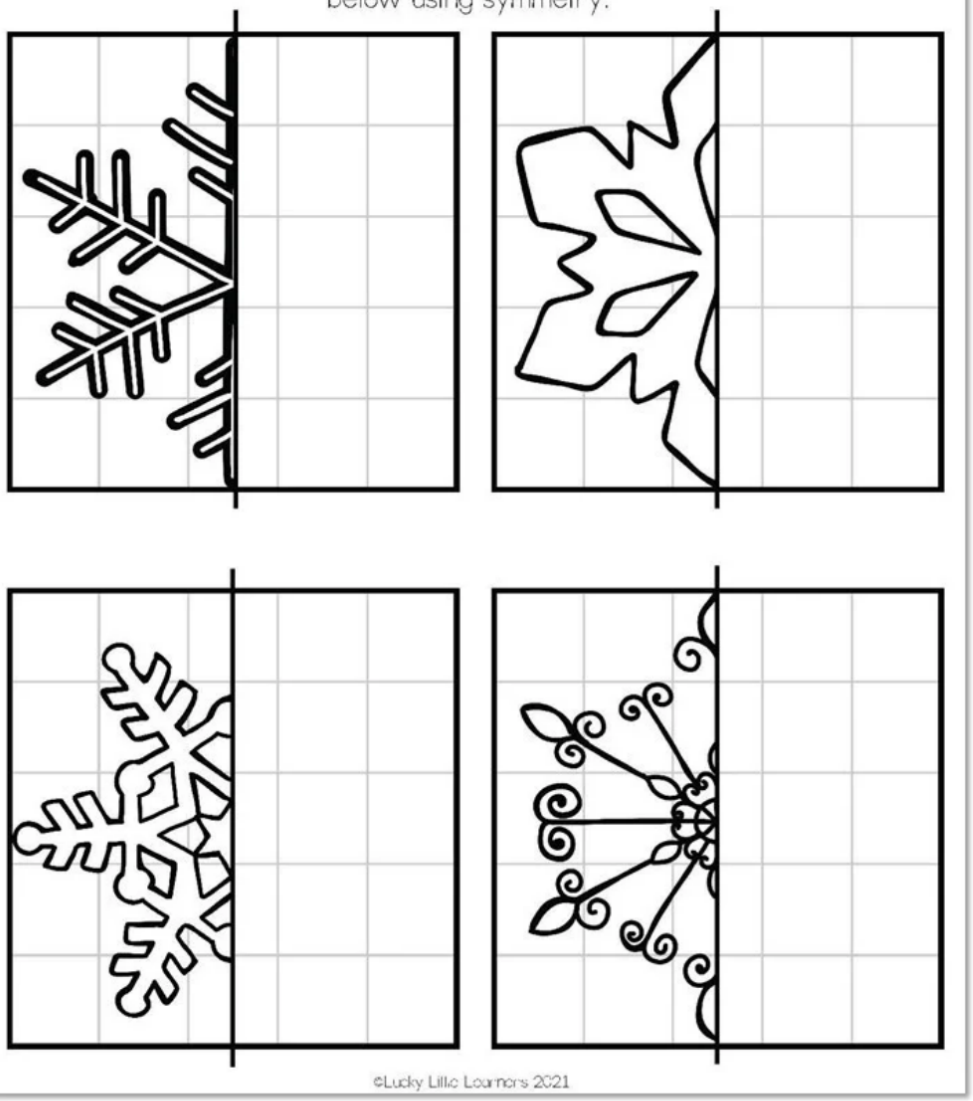


Name _____

Art

SNOWFLAKE SYMMETRY

Directions: Try your best to draw the opposite side of each snowflake below using symmetry.



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WRAPPING PRESENTS WITH MATHS

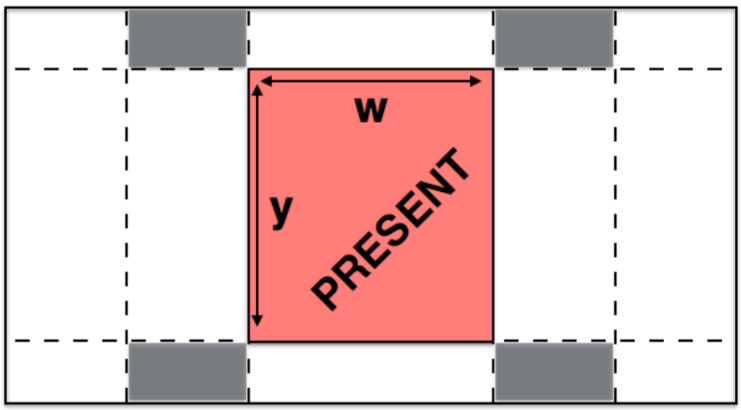
We can use maths to make sure we wrap presents efficiently, using as little wrapping paper as possible.

Task 1

One way to wrap a cuboid shaped present is featured below (let's call this method 1).

Write a **formula for the area of the rectangular piece** of wrapping paper that you would need to cut to wrap the present below, so there is no overlap (apart from the grey bits that don't get used).

We can call the depth of the present 'd'



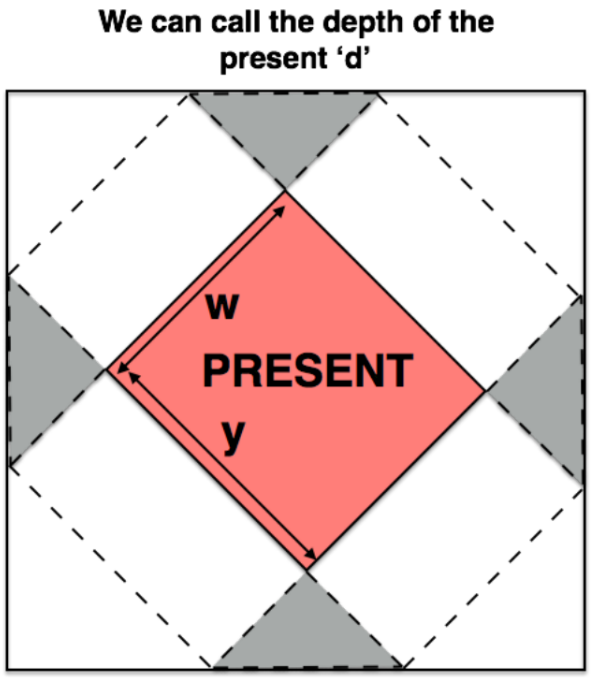
Not to scale

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Task 2

An alternative way (let's call this method 2) to wrap a cuboid shaped present is featured below.

Write a **formula for the area of the square piece** of wrapping paper that you would need to cut to wrap the present below, so there is no overlap (apart from the grey bits that don't get used).



Not to scale

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Task 3

Some cuboid shapes are more efficient than others – they use up less wrapping paper for same amount of volume.

Zoe is making a cuboid block of marzipan to give as a Christmas present to her mum who loves marzipan. She wants to wrap it with wrapping method 1.

She wants to mould the **108cm^3** of marzipan into the cuboid that would minimise the area of the wrapping paper that she would need to cut out.

a) Assuming the width of the block is fixed to **6cm**, show that we can solve the equation below to find the depth of the cuboid Zoe needs:

$$2d^3 + 6d - 108 = 0$$

b) The equation above has only one real solution, and it's an integer. Find the dimensions of the cuboid Zoe needs to make.

c) Could she cut a smaller area of wrapping paper if she makes a cuboid and wraps it with method 2?