

PROJECT SUGGESTIONS CORRELATED TO CHAPTERS IN A GEOMETRY TEXT

by

Adella S. Croft and Marilyn L. Keir
Skyline High School Salt Lake City, Utah

1. The Language of Geometry "Getting into Shape"

This assignment will help you to become aware of geometric shapes and their frequent occurrence in daily life. You will find pictures in magazines with examples of each of the following:

point	line	plane
circle	right triangle	isosceles triangle
square	nonsquare rectangle	equilateral triangle
trapezoid	pentagon	hexagon
octagon	nonsquare rhombus	kite

These pictures must be mounted without tape on several sheets of construction paper or on posterboard. Please trace or outline the shape within the picture with a black felt tip pen.

2. Reasoning and Introduction to Proof "The Logic of Advertising"

This assignment will give you practice in using some of the principles of logic that are used in geometry. You will select an advertisement from a magazine as the focus of this project. Please choose an ad for something that is considered legal, moral and appropriate for high school students. You will mount your advertisement on a piece of construction paper without using tape. Mount a separate sheet of notebook or typing paper on the reverse side of the construction paper. Write and label the following sentences:

1. A **conditional** statement of your choosing as suggested by your ad.
Write the conditional in if-then form. For example, if I use Pantene shampoo, then I will be beautiful.
2. The **converse** of your conditional statement.
3. The **inverse** of your conditional statement.
4. The **contrapositive** of your conditional statement.

3. Parallels "An Unparalleled World"

You will draw a picture, series of pictures, or write a poem or story illustrating how different the world would be if there were no parallel lines.

"Putting Things into Perspective"

Over a period of several days the students do a variety of exercises which lead them from simple perspective drawings to drawing a complex city block. See handout attached which is taken from "Discovering Geometry" by Michael Serra, published by Key Curriculum Press and Merrill Geometry supplement.

4. Congruent Triangles "Knowing All the Angles"

You will be given several sheets of dot paper. Illustrate one vocabulary item below on each square of the dot paper. Write the title below each picture and spell it correctly! Use color and pictures to give your illustrations personality!! Outline or darken the subject of each picture so that it is easy to see.

- | | | |
|--|---|---------------------------------|
| 1. Labeled Angle-Draw and label all the parts of the angle: vertex, sides, interior, exterior. | 5. Vertical Angles (Non-right) | 9. Opposite Rays |
| 2. Acute Angle | 6. Complementary Angles (Non-adjacent) | 10. Adjacent Angles (Non-right) |
| 3. Right Angle | 7. Supplementary Angles (Non-right, Non-adjacent) | 11. Angle Bisector (Non-right) |
| 4. Obtuse Angle | 8. Linear Pair (Non-right) | 12. Perpendicular Bisector |

5. Applications of Triangles "Building Toothpick Bridges"

See "Building Toothpick Bridges" by Jeanne Pollard, published by Dale Seymour. The following form is for grading the students at the end of the unit.

Bridge Building Group Evaluation

COMPANY NAME _____

Your group should fill out this form together under the Project Supervisor's direction.
 Note: The % column should sum to 100%.)

Name	% Participation	Quality of Work (grade)

Total Expenditure for Bridge \$ _____ Bearing Weight for Bridge _____

Expenditure/Weight Ratio _____ Overall Grade _____

6. Quadrilaterals "Let's Tessellate!"

Create a picture using a parallelogram that you have modified. Be sure to use color, illustrations and your imagination! Give your creation a title. (See "Discovering Geometry" by Michael Serra, published by Key Curriculum Press.)

7. Similarity "Creating Your Own Fractal"

You will complete a fractal on an 8.5" x 11" of paper. All triangles must be separate and complete, none may overlap. Each triangle must be isosceles with the altitude drawn and labeled as above. The ratio of growth/reduction must be stated and be constant for both the base and the altitude (lower right). Must give the depth of your fractal (lower left).

8. Right Triangles "Here's a Little Song I Wrote... about Pythagoras"

You will do library research and write a song about the mathematician, Pythagoras. (See handout attached.)

9. Circles "Crazy Daisy"

This assignment will help you to practice what you've learned about constructions. Follow the directions to construct a "daisy" using only a compass and straightedge. Use your imagination to turn it into a work of art! Be colorful!! (See handout attached taken from Merrill Informal Geometry.)

10. Polygons "Flatland Newspaper"

You will prepare a written project on the inhabitants of Flatland based on the book of the same name by Edwin Abbott. You will do this in the form of a storybook or newspaper. If you choose to do the newspaper make sure it contains at least four (4) different sections, i.e.: front page, sports, classifieds, births/deaths. The assignment will be graded on originality, neatness, understanding of Flatland and the geometric concepts presented in the book. Use illustrations! Be creative!! You may even catch yourself enjoying this project!!!

11. Solids, Area and Volume "Polyhedral Puzzlers"

Follow the directions on the pattern sheets for each puzzle. You will complete all five of the puzzles as directed. Use construction or other colored paper to make your project festive. (See handouts attached.)

12. Coordinate Geometry "AlgeBrush"

Sketch a picture on graph paper using only circles and lines. On a separate piece of paper, write the equations necessary to re-create your drawing. To make the picture precise, you must give the exact domains you wish to have used. You must give instructions for the picture as well as producing a drawing of how it looks when your directions are followed precisely. You should have more than 25 equations used in your picture, but no more than 100! Color it. Use AlgeBrush to verify your picture. You may want to add further detail.

Hand in:

- The equations as you wrote them,
- The picture as you drew it,
- The drawing from the computer,
- The list of equations from the computer.

13. Transformations "Seeing Symmetry"

This project will help you to become aware of the symmetry in the world around you. You will create a small poster. The minimum size you may use is one-fourth of a poster board. You will cut out pictures from magazines to illustrate different types of symmetry. You will neatly paste your pictures to the poster board, outline the symmetry, and label each example. Be sure to use a variety of examples and make it attractive.

Your poster will contain five (5) examples in each of the following categories.

- a) Vertical symmetry only
- b) Horizontal symmetry only
- c) Point or turn symmetry only
- d) Two or more types of symmetry (5 pt. bonus if you can find an example of a&c or b&c only.)

End-of-Year Review and Summary "ABC's of Geometry"

You will create a book using vocabulary words that you have learned this year. To do so you will choose a geometry term for each letter of the alphabet. For example, angle for A or endpoint for E. For each page in your book you will

- 1) State the letter of the alphabet,
- 2) Give the geometry term and a brief definition,
- 3) Provide an illustration of something man-made which contains/describes the term, and
- 4) Provide a picture of something from nature which contains/describes the term.

(Your pictures may be drawn by hand or clipped from a magazine.)

GEOMETRIC HOLIDAYS

Metric Week "I Spy Metrics"

Students will prepare a poster showing three categories of measurement: mass (grams), length (meters) and volume (liters). They will find five real-life examples for each of the categories. These posters are usually 3-D and lots of fun!

Mathematical Valentine's Construction

Students construct a heart shape through the instructions on the handout being given to them orally while you demonstrate each step on the board. (Don't let the kids see the picture before they are finished!) Afterwards have them write a valentines saying using math terms and symbols and decorate their mathematical valentine.

Geometric Jack o'Lanterns

Given an 8 x 11 piece of orange construction paper you will draw a pumpkin face using geometric figures and mathematical symbols. Use your math book for ideas! Be as original and colorful as you can!!

Snowflakes

National Math Month "Aftermath"

In celebration of National Math Month (April) students are to design a poster which shows the positive effect math has had on some area of life. They will find and mount on poster board a before picture and an after picture from a magazine to illustrate the benefits mankind has experienced through advances in mathematics and technology.



March 14th is the day we celebrate the number π (pi). (Can you guess why?) You may choose one of the following projects to help you enjoy the festivities.

1. A π symbol embellished to illustrate a play on the word "pi" in some other word.
For example:
The number π colored like a black and white cow to represent "cow pie."
The π symbol illustrated as a covered wagon for "pioneer."
2. A typewritten report about the number π or a famous mathematicians study of π .
3. A poster which illustrates some interesting facts about π .
4. A n original song or presentation (on videotape) about the number π .
5. Write an original poem (typewritten) or illustrated story about the number π .

Make your project entertaining, clever and exciting!! Attach this sheet to your project.

TITLE _____ NAME _____

0 1 2 On time
0 1 2 Difficulty and effort
0 1 2 Originality
0 1 2 Neatness and accuracy
0 1 2 Followed directions

TOTAL _____/10

Special Project Block Lettering in Perspective

Perspective drawing techniques can be used to create letters or words that appear to be solid — useful for giving emphasis to an element of a design. Your task in this special project is to draw letters or words with one-point and two-point perspectives.

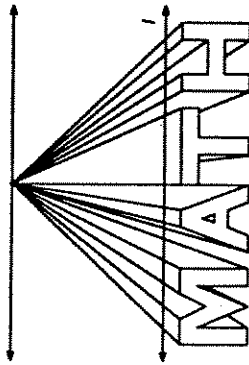
Drawing Block Letters in One-Point Perspective

Step 1



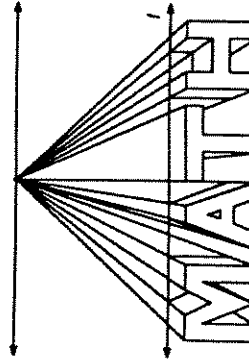
Write a word in block letters. Draw a horizon line parallel to the bottom edge of your word. Select a vanishing point on the horizon line.

Step 2



Draw vanishing lines from each corner point of the block letters back to the vanishing point. Select a thickness for your block letters and draw a line (line *I*) parallel to the horizon line.

Step 3

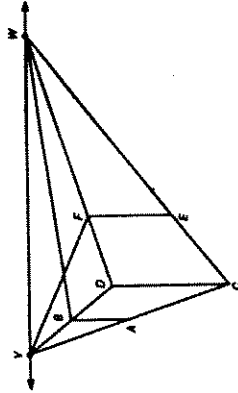


To create the back edges of your letters, draw lines parallel to the front edges, starting and ending on the points where line *I* intersects the vanishing lines.

Now you try making block letters. Draw a perspective view of your name or initials in block letters. You can change the perspective by making the horizon line high or low and by placing the vanishing point left or right.

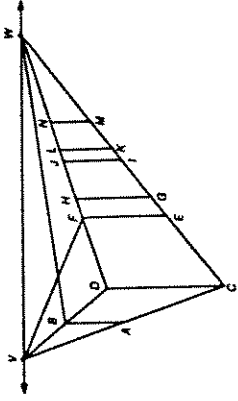
Drawing Block Letters in Two-Point Perspective

Step 1



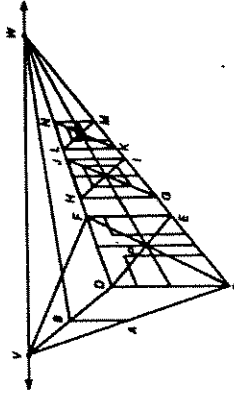
Draw a box in two-point perspective. Label the points as shown. Make height *CD* and width *CE* of your box about the same. For example, $CD = CE = 6$ cm. Do not erase the vanishing lines. Your first letter will fill the front face of this box. Select a distance between the first and second letters by drawing a vertical line *GH*. If you used 6 cm for the width *CE*, then use about 1 cm for *EG*.

Step 2



Select a width for your second box by drawing a vertical segment *IJ*. This box will eventually house your second letter. If you used 6 cm for *CE*, then use about 3 cm for *GJ*. Next, select a width for the space between the second and third boxes by drawing in a vertical segment *KL*. If you used 1 cm for *EG* then use .5 cm for *IK*. Repeat this procedure for the third box.

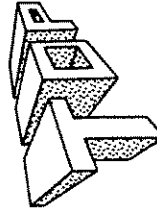
Step 3



Now design a letter on the front face of each box. Draw in diagonal lines *CF*, *DE*, *HI*, *GJ*, *LM*, and *KN*. The points where these diagonals intersect are the perspective centers for each front face. Draw vertical lines through these centers. Label the center in the first box *P*. Draw line *PW*. Use this line to center each block letter on its front face.

Draw a two-point perspective view of your name or initials in solid letters.

Step 4



Draw all the top vanishing lines from the top front corners to the back edges of the solid letters. Draw all the vertical edges at the back of the solid letters. Draw all the remaining vanishing lines. With a pen or felt tip marker outline all the edges of the solid letters. Erase all other lines. Decorate.

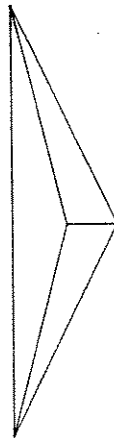
Special Project Drawing Skyscrapers

One of the more challenging perspective drawing problems is that of drawing skyscrapers. Drawing skyscrapers are challenging because there are many different rectangular solids and thus many different vanishing lines. Your task in this special project is to design a skyscraper complex with at least three towers in two-point perspective. Drawing a skyscraper in two-point perspective is demonstrated for you below. Read through the steps before you begin your own work.

Drawing a High Rise Complex

Step 1

Begin with a horizon line and two vanishing points. Draw the front vertical edge of your first building with all the vanishing lines.



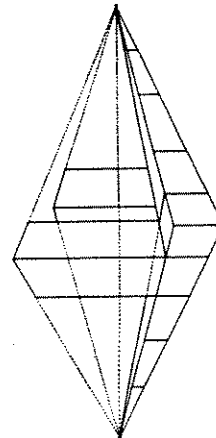
Step 2

Complete the two-point perspective view of the first building.



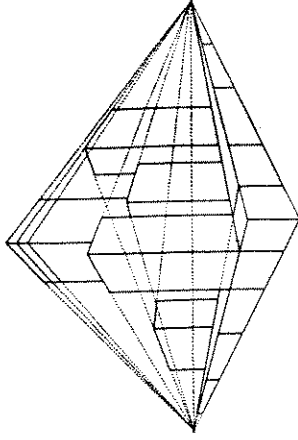
Step 3

Next, draw in a couple of the taller buildings. Start with the front vertical edge of each building and draw the vanishing lines. Complete the perspective view.



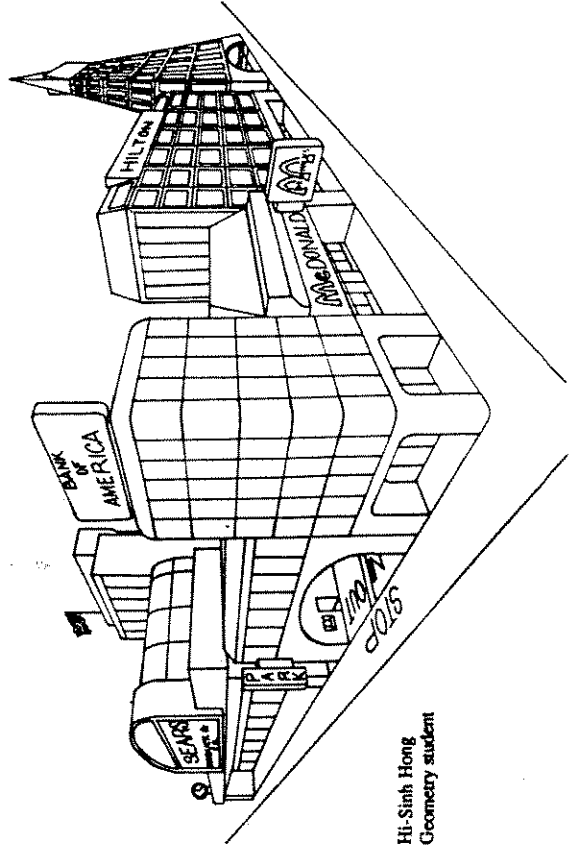
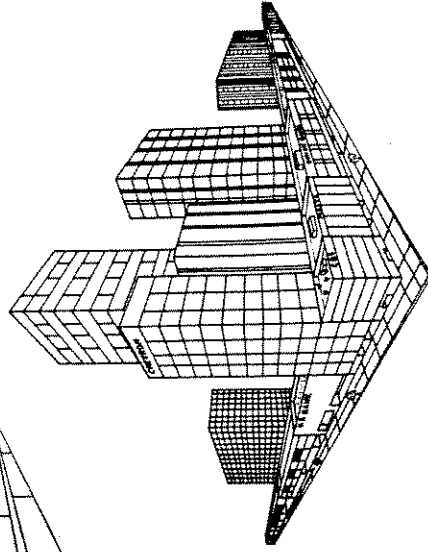
Step 4

Create additional buildings and use vanishing lines to add architectural details.



Step 5

Erase all unnecessary lines and add other details.



Hi-Sinh Hong
Geometry student



Name: _____

Partner: _____

Period: _____

Puny Facts about Pythagoras

You will find all of the following information in books in the library or in the classroom. Work with your partner. Both of you must fill in the information. Use at least three different reference books, not all of which are encyclopedias.

Pythagoras: Birth _____ Death _____

Place of birth _____

List ten interesting facts about Pythagoras and name your sources.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

PUNY TUNE FOR PYTHAGORAS

Name: _____ Partner: _____

Title: _____

Directions: You and your partner are to write a song about PYTHAGORAS using the facts that you looked up. You may join up with one other group. Your song can be written to some familiar tune that you like. It should have at least three verses and contain some true information about him and his accomplishments. The chorus of the song must be the full Theorem of Pythagoras in words, not symbols. To get full credit you must hand in a written copy of your song and present the song to the class in some way, such as:

- Sing it to the class alone or with a group.
- Have the class sing it together.
- Have someone put it on video or audio tape.

PROJECT SCORE

PART ONE: Fact sheet (10 points possible) _____

PART TWO: Song (25 points possible)

Information in song	0	1	2	3	4	5
Originality	0	1	2	3	4	5
Presentation	0	1	2	3	4	5
On time	0	1	2	3	4	5
Chorus (theorem)	0	1	2	3	4	5

TOTAL POINTS: _____/35

VOLUME PROJECT

Name _____

You may choose to work with one other person on this project. Please do not share your answers with others.

1. You will create a set of solids using the attached templates. You will make the five Platonic solids, a cone (height = diameter), a cylinder (height = diameter), a triangular prism, a square pyramid.
2. Find the surface area and volume of each of the solid figures you created. (Measure in centimeters and round to the nearest tenth.) If finding the volume is not a matter of a simple formula, find a way that you might estimate it and do that. Be sure to explain in detail how you calculated each area and volume.
For each of the 9 solids you should list the name of solid, dimensions, shape of faces, surface area and volume.
3. Check the formula for the volume of a cone and pyramid by removing the bottom from your cone, cylinder, triangular prism and triangular pyramid. Fill the cone with rice and pour it into the cylinder. How many 'conesfull' will it take to fill the cylinder? Do likewise with the pyramid and prism. Did it work? Why or why not?

Fill in this table to enter the competition.

THE GREAT SURFACE AREA/VOLUME COMPETITION!

Solid figure Name	Dimensions of shape	Surface area in cm^2	Volume in cm^3
Tetrahedron			
Cube			
Octahedron			
Dodecahedron			
Icosahedron			
Triangular Prism			
Square Pyramid			
Cylinder			
Cone			

Grade: On time
 accuracy of solids
 Accuracy of calculations
 Neatness and organization

NAMES _____

THE GREAT SURFACE AREA/VOLUME COMPETITION!

Solid figure Name	Surface area in cm^2	Volume in cm^3
Tetrahedron		
Cube		
Octahedron		
Dodecahedron		
Cube Octahedron		
Triangular Prism		
Square Pyramid		
Cylinder		
Cone		

ACTIVITIES on Volume

You may choose to work with one other person on this assignment. Please do not share your answers with other groups. You will hand in a single assignment, but make sure you both have a copy for your portfolio.

1. **Make a Box Activity:** You and your partner will each select an interesting (not a cylinder or a shoe) box to scale up or down. You will make a scaled version of the box, either double or half in every dimension. On the due-date, please bring both boxes to class.

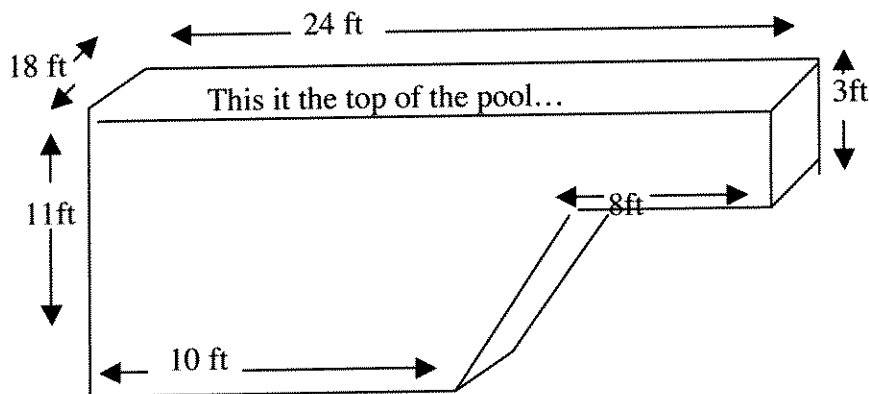
- Name the solid specifically using all words necessary to describe it.
- Draw a sketch of your box.
- Sketch a net of it (to scale), giving dimensions of each box (your original and the scaled one) in cm.
- State the shapes and number of the faces
- Calculate the surface area of both boxes.
- Calculate the volume of both boxes.

Regardless of the size of the original box, your scaled version should be either double the original measurements or half the original measurements, depending on how big the box is.

2. **Tennis Ball Activity:** Each of you will make a cylinder which will exactly hold one tennis ball and a cone which will exactly fit into the cylinder. Together you will determine the surface area and volume of the cone, cylinder and sphere using centimeters and rounding to the nearest tenth. . Show work.

3. **Swimming Pool Activity:**

a. Find the volume of water held by this swimming pool. Show all work.



- b. If water enters the pool at 8 cubic yards per hour, how many hours will it take to fill? How many days is that?
- c. If you want to tile the surface area of the pool (bottom, sides, etc) how many square feet of tile will it take?

Be sure to fill in the table about volume and surface area on the back of this page.

Volume table:

Shape, dimensions	Surface area	Volume
Original Box		
Scaled Box		
Partner's Original Box		
Partner's Scaled Box		
Sphere		
Cylinder		
Cone		
Swimming pool		
Time to fill the pool:		

Friendly (Platonic) And Other Solids

Polyhedra Names	Faces	Vertices	Edges	Euler's formula	Planes of symmetry	Axes of symmetry
PLATONIC SOLIDS						
	4					
	6					
	8					
	12					
	20					
OTHER POLYHEDRA						
Triangular prism						
Cube octahedron						
Triangular pyramid						
Square pyramid						
OTHER SOLIDS:						
Cone						
Cylinder						
Sphere						

Which of the following cross-sections are possible when a plane cuts a cube? Use the cubes on the back to illustrate each one.

- a. square
- b. rectangle
- c. equilateral triangle
- d. isosceles triangle
- e. scalene triangle
- f. trapezoid
- g. parallelogram
- h. pentagon
- i. regular hexagon

