IMPACT Problem-Based Task

Title of Task: Black Panther Artifacts   **Cluster:**

Course: Math 1   **Unit: Algebra & Geometry**

Author: James O'Neal, Jr.

Course Level: **Standards:**

Authors of the Task: **Formative/Summative:**

Total Points _____Feedback/Suggestions:

	5	**4**	**3**	**2**	**1**
Content Knowledge *The task constructs (formative) or assesses (summative) facts, concepts, theories, and principles that are taught and learned based on task objective.*	The task constructs/assesses an extensive and thorough content knowledge.	The task mostly constructs/assesses an extensive and thorough content knowledge.	The task minimally constructs/assesses an extensive and thorough content knowledge.	The task minimally constructs/assesses a basic content knowledge.	The task does not construct/assess content knowledge.
Leader Score and Comments: **Professor Score and Comments:**					
Conceptual Understanding *Conceptual understanding is knowing more than isolated facts and methods. The successful student understands mathematical ideas, and has the ability to transfer their knowledge into new situations and apply it to new contexts.*	Task demands students to independently and appropriately transfer their knowledge into new situations and apply it to new contexts.	Task mostly encourages students to appropriately transfer their knowledge into new situations and apply it to new contexts.	Task minimally requires students to transfer their knowledge into new situations and apply it to new contexts.	Task directly instructs students to transfer their knowledge into new situations but does not apply to new contexts.	Task requires only procedural understanding of content.
Leader Score and Comments: **Professor Score and Comments:**					
Addresses a Real-World Problem *The task is based on an application beyond abstract mathematics.*	The task encompasses a problem or principle that would occur in the "real-world" and requires methods authentic to the scenario to produce sensible solutions.	The task encompasses a problem or principle that would occur in the "real-world" but requires methods not authentic to the scenario **or** solutions are not sensible.	The task encompasses a problem or principle that would occur in the "real-world" but requires methods not authentic to the scenario **and** solutions are not sensible.	The task attempts to include a real world scenario but does so poorly.	The task does not encompass a problem or principle that would occur in the "real-world".

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Professor Score and Comments:

	5	**4**	**3**	**2**	**1**
Mathematical Practices *This is in reference to NCTM's 8 Mathematical Practices.*	Stated mathematical practices are clearly represented in the task **and** the task, in its entirety, appropriately stimulates the student to demonstrate multiple stated mathematical practices.	Stated mathematical practices are clearly represented in the task **or** the task, in its entirety, appropriately stimulates the student to demonstrate multiple stated mathematical practices.	Stated mathematical practices are somewhat represented in the task, or the task somewhat stimulates the student to demonstrate multiple stated mathematical practices.	The task somewhat incorporates the purposeful use of a stated practice.	The task does not purposefully engage students in any stated mathematical practices.

Leader Score and Comments:

Links to the Standards *This is in reference to the current NC State Standards.* ****This must be a level 5 to be accepted.***	The task completely aligns to the specified NC Math Standards.	The task mostly aligns to the specified NC Math Standards.	The task partially aligns to the specified NC Math Standards.	The task loosely aligns to the specified NC Math Standards.	The task does not align to the specified NC Math Standards.

Leader Score and Comments:

Incorporates Strategies to Enhance Student Engagement	The task clearly outlines any strategies that a teacher new to the task would need to carry out the task with sustained student engagement.	The task outlines most strategies that a teacher new to the task would need to carry out the task with sustained student engagement.	The task outlines some strategies that a teacher new to the task would need to carry out the task with appropriate levels of student engagement, but may need	The task attempts to provide helpful insights for implementation but a teacher new to the task would need additional support for success.	The task does not provide any strategies to enhance student engagement.

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			additional support.		

Leader Score and Comments:

Task Overview: This task explores the real world concepts of modeling math in cinema. It also models the real world application of what employers may look for in potential candidates. Throughout the task students will learn how to successful recreate the four popular artifacts of Black Panther by using equations of lines and properties of those equations. This task explores mathematical concepts such as distance, equations of lines, systems of linear equations, symmetry, and exponential functions.

Standards	**Objectives**
NC.M1.F-BF.1b *Build a function that models a relationship between two quantities.* Write a function that describes a relationship between two quantities. b. Build a function that models a relationship between two quantities by combining *linear*, *exponential*, or quadratic functions with addition and subtraction or two linear functions with multiplication.	Students should be able to write equations of linear and exponential functions.
NC.M1.F-LE.5 *Interpret expressions for functions in terms of the situation they model.* Interpret the parameters a and b in a linear function $f(x)=ax+b$ or an exponential function $g(x)=ab^x$ in terms of a context	Students should be able identify key elements of exponential and linear functions and build equations based on those elements.

Emphasized Standards for Mathematical Practices:

3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.

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Making Connections (Hook, Multi-media link, Visual Aid, etc.):

I Nevah Freeze:

https://www.youtube.com/watch?v=xT4RgWEds1E

Why Black Panther's box office success matters

https://www.youtube.com/watch?v=T2LAd43JoP4

Why BLACK PANTHER Is Important to the Black Community

https://www.youtube.com/watch?v=m03j8CrYdy4

Suggested Pacing Calendar (within the unit):

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Day One: Intro video, Tasks 1 & 2	Day Two: Task 3a & 3b	Day Three: Task 4

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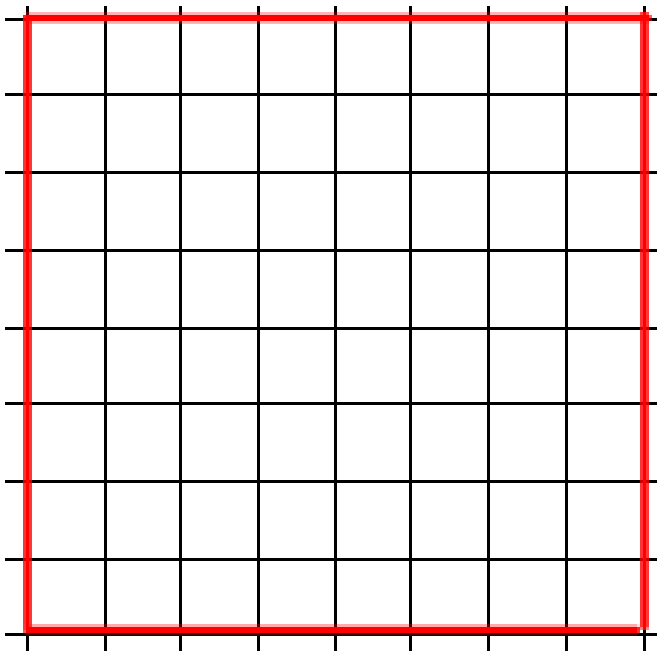
Author: James O'Neal, Jr.

Task: Your dream job is to work at Marvel Studios as a graphic artist. One of the tasks that Marvel puts before all their designers is to recreate four famous cultural artifacts of Black Panther. Black Panther broke box office records in 2017 as the most successful Black superhero movie. In order to be hired to work on any future projects involving Black Panther, you must recreate four artifacts: The "A" that is found in WAKANDA, the shield that will be introduced in newer movies, TChalla's claws from his necklace, and the iconic "Wakanda Forever" hand cross.

 TASK 1: Your first task is to recreate the "A" that is found in WAKANDA. You are given the following instructions to form the A.

1. The origin is at the center of the square.
2. The slope of one of the lines is opposite of the point of intersection two units away from the x-axis.
3. The other line has an opposite slope of the first.
4. The dot in the middle is on the line y = 1/2

Write the equation of each line in slope intercept form:

Line 1 _____

Line 2 _____

Line 3 _____

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TASK 2: Your second task is to recreate the "W" that is found in WAKANDA. You will recreate the W by using the equation from task 1.

1. To form the first 2 lines the y-intercepts remains the same from task 1 but slopes are perpendicular to the lines of task 1.
2. To form the 3rd line, it has an x-intercept of -1 and a slope of 5.
3. The 4th line is symmetric to the 3rd line over the y-axis.

When you have drawn each line, erase all line extensions so that the lines that remain form the W represented in the Wakanda symbol. Your lines should not pass the 5 on the y-axis.
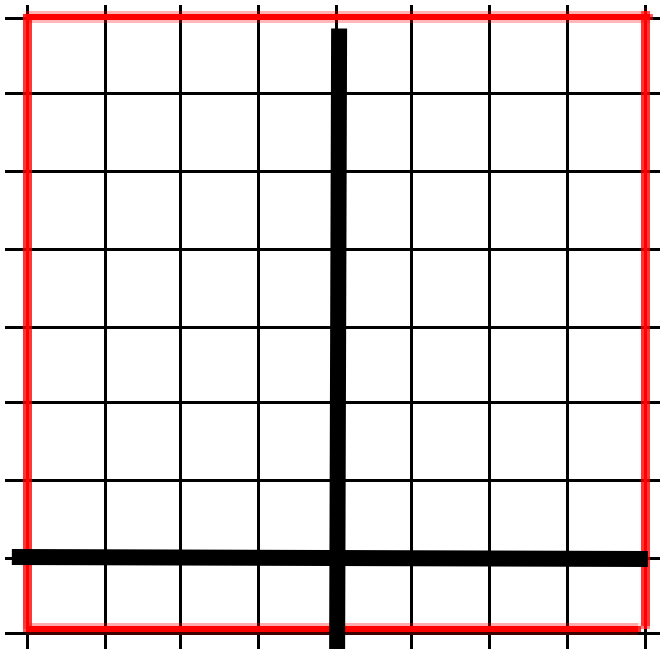
Write the equation of each line in slope intercept form:

**Line 1** _____

Line 2 _____

Line 3 _____

Line 4 _____

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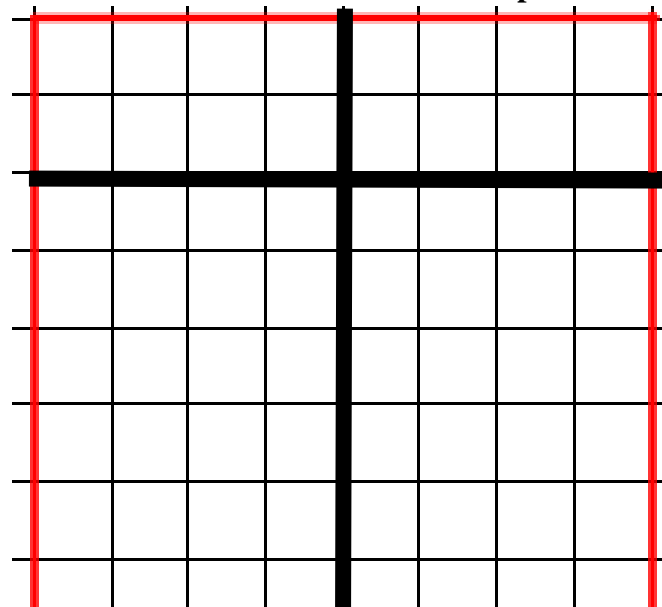
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TASK 3: Your director, Mrs. Patel, now asks you to recreate T'Challa's claw necklace by looking at the picture that will be used in the next film as a logo. She has given you the x and y-axis already. She informs you that if you use the lines that were graphed in task 2, you will have a huge help in graphing and find the equation of the functions that form the claws. The only difference is that the function curves at the point of intersection.

Task 3A: Recreate the lines from task 2 by extending them to fit on the graph below.
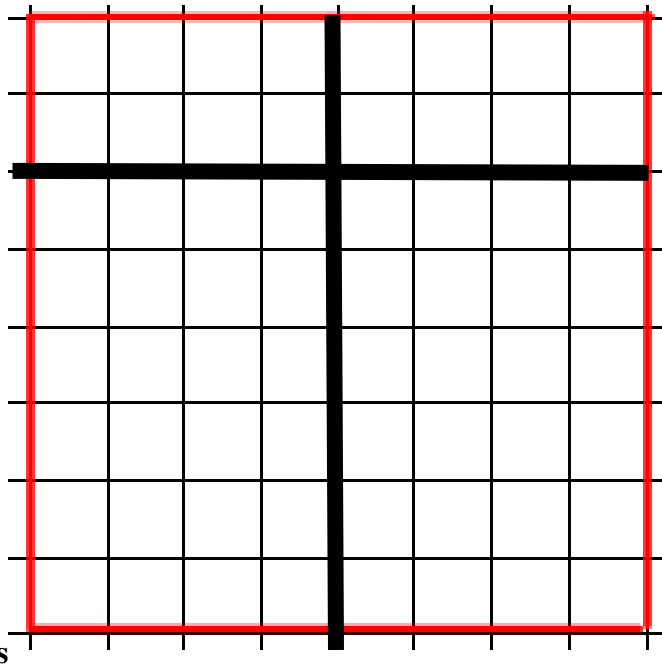
Task 3B:
1. **The left side of the claw is a function that grows at a constant rate that is 4 times the slope of the original line with a horizontal asymptote of y =1 while keeping the same y-intercept.**
2. **The other line is symmetrical to this line over the y-axis.**
3. **Use the table to write the equations of the lines and the points to be graphed. At the end erase all line extensions not needed to represent the claw drawing. Round to the nearest hundredth.**

X	$y =$ _____ (y-values)	X	$y =$ _____ (y-values)
-2		0	
-1.5		.5	
-1		1	
-.5		1.5	
0		2	

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TASK 4: Your final task is to create the shield that will be used in Black Panther 2. Mrs. Patel says that this task will be the easiest of them all! Two out of the 4 functions that you need can be found in task 3B! She then informs you that the new functions grows at the same constant growth rate of the other two functions and the y-intercepts are 7 units apart.
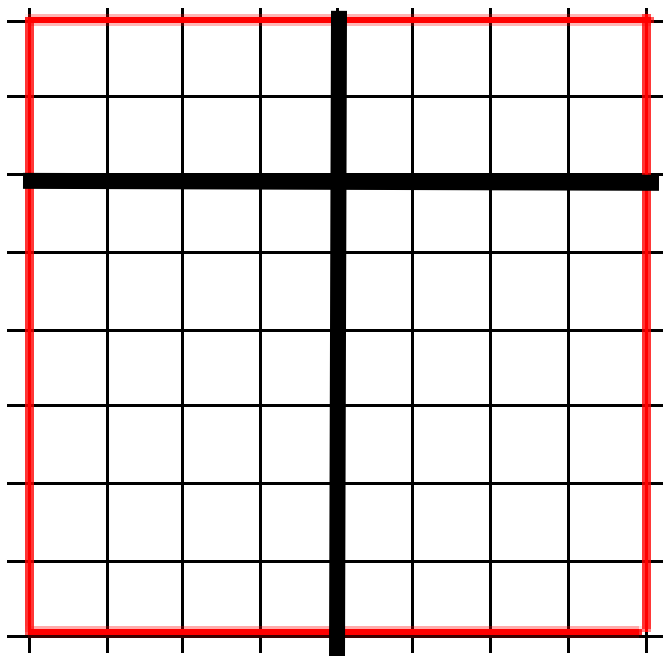
Write the equation of each line in table below in slope intercept form. Use the following values to find the ordered pairs.

x	$y = _____$ (y-values)	x	$y = _____$ (y-values)	x	$y = _____$ (y-values)	x	$y = _____$ (y-values)
-3		-3		0		0	
-2		-2		1		1	
-1		-1		2		2	
0		0		3		3	
1		1		4		4	

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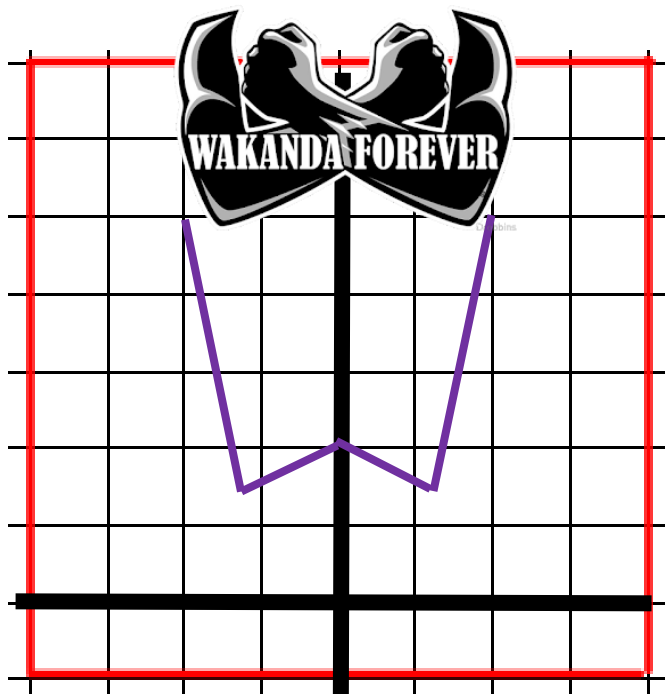**Solutions:**
TASK 1:
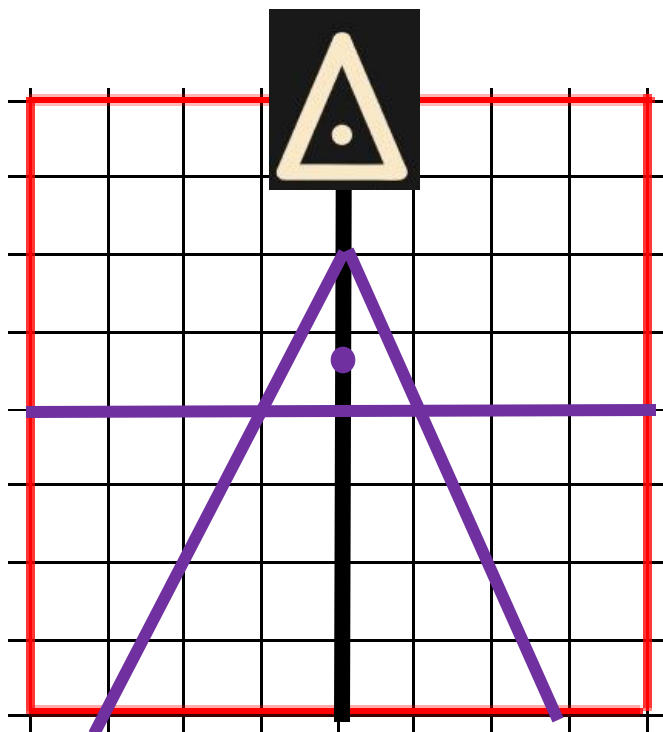
Write the equation of each line in slope intercept form:

Line 1: $y = 2x + 2$

Line 2: $y = -2x + 2$

Line 3: $y = 0$

Task 2:

Write the equation of each line in slope intercept form:

Line 1: $y = -1/2x + 2$

Line 2: $y = 1/2x + 2$

Line 3: $y = 5x - 5$
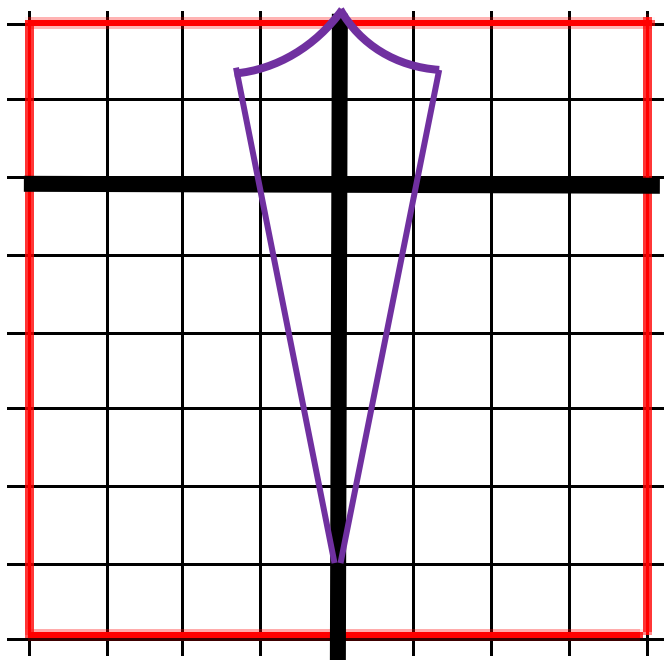
Line 4: $y = -5x - 5$
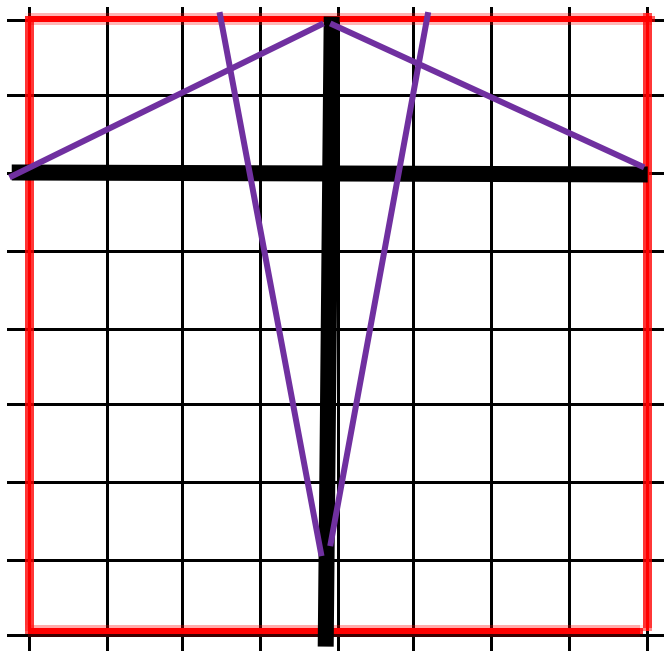
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X	$y = (1/2)^x + 1$ (y-values)	X	$y = (2)^x + 1$ (y-values)
-2	1.25	0	2
-1.5	1.35	.5	1.71
-1	1.5	1	1.5
-.5	1.71	1.5	1.35
0	2	2	1.25

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Task 4:
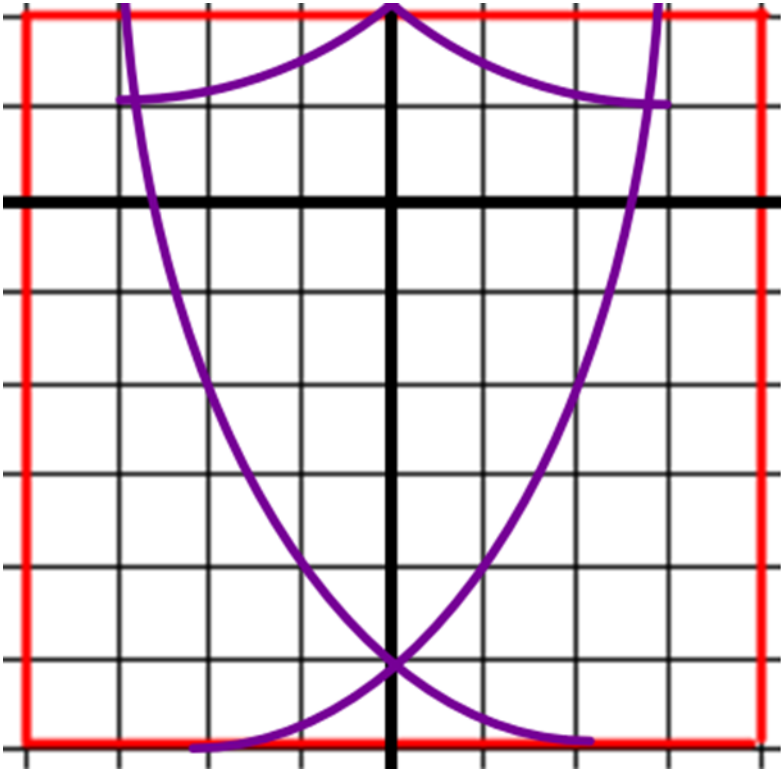
Write the equation of each line in slope intercept form:

x	$y = 2^X + 1$ (y-values)	x	$y = (1/2)^x - 6$ (y-values)	x	$y = 1/2^X + 1$ (y-values)	x	$y = (2)^x - 6$ (y-values)
-3	1.125	-3	2	0	2	0	-5
-2	1.25	-2	-2	1	1.5	1	-4
-1	1.5	-1	-4	2	1.25	2	-2
0	2	0	-5	3	1.125	3	2

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Scaffolding:

Task 1:
- What makes up the origin on the coordinate plane?
- What does the word opposite mean?
- If you are two points away from the x-axis, where are you? What does this represent?
- A line of y = # has what type of slope? What does this line look like? What is the y-intercept of this line?
- In order to write an equation in slope intercept form, what two things do you need to complete the equation (referencing the slope & y-intercept).

Task 2
- What is special about he slopes of perpendicular lines? Are they just opposite? Are they just reciprocals?
- If you have the x-intercept, then you also have an ordered pair. How can that help you write an equation in slop intercept form?
- What does symmetry mean? If you are symmetric to the y-axis, what does that mean? What does that look like?

Task 3
- What type of function has an asymptote? If it is growing at a constant rate, what does this represent?
- Why doesn't the function represent a quadratic function?
- In order for the line to go the opposite way, to represent rising the left, can we multiply by a negative? Let's see what happens?
- What type of exponential function rises to the left?
- If students cannot figure out the equation, you can tell them a point on the line and have the students to solve for the "a" of the $y = ab^x$. For example (2, -2) is on the line.
    - Therefore $-2 = 1(b)^2 - 6$. Therefore the growth rate would be 2.
- In order for this to be symmetric, it has to be the inverse/opposite of the other function.
- The exponential inverse of 3^1 is 3^{-1} or 1/3. Let that be your guide.

Task 4
- What equations have to be the same in order to form the shield?
- What is the y-intercept of the top part of the shield?
- What does it mean to be 7 units apart?
- What is the y-intercept 7 units away from the first one?
- How do I write that in to the equation, knowing that the growths are the same
- What affects the y-intercept in exponential functions (hinting at the asymptote). When x = 0, the parent function is 1 so the parent function starts at one as opposed to zero.
- Knowing this, how can I get to the intersection of -5 on the y-axis?

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Instructional Strategies:

Overall strategies:
- The following tools can help students visualize what is going on:
  - Graphing calculator on **Metacalculator** - http://www.meta-calculator.com/
  - Intro to Exponential Functions on **Gizmo**: https://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=134
  - Exponential Functions on **Gizmo**: https://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=134
- This movie has so much meaning to the Black Community and I thoroughly encourage you to show the videos on this. The first video may not be appropriate for students in lower grades because of the F*** marked out, and the use of d*** it at the end, so be aware of that.
- Have students use a straight edge. Have several copies available because students will make mistakes and ask for a new sheet to represent a neater paper.
-

Task 1:
- Students may struggle in the beginning that they need to draw the x & y axis. Therefore, if you feel like the majority of the class is struggling with this, it may be good to reward those students who figured it out by themselves and instruct the rest of the class to do so. Students may also struggle understanding the x-axis is a line so therefore remind them it's a horizontal line and their slope must be zero.

Task 2:
- Instruct students to practice first on a piece of graphing paper before they actually do this task. They will be erasing the extra lines, so it would be neater if they have found the equations and graphed them prior to putting them on this paper.
- Students may not remember symmetry from lower grades so be ready to review that. You may get into the language such as reflections, if they have seen this terminology in lower grades.

Task 3:
- If you have not covered the terminology "asymptote" then it would be a good idea to do that here so that students will understand that this has to be an exponential function. It will also be a good idea to go over the y-intercept of the parent function of $y = 2^x$. That the y-intercept does not start at zero like linear functions so whatever number being added or subtracted is being affected by the 1 when x is zero. Students who struggle with this will try to write down $y = 2^x + 2$, but quickly find that they can't fit this equation on the graph provided. Students will need a thorough understanding of the y-intercept of exponential functions in order to get these problems correct.

Task 4:
- Students can use a calculator to help them graph these points, gizmos, or the meta-calculator given in the instructional overview. In the scaffolding, you can give students a point that lies on the line if they struggle with finding the equations. It is important to instruct students to put the correct function

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covering the domain listed in the tables. As previously stated, a thorough understanding of how the function moves by adding or subtracting a constant must be understood if students are to understand what it means to be 7 units away from 2 on the y-axis. It may help for students to convert they decimals into fractions for students to see them written as mixed numbers so students can remember that $2^{-3} = 1/8$, therefore adding $1 = 1\ 1/8$.