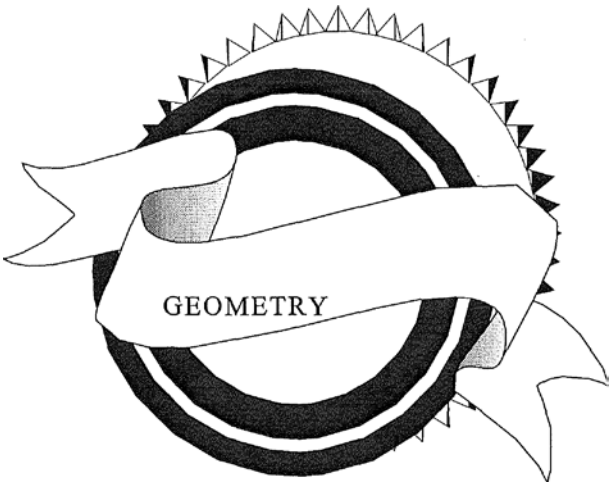
HONORS GEOMETRY

UNIT PROJECTS 2017 - 2018

PROJECT - UNIT #l

Line and Rotational Symmetry

A commercial logo is an important part of a company's advertising. The logo of a company is clearly marked in the mind of a consumer. The logo of a company such as Nike or Chevrolet is important to the success of the product.



Many commercial logos are symmetric in their design, with either one or more lines of symmetry or with rotational symmetry. Your project is to produce a poster (using poster paper) or a PowerPoint which demonstrates how important symmetry is in commercial logos. The poster must contain <u>at least</u> <u>ten (10) commercial logos.</u> Your poster or PowerPoint should demonstrate the lines of symmetry or rotational <u>symmetry for each logo you have selected</u>. Be sure you have some examples of rotational symmetry. See Chapters 0 and 8 in your text for examples of symmetry.

PROJECT - UNIT #2

The Golden Ratio Found in Living Things

The Golden Rectangle shows the Golden Ratio in its ratio of width to length. The approximate value of this irrational number is 0.618:1. This ratio is found throughout nature. The way branches are arranged on a stem, the curve of an elephant's tusk, and the nodules on the spirals of pineapple are some examples of how the Golden Ratio is present in all life.

The human body also demonstrates the Golden Ratio in several ways. For this project, use an adult subject to make the measurements described below. Once the measurements have been made, find the ratio of M_1 to M_2. Display each measurement on poster board or in a PowerPoint and display the resulting ratio.

M1	M2
1. Top of head to mid neck	Mid neck to navel
2. Top of head to navel	Navel to floor
3. Knee to floor	Knee to navel
4. Bottom of nose to mid-mouth	Bottom of nose to mid-eyes
5. Mid-eyes to bottom of nose	Bottom of nose to bottom of chin
6. End joint of any finger	Middle joint of the same finger
7. Middle joint of any finger	Base joint of the same finger

How close to the Golden Ratio did you come? The ratios of persons not fully grown will not be as close to the Golden Ratio as the ratios of grown persons. Once growing has stopped, the majority of people show ratios very close to the Golden Ratio for all of the above data.

PROJECT - UNIT #3

Pi Explorations Buffon's Experiment

Sometimes mathematics appears in the most unlikely of places. For example, a French aristocrat,

Louis LeClerc, the Compte de Buffon, conjectured that the value of *n* could be found by dropping needles onto a piece of paper covered with a series of parallel lines. He claimed the ratio of the number of needles tossed to the number of needles resting on the lines could be predicted using the number *n*.

You will replicate Buffon's experiment to experimentally verify his conjecture, which was eventually proven by a member of the French Academy some years later.

1. Fill a standard piece of 8Yz" by 11" unlined paper with parallel lines l" apart.

2. Cut the tops of five flat toothpicks to l" lengths.

3. Hold the five sticks over the paper and drop them. Keep track of how many sticks come to rest on one of the parallel lines.

4. Do Step 3 twenty times, which is equivalent to dropping one shortened toothpick 100 times.

5. Evaluate the following expression: $\frac{\text{number of tosses}}{\text{number of hits}} \cdot 2$

Buffon conjectured this number would be equal to n. How close did you come?
Using poster board or in a PowerPoint, make a chart showing the results of each drop and the resulting value of the expression. Demonstrate the experiment to the class.

PROJECT - UNIT #4

Children's Books

As a writer and Senior Executive at a well-known educational publishing company, you have recently been put in charge of the children's book division. The current trend is to teach young children advanced mathematical topics in a way that they will be able to understand the basic concepts. Your first assignment is to choose a topic from a high school geometry course and write a children's book that will serve as a model for the other writers in your department.

Below is a list of suggested topics. You may choose a specific topic in one of these general categories or write about the general category:

Parallel lines	Pythagorean Theorem	Circles
Congruent figures	Transformational Geometry	Quadrilaterals
Similar figures	Area of figures	Coordinate Geometry
Perimeter of figures	Trigonometry	Volume & Surface Area

<u>The book must be at least ten pages long and include a cover. There should be written text and illustrations (hand-drawn or computer generated).</u>

PROJECT - UNIT #5

History of Mathematics-Vocabulary

The vocabulary of mathematics developed over many centuries. Some words such as *cone* and *circle* are thousands of years old, while other words such as *fractal are* only about 20 years old. Many common vocabulary words were translated from other languages and interesting backgrounds. The word *rhombus*, for example, is taken from the Greek meaning 'spinning wheel' or 'top'. The reason for such an unusual origin is that the ancient Greeks used a spinning top shaped like a rhombus to foretell the future. Another term, *cevian* (a segment from the vertex of a triangle to the opposite side), is derived from Italian mathematician Giovanni Ceva (l 648-1734), who first wrote about such segments.

Your assignment is to produce a poster or PowerPoint which <u>shows the derivation of at least twenty (20) vocabulary words.</u> Drawings or photos must be included to illustrate each word.

<u>The poster should be on a standard-sized poster board and be colorful and eye-catching.</u>

PROJECT - UNIT #6

Polygonal Pickup

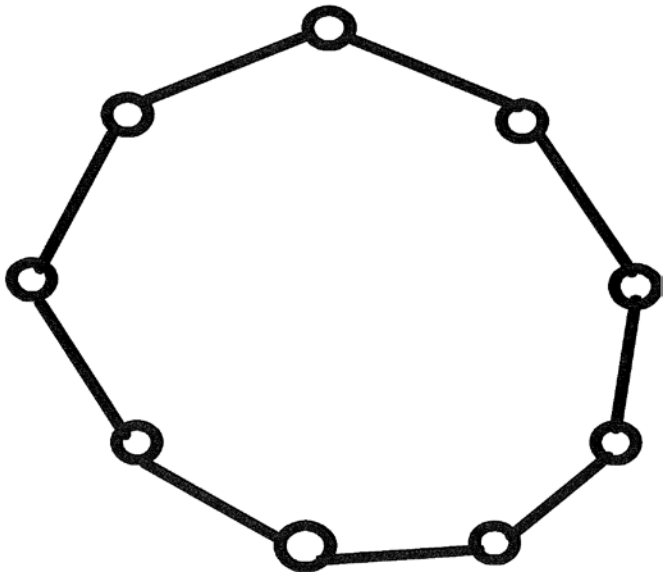
Place a checker or other counter on each vertex of a regular polygon. Take turns removing either one counter or two adjacent counter. The player who picks up the last counter is the loser.

On **poster board** draw the regular polygon. Make it large enough to be clearly visible to the class. Choose a second player and demonstrate the game.

1. Find a strategy that will enable you to always win.

2. Will the strategy you found work if the game is played on any regular polygon with an odd number of vertices? Draw another polygon on your poster board and illustrate.

3. Suppose the game is played on a regular polygon with an even number of vertices. Can you find a strategy that will guarantee that you will win? Illustrate.



HONORS GEOMETRY ESSAY PROJECT

For this project you will be doing some research about a mathematician chosen from the list below. In order to share your findings with the entire class, you will produce a full-sized poster board or a PowerPoint which highlights the mathematician's life and accomplishments. The poster or PowerPoint shall contain the mathematician's name with dates of birth and death prominently displayed. Include a portrait or photocopy of what the mathematician looked like. Items to be included are achievements in mathematics with a brief explanation of what the mathematician accomplished, such as the Pythagorean Theorem, complete with a diagram and/or formula. Accomplishments outside the field of mathematics such as Einstein's winning the Nobel Prize, should also be used. List at least two references you used for your research, visible on the poster board or-PowerPoint.

Be sure your poster or PowerPoint is easily read and eye-appealing.

The following is a list of mathematicians for the mathematics history project.

1. THALES
2. PYTHAGORAS
3. JOHN NAPIER
4. JOHANN KEPLER
5. LEONHARD EULER
6. ALBERT EINSTEIN
7. RENE DESCARTES
8. BLAISE PASCAL
9. ERATOSTHENES
10. GALILEO GALILEI
11. EMILIE DU CHATELET
12. APPOLONIUS OF PERGA
13. CHARLES BABBAGE
14. GRACE MURRAY HOPPER
15. EUCLID
16. BHASKARA
17. HYPATIA
18. SOPHIE GERMAIN
19. ADA LOVELACE
20. JANOS BOLYAI
21. NICCOLO TARTAGLIA
22. PIERRE DE FERMAT
23. GEORGE BOOLE
24. C.F. GAUSS
25. EVARISTE GALOIS
26. EVANGELISTA TORRICELLI
27. N.I. LOBACHEVSKI
28. ARCHIMEDES
29. G.W. LEIBNITZ
30. OMAR KAYYAM
31. MARY FAIRFAX SOMERVILLE
32. ISAAC NEWTON
33. LEWIS CARROLL
34. FIBONACCI
35. SONYA KOVALEVSKY
36. EMMY NOETHER
37. AL-KHWARIZMI
38. WITCH OF AGNES!
39. GOROLAMO CARDANO
40. SRINIVASA RAMANUJAN
41. FRANCOIS VIETE
42. HERON

The following set of books may serve as resources for any of the mathematicians listed.

Bell, T.E. (1937). *Men in Mathematics.*

Boyer, C. (1968). *The History of Mathematics.*

Burton, D. (1985). *The History of Mathematics: An Introduction.*

Cajori, F. (1928). *A History of Mathematics Notation.*

Dunham, W. (1990). *Journey Through Genius - The Great Theorems of Mathematics.*

Eves, H. (1983). *An Intoduction to the History of Mathematics.*

Eves, H. (1969). *In Mathematical Circles.*

Hollingsdale, S. (1989). *Makers of Mathematics.*

Johnson, Art. (1994). *Classic Math: History Topicsfor the Classroom.*

National Council of Teachers of Mathematics. (1969). *History Topicsfor the Mathematics Classroom.*

Osen, Lynn M. (1974). *Women in Mathematics.*

Information on mathematicians can be found on the internet. Use a search engine to find information on your choice.