Light Graphing Calendar (90 min blocks)

Week	Mon	Tues	Wed	Thur	Fri	
1	- Entry Doc - Intro to Light Photography	- Complete Phase 1: Light Graph a line - Begin Phase 2: Slope vs Angle investigation	- Continue Phase 2 and fill in the table - Create a grid of square inches to help you measure your robot's motion	- Complete Phase 2 - Begin Phase 3 Light Graph a line with any slope	- Complete Phase 3	---------- Possible student solution - py code - ch code ----------
2	- Do Now: Linear Absolute Value Graphs - Begin Phase 4 Light Graph an absolute value function with any slope	- Do Now: Stretching Absolute Value Graphs - Continue Phase 4. - Twist*	- Do Now: Shifting Absolute Value Graphs - Finish Phase 4 and Begin Reflections	Catch-Up day: Finalize all materials and Complete Reflection		*Change the vertex
3						

eritech Violins

Dear Designer,

We at Veritech Violins make the most technologically interesting violins you have ever seen. Verruca Veritas, our new CEO, thinks her father's old V logo is holding the company back from entering the hipster ironic violin market. She wants to attach a light to a robot and use a long exposure picture to capture her new hi tech V. She also likes the idea of using the graph of an absolute value function to represent the V, she thinks it will *absolutely* send the right message.

She doesn't know how steep the sides of the V are going to be, but she does want the picture to span ten inches in width. Your task is to write a program that will draw her a V to match the slope of the absolute value function she enters and send her an example V to show that it works.

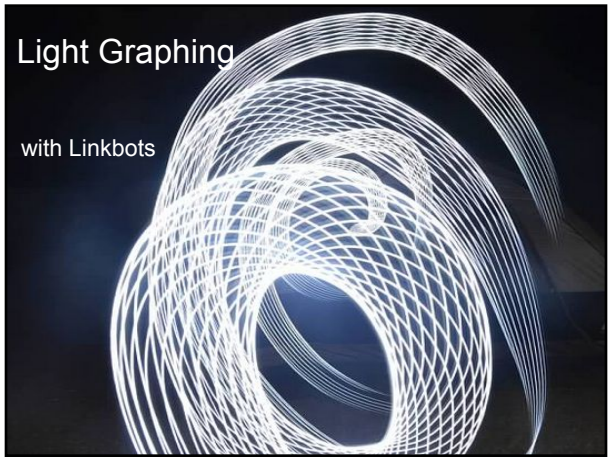
Sincerely,
Vincent Vanderbilt
Communications Specialist

Know	Need to Know	Next Steps

Fancy V from: https://pixabay.com/p-33685/?no_redirect

Light Graphing

with Linkbots



What is Light Photography

Why do these pictures look different?

How does Shutter Speed affect a picture?

Which is a longer interval of time 1/800th of a second or 1/15th of a second?

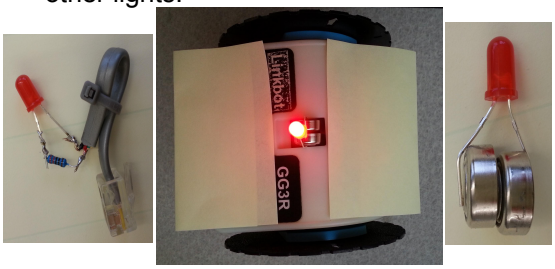
1/800 1/15

In this image the shutter was open for 1/800th of a second

In this image the shutter was open for 1/15th of a second

Light Add-on

This works best if you have a light directly on top of the phone jack and tape over the other lights.



Download the free version of the Long Exposure App

- Pick a partner and install the app
- Let's get Started on the Entry Doc

Phase 1: Light Graph a Line[1]

A) Download the Long Exposure App and practice taking some pictures of the Linkbot's Light. Try to hold the camera as still as possible.

B) Now program the robot to move along the line y=x with the domain $0<x<5$. Once that program works, use the Long Exposure App to take a picture of the graph you make.

C) What would change if the line you were graphing had a different slope? y-intercept?

D) Show your teacher your pictures and move on to the next phase after they approve your picture by signing below.

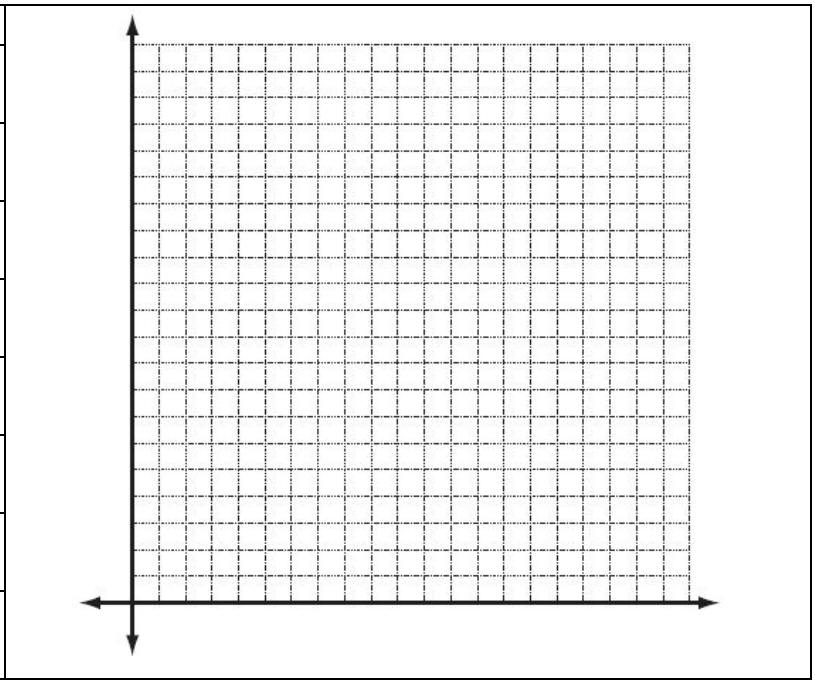
E) Attach your picture below…

Teacher Approval:_____

[1] Polya's How to Solve It, "Can you solve a simpler problem first?"

Phase 2: Slope/Angle Investigation
In this table record the number of degrees a Linkbot has to turn in order to travel a specific slope.

Slope	Angle
1/4	
1/3	
1/2	
3/4	
1	
2	
3	
6	



Observations:

1) Note any patterns that you observe from your data and graph above.

2) What is the relationship between the slope and the angle the bot has to turn?

3) Would any of the functions we have studied so far fit this?

4) What other important things did you learn or notice?

Phase 3: Graph any Slope

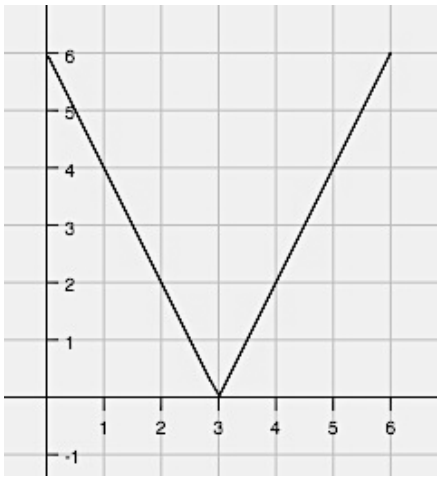
Part 1: Using atan() that we just learned, program your bot to graph any positive slope.

Attach a picture of your robot's successful graph of y=1.73x on the domain 0<x<5 below:

Part 2: Negative Slopes
How far does your bot have to turn to graph a line with a negative slope? Add negative slopes to your program and attach a picture of the graph of y=-0.58x on the domain -5<x<0.

Warm-up:
Linear Absolute Value Graphs

Michelle likes riding her bike to and from her favorite lake on Wednesdays. She created the following graph to represent the distance she is away from the lake while biking.



1. Interpret the graph by writing three observations about Michelle's bike ride.

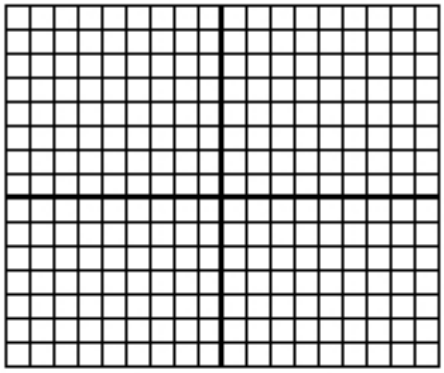
2. Write a piece-wise function for this situation, with each linear function being in point-slope form using the point (3,0). What do you notice?

3. This particular piece-wise function is called a linear absolute value function. What are the traits you are noticing about linear absolute value functions?

Part II

In this part of the task, you will solidify your understanding of piece-wise and use your knowledge of transformations to make sense of absolute value functions. Follow the directions and answer the questions below.

1. Graph the linear function $f(x) = x$



2. On the same set of axes, graph $g(x) = |f(x)|$.

3. Explain what happens graphically from $f(x)$ *to* $g(x)$.

4. Write the piece-wise function for $g(x)$. Explain your process for creating this piece-wise function and how it connects to your answer in question 3.

5. Create a table of values from [-4, 4] for *f(x)* and *g(x).* Explain how this connects to your answer in questions 3 and 4.

x	*f(x)*	*g(x)*
-4		
-3		
-2		
-1		
0		
1		
2		
3		
4		

Phase 4 - Make a V

Adapt your program to graph an absolute value function with any slope.

Attach a picture of your robot’s successful path below:

Warm-up: Stretching Absolute Value Graphs

Exploratory Challenge

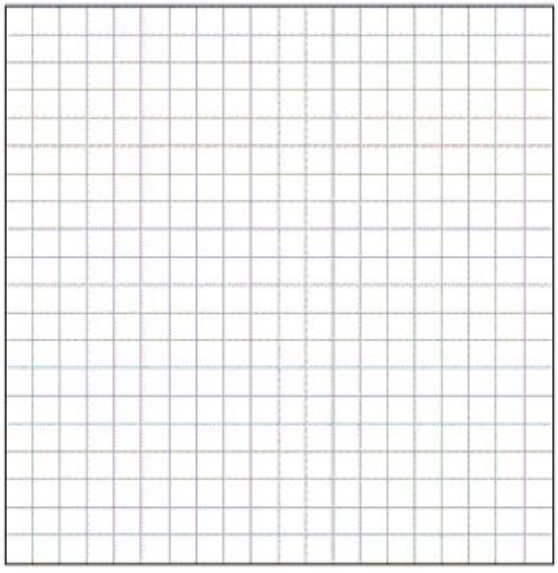
Complete the following to review Module 3 concepts:

a. Consider the function $f(x) = |x|$. Complete the table of values for $f(x)$. Then, graph the equation $y = f(x)$ on the coordinate plane provided for part (b).

x	$f(x)$
-4	
-2	
0	
2	
4	

b. Complete the following table of values for each transformation of the function f. Then, graph the equations $y = g(x)$, $y = h(x)$, $y = j(x)$, *and* $y = k(x)$ on the same coordinate plane as the graph of $y = f(x)$. Label each graph.

x	$f(x)$	$g(x) = 3f(x)$	$h(x) = 2f(x)$	$j(x) = 0.5f(x)$	$k(x) = -2f(x)$
-4					
-2					
0					
2					
4					



c. Describe how the graph of $y = kf(x)$ relates to the graph of $y = f(x)$ for each case.

i. $k > 1$

ii. $0 < k < 1$

iii. $k = -1$

iv. $-1 < k < 0$

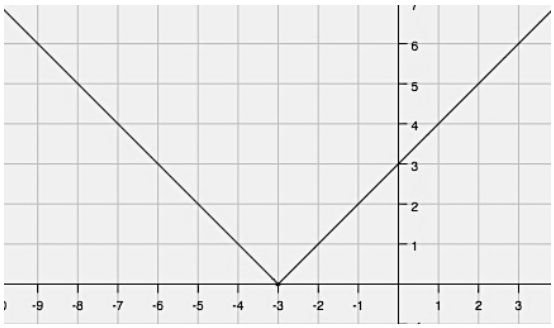
v. $k < -1$

d. Describe the transformation of the "graph" of f that results in the "graphs" of g and h.

$f(x)$ $g(x)$ $h(x)$

Warm-up: Shifting Absolute Value Graphs

6. The graph below is another example of an absolute value function. The equation of this function can be written two ways:



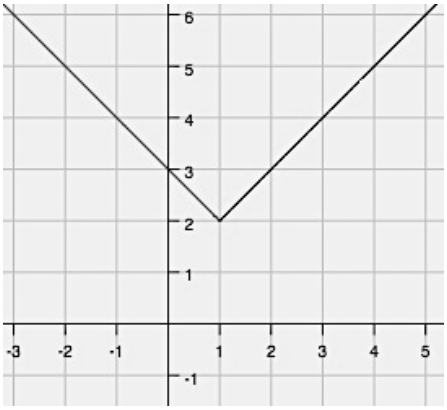
as an absolute value function: $f(x) = |x + 3|$

or as a piece-wise: $f(x) = \begin{cases} -(x+3), & x < -3 \\ (x+3), & x \geq -3 \end{cases}$

How do these two equations relate to each other?

Below are graphs and equations of more linear absolute value functions. Write the piece-wise function for each. See if you can create a strategy for writing these equations.

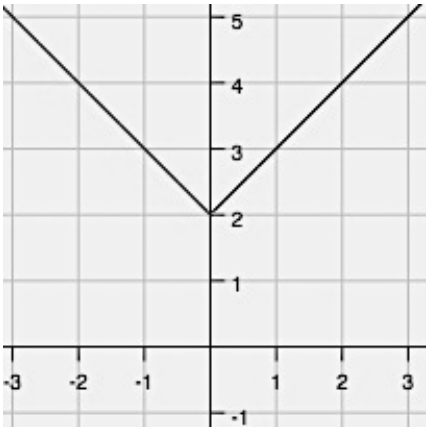
7.



Abolute value: $f(x) = |x - 1| + 2$

Piece-wise: $f(x) =$

8.

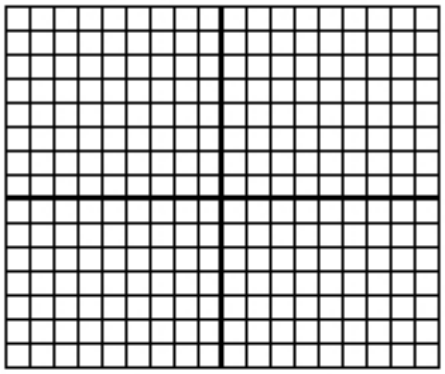


Abolute value: $f(x) = |x| + 2$

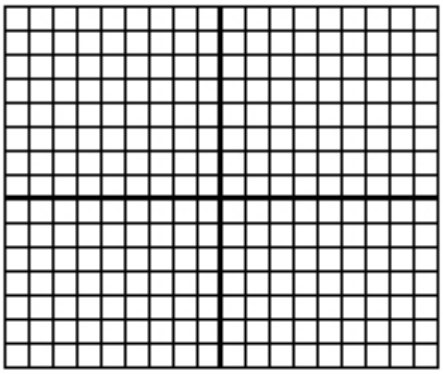
Piece-wise: $f(x) =$

Graph the following linear absolute value piece-wise functions.

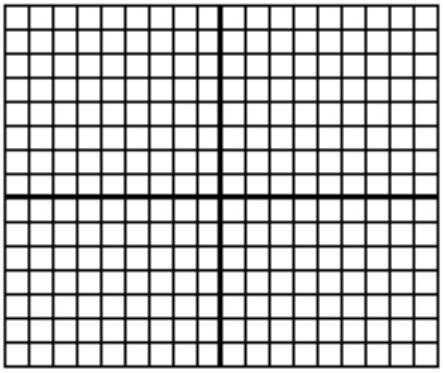
9. $f(x) = |x-4| = \begin{cases} -(x-4), & x < 4 \\ (x-4), & x \geq 4 \end{cases}$



10. $f(x) = |x| + 1 = \begin{cases} -(x)+1, & x < 0 \\ (x)+1, & x \geq 0 \end{cases}$



11.



Piece-wise: $f(x) = \begin{cases} -3(x+2)+1, & x < -2 \\ 3(x+2)+1, & x \geq -2 \end{cases}$

Absolute Value: $f(x) =$

12. Explain your method for doing the following:

a) Writing piecewise linear absolute value functions from a graph.
b) Writing piecewise linear absolute value functions from an absolute value function.
c) Graphing absolute value functions (from either a piecewise or an absolute value equation).

Reflection Sheet:

1. What were the most challenging parts of this activity? Why?

2. How did you use Algebra and Graphing to find a relationship between the slope and the angle?

3. What was your favorite part of the activity?

4. What did you teach your partner and did they teach you?