

# **Conference for the Advancement of Mathematics Teaching Summer 2015**

## **Exploring Functions with Physics Concepts**

**Presenter:**

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**(Aldine Independent School District)**

**(Mathematics Leadership Institute)**

**(NSF/NOYCE Scholar)**

**Rice University School Mathematics Project**

This presentation has been compressed and edited; Student pictures have been removed, but the web resources and links are still included.

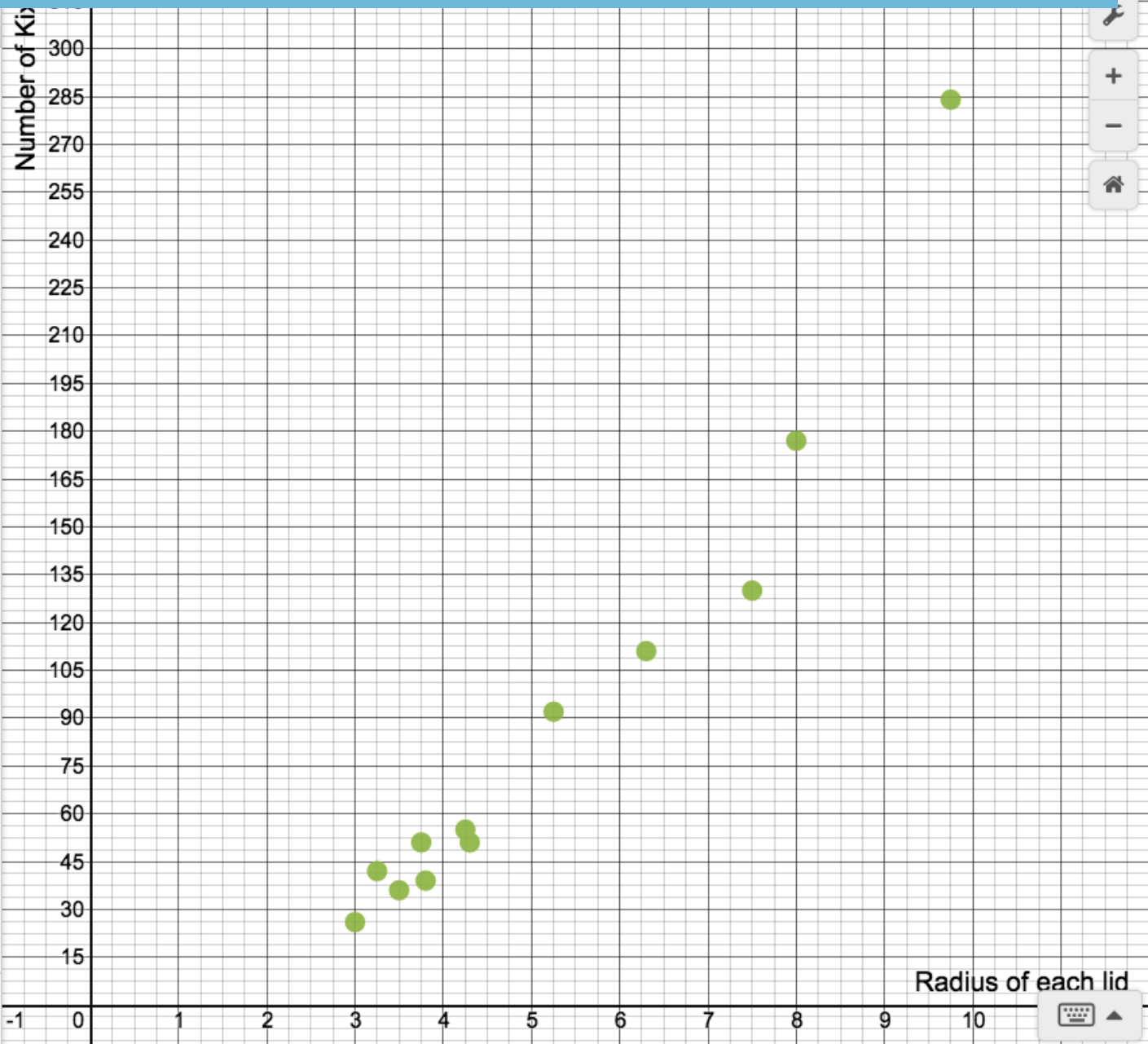
## II. Student Activity #2 - Exploring Quadratic Functions

- **Quadratrix with KIX**



## II. Student Activity #2 - Quadratix with KIX

$x_1$	$y_1$
3	26
3.25	42
3.5	36
9.75	284
3.75	51
5.25	92
3.8	39
4.25	55
6.3	111
7.5	130
8	177
4.3	51
.....	.....
.....	.....



## II. Student Activity #2 - Quadratrix with KIX



$$y = c^x$$

2



$$c = 1.8$$

-10

3



$$y = mx + b$$

4



$$m = 19$$

-10

5



$$b = 1$$

-10

6



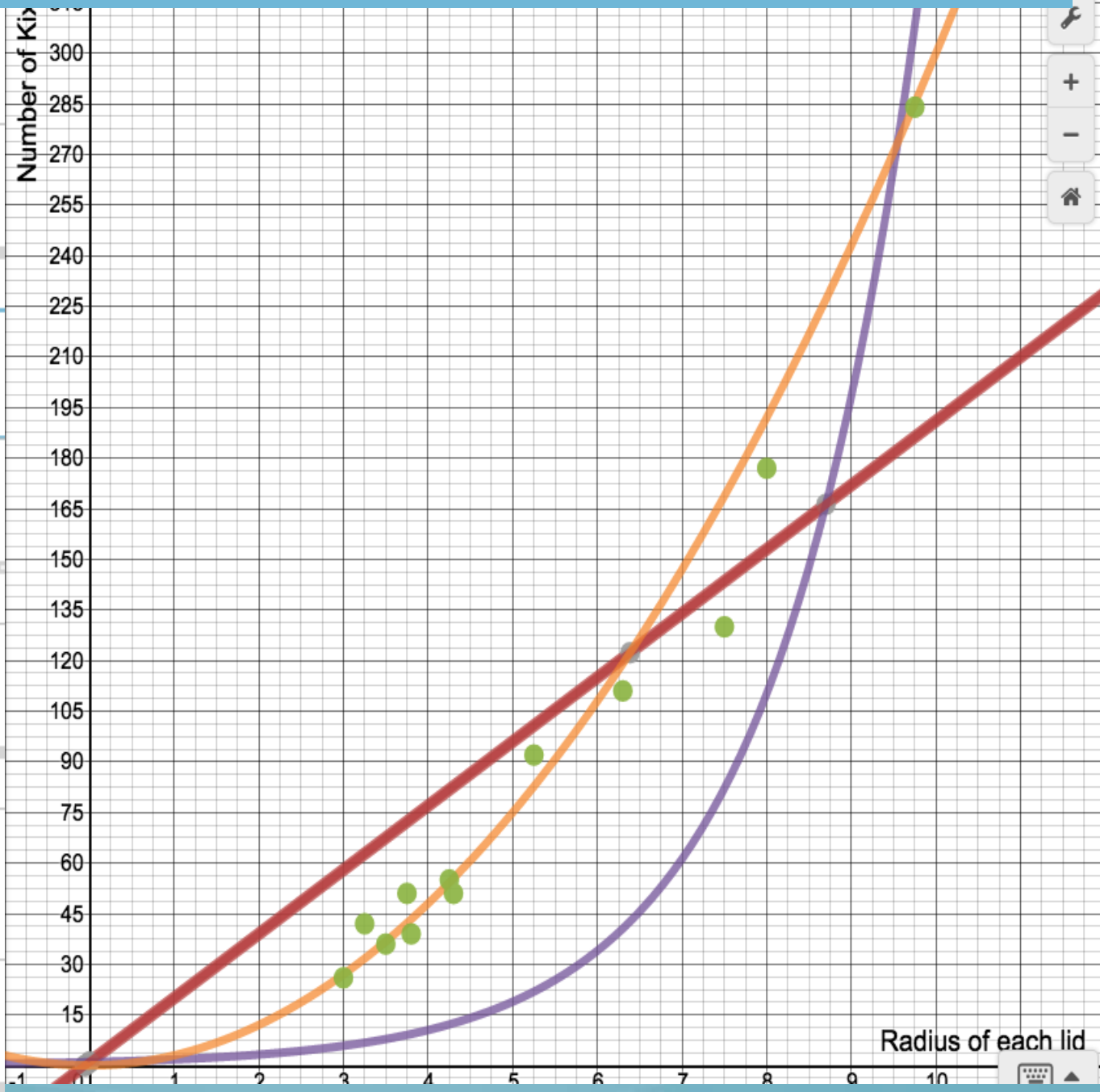
$$f = ax^2$$

7



$$a = 3$$

-10



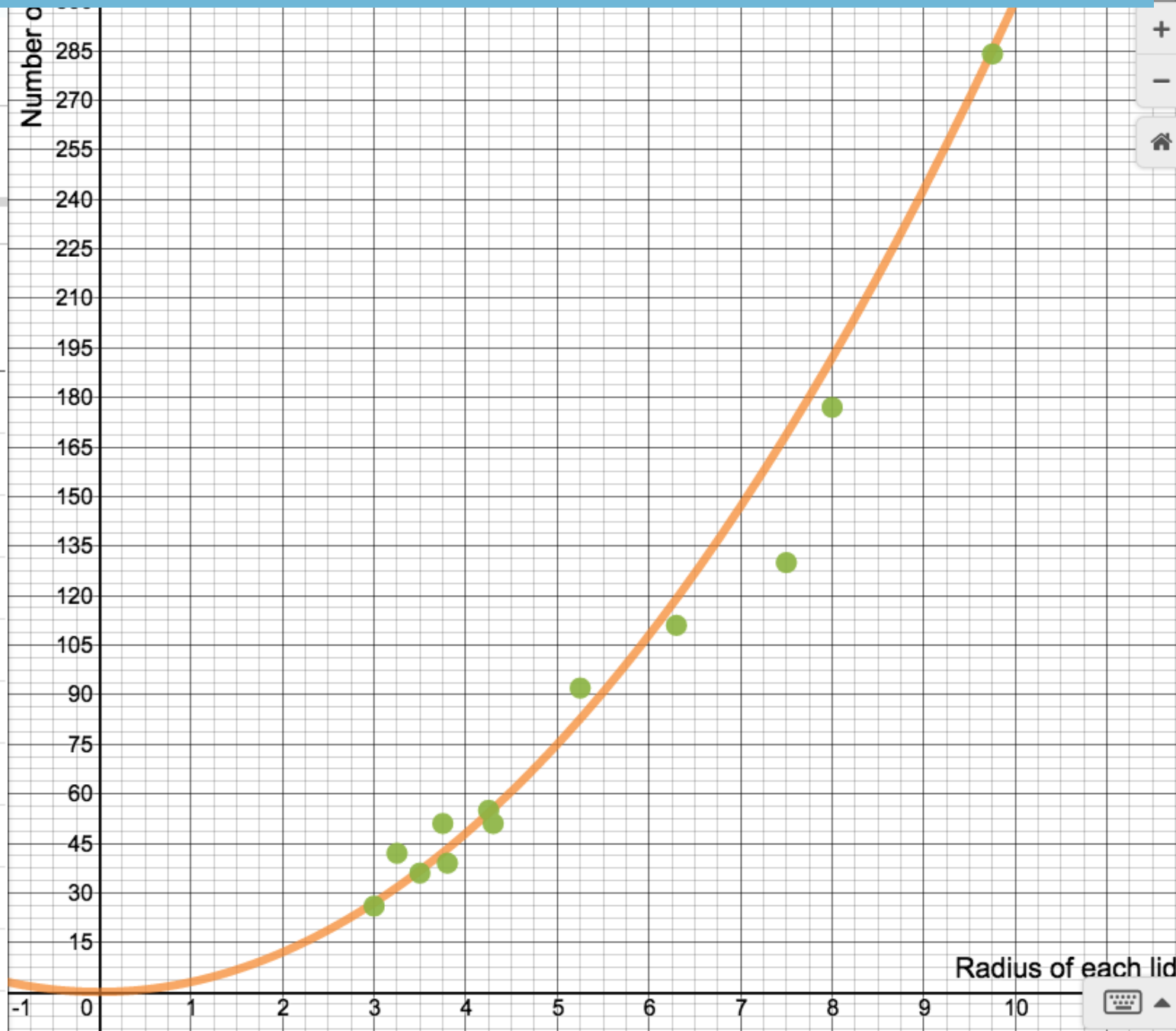
## II. Student Activity #2 - Quadratix with KIX

$$f = ax^2$$

$$a = 3$$

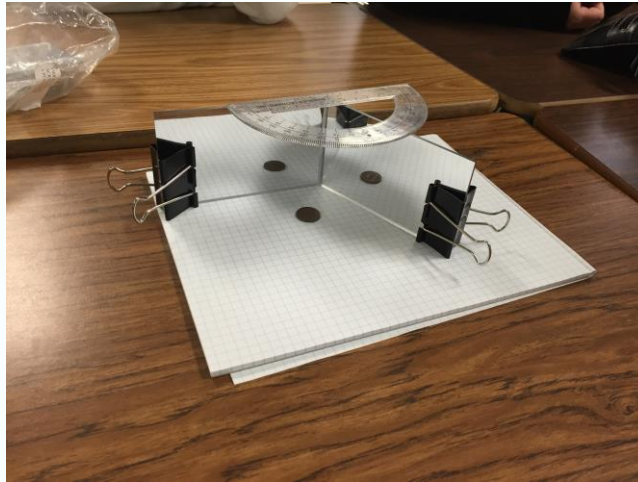


$x_1$	$y_1$
3	26
3.25	42
3.5	36
9.75	284
3.75	51
5.25	92
3.8	39
4.25	55
6.3	111
7.5	130
8	177



## II. Student Activity #3 - Exploring Rational Functions and Inverse Variation

- **Multiple IMAGES**



## II. Student Activity #3 - Multiple Images

Function rule:

$$y = \frac{360}{q}$$


What does this mean?

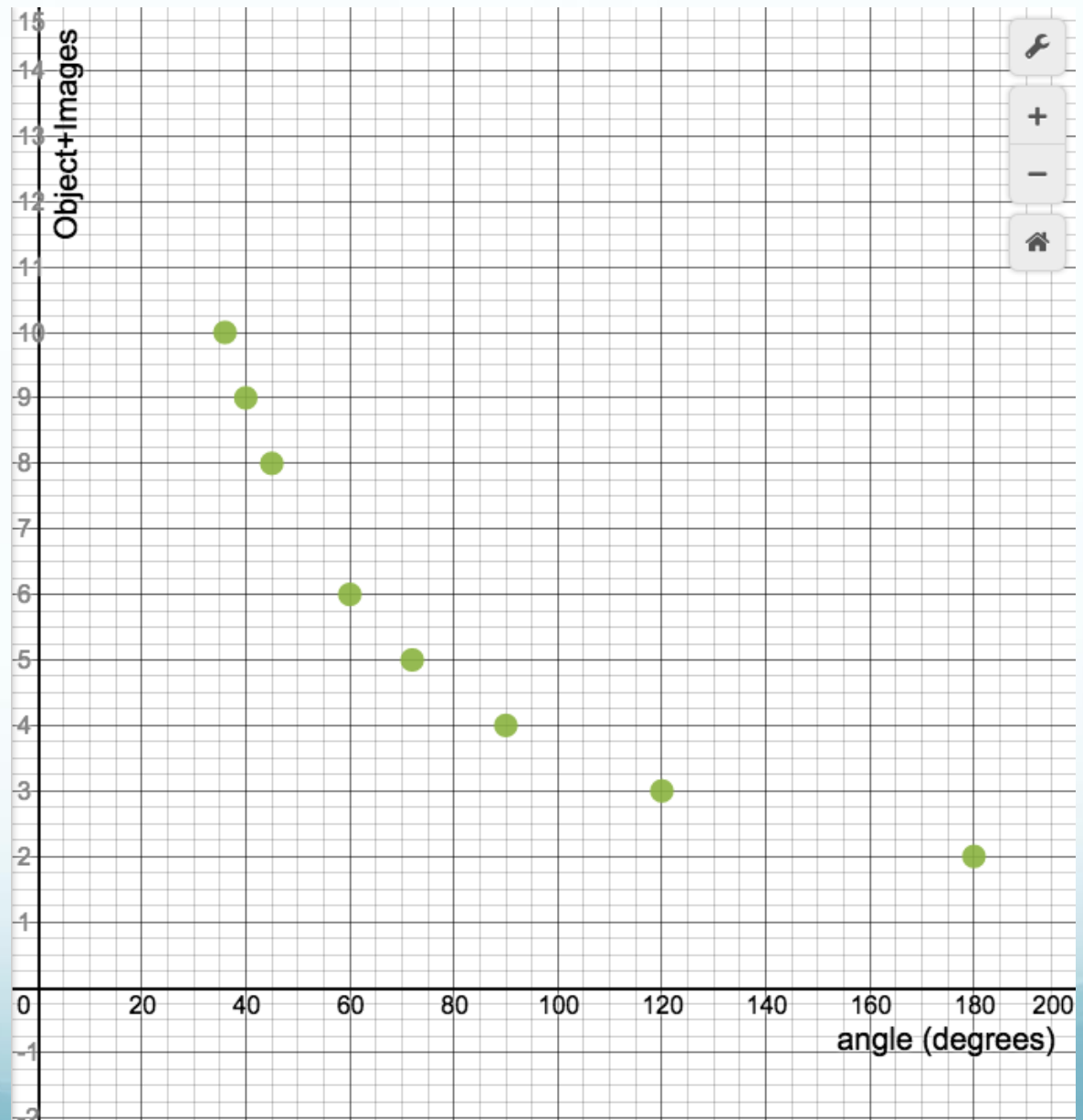
$$N = \frac{360}{q} - 1$$

Angle Between the two mirrors	Object + Number of Images
180°	2
120°	3
90°	4
72°	5
60°	6
45°	8
40°	9
36°	10




## II. Student Activity #3- Multiple Images

$x_1$	 $y_1$
180	2
120	3
90	4
72	5
60	6
45	8
40	9
36	10



## II. Student Activity #3- Multiple Images

$x_1$	 $y_1$
180	2
120	3
90	4
72	5
60	6
45	8
40	9
36	10

3



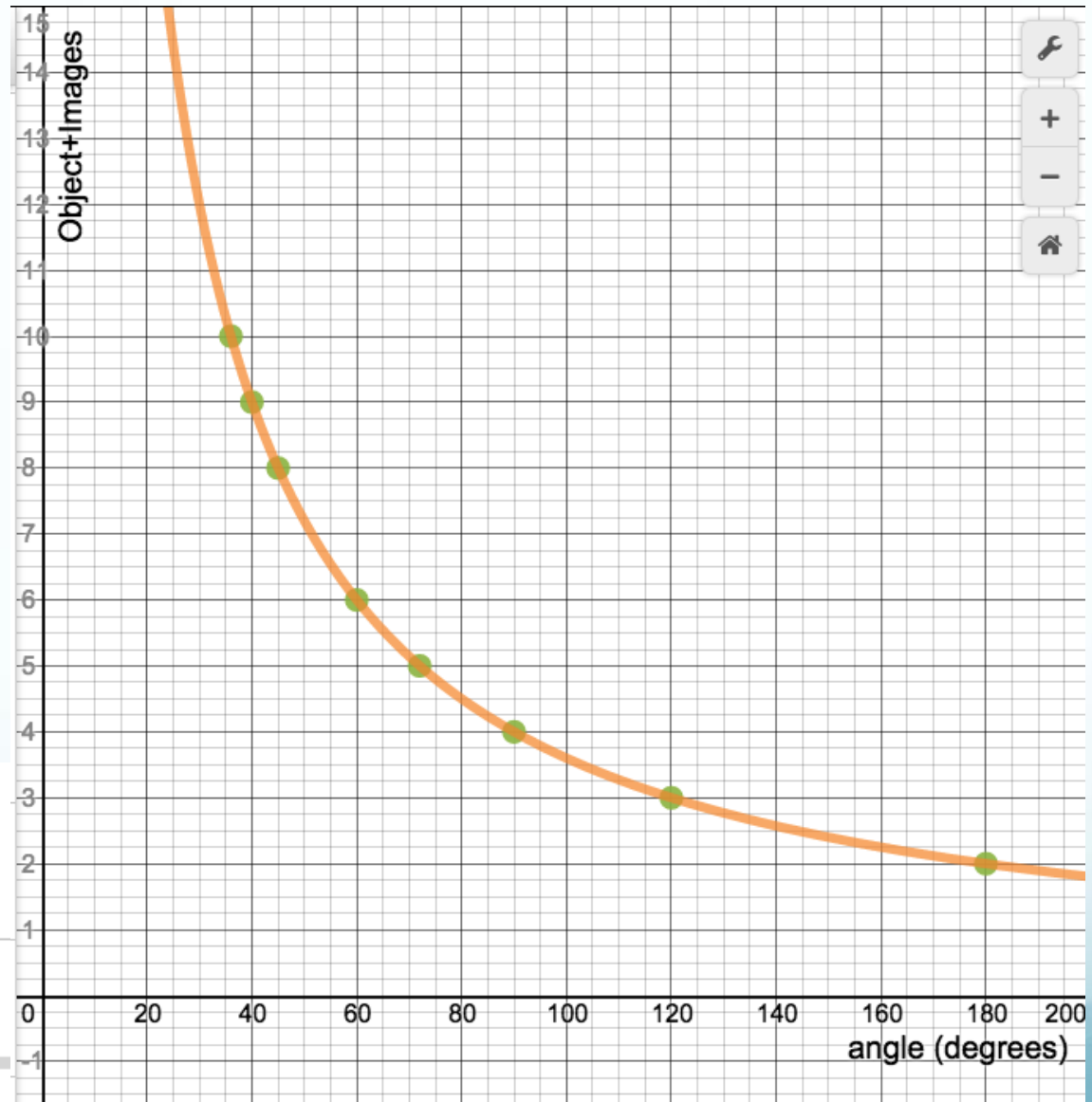
$$f(x) = \frac{a}{x}$$

4



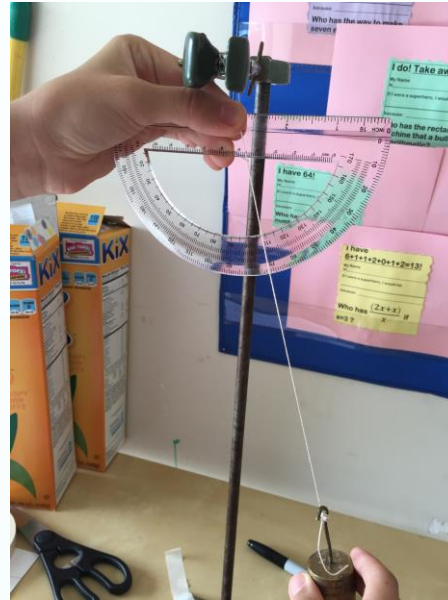
$$a = 360$$

10




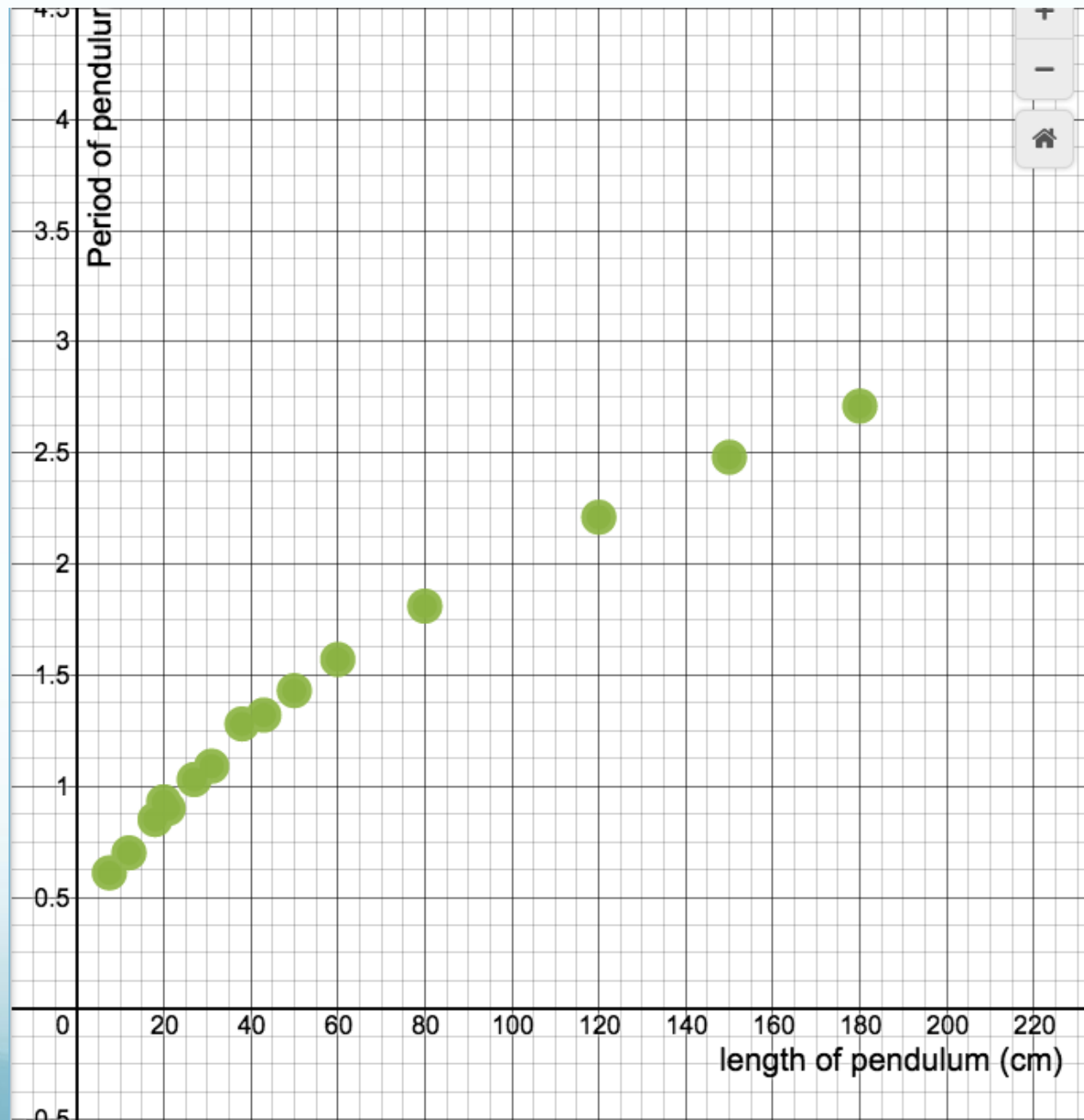
## II. Student Activity #4 – Exploring Square Root Functions

- Period of a pendulum



## II. Student Activity #4 – Period of a Pendulum

$x_1$	 $y_1$
7.5	.61
12	.70
18	.85
20	.93
21	.90
27	1.03
31	1.09
38	1.28
43	1.32
50	1.43
60	1.57
80	1.81
120	2.21
150	2.48
180	2.71

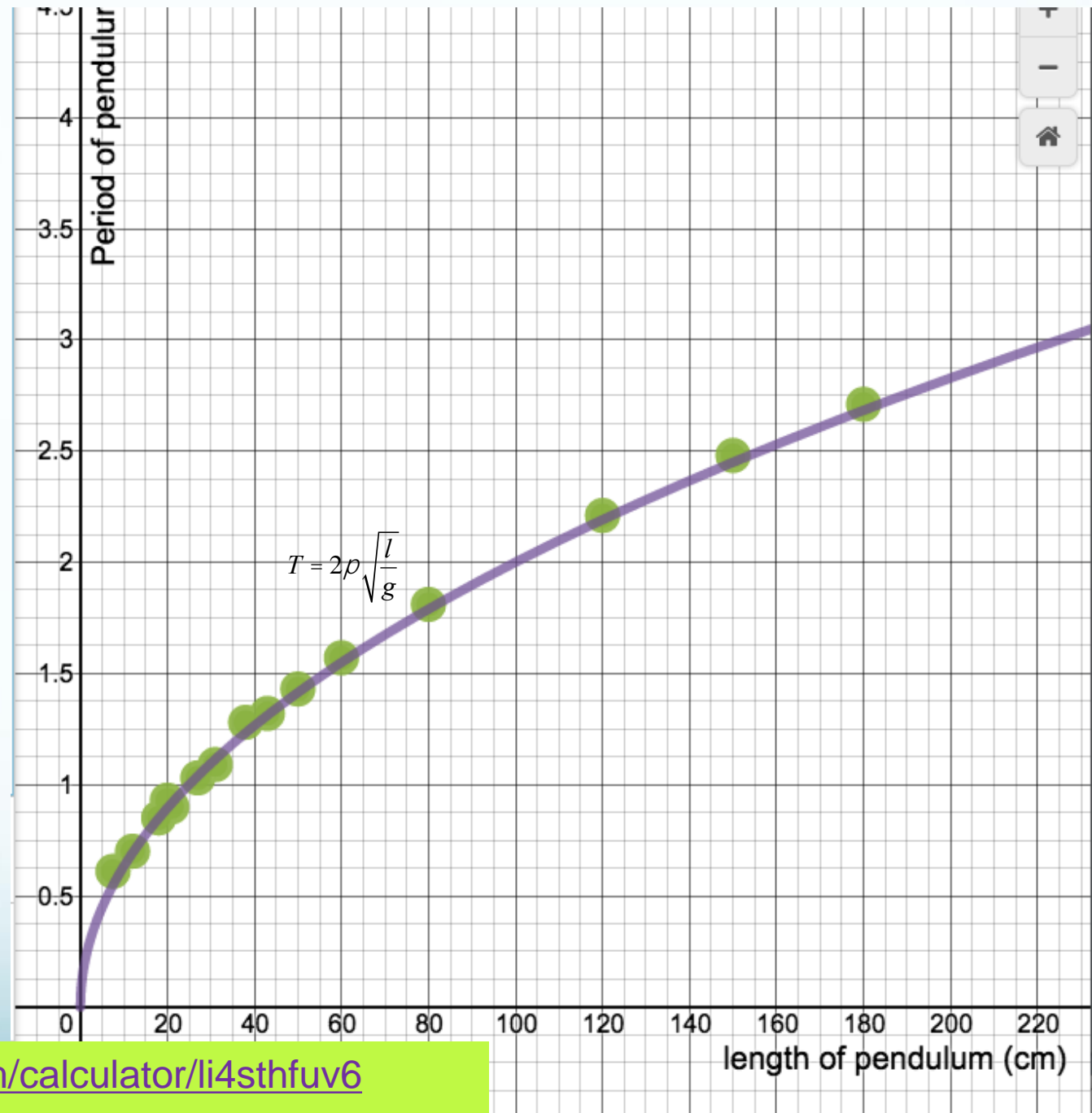


2  $f(x) = a\sqrt{x}$

3  $a = 0.2$

-10

$$T = 2\pi\sqrt{\frac{l}{g}}$$

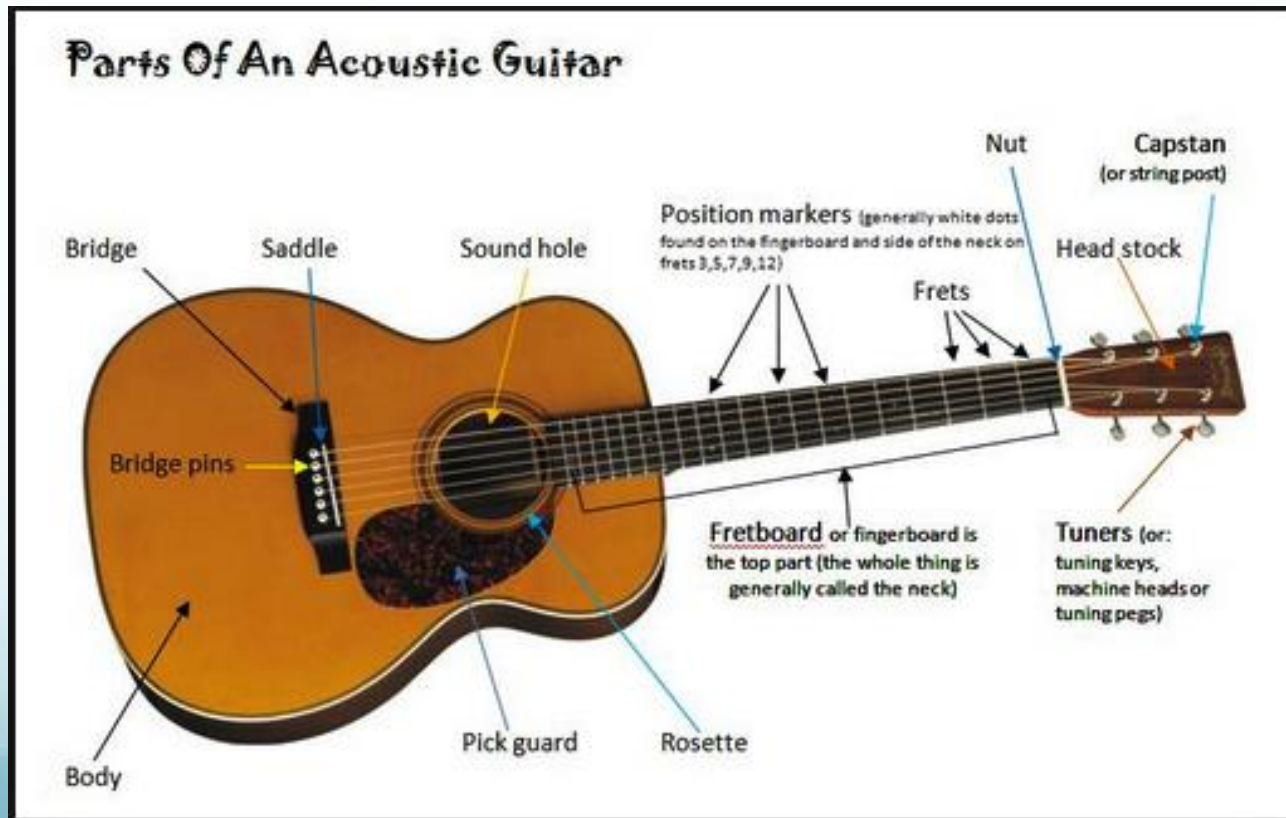


<http://phet.colorado.edu/en/simulation/legacy/pendulum-lab>

<https://www.desmos.com/calculator/li4sthfuv6>

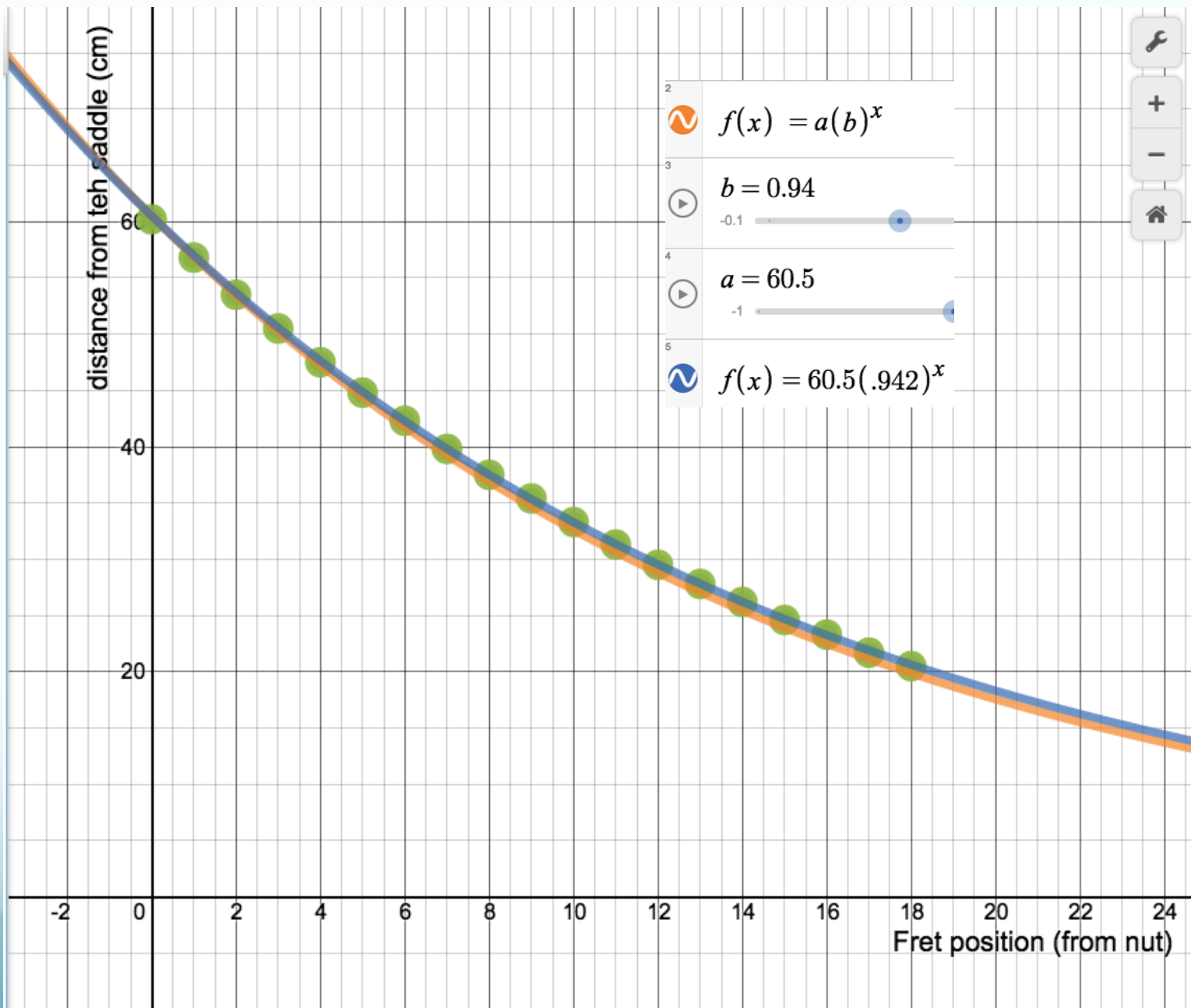
## II. Student Activity #5 – Exploring Exponential Functions

- Exponential Growth and Decay with M & Ms
- Bouncing Balls
- The Design of a guitar



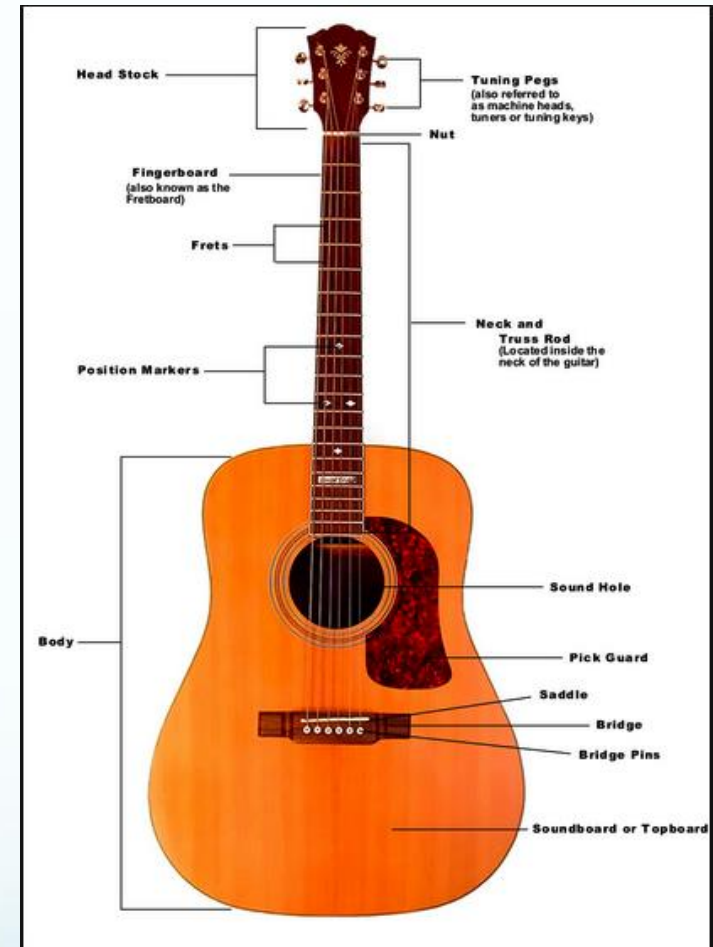
## II. Student Activity #5 – Exploring Exponential Functions

$x_1$	$y_1$
0	60.2
1	56.8
2	53.5
3	50.5
4	47.5
5	44.8
6	42.3
7	39.8
8	37.5
9	35.4
10	33.3
11	31.3
12	29.5
13	27.8
14	26.2
15	24.6
16	23.3
17	21.7
18	20.5



## II. Student Activity #5 – The Design of a Guitar

note in the scale	corresponding fret position	relative predicted distance from saddle in millimeters
A	0	645.00
A <sup>#</sup>	1	609.17
B	2	575.32
C	3	543.36
C <sup>#</sup>	4	513.17
D	5	484.67
D <sup>#</sup>	6	457.74
E	7	432.31
F	8	408.29
F <sup>#</sup>	9	385.61
G	10	364.19
G <sup>#</sup>	11	343.95
A	12	324.85



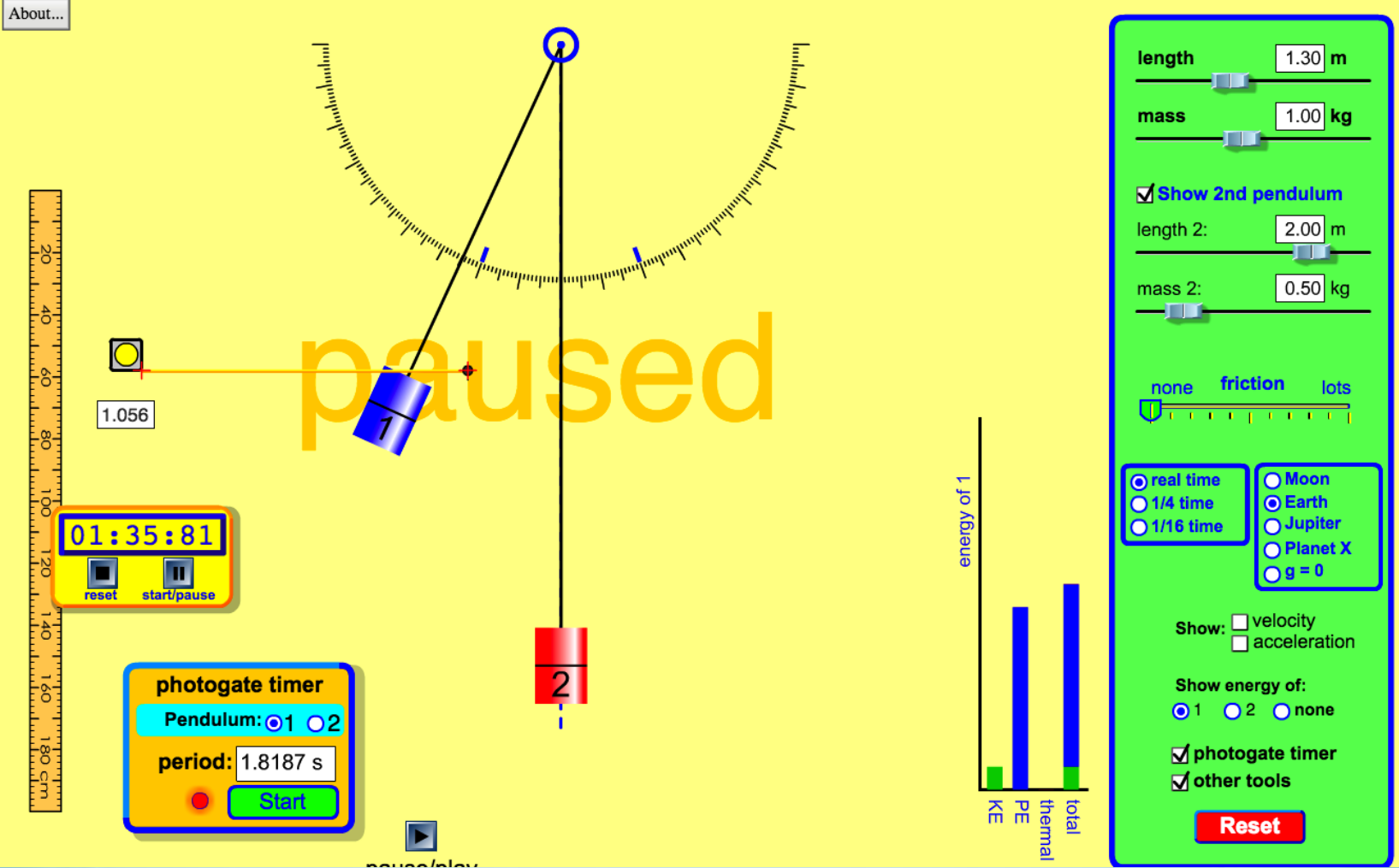


## **II. Student Activity #6 – Exploring Trigonometric Functions**

- **Rolling Hula-Hoop**
- **Weather and Climate, and Tides**

# Interactive Activities & Web resources

1. <https://phet.colorado.edu/en/simulation/legacy/pendulum-lab>




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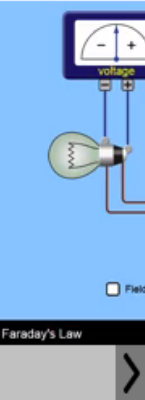
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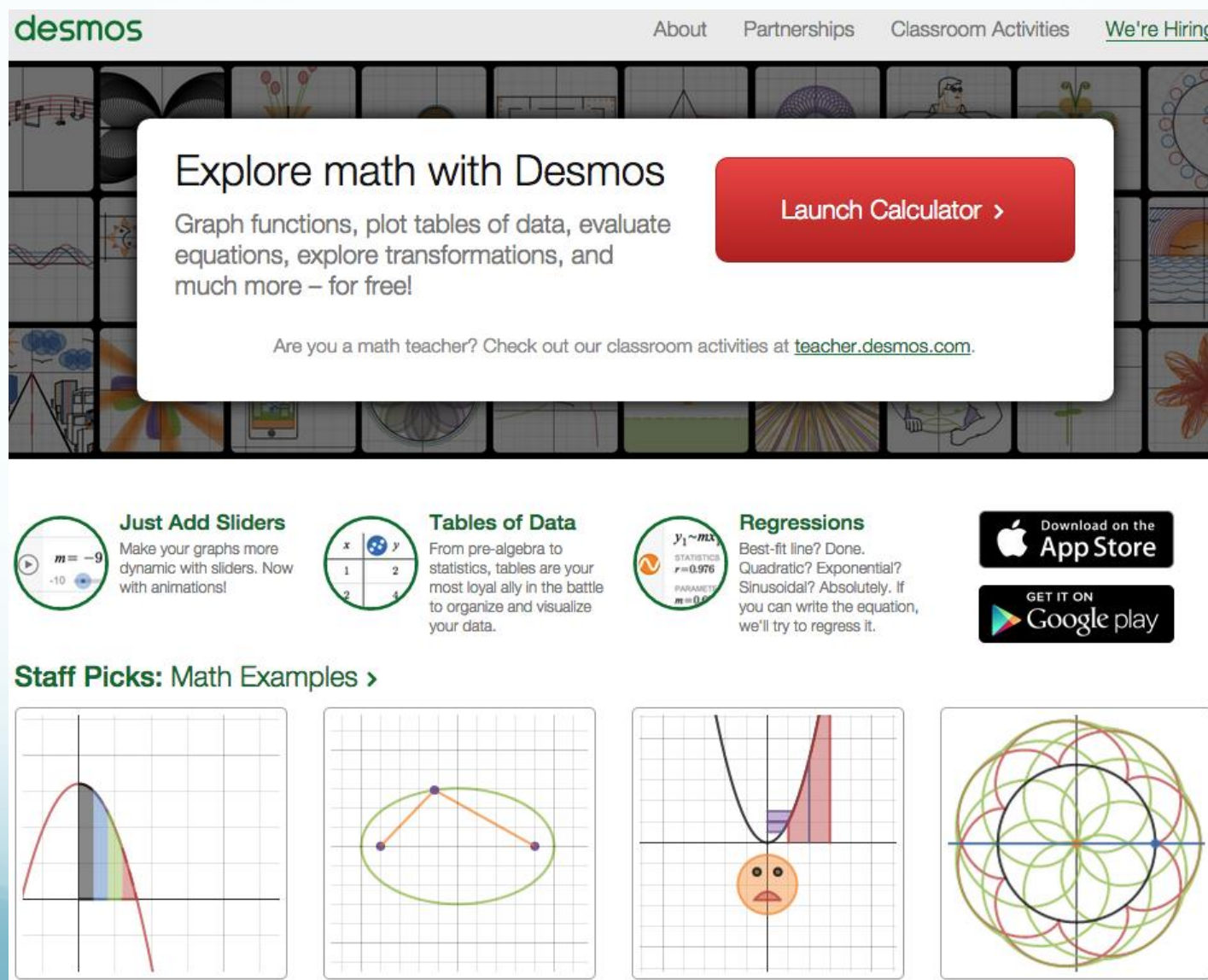
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## 2. <https://www.desmos.com/>



The screenshot shows the Desmos website homepage. At the top, the "desmos" logo is on the left, and navigation links for "About", "Partnerships", "Classroom Activities", and "We're Hiring" are on the right. Below the navigation bar is a grid of various mathematical visualizations. A large white box in the center contains the text "Explore math with Desmos" and "Graph functions, plot tables of data, evaluate equations, explore transformations, and much more – for free!". To the right of this box is a red button that says "Launch Calculator >". Below the box, it says "Are you a math teacher? Check out our classroom activities at [teacher.desmos.com](https://www.desmos.com/teacher)." Below this is a row of four featured sections: "Just Add Sliders" with a slider icon and text "Make your graphs more dynamic with sliders. Now with animations!", "Tables of Data" with a table icon and text "From pre-algebra to statistics, tables are your most loyal ally in the battle to organize and visualize your data.", "Regressions" with a regression icon and text "Best-fit line? Done. Quadratic? Exponential? Sinusoidal? Absolutely. If you can write the equation, we'll try to regress it.", and two app store buttons: "Download on the App Store" and "GET IT ON Google play". At the bottom, there is a section titled "Staff Picks: Math Examples >" with four grid-based mathematical examples: a parabola with a shaded area, a triangle inscribed in an ellipse, a graph with a sad face and a shaded area, and a complex geometric pattern of overlapping circles.

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**Regressions**  
Best-fit line? Done. Quadratic? Exponential? Sinusoidal? Absolutely. If you can write the equation, we'll try to regress it.

**Staff Picks: Math Examples >**

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1. Write a quadratic function (in vertex form) that is shifted to the right 5 units, and 7 units.

160 characters

Generate

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<http://www.qrstuff.com/>

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☐ FourSquare

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☐ iTunes Link

☐ Dropbox

☐ Plain Text

☐ Telephone Number

☐ Skype Call

☐ SMS Message

☐ Email Address

☐ Email Message

☐ Contact Details

☐ Digital Business Card

☐ Event (VCALENDAR)

☐ Wifi Login (Android Only)

☐ Paypal Buy Now Link

☐ Bitcoin

2 CONTENT

Video ID

OR

Video URL

Encoding Options

☒ Static - Embed URL into code as-is

☐ Dynamic - Use our qrs.ly URL shortener

What's the difference?

Subscribers get analytics and dynamic QR code editing when using our URL shortener.

3 FOREGROUND COLOUR

Foreground Colour (Hex):

000000

Subscribers can also specify image size and resolution, and choose from 6 raster or vector output file types and 4 error correction levels.

QR CODE PREVIEW

DOWNLOAD QR CODE

4 OUTPUT TYPE

DOWNLOAD

PRINT

EMAIL

BATCH FILE UPLOAD

PUT YOUR CODE ON OTHER STUFF


CREATE A VISUAL QR CODE

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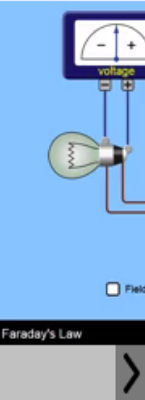
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## V. Student Products

1. Websites – weebly.com; wix
2. Videos, Powerpoints and Prezis
3. Math Paper

Thank you!



# Other References

Source:

<http://www.education.vic.gov.au/school/teachers/teachingresources/discipline/maths/continuum/pages/exponentialfunction55.aspx>

<http://archives.math.utk.edu/ICTCM/VOL15/S72A/paper.pdf>

<http://www.rivermill-academy.org/common/pages/DisplayFile.aspx?itemId=25128065>

<http://www.qrstuff.com/>