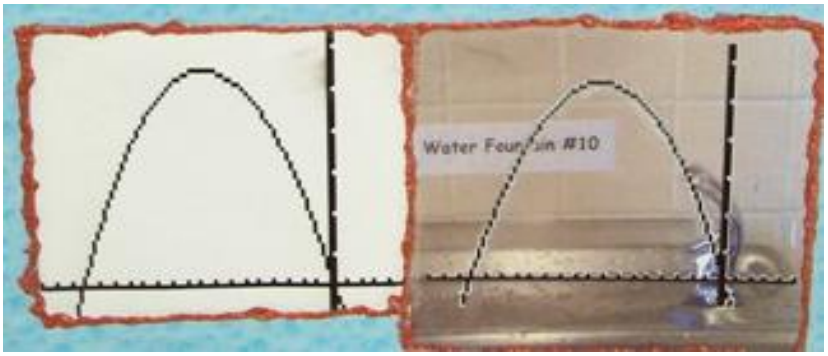
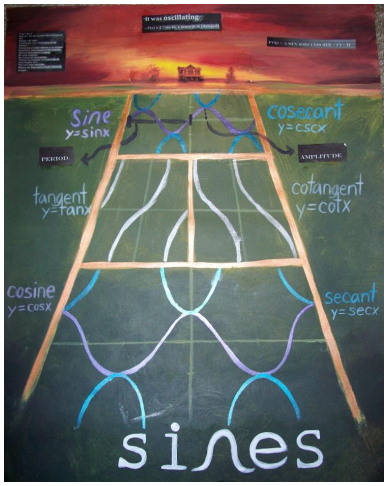
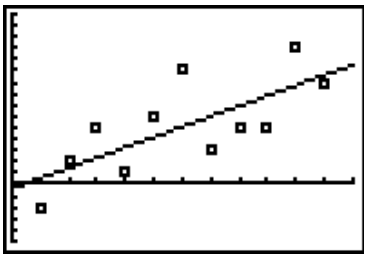
Innovative Assessments in Pre-Calculus



From Classroom to Real World





NCTM Regional Conference
Dallas, TX
10/11/12

Presented by:

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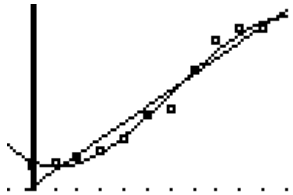
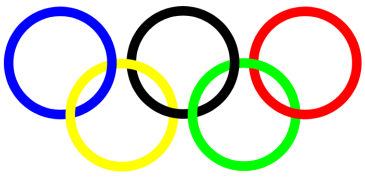




Lenape Regional High School District
PreCalculus Olympic Times Project

Are we faster, stronger and better than we used to be?
Compare the records of gold medal Olympic winners and decide.

FOCUS

The focus of this project is to give you an opportunity to find and analyze real-world data from the Internet regarding Olympic times in Track & Field or Swimming. Once you have found and studied the data, you will find BOTH linear and exponential equations that model the behavior then analyze these models to see which would be the "best fit."

OBJECTIVES

* collect and organize real-world data
* present this data on a T-chart and Cartesian Coordinate Plane
* analyze and interpret the data
* find functions to model the data

DIRECTIONS

1. You are to pick an Olympic event in either Track & Field or Swimming. The event you choose must have results posted in the last ten Olympics (1972-2008). Print out the data from the Internet. You will include this page(s) in your project. Use the following website to gather your data:

   http://www.hickoksports.com/history/olympix.shtml (scroll down to *Medalists* and click your sport)

2. Make a T-chart of your data, letting the years represent the x-values and the times represent the y-values.

3. a) Find a linear regression equation and an exponential regression equation using ALL the data.

   b) Then find an exponential regression equation using only the last 5 Olympic times.

4. Using either graph paper or a computer program with graphing capabilities, NEATLY graph both the "raw" data from the Internet and all three of the regression equations on ONE SET OF AXES.

5. Write a thorough summary of the project. Be sure to use complete sentences as well as proper grammar and punctuation in paragraph form. (What constitutes a paragraph?) Include any trends that you notice over time.

   a) Is there a year where a performance stands out from others around it? Can you think of a reason(s) for that performance?
   b) What factor(s) might influence the athletes in this event? How would that affect the result(s)?
   c) Do you think that the linear regression is a good model for this data? Why or why not?
   d) Do you think that the exponential regression is a good model for this data? Why or why not?
   e) Which exponential regression equation, the 10 or 5, better fits the data? Why?
   f) Use all these models to predict the time of the Olympic gold medalist in this event in the year 2024.

6. Your final project is due on _____.
   Late projects will lose 10% for every day late. The project must be typed, double-spaced and must include:

   a) A title/cover page that has - Name of the project
      Your name
      PreCalculus: Period ____
      Due date
      Teacher's name

   b) Page 1: An introduction to the project, including the event you chose and why. Have you ever watched this event on TV during an Olympic broadcast? Have you ever seen this event in person or do you know someone who participates in this event?

   c) Page 2: A computer print out of the data from the Internet

   d) Page 3: All three regression equations along with a T-chart of your "raw" data and the data from all the regression equations using headings such as:

Year	Raw Data	Lin. Reg. Data	Exp. Reg. Data (10 yrs)	Exp. Reg. Data (5 yrs)

   e) Page 4: The graph of your raw data plotted along with a graphs of your linear and both exponential regression equations. Be sure to include proper labeling and a legend.

   f) Page 5: Project summary – answer all the questions posed in part 5) above.

Sample of Olympic Times Project in Microsoft Excel

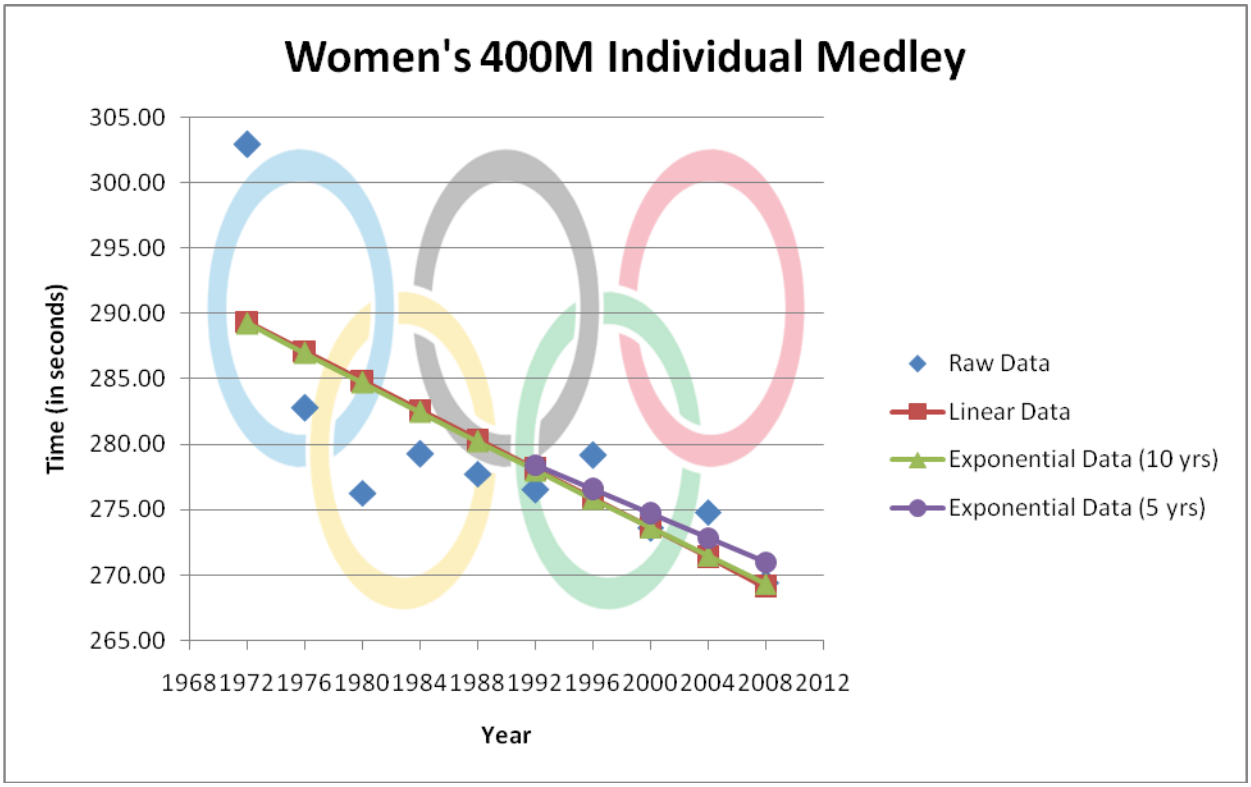
Women's 400M Individual Medley Sample

Year	*Internet Data* Time (min:sec)	*Raw Data* Time (sec)	*Linear Data* Time	*Exp. Data* Time	*Exp. Data w/ 5 years*
1972	5:02.97	302.97	289.41	289.28	288.02
1976	4:42.77	282.77	287.16	286.99	286.08
1980	4:36.29	276.29	284.90	284.72	284.15
1984	4:39.24	279.24	282.65	282.48	282.23
1988	4:37.76	277.76	280.39	280.24	280.33
1992	4:36.54	276.54	278.13	278.03	278.44
1996	4:39.18	279.18	275.88	275.83	276.56
2000	4:33.59	273.59	273.62	273.65	274.70
2004	4:34.83	274.83	271.37	271.49	272.85
2008	4:29.45	269.45	269.11	269.35	271.01

Linear Regression Equation: $y=-0.564x + 1401.381$

Exponential Regression Equation w/ 10 years: $y=14441.302(0.998)^x$

Exponential Regression Equation w/ 5 years: $y=8088.021(0.998)^x$



Name:

Olympic Times Project Rubric

35 point project:

Presentation (0-6) pts

a. has cover page with required information _____ (1 pt)

b. is stapled or bound in some manner BEFORE class _____ (1 pt)

c) is typed clearly, neatly and is <u>double-spaced</u> _____(2 pts)

d) appearance is neat; reflects effort/creativity _____(2 pts)

Mechanics (0-15) pts

a) all requested information is provided

computer print-out(s) _____(3 pts)

three regression equations _____(3 pts)

b) T-chart complete with values computed correctly _____(3 pts)

c) graph contains depiction of 3 equations and raw data _____(3 pts)

d) graph is easy to read/interpret; includes legend _____(3 pts)

Written Explanation (0-14) pts

a) grammar and spelling are correct _____(2 pts)

b) math vocabulary appropriate _____(2 pts)

c) introduction complete _____(2 pts)

d) conclusion complete with all questions answered _____(8 pts)

Total points earned: _____/ 35

Lenape Regional High School District
Pre-Calculus Car Depreciation Project

For this project you will collect data on any USED foreign or domestic car. 2010 cars will be considered brand new and off limits! 2009 cars are considered 1 year old. You will use this data to create charts and graphs reflecting the used car price versus the age of the car. You will create a linear model of this data and use this model (equation) to analyze the data.

PART A

DATA COLLECTION

1) You will need to gather data about the age and price of used cars. You can gather this data by visiting the following website:

http://www/kbb.com

You will start by choosing a year, make and model for a USED CAR. The make and model you select must have been manufactured for at least ten consecutive years. Request the suggested retail price and then choose a trim. You will be asked to enter the mileage of the used car that you wish to purchase. For this project, we will use 10,000 miles per year of the car's age, (i.e. a 2007 car would be 3 years old and have 30,000 miles). Choose EXACTLY THE SAME TYPE OF OPTIONS for each car you examine. You should be selecting the same trim, engine, drive train, and transmission. We want all other options to be whatever comes "standard" that year. Do not change any of the "equipment."

2) The AGE of the car represents our independent variable ("X"), while the PRICE of the car represents our dependent variable ("Y"). For example, if you find that a 1994 Monte Carlo has a retail price of $5,543, then the ordered pair will be (16, 5543).

3) Use the statistics capabilities of your graphing calculator to calculate a linear regression equation . . . **round all decimals to three places.**

PART B

DATA DISPLAY

1) Create an expanded t-chart with the following headings:

Year	Miles	Age	Price	RegEq Price

to display the information from both your raw data AND linear regression values. You will have to graph your linear regression equation on your calculator and either use the table feature or the "Calculate - Value" feature to find the linear regression values.

2) For each of the years you are researching, you must turn in the data *directly from the website*. These pages are to be included in your final product. Please try to save paper by taking a "Print Screen" of each internet page and pasting it into a word document. Then you can combine several print-outs on one piece of paper. Each print out must clearly show the year, make, and model of the car, the price, and the mileage. Make sure that it is not so small that it isn't readable. Don't forget to site your source somewhere in the project!

3) Using Microsoft Excel, graph both sets of data on *one set of axes*, using the x-axis to represent the age of the car and the y-axis to represent the price of the car. The raw data should be graphed as a scatter plot, and the linear regression data should be graphed as a line. Labeling and/or a legend is required.

PART C

DATA ANALYSIS

1) Using the **linear regression equation**, determine the market value of your car when it is 18 years old. Does the value seem reasonable? Explain your response.

2) Compare the graphs of your raw data and your regression equation. How well does the regression equation fit your raw data? What explanation can you give for any differences in the graphs? If your graphs have major differences, what could be done to produce a line of better fit?

3) In general, predict what will happen to the value of the car you chose over time. Do you think that the regression equation will model your prediction? Why or why not? If the regression equation does not reflect your prediction, sketch a graph that does.

4) Using the **linear regression equation**, determine how old the car will be when it is only worth $600. Compare your results to three (3) other students in this class. List their full names, along with the make, model and year of the cars that they chose. What conclusions can you make about which types of cars hold their value over time? Be sure to state reasons for these conclusions.

REPORTING YOUR RESULTS – THE FINAL PRODUCT

Your final project is due on _____. There will be a 10% late penalty for each day. You may turn in your project early. Your project must be **stapled <u>BEFORE</u>** you get to class on the due date. The paper must be **TYPED, DOUBLE-SPACED, AND INCLUDE**:

Page 1 - Cover Page

A title for the project
Your name(s)
PreCalculus – your class period
Due date
Your teacher's name
A picture of the car you chose
Make it unique, original and creative!

Page 2 - Introduction and Data Display

The introduction should be typed and double spaced and include why you selected this particular make and model car. It should include a detailed description of the car from the year, make and model through its standard and optional equipment. Be unique, original, creative and detailed in your introduction!

The data display page should include the t-chart from PART B. The table should have a title, the year, make, and model of your car. The regression equation from your calculator must also be stated on this page.

Page 4 - ??? - Internet Data

These pages are the data print-outs of your vehicle obtained from your internet research.

2nd to last page - Graph – From PART B

Graph your data in Microsoft Excel. Raw data and linear regression values are to be graphed on the **same set** of axes. Be sure your graph is legible, labeled with a title and axis labels, and include legend!!

Last Page - Data Analysis – From PART C

Answer all the questions that were posed in this text using complete sentences with proper paragraph structure, typed and double spaced. **Write a concluding paragraph**(s) containing your thoughts about this project and your findings.

GRADING RUBRIC

Cover Page – 14 pts
_____ Title – 2
_____ Picture – 2
_____ Name – 2
_____ Teacher's name – 2
_____ Class period – 2
_____ Due date – 2
_____ Appearance – 2

Introduction – 3pts
_____ – 3

Data Display – 13 pts
_____ easy to read – 4
_____ Regression equation – 3
_____ t-charts/values – 6

Internet Data – 5 pts
_____ Internet Print outs – 5

Overall Presentation – 15 pts
_____ Typed, double spaced – 2
_____ Stapled or bound – 2
_____ Pages in correct order – 2
_____ Spelling and grammar – 3
_____ Use of math terminology - 3
_____ Personal touch/creativity - 3

Data Analysis – 33 pts
_____ Question 1 – reasonableness – 5
_____ Question 2 – comparison – 5
_____ Question 3 – prediction – 5
_____ Question 4 – worth – 5
_____ other students – 3
_____ conclusions – 5
_____ Format/Structure – 5

Graph – 17 pts
_____ raw data line – 3
_____ regression line – 3
_____ axes labeled – 4
_____ key or legend – 3
_____ readability/appearance – 4

Total Possible Points: 100

Your total points _____

Scaled to 30 points. . .

Your final score is _____.

Lenape Regional High School District
Car Depreciation Project
Student Sample

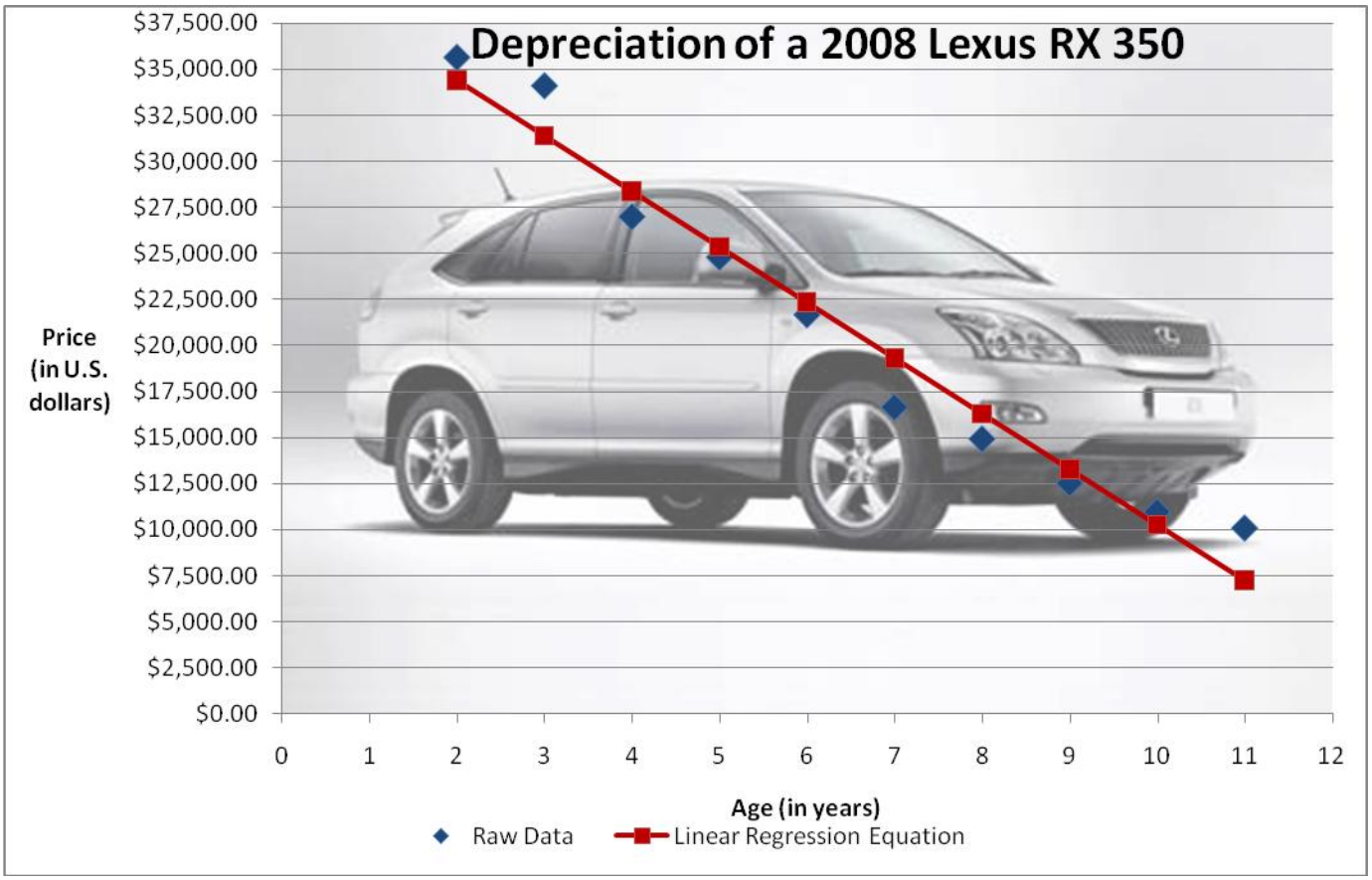
Car Depreciation Project

2008 Lexus RX 350

Year	Miles	Age	Price	RegEq Price
2008	20,000	2	$35,625.00	$34,424.00
2007	30,000	3	$34,085.00	$31,406.33
2006	40,000	4	$26,990.00	$28,388.67
2005	50,000	5	$24,790.00	$25,371.00
2004	60,000	6	$21,675.00	$22,353.33
2003	70,000	7	$16,665.00	$19,335.67
2002	80,000	8	$14,950.00	$16,318.00
2001	90,000	9	$12,550.00	$13,300.33
2000	100,000	10	$11,000.00	$10,282.67
1999	110,000	11	$10,115.00	$7,265.00

** Note - The 350 was only produced in 2007 and 2008. The older model was a 330, which was made in 2004-2006. The RX 300 was made from 1999-2003.

Regression Equation : y = -3017.667x + 40459.333



Lenape Regional High School District
Pre-Calculus Internet Project - Tidal Waves and Sinusiods

Focus

The focus of this project is to give you an opportunity to find and analyze real-world data from the internet regarding high and low OCEAN tides anywhere in the world and then to find the equation of a cosine function that models that behavior.

Objectives

* Collect and organize the real-world data
* Present this data on a T-chart and then on a Cartesian Coordinate Plane
* Analyze and interpret the data
* Calculate a function to model the data and make a prediction

Overview

People going into or out of a harbor, or anchoring near a shore need to know in advance about the behavior of the tides. The tide is caused by the pull of the sun and the moon on the oceans and the rotation of the earth, but its exact pattern at any particular location on the coast depends very strongly on the shape of the coastline and on the profile of the sea floor nearby. Even though the forces that move the tide are completely understood, the tides at any given location are essentially impossible to calculate theoretically. What we can do is to record the height of the tide at that location over a certain period of time, and use these measurements to predict the tides in the future.

Directions:

1. Your link on the Web is:
   http://tbone.biol.sc.edu/tide/sitesel.html

2. Select a region from this page and then choose a site from the next page. Do NOT choose a site that ends in "current". Do NOT choose a basin, bay or river.

3. Scroll down and select the prompt [Make a Prediction Using Options]

4. Set the following two options:
   Change "Select Presentation Options" to 3 days
   Change "Starting Time and Time Display Options" to start sometime between April 1 and August 15, 2009 at 0:00.

5. Click on [Make Prediction Using Options]

6. Print out the data (just the first page) that shows the dates, times and tidal heights. You will include this print-out in your project. *Be sure that you have 2 high tides and 2 low tides for ALL THREE days*. Pick a location where the tides are at least 3 feet or meters in difference.

7. Using the data from your print-out, convert all times (hours and minutes) into decimal hours by dividing the minutes by 60 and round to 2 decimal places. Ex. 2:15 = 2.25

8. Find the equation of the sinusoid that best fits this data by following the directions on the subsequent data page.

9. Put your information into a T-chart, using time for the independent variable (x-axis) and tide height for the dependent variable (y-axis). Your project begins at "time 0.00 on Day 1 and ends with time 72.00 on Day 3". You need to add 24 hours to all your times on Day 2 and 48 hours to all your times on Day 3 before you graph, so that your x-values run from 1 -72.

10. Using graph paper or the computer, plot the data from your T-chart, connecting the points with a smooth curve (not segments) and scaling the axes according to your needs. The two axes may be scaled differently. You will have two graphs on one set of axes – one from the raw data and the second from your cosine equation. Be sure to state the cosine equation with your graph.

Presentation: Your final project is due on _____. You may turn your project in early and late projects will lose 10% for each day late. Your project must be typed, double-spaced and must include, in this order

*A cover page that includes: The name of the project
Your name
Pre-Calculus – Class period
Date Due
Teacher's name

* Page 1: An introduction to the project, including the location you chose, the dates selected and why you chose this particular place and time of year. Give a little background of the place you selected. Is it a tourist place? Are the tides consistent all year round or are they higher at certain times of the year? In other words, do some research on your location. Include a picture, if possible.

* Page 2: The print-out of the tides from the Internet

* Page 3: The "data page", including the T-chart with your original data. Make sure your mathematical calculations are correct!

* Page 4: The graph of the raw data and the cosine equation on the same set of axes. State the cosine equation.

* Page 5: A summary of the project answering these questions –

1) State any tendencies that you saw in the high and low tides. For example, were there any consistencies between the time or height of the high/low tides from day to day.
2) Is there a predictable pattern?
3) Might the moon have had an influence on this pattern? (your print-out might have information about this)
4) State at least one other natural phenomena that is also predictable by means of a periodic sine or cosine wave or curve.
5) Predict the height of the tidal wave at 11am on the 6^{th} day. Explain how you got it.
6) Predict the height of the tidal wave at 6 am on March 1, 2011. Explain how you got it.

FINDING THE EQUATION OF YOUR SINUSOID

Analysis: Follow the directions below for finding a cosine equation that best fits your data. Your equation will be in the general form $y = a \cos (bx-h) + d$. Throughout this page, round your decimals to three places.

a) Find "d", the vertical shift. The vertical shift is the **average** of the average of your high tides and the average of your low tides (the average of the averages)

Enter your "d" value here:_____

b) Find "a", the amplitude. The amplitude is the distance between your average height and "d" (or your average low and "d"). (Hint-you may need to make "a " negative. Look at your data and decide.)

Enter your value for "a" here: _____

c) Enter "b". Use a half a lunar day as the period for the tides, 12 hours and 24 minutes (12.4).
Since **P** = 12.4, **b** = $2\pi/12.4$ or $5\pi/31$.

Your value of "b" is : $5\pi/31$

d) Find "h", the horizontal shift. Let h equal the time of your first tide.

Enter your value of "h" here: _____

e) Put it all together and write the equation of the cosine curve in the form from $y = a \cos (b(x-h)) + d$.

Enter your equation here: _____

Create a T-chart like the one in the sample below and include it with your project. The y-values for your sinusoid can be found by calculating the max and min of the cosine equation using you graphing calculator. Enter your equation into y_1=. Remember that all high tides will be 12.4 hours apart and all low tides will be 12.4 hours apart.

Sample of Tidal Wave Project in Microsoft Excel

Date	Type	Time	Raw Data- Time	Raw Data – Height	Sinusoid Max & Min Times	Sinusoid Max and Min Values
			x-values	*y-values*	*x-values*	*y- values*
10-Aug	Low	0:35	0.58	1.31	.580	1.642
10-Aug	High	6:52	6.87	7.22	6.780	7.732
10-Aug	Low	12:43	12.72	1.89	12.98	1.642
10-Aug	High	19:08	19.13	8.25	19.18	7.732
11-Aug	Low	1:34	25.57	1.40	25.38	1.642
11-Aug	High	7:51	31.85	7.09	31.58	7.732
11-Aug	Low	13:39	37.65	2.00	37.78	1.642
11-Aug	High	20:04	44.07	8.27	43.98	7.732
12-Aug	Low	2:32	50.53	1.33	50.18	1.642
12-Aug	High	8:49	56.82	7.14	56.38	7.732
12-Aug	Low	14:34	62.57	1.92	62.58	1.642
12-Aug	High	20:58	68.97	8.42	68.78	7.732

Equation…

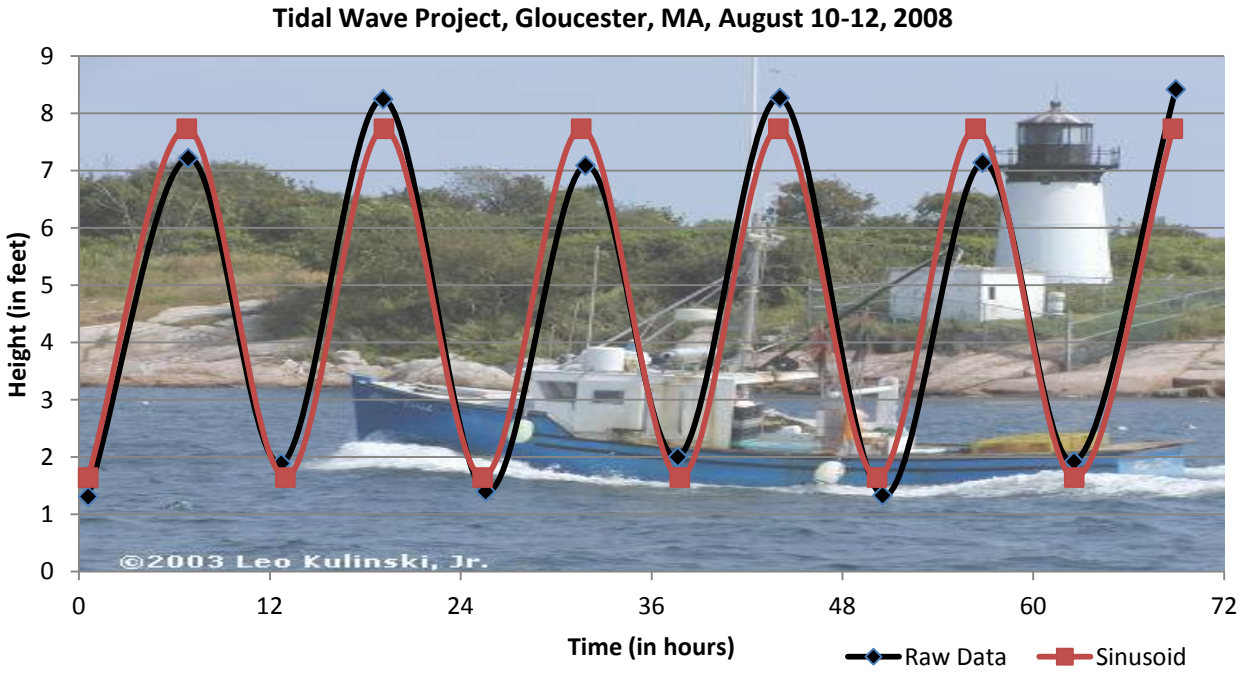
a) **d =** (1.6417 + 7.7317)/2 = **4.687**

b) **a** = 7.7317 - 4.687 = **3.045**

c) **b** = 5π / 31

d) **h = 0.58**

e) **y = - 3.045 cos (5π/31)(x - .58) + 4.687**



y = - 3.045 cos (5π/31)(x - .58) + 4.687

Name:

Tidal Wave Project Rubric

50 Point Project

Presentation (0-10 points)

a. cover page with required information _____(2 pts)
b. stapled or bound in some manner before class _____(2 pts)
c. typed clearly, neatly, and double-spaced _____(2 pts)
d. graphics/charts are clearly labeled and easy to understand; appearance is neat _____(2 pts)
e. followed directions throughout the project _____(2 pts)

Computations: (0-20 points)

a. times are correctly converted _____(5 pts)
b. T-chart/cosine values are correct on data page _____(5 pts)
c. equation of cosine curve has been computed correctly _____(5 pts)
d. raw data and cosine curve are correctly displayed on one set of axes _____(5 pts)

Written Explanation: (0-20 points)

a. introduction _____(4 pts)
b. conclusion where all questions are answered _____(6 pts)
c. correctly predicted high tide at 11am on the 6^{th} day _____(2 pts)
d. correctly predicted high tide at 6am on 3/1/2011 _____(2 pts)
e. explanations are easy to follow and understand _____(4 pts)
f. grammar, spelling are correct/math words are appropriately used _____(2 pts)

Total points earned: _____/ 50

Lenape Regional High School District
Picture This!
PreCalculus Graphing Project

Using the 12 basic shapes that we have studied so far plus the 3 additional shapes listed below, you are to create a drawing. You are to use at least 5 different basic shapes and a total of 8-10 equations in creating your drawing. You can create abstract drawings or drawings of objects such as basketballs, violins, company logos or cartoon characters. Some examples are posted on my eBoard.

You are to input the equations and their domain restrictions into the graphing area (Y=) of your calculator. Using your graphlink, take screen shots of the equations and the picture from your calculator and copy them into a Word document. You may need to take more than one screen shot of your equations in order to capture all of the equations.

Three additional shapes you may find useful are:

Ellipse: $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

Hyperbola: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$

Circle: $(x-h)^2 + (y-k)^2 = r^2$

You would need to solve these for y in order to enter them into your calculator.

You may work with one other Pre-Calculus student (you do not have to be in the same class period) or you may work alone.

When you turn it in, **staple** the following together:

1) A cover page (include subject, name(s), date)
2) An paragraph introducing your picture. What is it supposed to be? Is there a reason you chose to "draw" this picture?
3) A screen shot of the picture you created. Include the viewing window for your picture.
4) Screen shot(s) of the equations you used. Label each equation with the name of the basic shape used and the location of where the equation appears on the picture.
   Example: $y_1 = x^2 + 4$ parabola, bottom of face

In addition to turning in a hard copy of the project, you must email me #3 and #4 above by the due date.

Color your picture (use Paint) but feel free to be even more creative. Put a border around it to frame it, put a background color to set it off, etc. You do not have to list the equations for a border. Let your creative juices flow!

Student samples from last year are posted on my eBoard. While this seems to be a fairly simple project, it will probably take more time than you realize. Please plan ahead and don't wait until the night before. This will be a graded assignment.

Here's the rubric that I will be using to grade your projects:

Scoring Rubric for Graphing Project

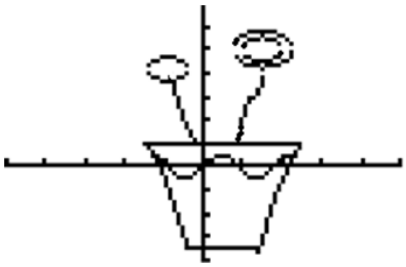
	Points possible	Points earned
Followed all directions Minimum of 8 equations Minimum of 5 different shapes Turned in stapled cover sheet, equations and graph Emailed screen shots of equations and picture	10 points	_____
Correctly stated equations and domain restrictions	10 points	_____
Creativity and originality	5 points	_____
Total points earned out of a possible 25 points		_____

Lenape Regional High School District

Picture This!

Student Samples (more pictures are on the eBoard)

Student Sample #1



```
WINDOW
 Xmin=-10
 Xmax=10
 Xscl=2
 Ymin=-8
 Ymax=14
 Yscl=2
 Xres=1
```

```
\Y1=sin(100X)/(X>-2.5778)/(X<4.5822)
\Y2=-(X+4)^2+3/(X≥-3)/(X≤-.73772)
\Y3=2(X)^2+2/(X≤0)/(X≥-1.9145)
\Y4=-7/(X>-.83772)/(X<2.8377)
\Y5=2/(X≥-3)/(X≤5)
\Y6=-(X-6)^2+3/(X≥2.7377)/(X≤5)
\Y7=(2.4X-6)^3+6/(X≥1.8385)/(X≤3.065)
\Y8=(1,-1)√(-X^2-3.574X+-2.193369)+8.33841
\Y9=(-1,1)√(-X^2+6X-8)+10
\Y10=(-1,1)√(-X^2+6X-6.75)+10
```

Y_1 sine, wavy line on flower pot

Y_2 parabola, left side of flower pot

Y_3 parabola, left vein of flower

Y_4 line, bottom of flower pot

Y_5 line, top of flower pot

Y_6 parabola, right side of flower pot

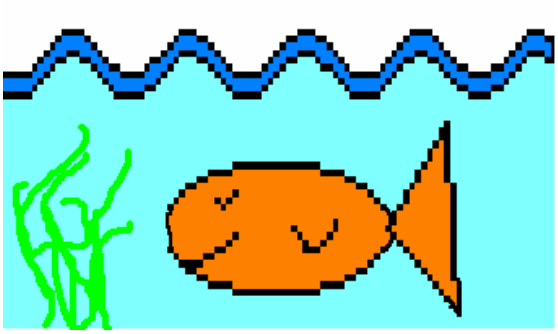
Y_7 s-curve, right vein of flower

Y_8 circle, left flower

Y_9 circle, right flower (inner)

Y_{10} circle, right flower (outer)

Student Sample #2



[-15, 15] x [-10, 10]

```
Plot1 Plot2 Plot3
\Y1=(1,-1)√((-X^2/4)+9)
\Y2=1.5(X-6)/(X≥6)/(X≤9)
\Y3=-X+6/(X≥6)/(X≤9.5)
\Y4=-√(-X-2)/(X)-5)
\Y5=sin(X)+8
\Y6=(X-2)^2-1/(X≤3.5)/(X≥0.75)
\Y7=abs(X+3)+1/(X≥-3.5)/(X≤-2)
\Y8=sin(X)+7
\Y9=16(X-10)^2-4/(X≤10.0039)/(X≥9.249)
```

Y_1 ellipse, fish body

Y_2 line, top of the tail

Y_3 line, bottom of the tail

Y_4 square root, smile

Y_5 sine, top wave

Y_6 parabola, end of the tail (closing the tail)

Y_7 absolute value, eye

Y_8 sine, bottom wave

Y_9 parabola, end of the tail (closing the tail)

Lenape Regional High School District
Pre-Calculus Water Fountain Parabolas Project

Objective:
Parabolas are everywhere around us. Did you ever notice that when you turned on the water fountain to take a drink that the water came out in a parabolic shape? We're going to enlighten the students of this school so that they too see a parabola when they turn on the fountain. Not only that, we're going to tell them the equation parabola that they are drinking from!

Materials:
Paper, Pen, String, Meter Stick

Directions:
With your group, go to your assigned water fountains. Using the right side of the frame as your y-axis and the bottom of the fountain as your x-axis, find an equation of the parabolic curve formed by the water while the fountain is on. Take a picture of the fountain from a distance and a close-up with the fountain turned on. Each person in your group is responsible for their own fountain.

Rules:
You must be QUIET while making your measurements. DO NOT disrupt any classes in the area where you are. Return to class after taking the measurements. You will compute the equation of the parabola when you return.

Final Product:
Each group must submit a poster (not smaller than 8.5" x 11", not bigger than 12" x 12") that contains each of the following:

- A title and original, catchy slogan
- A picture of the fountain from a distance
- A picture of the fountain turned on (showing the parabolic curve) – label the vertex and one other point
- The equation of the parabola in both standard and vertex form
- A screen shot of the parabola equation from the graphing calculator
- On the back – your name, all work for finding the equation, and the location of your fountain (be sure to specify "left," "middle," or "right"
- Round all decimals to three places

Make the posters creative, unique and exciting to look at. These will hang at the water fountains for everyone to see!

Grading Rubric- Each person will turn in their own poster. They will be graded on creativity and accuracy.

Title/Slogan - _____/2 pts

Picture from a distance - _____/ 2 pts

Picture of fountain turned on, with labeled points - _____/2 pts

Graph screen shot from calculator - _____/2 pts

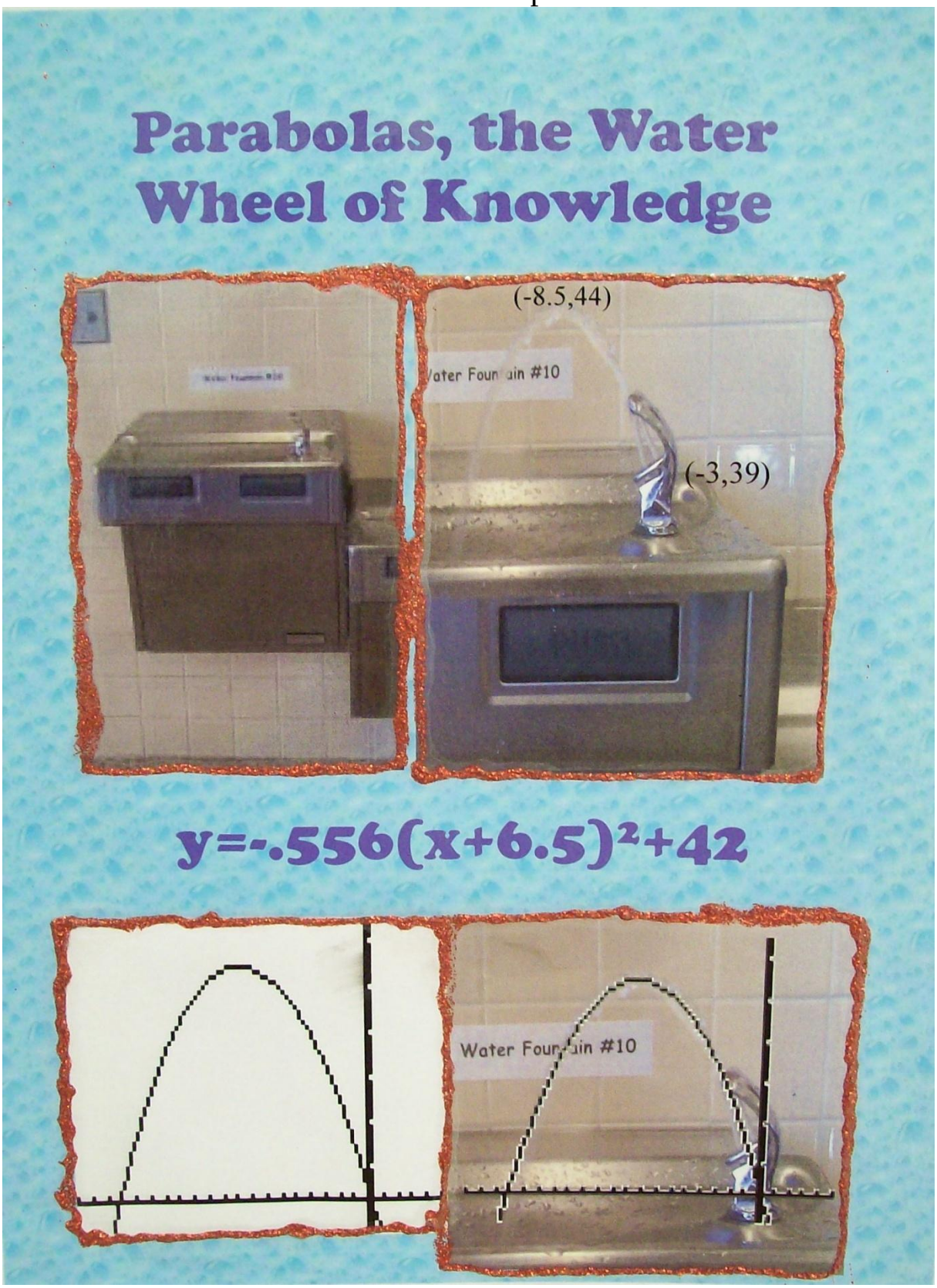
Equation in vertex form - _____/4 pts

Equation in standard form - _____/4 pts

Presentation – Color, Originality, & Creativity - _____/4 pts

Final Grade - _____/20 pts

Getting Calculator Screen Shots
Visit www.education.ti.com , click on Downloads: Apps, Software & Updates.
Under Technology, select "Computer Software" and under View select "connectivity software."
The first two options are for TI-Connect – choose Windows or Mac and download the program.
Use the USB cable that came with your calculator to connect to the computer.


Parabolas, the Water Wheel of Knowledge
(-8.5,44)
(-3,39)
y=-.556(x+6.5)²+42
Water Fountain #10

Lenape Regional High School District
Pre-Calculus Candid Camera Project

Objective:
The world is full of different shapes. This project requires you to find examples of the 12 basic shape functions we just finished studying and to take a picture of each one. Signs and logos are a great place to start.

Directions:
After gathering your 12 pictures, label each one with the name and the equation of the function. Capture a screen shot of the function from your graphing calculator and include a sentence or two about the picture. What did you take a picture of and where did you take it? Superimpose the shape of the function over the picture (see examples).

Here's a list of the 12 basic shapes:

Linear function: $f(x) = x$

Absolute Value function: $f(x) = |x|$

Reciprocal function: $f(x) = \frac{1}{x}$

Squaring function: $f(x) = x^2$

Cubing Function: $f(x) = x^3$

Square Root function: $f(x) = \sqrt{x}$

Sine Function: $f(x) = \sin x$

Cosine function: $f(x) = \cos x$

Log function: $f(x) = \ln x$

Exponential function: $f(x) = e^x$

Logistic function: $f(x) = \frac{1}{1+e^{-x}}$

Greatest Integer function: $f(x) = [x]$

You may work with one other person or you may work alone.

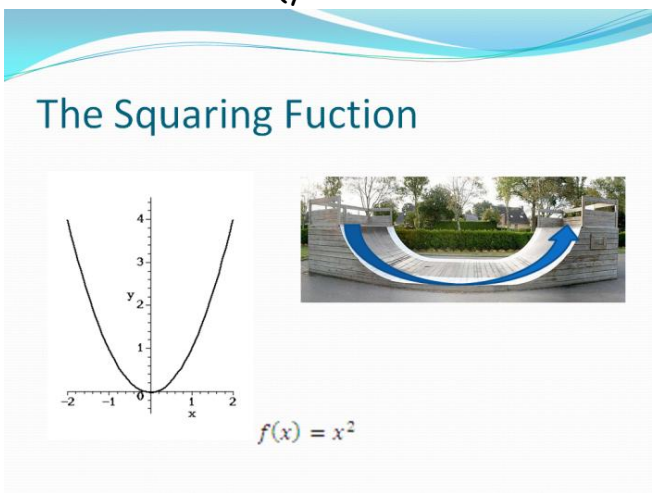
When you turn it in, **staple** the following together:
1) A cover page (include subject, name(s), date)
2) Introduction: Describe the project. Talk about what you learned doing this project.
3) 12 pictures (no more than 6 per page) with a sentence or two about the picture
4) The basic shape should be superimposed over each picture

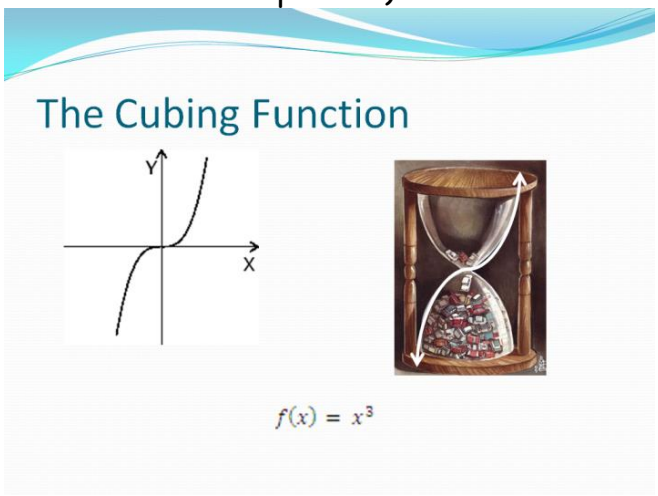
You are to turn in both a hard copy and an electronic copy of the project. Extra credit will be given to pictures that are original and clever. Samples and a scoring rubric are on the back.

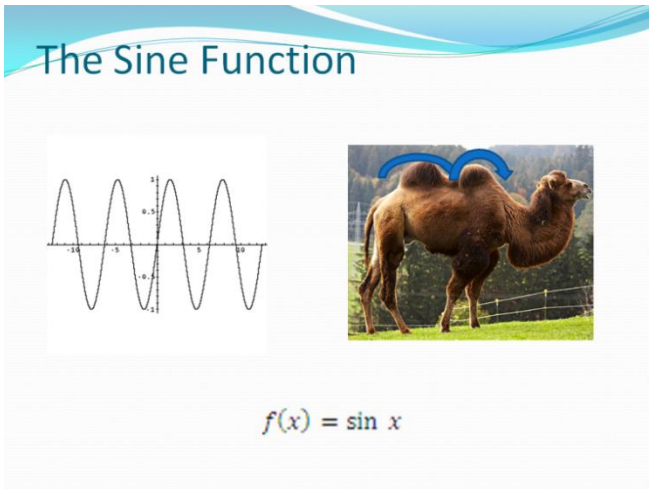
Due date:

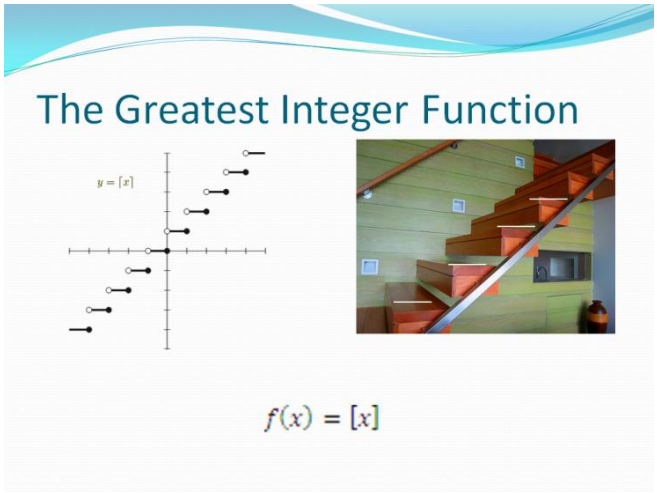
Candid Camera Samples

(you still need to add a sentence or two about each picture)









Scoring Rubric for "Candid Camera"

	Points possible	Points earned
Followed all directions		
Picture of all 12 shapes	24 points	_____
Sentence or two describing the picture	12 points	_____
Basic shape superimposed over shape	12 points	_____
Turned in hard copy and electronic copy	2 points	_____
Total points earned out of a possible 50 points		_____

Lenape Regional High School District
PreCalculus Project

The TRIG Network Project

Objective: This project requires you to design a Facebook social networking profile detailing your assigned trig function.

Assignment:

Each person in your group will take two of the following categories to address:

- Definition of the trig function and it's reciprocal
- Right Triangle Trig
- The Unit Circle
- Graphing
- Inverse Trig
- Identities

In each category you should include information on the basic definition of the trig function, any rules that apply to that information, and some examples. You will receive an individual grade out of 8 points for each category that you cover.

Your group will receive a group grade out of 8 points for the manner in which you piece together each section and present the profile.

The final project is due on **_____.** You must turn in a hard copy, but you are welcome to also submit your project electronically.

Lenape Regional High School District
PreCalculus Project

The TRIG Network Project

What trig function did you have? _____

Your name _____ Other group members: _____

Which two parts did you do:

_____ _____

Group Grade – 8 points

Design closely resembles a realistic Facebook page ____/2

Design is colorful and creative ____/2

Design applies multiple aspects of the profile (info, photos, wall, notes, etc.) ____/2

All six individual projects match and fit together to form one profile ____/2

TOTAL = _____

Individual Grade Part 1 – 8 points

Basic definition of category is included ____/2

Notes and steps for solving are included ____/3

Solved examples/sample problems are included & correct ____/3

TOTAL = _____

Individual Grade Part 2 – 8 points

Basic definition of category is included ____/2

Notes and steps for solving are included ____/3

Solved examples/sample problems are included & correct ____/3

TOTAL = _____

Everyone must turn this in with the project (3 per group)

Lenape Regional High School District
Pre-Calculus Right Triangle Trig Clinometer Project

Your mission: Mr. Furgione forgot to leave some VERY IMPORTANT information with our principal Mr. Spector before he retired. Mr. Spector has enlisted your help to find some measurements in front of the school. You will work in groups of 3 or 4 to apply right triangle trigonometry to real world situations.

Your materials:

a large tape measure
a homemade clinometer
paper & pencil
a calculator
a camera (or cell phone)

We need the following measurements:

The height of the flag pole
The height of the front entrance (to the bottom of the roof)
The height of the first floor (the middle of the dark colored bricks)
The height of the security camera
The horizontal distance of the camera from the building
The width (vertical distance) of the flag

The rules:

You must stay where I can see you at all times.
We will only be outside for about 15 minutes – take all of your measurements outside and we will come inside to do the calculations.
Be quiet – do not disrupt any of the classes in the rooms near where we are working.
Be very careful with the tape measures!!!
HAVE FUN WITH THIS!!!

The final product:

A large poster, including all 6 measurements
Each piece must include a picture of the item, the right triangle, and the work necessary to solve.
Make sure the names of all group members are on the FRONT of each poster.

These will hang in the hallways! Make them creative, unique, and exciting to look at!!!

Grading Rubric – 30 points total

Each measurement is worth 5 points, broken up as:

Calculations – 3 points
Picture – 1 point
Presentation/Creativity – 1 point

Lenape Regional High School District
Right Triangle Trig Clinometer Project
Student Samples

Height of the Flag Pole

Height of pole = y

Distance from pole = 39 ft.

Angle = 31°

Tan31° = y / 39

.601(39) = y

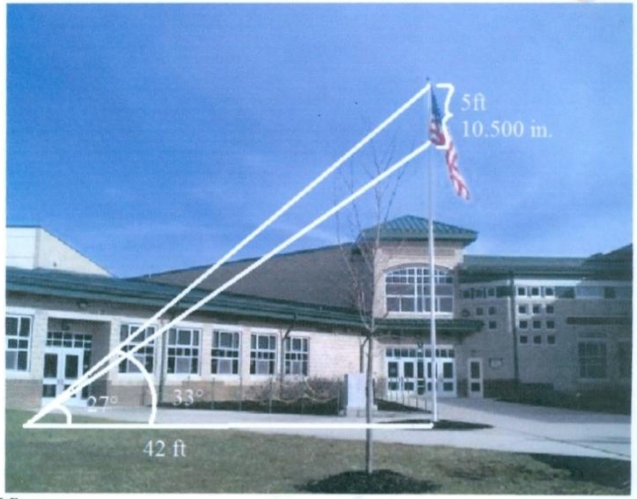
y = 23.433 ft.

.433(12 inches) = 5.196 inches

Because the height of the pole was not taken from ground level, Chas' height had to be added to the final height.

23 ft 5.196 in + 5 ft f in = 28 ft 10.196 inches

Width of the Flag



Width of flag = p

Distance from pole = 42 ft

Angle to the bottom of flag = 27°

Angle to the top of flag = 33°

Tan27 = p / 42

.510(42) = p

p = 21.400 ft

.400(12 in) = 4.8 in.

p = 21 ft 4.800 in

Tan33 = p / 42

.649(42) = p

p = 27.275 ft

.275(12 in) = 3.3 in.

p = 27 ft 3.300 in

Even though both heights were not taken from ground level, Chas's height does not need to be added because they would cancel each other out.

27 ft 3.3 in – 21 ft 4.8 in = 5 ft 10.500 in p= 5ft 10.500 in

"All is Right with the World"

Lenape Regional High School District
Right Triangle Trig Project

Right Triangle Trigonometry is all around us in everyday life…

Objective: In this project, you will write your own right triangle word problem and build a 3-dimensional diorama to model the problem.

Directions:

- Write your own right triangle word problem that is applicable to everyday life
  - You will need to give two pieces of information, ask for a third
    - Give two sides, find an angle
    - Give a side and an angle, find another side

- Build a diorama or shadow box to model your word problem
  - (see http://www.abcteach.com/babysit/projects/dioramas.htm for instructions)
  - must be built to scale -- you can do this with just a ruler

- Type or neatly print the word problem, attach it to the box, along with the scale, and provide a solution on a separate sheet of paper
  - In class on the due date, you will be solving each other's word problems.

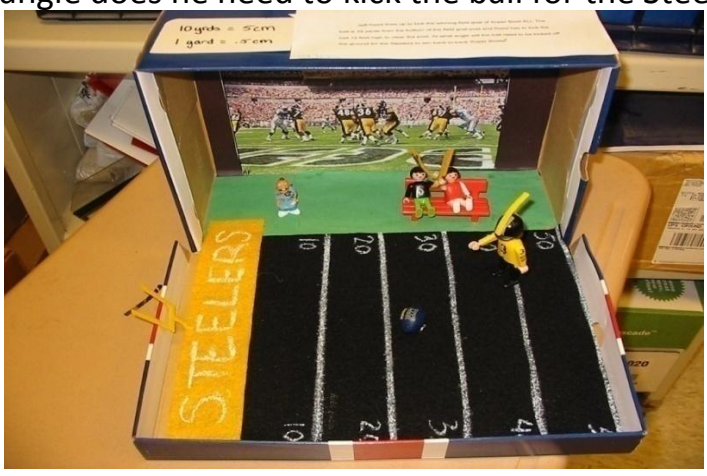
- Be creative!!!

The final product must include:

- Typed or written word problem attached to box
- Shadow box/Diorama decorated and built to scale
- Scale attached to box
- Solution to the problem on a separate sheet of paper

Sample:

Jeff Reed lines up to kick the winning field goal of Super Bowl XLI. The ball is 35 yards from the bottom of the field goal post and Reed has to kick the ball a vertical distance of 12 feet. At what angle does he need to kick the ball for the Steelers to win?



All is Right with the World
Lenape Regional High School District
Right Triangle Trig Project

Your name: _____ Group members: _____

Here is a copy of the rubric I will use to grade you. How do you think you did? Write in box that you think your final project represents. How creative or original do you think you were with the problem you came up with and the box you made? Feel free to write any comments on the rubric to defend your answers. Be honest here – my grade is still the one that counts, but I want to see what you think of your own work.

	4	3	2	1
Problem	Problem is neatly typed and solution is provided and correct.	Problem is neatly typed and solution is given, but contains slight errors.	Problem is provided; several errors present in solution.	The word problem is not stated or a solution is not provided.
Your Score				
My Score				
Box	Box is neatly decorated and applicable to problem. Model is built to scale, scale is given.	Box is decorated and built to scale, but scale is not given.	Box is decorated, not built to scale.	Box is not decorated or built to scale
Your Score				
My Score				
Creativity & Originality	4	3	2	1
Your Score				
My Score				

Evaluate your group:
What parts of this project did the whole group complete together (if you worked with other people)?

What parts did you do on your own?

Do you think you all deserve the same grade? Why or why not?

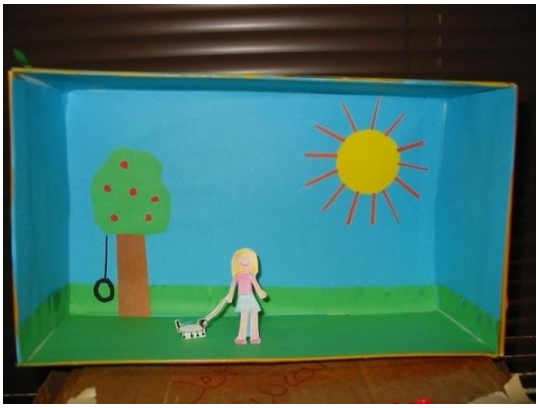
Help me evaluate the project:
-- Be honest, these answers will not affect your grade. This is just to help me learn from the project.

What did you enjoy about this project?

What parts of this project did you not like? (working in groups, time, requirements, etc.)

Would you recommend this for next year? Any changes?

Lenape Regional High School District
Shadow Box – Diorama Project
Right Triangle Student Samples



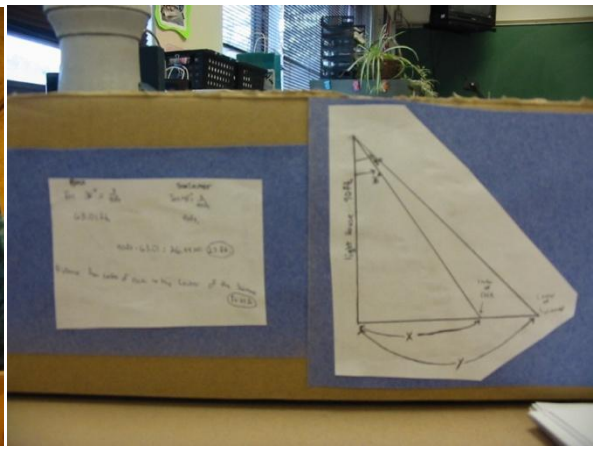
A girl is 5 feet and 7 inches tall. Her dog is ready for a walk and standing 3 feet away from her. What is the angle of elevation from the dog to the top of the girl?

Scale – 1 inch = 17 inches

Sir Issac's pet elf is stuck in a tree! If the elf is 25 feet off the ground, and Sir Issac's ladder will form a 65 degree angle with the tree, how long does his ladder need to be?

Scale - 1 inch = 5 feet

Evil Kanevil is getting ready to perform a death defying stunt for a large crowd of people. He plans to jump over a row of cars from a ramp that from base to base is 8 feet long and is tilted at a 40 degree angle. Evil needs to be at least 7 feet in the air to clear the cars, otherwise he'll crash and his stunt career will be over. Find out if the technicians built the ramp high enough for Evil.



A lighthouse is 90 feet above sea level. The angle of depression from the top of the lighthouse to the center of the rock is 35 degrees, and the angle of depression to the swimmer is 45 degrees. Find the distance between the center of the rock and the swimmer.

Scale – 1 inch = 10 ft

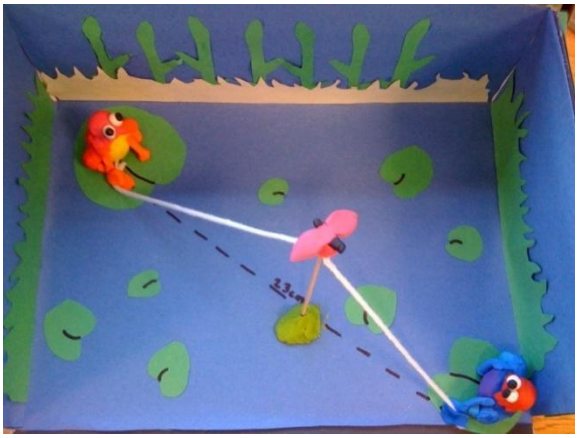
Lenape Regional High School District
Shadow Box – Diorama Project
Law of Sine/Cosine Student samples

Sydney, the turtle, was distracted by a bird and has fallen behind her two other turtle friends, Fabio and Tim. She is on a grass ledge above the lake where her turtle friends are. Sydney is looking down at an angle of 55° and the other turtles are 27 feet away from that angle. Sydney also knows that the hill meets the water at an angle of 125°. She wants your help to know: How far she has to travel downhill on the grass? How far she has to swim in the water? And finally, at what angle are Fabio and Tim looking up at her?

Scale – 1 inch = 3 ft

Lilly was visiting Italy and was taking a picture of her son at the top of the Leaning Tower of Pizza. The tower leans 13° left from the vertical. Lilly looks up to her son at an angle of 47°. Lilly is standing 150 feet from the bottom of the building. Solve the following:

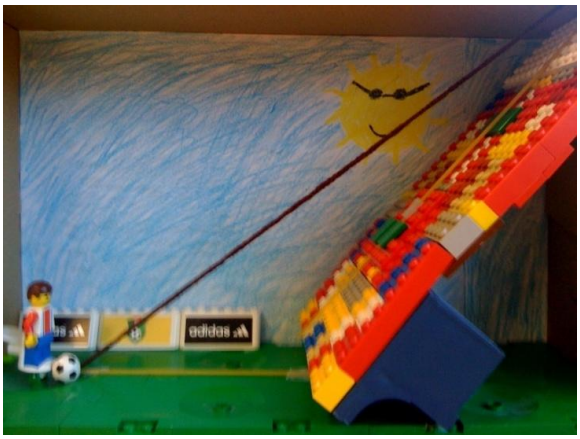
a.) Find the remaining angle of the triangle
b.) How far is the son from the camera?
c.) How tall is the Tower?



Two frogs, Gandalf and Bob, are 23 cm apart. Gandalf, also known as Frog A, spots a frog 37° up from is foot. He is 17 cm from that bug as well. Using the law of Cosines, find Bob's angle to the bug, how far away he is, and the bug's angle from both of them.

Scale – 1 cm = 1 cm

Christiano is kicking a soccer ball against a very colorful, slanted wall. The distance from the ball to the wall on the ground is 15 yards. The length of the wall is 27 yards. The angle that the wall makes with the ground is 129°. Find the distance that the ball travels in the air, the angle of elevation, and the remaining angle in the triangle.



Lenape Regional High School District

Chapter Review Project

Pre-Calculus Goes to the Movies

Objective:

For this project, you are to select a chapter from this year and create a "Coming Attractions" poster that highlights the most important content of the chapter. These posters will be hung in my room at the beginning of each chapter next year, so you want to make the students excited about starting the chapter. Besides including the topics in the chapter, you might also want to include:

Title
Starring
Ratings/reviews
Director

Here are some examples titles:

Teenage Mutant Ninja Roots

Raiders of the Lost Exponential and Logarithmic Functions

Or catchy phrases:

Just when you thought it was safe to go back into PreCalc class. . .

A long time ago in a classroom far, far away . . .

The poster should be standard poster size: 24"x36". All posters are due on June 9th.

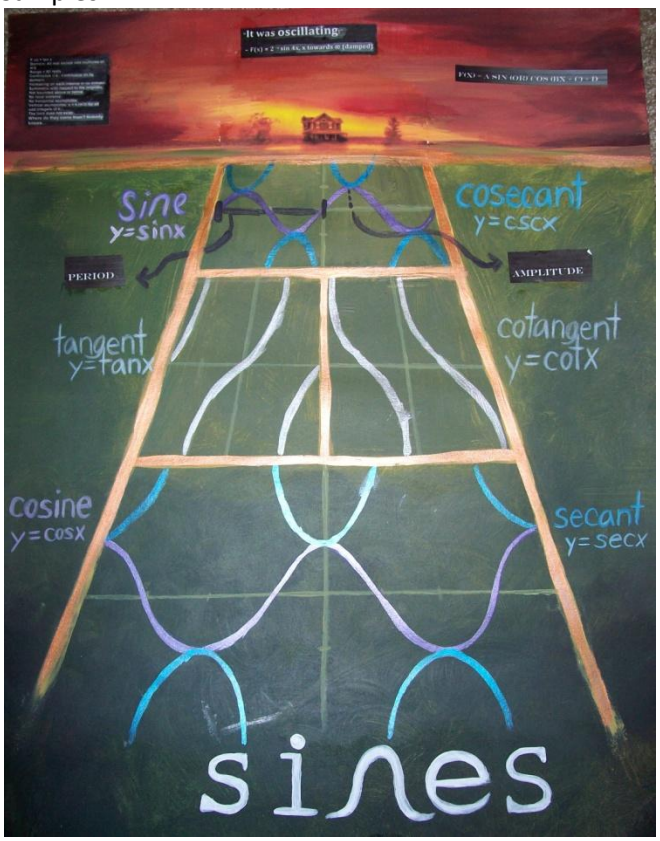
You will be graded according to the following rubric:

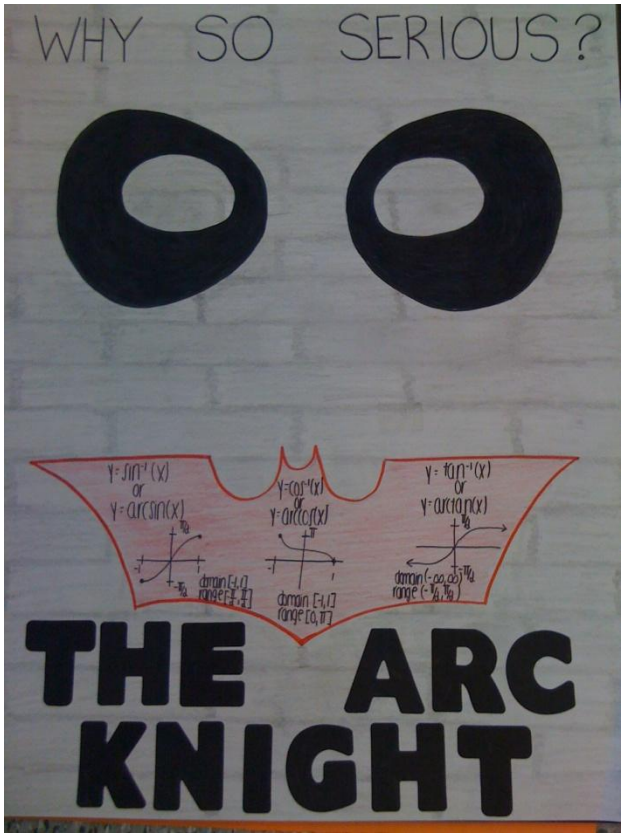
Layout and Design	5 points
Accuracy of Chapter Content	5 points
Neatness	5 points
Creativity	10 points
Total	**25 points**

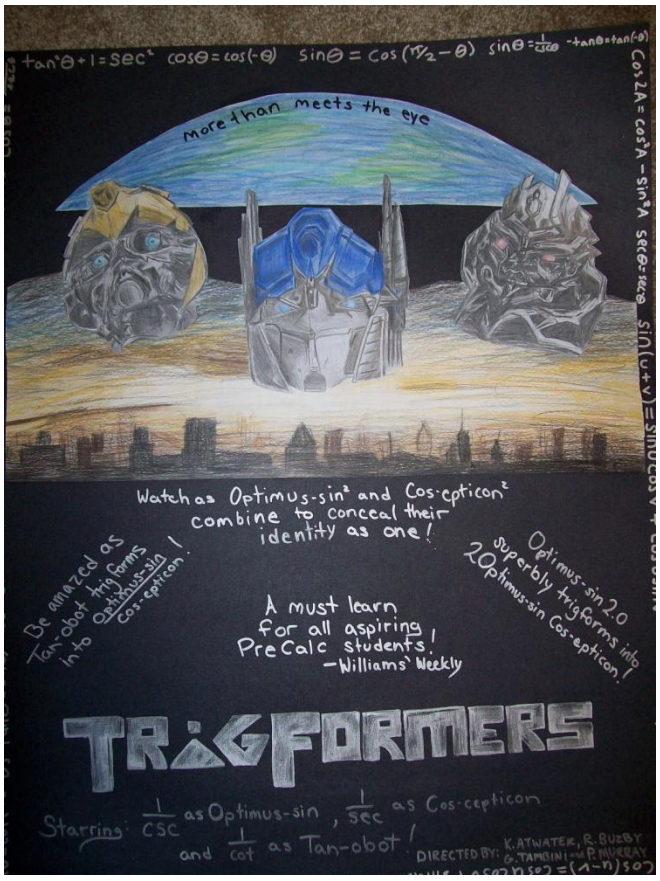
Topics:

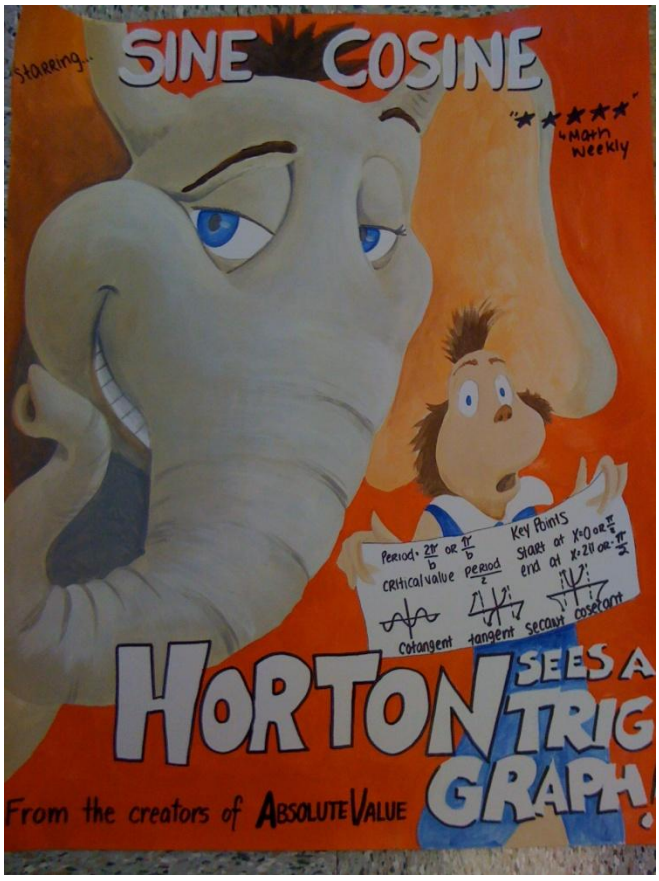
Chapter 1 – Functions and Graphs
Chapter 2 – Polynomial, Power, and Rational Functions
Chapter 3 – Expon., Logistic, and Log. Functions
Trig – The Unit Circle and Special Angles
Trig – Right Triangle Trig
Trig – Graphing
Trig – Identities & Solving Trig Equations
Trig – Law of Sines/Cosines
Trig – Inverse Trig Functions
Chapter 6 - Parametric and Polar Equations
The Algebra of Calculus
Limits

Samples:


It was oscillating...
Sine
y=sinx
cosecant
y=cscx
PERIOD
AMPLITUDE
tangent
y=tanx
cotangent
y=cotx
cosine
y=cosx
secant
y=secx
sines


WHY SO SERIOUS?
THE ARC KNIGHT


more than meets the eye
Watch as Optimus-sin² and Cos-ecticon² combine to conceal their identity as one!
Be amazed as Tan-obot trig forms Optimus-sin! Cos-ecticon!
Optimus-sin 2.0 superbly trigforms into Optimus-sin Cos-ecticon!
A must learn for all aspiring PreCalc students! -Williams' Weekly
TRIGFORMERS
Starring 1/csc as Optimus-sin, 1/sec as Cos-ecticon and 1/cot as Tan-obot!
DIRECTED BY: K.ATWATER, R.BUEBY, D.TANCINI and P.MURRAY


Starring...
SINE COSINE
"★★★★" -Math Weekly
Period: 2π/b or π/b
Critical value
Period/2
Key Points
start at x=0 or π/2
end at x=2π or 3π/2
Cotangent
tangent
secant
cosecant
HORTON SEES A TRIG GRAPH!
From the creators of ABSOLUTE VALUE

Lenape Regional High School
Children's Book Review Project

Objective:
Working in groups of 3-4, design a children's book that explains concepts that we've covered. Each group will be assigned a chapter (or portion of a chapter) that we have already covered this year.

Rubric

Your book must include:

	Points Possible	Points earned
1) A summary of the material: • include key concepts and important definitions • include pertinent formulas • include 5 original problems that increase in difficulty • include solutions and work for the 5 problems You will be graded on thoroughness and accuracy	12 Points	_____
2) Originality and Creativity • book is illustrated • book is colorful • book has a consistent storyline	10 Points	_____
3) Submit both a hard copy and an electronic copy of your project via email (electronic copy may be scanned)	3 Points	_____
Total: 25 Points		_____

Lenape Regional High School District
Re-Teach Chapter Review Video Project

Objective:
We will help each other review concepts on chapter tests and the final exams by creating review videos.

Directions:
You will work in groups of 2-3 to create a review video of everything in your assigned section. These videos will be used by you and your classmates at the end of each chapter to review for the tests, and at the end of the year to review for the final exam. Each video must meet the following requirements:

- **5-10 minutes in length**
- **a detailed explanation of the concept covered**
- **multiple example problems (with solutions), varying in difficulty**

Your video should have a storyline or a plot to it, but be careful not to lose the educational value in an attempt to entertain.

Due Dates: Each video will be due TWO WEEKS after the assigned section is finished in class.

The following links provide some samples from last year:
Simplifying and Verifying Trig Identities: http://vimeo.com/9984216
Sum and Difference Identities: http://vimeo.com/10423700

Grading Rubric
Chapter Review Videos

Entertainment – 8 pts
The video grasps and holds the audience's attention… _____/3

The video doesn't lose educational value in the attempt to entertain… _____/2

The video is between 5 and 10 minutes in length… _____/3

Content – 22 points

There are several example problems and solutions given … _____/3

The examples vary in difficulty – some problems given are advanced … _____/3

The video addresses each type of problem covered in the section… _____/3

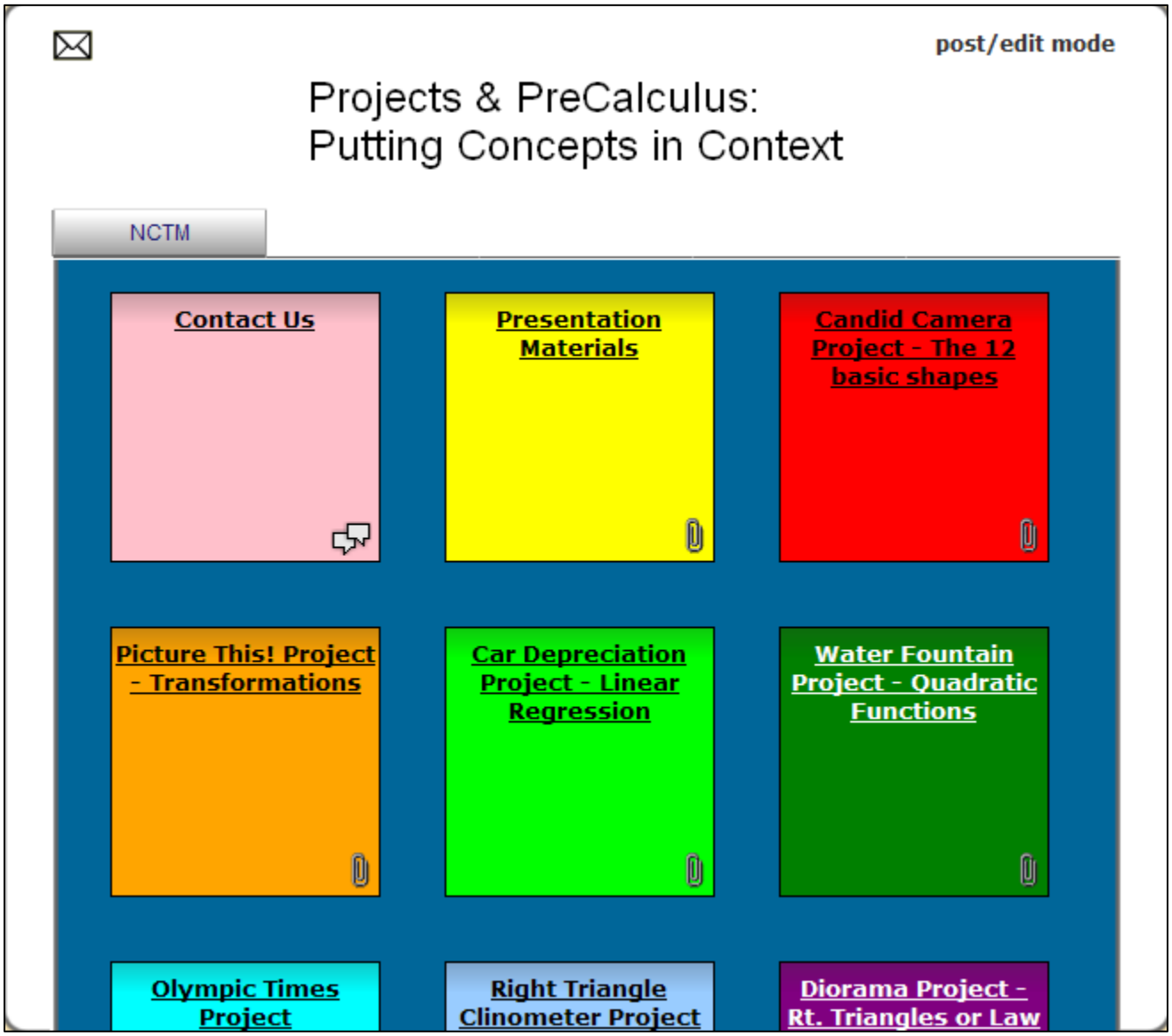
The math used in the video is correct… _____/8

Accurate, detailed explanations are given for each concept… _____/5

Total Score _____/30

To access this document (& more) online…

http://precalculus.lrhsd.org



On the eBoard you will find:

- Detailed instructions on using a TI 83/84 calculator to calculate regression equations
- Detailed instructions for using Excel to graphically represent data
- Additional student samples
- Instructions and Rubrics for each project in a Word document