DOCUMENT RESUME

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ABSTRACT

This is a collection of activities for individual or small group work. All can be done with a minimum of teacher direction. Major topics are: (1) measurement--length, area, and volume; (2) geometric shapes--triangles, quadrilaterals, polygons, and three-dimensional; (3) graphing in the plane and use of statistical graphs; and (4) angular measurement and circles. Most sections have worksheets, explanations, examples, and questions for discussion. (LS)

year 4-6

ACTIVITIES IN GEOMETRY

CODE	TOPIC
G- 1	Length - Units, Measurement
2	Area - Units and Measurement
3	Volume - Units and Measurement
4	Perimeter
5	Points, Lines, Planes
6	Geometric Shapes (Triangles)
7	Geometric Shapes (Quadrilateral)
8	Geometric Shapes (Polygons)
9	Geometric Shapes (3-D)*
10	Graphing in a 2-D Plane
11	Graphs of Equations in 2-D
12	Bar and Pie Graphs, Pictographs
13	Angle Measurement
14	Circles
15	Symmetry
16	Construction in Geometry

* 3-D = Three Dimensions

1. Complete each equation:

$(3 \times 6) = 12 +$ ____ $\quad 17 -$ ____ $= \frac{3}{4} \times 12 \quad 3 =$ ____ ± 5

$(2 \times 7) = 20 -$ ____ $\quad 16 + 2 = 19 -$ ____ $\quad 9 =$ ____ $\div 2$

$(2 \times 10) = (4 \times$ ____$) \quad \frac{3}{4} \times 16 = 2 \times$ ____ $\quad 4 =$ ____ $\div 5$

$\frac{2}{3} \times 15 =$ (____ $\cdot 2) \quad \frac{2}{3} \times 18 = 3 \times$ ____

$3 =$ ____ $\div 3 \quad 6 =$ ____ $\div 3$

2. Do the following:

18 inches $\equiv$ 1 foot ____ inches

24 inches $\equiv$ ____ feet

8 inches $\equiv$ 1 foot less ____ inches

1 yard + 2 inches $\equiv$ ____ inches

3. Do page 84 in your workbook.

Measure the height and width of the blackboard. Calculate its area. Find five other rectangles in the classroom and after measuring them calculate their areas.

In your notebook - draw sketches of your rectangles and show your calculation of the areas.

Cut four pieces of string, each 10 inches long.
Fasten one end of each string to a different place
on a large sheet of paper.
Make each of these figures with one piece of string.

(a) a square
(b) a rectangle with a width of 2 inches
(c) a circle
(d) a triangle with two equal sides and one side
4 inches long.

Give this information about your shapes.

(a) the length of one side of the square
(b) the length of the rectangle
(c) the length of the diameter of the circle
(d) the length of one of the equal sides of the triangle.

Measure the height of the goal posts.

Measure the distance between the two posts.

Calculate the area of the goal rectangle.

Find two other rectangles outside.

Measure them and calculate the area.

In your notebook - draw sketches of your rectangles, and show your calculations of the areas.

A. Take 50 counting blocks, and build

   1. A block 4 units long, 3 units wide and 2 units high.

B. Make a record in your notebook, e.g.

Length	Width	Height	No. of Units
4"	3"	2"	?

C. Make five more different blocks.

D. Make a neat record of all these blocks in your notebook.

Linear Measure

Materials -- children should be free to use string, ribbon, rulers, tape measure, etc. -- anything they wish.

Measure your neck, wrist, waist.

What will you use to measure this?

How many wrist measurements will go around your neck? (estimate first.)

How many neck measurements will go round your waist? (estimate first.)

See if your measurements are different from your partner's.

Sample Worksheet Pupil's Name

My neck is _____ long.

My wrist is _____ long.

My waist is _____ long.

3 wrist measurements = my neck measurement.

2 and some more neck measurements = my waist measurement.

Linear Measure

Materials -- string, book or paper for recording.

Estimate the following (a) length of a book
(b) length of your leg from knee to the floor.
(c) length of your arm.
(d) width of your desk.

Measure the items with a piece of string and record your findings.

Make a chart showing estimations, measurement, difference.

Sample Worksheet Pupil's Name

I think my book is _____ long.

My book is _____ long.

I think my leg is _____ long.

My leg is _____ long.

I think my arm is _____ long.

My arm is _____ long.

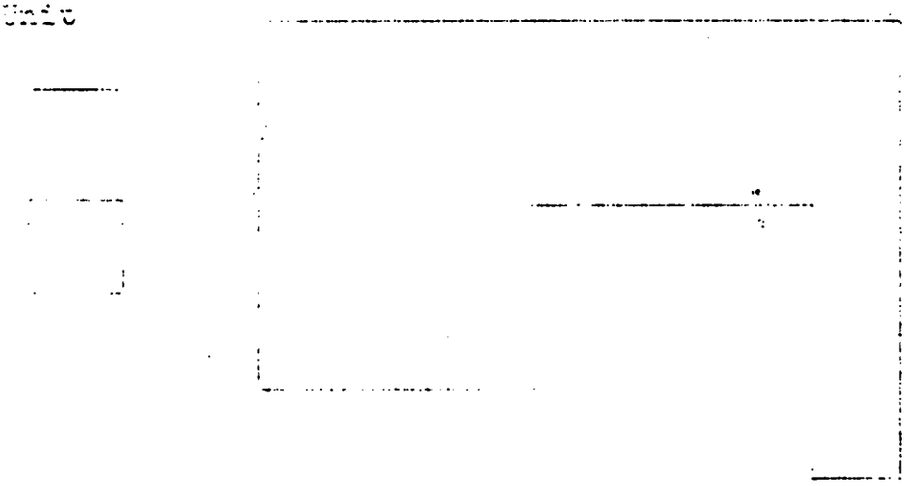
I think my desk is _____ long.

My desk is _____ long.

Measurement

Find the measure of the distance around the shape shown below using the unit of measurement given. Also, find the area using the square unit of measurement given.

Unit



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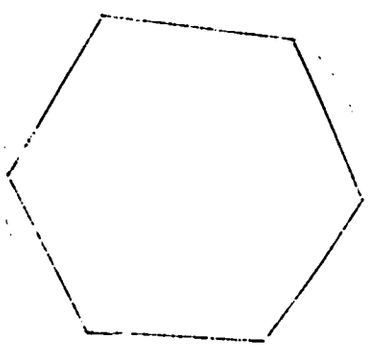
1. Measure the length of the sides of the hexagon and the radius of the circle.



What did you discover?

Will this help you to construct a hexagon? (Construct one)

Using the clinometer find the height of the flagpole of the school.

In your notebook, show

1. How you measured the height.
2. Your calculations you used to calculate the height.

A. Measure the height of each person in your group, as well as of each person in the other group doing the same project. Use a yardstick.

B. Take a sheet of graph paper and a magic marker, and make a graph to show your results.

C. In your notebook, write a <u>short</u> note about how to make a graph.

Measurement

Count the number of times the unit is contained in each shape to be measured.

Unit	Shape to be measured	Measure
———	B C A D	
	A B C	

How would you compare the measure of the distance around each shape?

Count the number of times the unit is contained in each of the following shapes.

Unit	Shape to be measured	Measure
		———
———		———

How would you compare the measure of the distance around each shape?

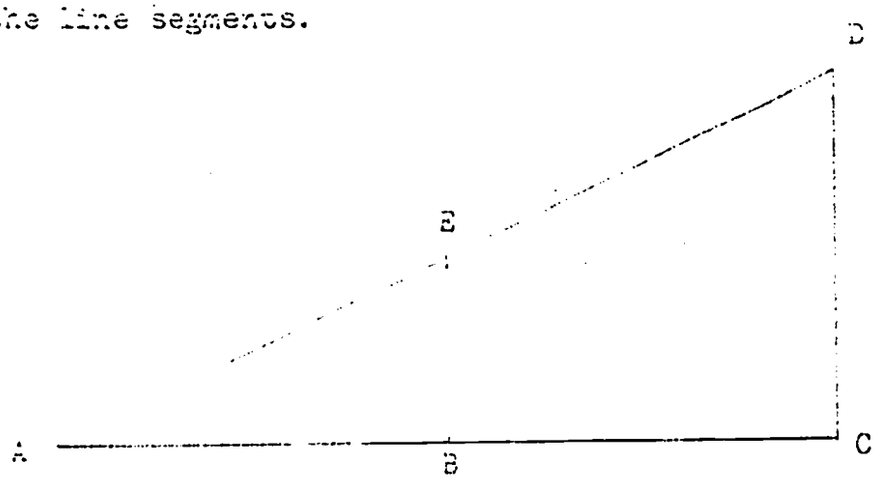
Measurement

Measure the line segments.

AC =
CD =

AB =
BE =

AD =
AE =



1. Find the ratios $\frac{AC}{CD}$, $\frac{AB}{BE}$, $\frac{AC}{AD}$, $\frac{AB}{AE}$

What did you discover?

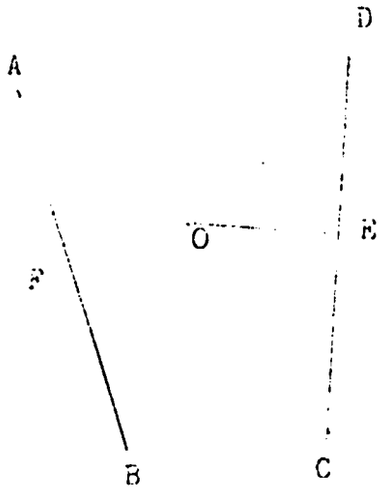
Measure the line segments.

AB =

CD =

OA =

OF =



Summarize your finding.

14.

C-1.10 Can you find out how far you walk from your home to school?

How far do you walk in going to and returning from school in a week?

During the whole school year?

* * * *

[illegible]

Materials -- set of geometric shapes, cans, boxes of various sizes, spheres of several sizes, e.g. balls, globe, oranges, etc.

Find as many round objects as you can and measure the distance around them to the nearest inch. Make a list of these and record the measurement of each. Don't forget to estimate first.

Using inch square graph paper, cut out a set of squares of dimension
(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)

and complete the following table:

Measure of Square	Perimeter of Square	Area sq. units
1	4	1
2	8	4
3	.	.
4	.	.
5	.	.
.	.	.
.	.	.

1. Write the measure and perimeter as a set of ordered pairs as follows (measure, perimeter)

$\{(1,4), (2,8) \ldots\}$

2. Graph this set of ordered pairs; what did you discover?

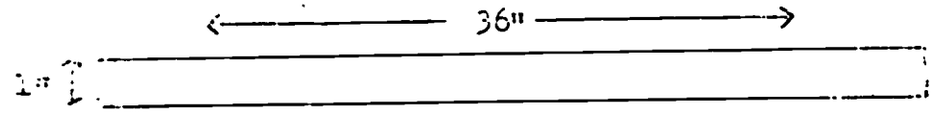
3. Write the measure and area as a set of ordered pairs.

$\{(1,1) \quad (2,4) \quad (3,9) \ldots\}$

4. Graph this set of ordered pairs; what did you discover?

Use a set of 36 1 inch squares and use them to make all possible rectangles 36 square inches in area.

For example, one rectangle would be 36" by 1".



1. Write down the set of ordered pairs (width, length)
   $\{(1,36), (2, 18)\}\ldots$
2. How many members does the set have?
3. Graph this set of ordered pairs and join the points.
4. What did you discover regarding this line?
5. For each of the rectangles, find the perimeter and write the set of ordered pairs (area, perimeter) as follows: $\{(36, 74), (36, 40) \ldots\}$
6. What is the shape of the rectangle for which the perimeter is smallest.

Using the scales and measuring device in your school make a record of the heights and weights of the pupils. Make a graph of your findings.

How many graphs did you have to make? Why?

What conclusion can you make as a result of your survey?

MULTIPLICATION

M-10
C-2.7

Arithmetical sentences such as 3x4 = 12 can be used to describe many problems. Examples of such problems are:

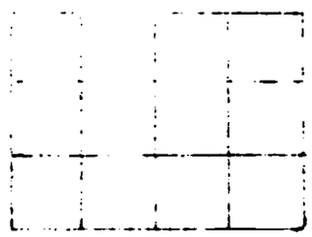
Three children each have four candies.

I work four hours at a wage of $3.00 per hour.

I walk for four miles at a rate of 3 miles per hour.

It would be easy to draw a picture to describe each of these problems.

Arithmetical sentences can also be related to Geometry. The example below demonstrates this relationship.



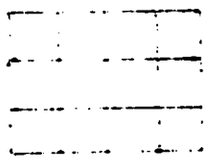
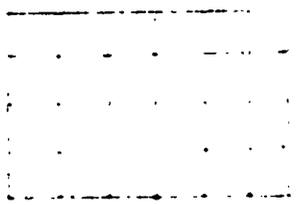
This picture is a rectangle consisting of 3 rows of squares with 4 squares in each layer. There are a total of 12 squares.

The sentence 3 x 4 = 12 tells us that a rectangular shape which is 3 units wide and 4 units long has an area of 12 square units.

a. Measure the rectangle and see if you can discover what unit of measurement was used to draw the geometric picture of the mathematical sentence - 3 x 4 = 12.

b. Complete the following chart.

Solutions
C-2-1

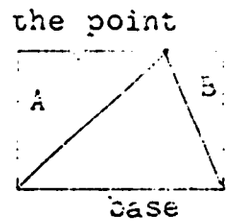
Rows	Squares in each row	Geometric model	Mathematical Sentence	Area of Geometric Model in square units
3	4		3 × 4 = ☐	12
2	6		2 × 6 = ☐	12
4	4			
6	9			
7	5			
	5			
	5			

Geometry: Area of a Triangle. Method I.

1. Cut a rectangle from a sheet of construction paper. Calculate its sides.

2. Call any side the base. On the opposite side select any point and draw line connecting the point with the base:

Example:



3. Estimate the area of the triangle in square inches.

4. Cut the triangle out. Rearrange pieces "A" and "B", to see how much of triangle can be covered by them.

5. What is the area of the triangle? What fraction of the rectangle is this area? Compare with your estimate.

6. Will this work for any triangle? Why?

7. In your notebook, draw a diagram to illustrate your method. Write your conclusions in a few sentences. Answer question #6, giving reasons. State a method for finding the area of any triangle.

A. Take a double handful of 1" squares and make the following rectangles:

1. 6" long and 6" wide
2. 5" long and 3" wide
3. 10" long and 6" wide

4, 5, 6 - three more of your choice.

B. Make a record in your notebook about each rectangle:

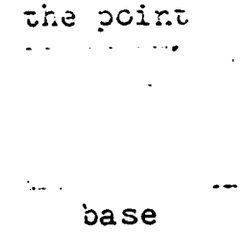
Length	Width	Distance around edge	No. of paper squares used
6"	6"		

Geometry: Area of a Triangle

1. Cut a rectangle from a sheet of graph paper. (The maximum size should be about 12" x 12"). Find its area.

2. Call any side the base. On the opposite side select any point and draw lines connecting the point with the base. Shade the triangle lightly.

Example:



3. Estimate what area of the rectangle is shaded (without counting squares).

4. Count squares shaded to find the area of the triangle. What is it?

5. Will this be true for all triangles. Why?

6. Would it be better to use smaller squared graph paper. Why?

7. In your notebook, draw a diagram to illustrate what you did, and answer questions 5 and 6.

Area - Units of Measure

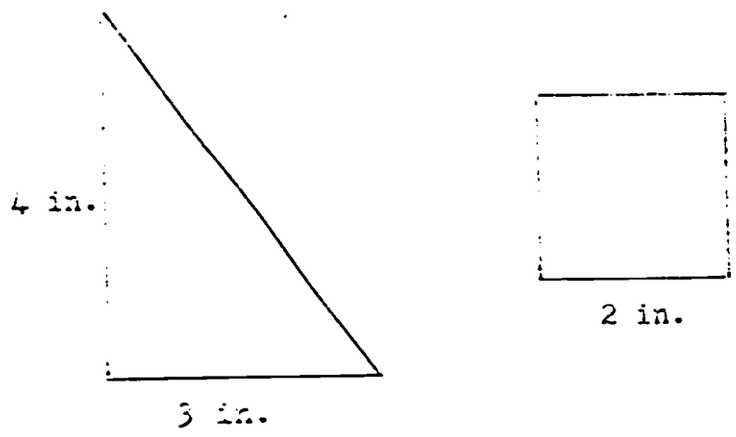
From a sheet of construction paper, make a square 12" x 12" and another 1" x 1". What are each of these called? How many of the smaller squares will fit in the larger square?

Construct another square, one yard - to a side on the blackboard. How many of the one foot squares will you need to fill it?

Write a note in your math. workbook in the form of a table -

Using these measurements make four cutouts of the triangle and one cutout of the square.

Arrange the five figures to form a square then find the perimeter and the area of the square you made.



Measure the height of the goal posts.

Measure the distance between the two posts.

Calculate the area of the goal rectangle.

Find two other rectangles outside.

Measure them and calculate the area.

In your notebook - draw sketches of your rectangles, and show your calculations of the areas.

A. Take 50 counting blocks, and build
   1. A block 4 units long, 3 units wide and 2 units high.

B. Make a record in your notebook, e.g.

Length	Width	Height	No. of Units
4"	3"	2"	?

C. Make five more different blocks.

D. Make a neat record of all these blocks in your notebook.

Measure the height and width of the blackboard. Calculate its area. Find five other rectangles in the classroom and after measuring them calculate their areas.

In your notebook - draw sketches of your rectangles and show your calculation of the areas.

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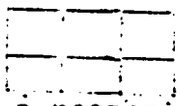
1. Arrange 17 toothpicks to form 6 squares like those in the picture.



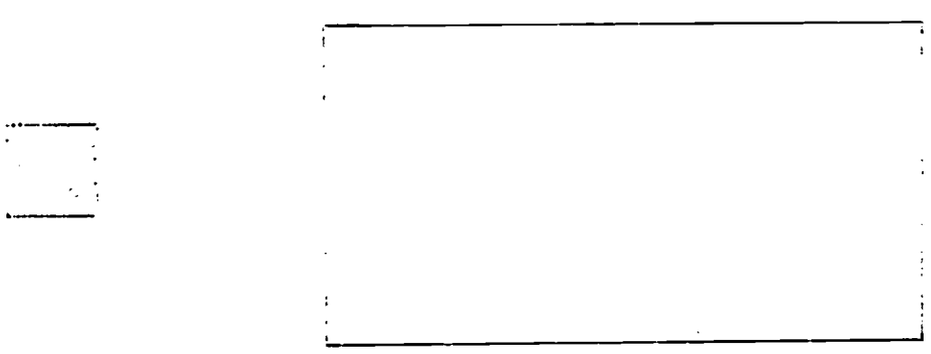
2. Remove 6 toothpicks to make 2 squares.

3. Remove 5 toothpicks to make 3 squares.

Measurement

Unit of Square Measure

SHAPE



Use the square unit of measurement to find a method to obtain the area of the shape above.

Use a geo-board and rubber bands to make as many shapes as you can with an area of 8 squares. Copy some of the most interesting ones on squared paper with coloured pencil.

Make irregular shapes with elastics and a geo-board, or cut irregular shapes from cardboard.

Which has the largest area?

How did you find out which has the largest area?

Using inch square graph paper, cut out a set of squares of dimension

(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)

and complete the following table:

Number of Squares	Perimeter of Square	Area sq. units
1	4	1
2	8	4
3	.	.
4	.	.
5	.	.
.	.	.
.	.	.

1. Write the number and perimeter as a set of ordered pairs as follows (number, perimeter)

$\{(1,4), (2,8, \ldots\}$

2. Graph this set of ordered pairs, what did you discover?

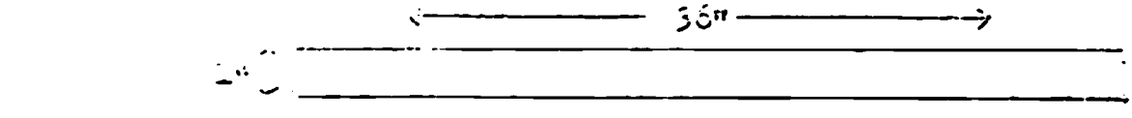
3. Write the number and area as a set of ordered pairs.

$\{(1,1) \quad (2,4) \quad (3,9) \ldots\}$

4. Graph this set of ordered pairs; what did you discover?

Use a set of 36 1 inch squares and use them to make all possible rectangles 36 square inches in area.

For example, one rectangle would be 36" by 1".



1. Write down the set of ordered pairs (width, length)
   $\{(1,36), (2, 18)\} \ldots$
2. How many members does the set have?
3. Graph this set of ordered pairs and join the points.
4. What did you discover regarding this line?
5. For each of the rectangles find the perimeter and write the set of ordered pairs (area, perimeter) as follows: $\{(36, 74), (36, 40) \ldots\}$
6. What is the shape of the rectangle for which the perimeter is smallest.

LIQUID MEASURE CENTER

Materials - you will need a large jar and cup.

Estimate how many cupfuls of water you would use to fill the jar.

Pour the water into the jar a cupful at a time until it is full.

1. How many cups did you use?
2. How many were you?
3. Did you estimate too many or not enough?
4. Record your findings.

Sample Worksheet (chart form)

Type of Container	No. of cups Estimated	No. of cups used

Liquid Measure

Materials -- you will need a drinking glass and a large plastic bowl, -- a cup and a pint jar.

1. How many drinking glasses of water are needed to fill the bowl?
2. Now use the cups and pint measure to fill the bowl.
3. Which measure did you like to use best?
4. Why?
5. Record your findings on a chart.

Using inch square graph paper, cut out a set of squares of dimensions

(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)

and complete the following table:

Measure of square	Perimeter of Square	Area sq. units
1	4	1
2	8	4
3	.	.
4	.	.
5	.	.
.	.	.

1. Write the measure and perimeter as a set of ordered pairs as follows (measure, perimeter)

$\{(1,4), (2,8) \ldots\}$

2. Graph this set of ordered pairs, what did you discover?

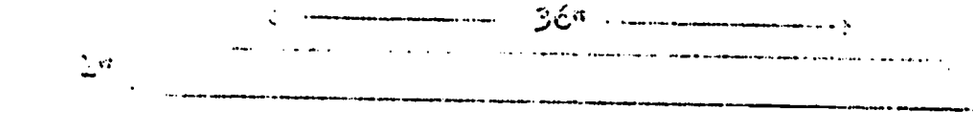
3. Write the measure and area as a set of ordered pairs.

$\{(1,1) \quad (2,4) \quad (3,9) \ldots\}$

4. Graph this set of ordered pairs; what did you discover?

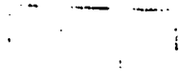
Use a set of 36 1 inch squares and use them to make all possible rectangles 36 square inches in area.

For example, one rectangle would be 36" by 1".



1. Write down the set of ordered pairs (width, length)
   (1,36), (2, 18) ...
2. How many members does the set have?
3. Graph this set of ordered pairs and join the points.
4. What did you discover regarding this line?
5. For each of the rectangles, find the perimeter and write the set of ordered pairs (area, perimeter) as follows: $\{(36, 74), (36, 40) \ldots\}$
6. What is the shape of the rectangle for which the perimeter is smallest.

1. Arrange 17 toothpicks to form 6 squares like those in the picture.

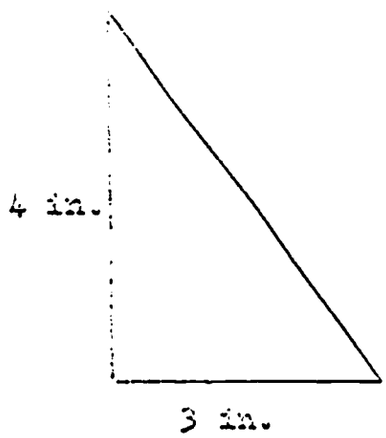


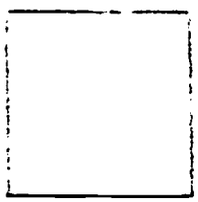
2. Remove 3 toothpicks to make 2 squares.

3. Remove 5 toothpicks to make 3 squares.

Using these measurements make four cutouts of the triangle and one cutout of the square.

Arrange the five figures to form a square then find the perimeter and the area of the square you made.





Co-ordinate Geometry

1. A rectangle has a perimeter of 36 units.

2. Make a table similar to the one shown in table 1 and list all the possible lengths and widths of rectangles whose perimeter could be 36 units using the set of whole numbers.

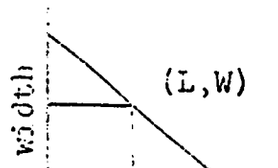
Length	Width	(Length,Width)
0	18	(0,18)
.	.	.
.	.	.
.	.	.

Table 1

3. Make a co-ordinate plane and plot the length along the x-line and the width along the y-line then graph the ordered pairs you recorded in Column 3.

4. Join the points with a straight edge and colouring pencil.

5. What are the dimensions of the rectangle having the largest area. Draw this area on your graph.



6. Make a table similar to the one shown below (Table 2) and list the ordered pairs from Table 1 and the corresponding area.

Co-ordinates	AREA
(0,18)	0
(1,17)	17

Table 2

7. Make a co-ordinate plane and plot the length along the x-line and the area along the y-line. Draw a smooth curve through the points.

Co-ordinate Geometry

1. Make a co-ordinate plane with the x-line numbered -20 to +10, the 6-line numbered -20 to +20.

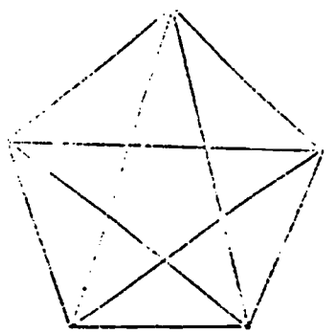
   Plot and join these points in order.

   (0,15), (-4,12), (-2,12), (-2,7), (-2,3),
   (-5,0), (-5,-5), (-7,-3), (-7,-10), (-7,-15),
   (-7,-18), (-5,-18), (-5,-15), (-2,-15), (-2,-17),
   (2,-17), (2,-15), (5,-15), (5,-18), (7,-18),
   (7,-5), (7,-10), (7,-3), (5,-5), (5,0),
   (2,3), (2,7), (2,12), (4,12), (0,15)

2. Approximate the perimeter and area of the figure.

3. Draw a picture on a number plane. Make up ordered pairs as a code for another member of your group to use to draw your picture.

How many triangles are in this figure?



You should be able to find 35 triangles.

1. Write the roman numerals for: (example 12 = XII)

   4, 11, 7, 5, 9, 6, 3, 20, 15, 13

2. Make the following true:

   2 quarters + 3 dimes + 2 pennies = _____ cents

   1 half dollar + 1 quarter = _____ cents

   3 dimes + 1 nickel = _____ cents

   4 quarters = _____

   50 cents = _____ nickels

   1 quarter = _____ nickels

   5 dimes = _____

3. Do: ____ eggs = 1 dozen, ____ feet = 1 yard

   ____ inches = 1 foot, ____ pints = 1 quart

   ____ inches = 1 yard, ____ quarts = 1 gallon

4. Draw a rectangle, 3 inches long and 2 inches wide.

5. Draw a square with 3 inch sides.

6. Draw a triangle with each side a different length.

7. Do page 79 in your workbook.

Take a walk in your neighbourhood.

Do this as you walk:

Record the shapes which you see in road signs.

---

1. Make a skeleton model of a square using cardboard strips and paper fasteners.

2. How can you make it rigid?

3. What plane shapes do you have?

4. Do the same for a rectangle, a pentagon, a hexagon, an octagon.

5. What do you discover about the number of sides of the plane shape and the number of △'s formed when it is made rigid?

6. What is the strongest shape?

Prepare a Multiplication - Division Matrix.

M-11
M-27
G-7.7

	1	2	3	4	5	6	7	8	9	10	
1	1	2	3	4	5	6	7	8	9	10	
2	2	4	6	8	10	12	14	16	18	20	
3	3	6	9	12	15	18	21	24	27	30	
4	4	8	12	16	20	24	28	32	36	40	
5											
6											
7											
8											
9											
10											

Complete the above Multiplication - Division Matrix.

Note that 4 → 6 → 24 $4 \times 6 = 24$

3 → 5 → 15 $3 \times 5 = 15$

and 4 ← 7 → 28 $28 \div 7 = 4$

4 ← 3 → 12 $12 \div 3 = 4$

K-11
K-27
G-7.1 cont'd...

If you look at the diagonal - numbers from the upper left hand corner to lower right - you will note the following set.

$$\{1,4,9,16,25,36,49,64,81,100\}$$

Name the set of product pairs which resulted in these numbers.

Numbers resulting from a product pair which are the same are called square numbers.

Can you draw a geometric shape which represents a square product pair?

Take a walk in your neighbourhood.

Do this as you walk:

Record the shapes which you see in road signs.

---

1. Make a skeleton model of a square using cardboard strips and paper fasteners.

2. How can you make it rigid?

3. What plane shapes do you have?

4. Do the same for a rectangle, a pentagon, a hexagon, an octagon.

5. What do you discover about the number of sides of the plane shape and the number of △'s formed when it is made rigid?

6. What is the strongest shape?

1. Write the roman numerals for : (example 12 = XII)

   4, 11, 7, 5, 9, 6, 3, 20, 15, 13

2. Make the following true:

   2 quarters + 3 dimes + 2 pennies = _____ cents

   1 half dollar + 1 quarter = _____ cents

   3 dimes + 1 nickel = _____ cents

   4 quarters = _____

   50 cents = _____ nickels

   1 quarter = _____ nickels

   5 dimes = _____

3. Do: ____ eggs = 1 dozen, ____ feet = 1 yard

   ____ inches = 1 foot, ____ pints = 1 quart

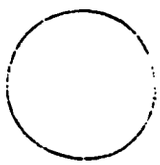
   ____ inches = 1 yard, _____ quarts = 1 gallon

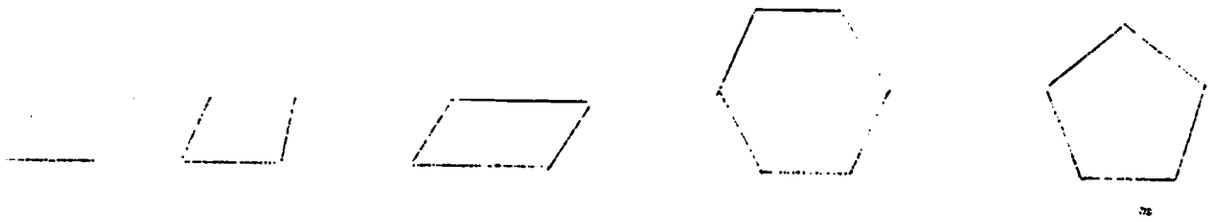
4. Draw a rectangle, 3 inches long and 2 inches wide.

5. Draw a square with 3 inch sides.

6. Draw a triangle with each side a different length.

1. Find objects or solids with faces shaped like this drawing.

2.  Now, using this drawing, repeat #1.



1. Use cut-outs of each of the above shapes to cover surfaces.

2. Which shapes can be used for "tiling"?

3. Why do bees use hexagonal-shaped cells?

---

1. Use models of a number of geometric solids.

2. Sort into the following sets:
   (a) those that roll only
   (b) those that slide only
   (c) those that roll and slide

3. Find those that roll in any direction, those that roll in a straight line, and those that roll in a curved line.

Take a walk in your neighbourhood.

Do this as you walk:

Record the shapes which you see in road signs.

---

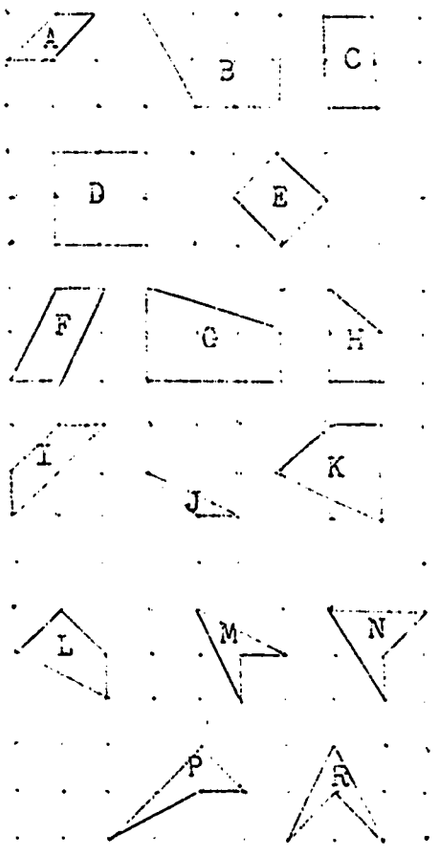
1. Draw shapes with 3 sides, 5 sides, 7 sides, 8 sides.

2. How many vertices are in each shape?

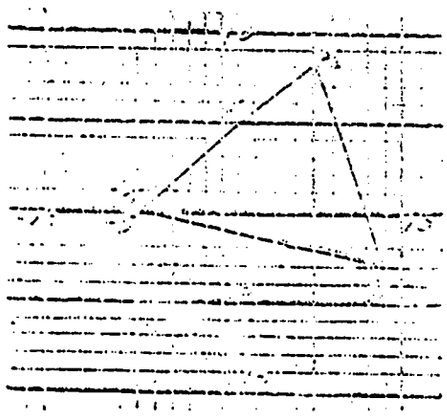
3. Make a chart to show a comparison of the number of sides with the number of vertices.

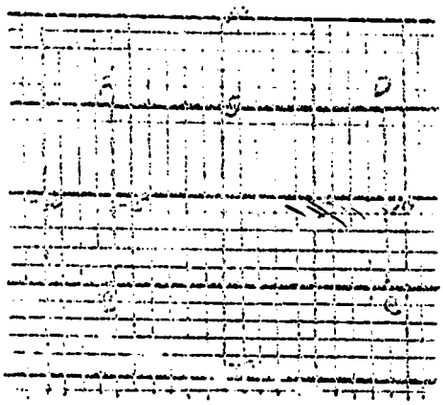
4. Test with other shapes to see if this is always true.

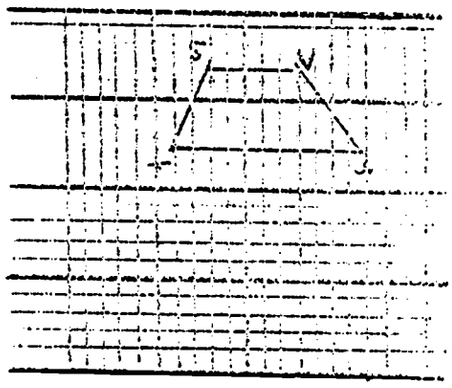
Make the following shapes on your geoboard. Transfer each figure to dot paper and draw in all the diagonal lines using a red pencil. In which shapes are the diagonals of equal length?



Co-ordinate Geometry







1. Write the co-ordinates of the verticies of the above figures.

2. Draw congruent figures of the above figures on a separate co-ordinate plane.

---

1. Tabulate the articles on the work table according to their shapes.

2. Make a graph of your findings.

3. What is the most common shape?

4. What is the least common shape?

Use a geo-board and rubber bands to make as many shapes as you can with an area of 8 squares. Copy some of the most interesting ones on squared paper with coloured pencil.

Make irregular shapes with elastics and a geo-board, or cut irregular shapes from cardboard.

Which has the largest area?

How did you find out which has the largest area?

Cut four pieces of string, each 10 inches long.
Fasten one end of each string to a different place on a large sheet of paper.
Make each of these figures with one piece of string.

(a) a square
(b) a rectangle with a width of 2 inches
(c) a circle
(d) a triangle with two equal sides and one side 4 inches long.

Give this information about your shapes.

(a) the length of one side of the square
(b) the length of the rectangle
(c) the length of the diameter of the circle
(d) the length of one of the equal sides of the triangle.

Use plane shapes to construct solids from these shapes.

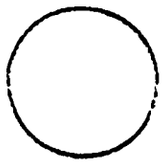
(a) cube

(b) cuboid

(c) triangular prism

(d) square-based pyramid

1. Find objects or solids with faces shaped like this drawing.

2.  Now, using this drawing, repeat #1.

Take a walk in your neighbourhood.

Do this as you walk:

Record the shapes which you see in road signs.

GEOMETRY CENTRE

Materials -- set of geometric shapes, cans, boxes of various sizes, spheres of several sizes, e.g. balls, globe, oranges, etc.

Find as many round objects as you can and measure the distance around them to the nearest inch. Make a list of these and record the measurement of each. Don't forget to estimate first.

Materials -- set of boxes of various sizes with lids.
i.e. shoe box, candy box, plenty of wooden blocks.
Pick a box and see if you can make a shape just like
it using the wooden cubes.
Show your teacher when you have finished.
Do the box and the model take up the same amount of space?
Now make a different shape using all these cubes.

Co-ordinate Geometry

1. Make a co-ordinate plane with the x-line numbered -10 to +10, the 6-line numbered -20 to +20.

   Plot and join these points in order.

   (0,15), (-4,12), (-2,12), (-2,7), (-2,3), (-5,0), (-5,-5), (-7,-3), (-7,-10), (-7,-15), (-7,-18), (-5,-18), (-5,-15), (-2,-15), (-2,-17), (2,-17), (2,-15), (5,-15), (5,-18), (7,-18), (7,-15), (7,-10), (7,-3), (5,-5), (5,0), (2,3), (2,7), (2,12), (4,12), (0,15)

2. Approximate the perimeter and area of the figure.

3. Draw a picture on a number plane. Make up ordered pairs as a code for another member of your group to use to draw your picture.

Favourite Things

Make up a list of twelve flavours:
(e.g. cherry, chocolate, lemon, lime, etc.)
Write them on a large sheet of paper. Give every child in your class 3 votes for his, or her, favourite flavour.
Count the votes. Arrange them in order with the things liked best at the top.

Make a graph to show your findings.
Give it a title.

Favourite Things

Make a list of school activities on a large sheet of paper: e.g. MATH, SCIENCE, MUSIC, ART, ETC.

Ask each boy in your class his two favourite subjects. Give 7 votes for his first choice and 4 votes for his second choice.

Count the votes and arrange the subjects in order of choice. Begin with the least popular. Make a graph of your findings. Give it a title.

Now do the same things with the girls in your class. Graph the results. Compare the two graphs.

Co-ordinate Geometry

1. A rectangle has a perimeter of 36 units.

2. Make a table similar to the one shown in table 1 and list all the possible lengths and widths of rectangles whose perimeter could be 36 units using the set of whole numbers.

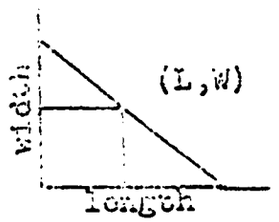
Length	Width	(Length, Width)
0	18	(0,18)
.	.	.
.	.	.
.	.	.

Table 1

3. Make a co-ordinate plane and plot the length along the x-line and the width along the y-line then graph the ordered pairs you recorded in Column 3.

4. Join the points with a straight edge and colouring pencil.

5. What are the dimensions of the rectangle having the largest area. Draw this area on your graph.



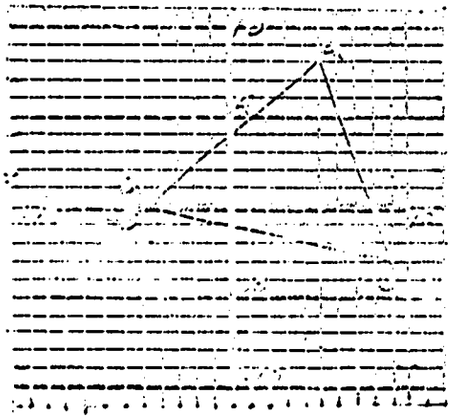
6. Make a table similar to the one shown below (Table 2) and list the ordered pairs from Table 1 and the corresponding area.

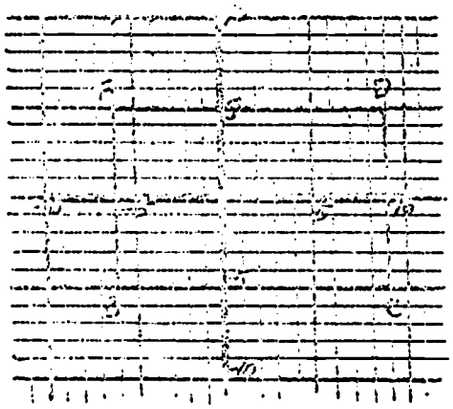
Co-ordinates	AREA
(0,18)	0
(1,17)	17

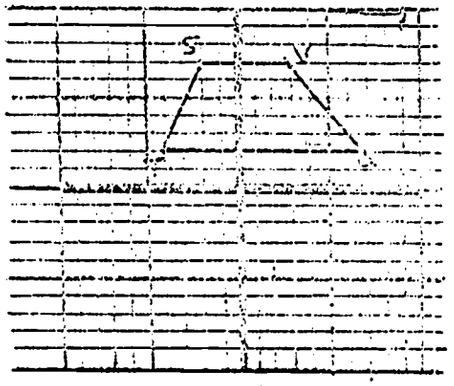
Table 2

7. Make a co-ordinate plane and plot the length along the x-line and the area along the y-line. Draw a smooth curve through the points.

Co-ordinate Geometry







1. Write the co-ordinates of the vertices of the above figures.

2. Draw congruent figures of the above figures on a separate co-ordinate plane.

Graph the set of ordered pairs of numbers. Label each point with the letter given before each ordered pair.

Draw line segments to connect points A and B, points B and C, points C and D, points D and E, points F and G, points G and H, points H and I, and points B and D.

Point A	(2,0)	Point F	(5,0)
Point B	(2,5)	Point G	(5,2)
Point C	(6,5)	Point H	(4,2)
Point D	(9,5)	Point I	(4,0)
Point E	(9,0)		

---

1. Graph the following points and identify the polygon.

   (a) (1,1), (5,2), (2,5)

   (b) (2,1), (4,1), (4,3), (2,3)

   (c) (1,6), (1,2), (6,2)

   (d) (0,-4), (-2,-3), (2,-3), (4,-4)

   (e) (-4,0), (4,0), (0,5)

Co-ordinate Geometry

1. In the index of a road map find the name of a city, lake, mountain or river. Locate the place on the map. Record the place and its co-ordinates which define its location on the map.

Get some squared paper.

Draw a vertical line and a horizontal line to make a co-ordinate plane.

Locate these points in the order given.

Connect the points in the order given to make a picture.

(3,2) (4,3) (5,4) (5,5) (5,6) (5,7) (5,8)
(6,9) (6,10) (6,11) (6,12) (6,13) (7,14) (7,15)
(7,16) (7,18) (8,19) (9,18) (9,17) (9,16) (9,15)
(9,14) (10,13) (10,12) (10,11) (10,10) (10,9)
(11,8) (11,7) (11,6) (11,5) (11,4) (12,3) (12,2)

CO-ORDINATE BINGO

1. Played with groups of 4 players and 1 caller.

2. Students make up 4 sets of ordered pairs as shown in Table 1, each pair marked on a square piece of bristle board approximately 1 inch square.

3. Have each set distinguishable by colour or by some identifying mark.

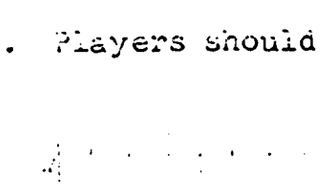
4. Supply each student with graph paper. Students draw in co-ordinate axes to correspond to the domain and range of the set of ordered pairs.

5. The game is then played as BINGO.

6. The caller mixes the squares well in a container, draws a card and calls out the colour and ordered pair. The player with the identifying colour marks a dot on the graph.

7. When a player has six points all on the same horizontal, vertical or diagonal he calls BINGO.

8. Players should graph their wins using a bar graph.



Names

Variations of the Game

1. Extend the co-ordinate system to include negative integers.

2. Have 4 pairs of dice. Each student rolls his dice in turn and chooses the number pair the dice show. Example, if one die turns up 3 and the other 5, he can choose (3,5) or (5,3). He then graphs the point.

If (4,2) is P, what are these words?

(0,5)(2,2)(2,2)(1,5)(0,1)
(2,5)(0,5)(3,1)(1,1)
(0,3)(2,0)(0,5)(4,4)(4,5)

7	
6	
5	J L M A Y
4	B K V W Z
3	C J O V
2	D I P U
1	E H Q T
	F G R S

Decode this sentence:

(2,2)(1,5)(3,4); (1,5)(0,5)(4,4)(4,5);

(0,4)(4,4)(2,3)(3,4)(2,4); (0,0)(2,3)(3,5)

(1,3)(3,4)(2,5)(2,2)(0,1)(0,2); (2,3)(3,3)(0,1)(2,0)

(3,1)(1,1)(0,1); (1,5)(1,2)(3,1)(3,1)(1,5)(0,1); (0,2)(2,3)(1,0).

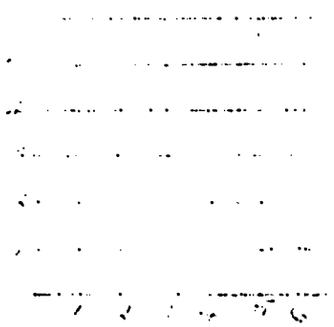
Make a sentence using ordered pairs for a friend to decode.

Co-ordinate Geometry

Game called "Co-ordinates"

1. You need two different dice, one for the x-number and the other for the y-number.

2. Draw and colour a co-ordinate plane as shown.



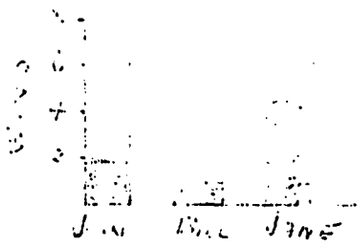
3. To play the game, shake and toss the dice in turn.

   The point indicated by the dice is plotted and scored as follows:

Colour Point	Score
red	6
green	4
yellow	2

4. Before starting, decide what score will win the game.

5. Graph your wins using a bar graph.



Get some squared paper.

Draw a vertical line and a horizontal line to make a co-ordinate plane.

Locate the points in the order given.

Then connect the points in the same order to make a picture.

(0,5) (1,8) (2,7) (2,8) (3,7) (3,8) (4,7) (4,6) (5,5)

(11,5) (12,8) (13,7) (13,6) (12,5) (11,4) (11,2) (12,1)

(13,0) (12,0) (11,1) (10,2) (10,0) (9,0) (9,2) (5,2)

(5,0) (4,0) (4,2) (3,1) (2,0) (1,0) (2,1) (3,2)

(3,3) (2,4) (1,4) (0,5)

Get some squared paper.

Draw a vertical line and a horizontal line to make a co-ordinate plane.

Locate these points in the order given.

Then connect the points to make a picture.

(9,4) (3,4) (10,6) (11,10) (3,5)

(2,5) (1,5) (1,4) (2,4) (3,4)

(10,0) (9,4) (13,3) (12,7) (10,6) (8,4)

Get some squared paper.

Find the starting point by drawing two lines that meet at a right angle.

Find these points in the order given, then join the points to make a picture.

(3,16) (5,18) (6,17) (7,17) (7,18) (6,19) (8,19) (9,18)

(10,17) (11,16) (12,15) (12,11) (11,10) (11,7) (10,6) (9,9)

(9,5) (8,7) (7,6) (6,5) (9,4) (10,3) (10,0) (9,1)

(8,2) (7,3) (6,2) (5,1) (4,0) (4,3) (5,4) (6,5)

(7,6) (6,7) (5,8) (5,9) (4,8) (3,7) (3,10) (2,11)

(2,13) (3,16) (4,15) (5,14) (6,14) (7,15)

Draw two lines that intersect at a right angle on squared paper to make a number plane. Mark the intersection O.

Locate these points in the order given and then connect them to form a picture.

(10,10) (10,9) (11, 8) (10,8) (9,7) (8,7) (14,0) (1,0)

(6,7) (2,2) (6,7) (2,4) (4,7) (2,6) (4,9) (2,8)

(4,11) (2,11) (4,13) (2,13) (4,14) (5,14) (7,13)

(8,12) (9,11) (10,10)

Locate these points on squared paper.

Connect the points in the order given.

What picture have you made?

(10,9) (9,8) (8,7) (7,6) (6,5) (5,4) (4,3)
(3,2) (2,1) (1,0) (5,0) (6,1) (7,2) (8,3)
(9,2) (10,1) (11,0) (15,0) (14,1) (13,2)
(12,3) (11,4) (10,5) (9,6) (8,7) (7,8) (6,9)

Using squared paper, construct a co-ordinate plane by drawing an x-line and y-line.

Connect these points in this order to make a picture.

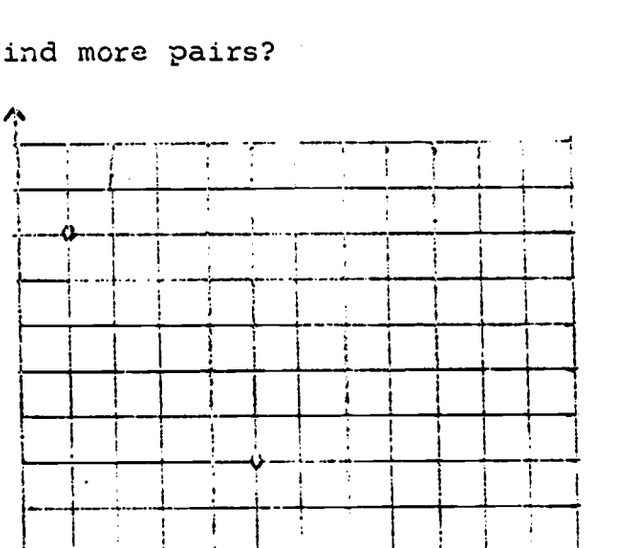
(8,17) (7,16) (6,15) (5,14) (6,14) (5,13) (4,12)
(3,11) (6,11) (5,10) (4,9) (3,8) (2,7) (5,7)
(4,6) (3,5) (2,4) (1,3) (7,3) (7,0) (9,0) (9,3)
(15,3) (14,4) (13,5) (12,6) (11,7) (14,7) (13,8)
(12,9) (11,10) (10,11) (13,11) (12,12) (11,13)
(10,14) (11,14) (10,15) (9,16) (8,17) (8,18)
(9,19) (8,20) (7,19) (8,18)

C-10.1
M-5

This is an open sentence.

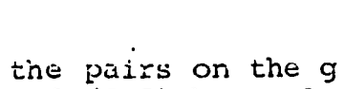
Some whole number pairs (□, △) that make the sentence true are (1, 9) (5, 5).

1. Can you find more pairs?



2. Graph the pairs on the grid above, the pair (1,9) and (5,5) have already been graphed.

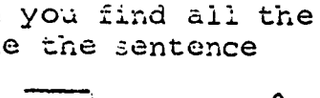
3. Find number pairs that make the sentence



true? Is the number pairs (7,10) one of them?

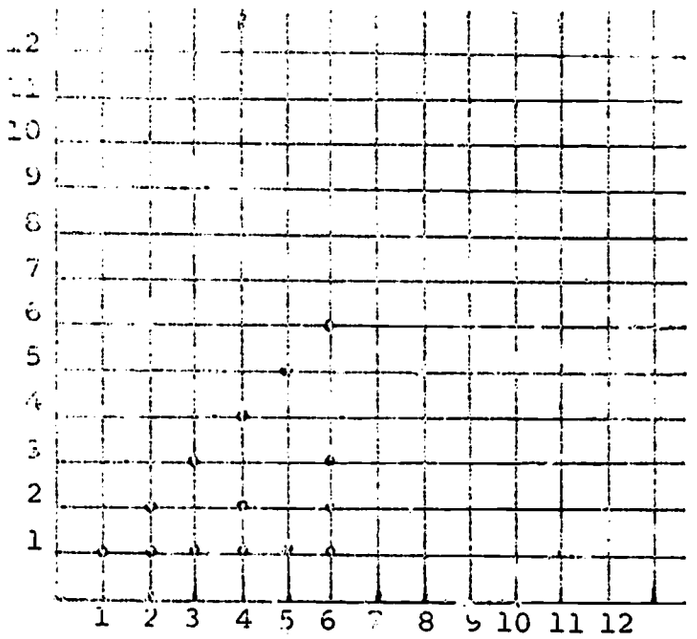
4. Draw a graph of the sentence in question 3.

5. Can you find all the whole number pairs that make the sentence

 - 3 = true?

Graph this sentence.

6-10.7/ You can use a piece of graph paper to show the
M-11 factors of a number.



Note that 1, 2, 3 and 6 are factors of 6 since

1 x 6 = 6 2 x 3 = 6 1 x 2 x 3 = 6

Complete the above 12 x 12 grid for factors of numbers 1 to 12.

RELATIONS AND GRAPHING

G-10-11. The set W = {0, 1, 2, 3, 4, . . .} is called the set of Whole Numbers.

If we choose any two members from this set and add them, the result is also a member of the set.

EXAMPLE:

$$3 + 5 = 8$$

We will now let X represent any member of the set and write a mathematical sentence using the addition rule.

$$X + 1 = Y$$

This sentence says, "to any member of the set W, add 1 and the result is another number Y." Such a sentence is sometimes called a "Relation" because it is a rule for relating two sets of numbers to each other.

a. Will Y always be a member of W? Explain.

b. We will draw a chart to show what values of Y we get when we let X take all possible values in W.

We could begin by choosing any value for X in the sentence.

$$X + 1 = Y$$

For example choose $X = 5$

then $5 + 1 = Y$

and $Y = 6$

Notice that choosing 5 to replace X results in a value of 6 for Y. We will write the pair of numbers 5 and 6 in a bracket and call them an ordered number pair. The ordered number pair in this example is (5,6). We

8-10-11-//cont'd...

will remember that the first number is the one we assigned to X and the second number resulted from the operation rule given by the sentence.

$$X + 1 = Y$$

The operation rule is "Add One"

We will construct the chart to contain the following information.

Complete it to a value of X up to 15.

CHART 1

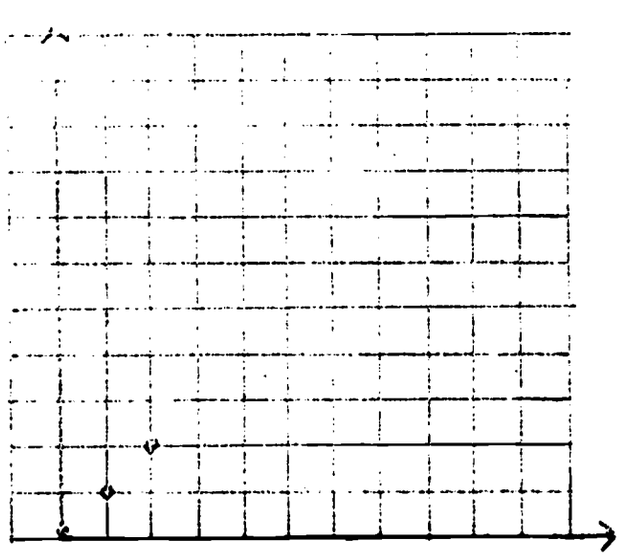
X	X+1	Y	Ordered Number Pairs
0	0+1	1	(0,1)
1	1+1	2	(1,2)
2	2+1	3	(2,3)
3	3+1	4	(3,4)
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
8	8+1	9	(8,9)
.	.	.	.
.	.	.	.

C-10.4
M-5

For the open sentence

$\square \cdot = \triangle$

the number pairs (0,0), (1,1), (2,2) make it true.



Can you find some more points on the graph of

$\square = \triangle$

Can you find points and graph the set

$2 \times \square = \triangle$

1. Tabulate the articles on the work table according to their shapes.

2. Make a graph of your findings.

3. What is the most common shape?

4. What is the least common shape?

Using the scales and measuring device in your school make a record of the heights and weights of the pupils. Make a graph of your findings.

How many graphs did you have to make? Why?

What conclusion can you make as a result of your survey?

---

1. Survey the class to find the time of rising of each child to the nearest hour or half-hour. Tabulate and graph the findings of your survey.

2. Make a similar survey of the students in another class.

3. Compare the two graphs. What are your conclusions?

Survey the class to find the numbers of brothers and sisters each child has.

Make a graph of your findings.

What conclusions can you make from the results?

Choose one of the following to conduct a survey, make a graph, and draw conclusions.

1. Number of absentees on different days of the week.

2. The number of words per line in various books.

3. The number of times an author uses certain words such as "and" or "the" on a page.

4. Your choice.

---

1. Fold a piece of paper to make a straight edge.

2. By folding again make the folded edges come together.

3. Use this to test many things in the classroom to see if they have "square" corners or "right angles".

Make a picture graph to show the following information:

A gas station sold gasoline as listed below.

Friday	600 gallons
Saturday	690 gallons
Sunday	700 gallons
Monday	350 gallons
Tuesday	400 gallons

Now make a bar graph to show the same information.

Make a bar graph to show the following information:

These are scores that George got on six spelling tests.

Test	1	2	3	4	5	6
Score	95	80	90	75	90	95

When you have finished, ask a friend to tell you the information on your graph. See if he gives the same information that you used to make the graph.

GEOMETRY: CIRCUMFERENCE OF A CIRCLE

1. Measure the diameter and the circumference of:

   (a) a bicycle wheel
   (b) a trundle wheel's wheel
   (c) a jar top.

2. Divide the circumference by the diameter.

3. Do you find a pattern? If so, what is the pattern?

4. research: Find out more about the diameter and the circumference of a circle by using the research method.

   Suggested index titles:

Circle	Circumference
Diameter	Pi

   In your notebook, etc.

Make a graph from the following information.

These are the number of car accidents per month in Greensville.

March	7	February	6
August	6	May	2
December	12	November	14
April	4	January	8
September	8	July	5
June	3	October	7

Newspaper

Get a copy of the newspaper.
Look at the T.V. section.

Compare the number of cartoons, movies and news reports (or news programs) that are listed.

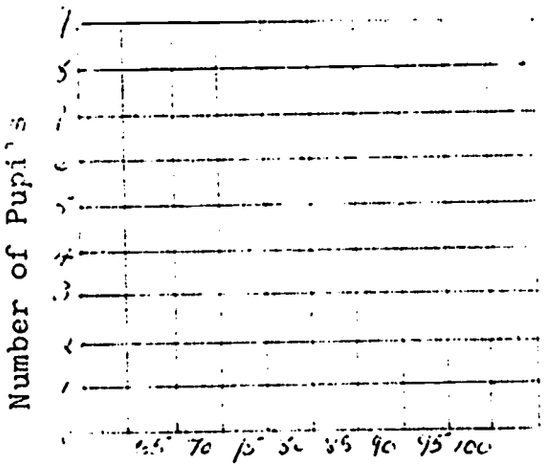
Show your results on a graph.

What conclusions can you make?

Newspaper

Get a copy of the newspaper.
Look at the obituaries.
Make a graph to show the number of men, women and children (infants to 18 years) who died.

On Friday, the fourth year pupils had a math test. These are their results. Make a graph like this one and title it Math Test Scores.



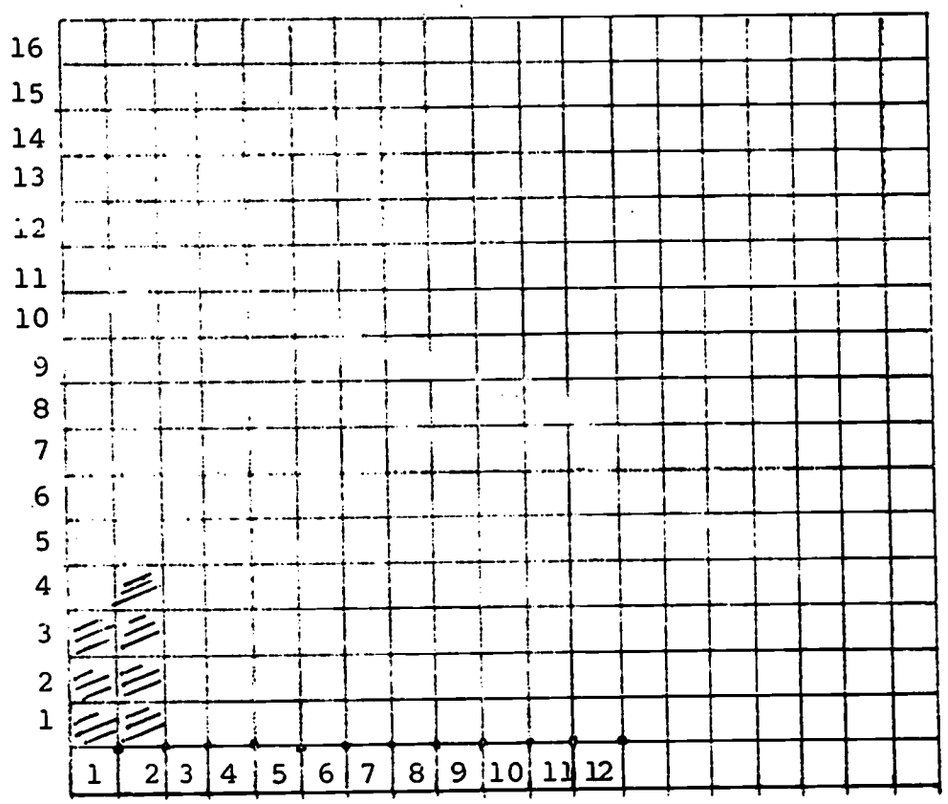
Scores			
95	75	90	70
75	80	75	75
85	70	80	85
85	85	90	90
90	90	95	80
100	100	65	95
85	85	90	70

How would this graph look on a geo-board?

Symmetry

Using a line of symmetry draw a moon crescent, a heart and a diamond. Use scissors to cut out the complete figures.

G-12.3



In a class of 40 pupils the following data was collected regarding the number of months until the next birthday. Assume that a pupil born in this month has zero month until his next birthday, unless he has had his birthday in this month, then it will be 12 months till his next birthday.

Number of months till next birthday.	0	1	2	3	4	5	6	7	8	9	10	11	12
Number of students.	3	4	2	7	5	3	4	1	4	1	3	0	3

Can you prepare such a table for your class and graph it as done above.

What is an angle?

G-13./

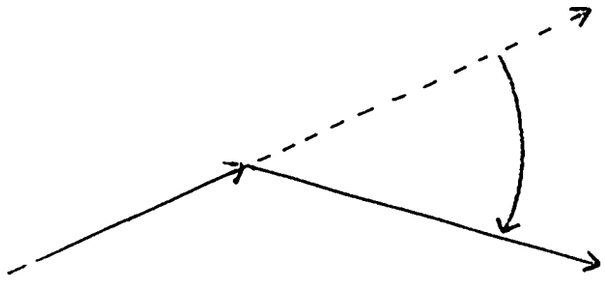
When we move from one point to another along a straight line, we move through a distance. Distance is measured in some familiar unit such as the inch, foot, yard, mile or some other unit.

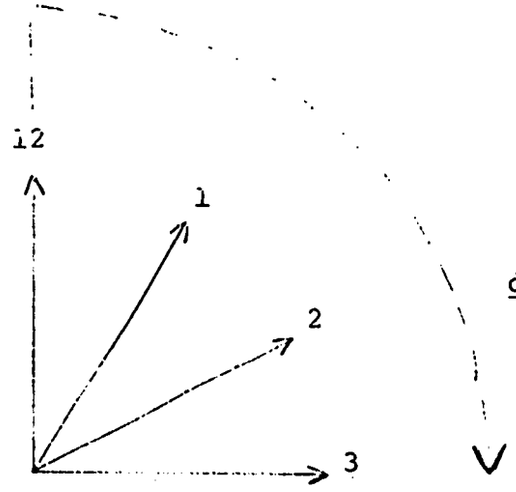
In addition to measuring distance or length, it is sometimes necessary to measure an amount of turning. For example, an airplane may fly in a certain direction and then turn to fly another direction.

The word distance is used when we talk about travelling in a straight line.

The word angle is used when we talk about turning to move from one direction to another direction.

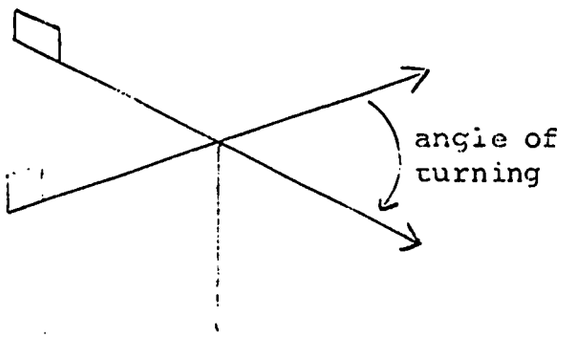
Examples to demonstrate angles of turning or rotation



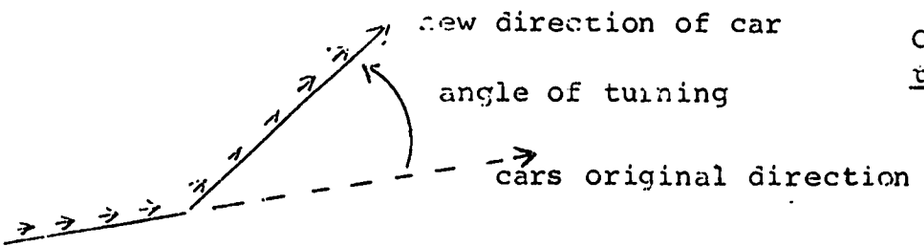


direction of clock hand turning

Cont'd...
G-13./

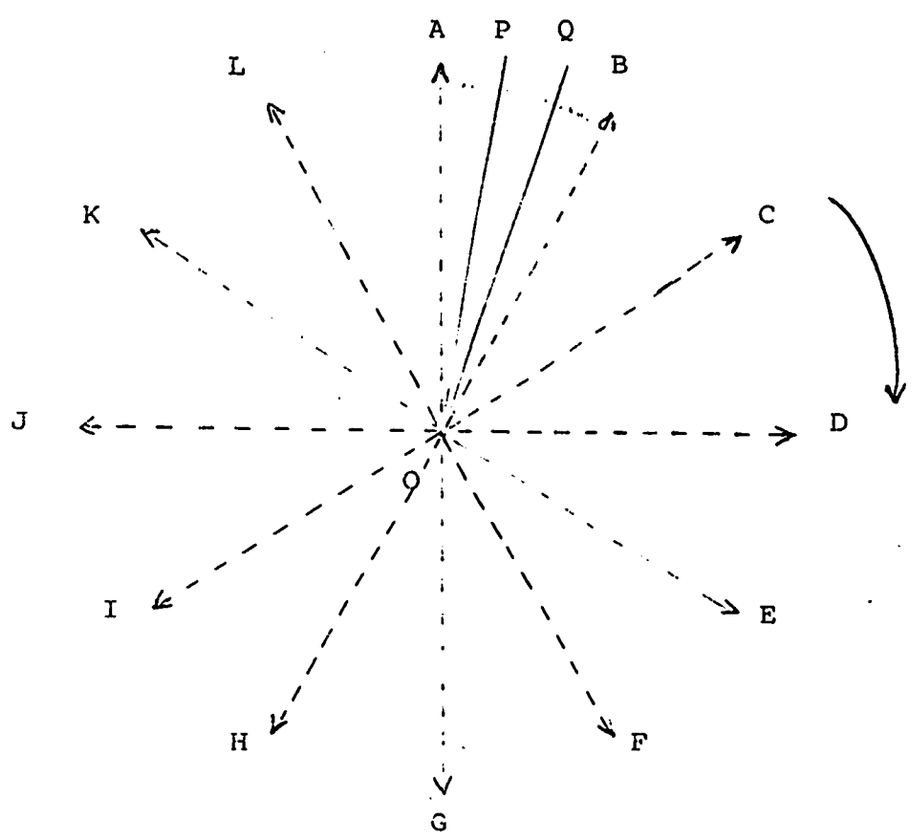


Wind Vane turning



Car turning at the crossroads

When the minute hand of the clock has moved for one hour, it has turned through one complete rotation.



direction in which hand is turning

DIAGRAM I

Cont'd...
G-13./

(i) In diagram I, when the hand moves from point A to point D, it has moved through <u>One quarter</u> of a rotation.

(ii) Where will the hand stop when it has moved through one half of a rotation?

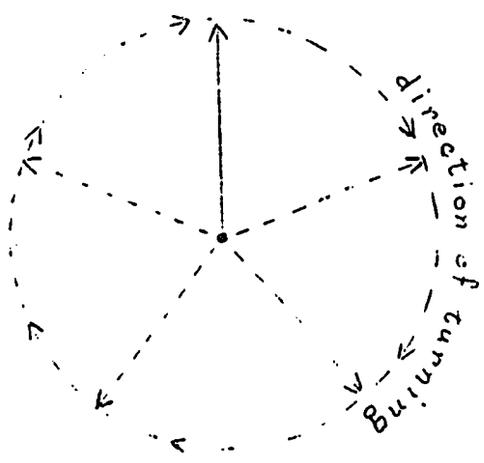
(iii) How long does it take the hand to move through three quarters of a rotation?

(iv) How long does it take the hour hand to move through one half of a rotation?

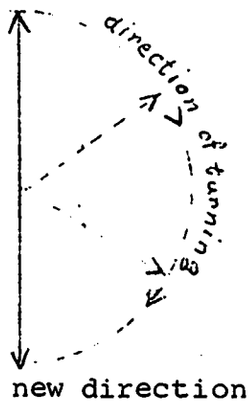
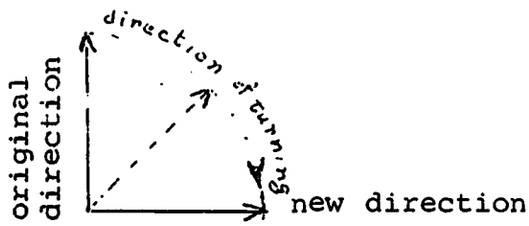
(v) Draw a picture to show the position of the hour hand at noon and:

1. Three hours later.
2. Six hours later.
3. Nine hours later.
4. Twelve hours later.

Units to measure angles.

Name of angle	diagram
(i) complete rotation	

Cont'd...
C-13//

Name of angle	diagram
(ii) One half rotation or straight angle	
(iii) One quarter rotation or right angle	

It is not very convenient to use only the units "complete rotation", "one half rotation", "one quarter rotation", etc. A unit has been chosen which is more convenient it is called the degree.

You know that in linear measurement we have the yard as a unit of measurement. The yard is divided into 36 equal parts. Each division is called an inch.

1 yard = 36 inches

In angle measurement the complete rotation is unit of measurement. The complete rotation is divided into 360 equal parts, each of these is called a degree.

1 rotation = 360 degrees

In diagram I a complete rotation has been divided into 12 equal angles. The centre of rotation is labelled with the letter O.

Since of the amount of turning from A to B is $\frac{1}{12}$ of a complete rotation.

Angle AOB = (360 ÷ 12) degrees

= 30 degrees

In naming an angle the turning point (Vertex) of the angle is always included and is always the centre letter. Complete the following table:

Name of angle	Measure in degrees
AOB	30
AOC	____
COH	____
AOD	____
IOH	____
DOJ	____
EOH	____
DOI	____

Look at diagram I again you will notice that the angle AOB has been divided into three equal parts. These angles are

Angle AOP
Angle POQ
Angle QOB

What is the measure of degree of each of these angles?

Each of angles AOP, POQ, and QOB, have been divided into ten equal parts. What is the measure of each of these small angles?

Measuring Angles

G-13.1

The instrument used to measure distance in usually a straight rod of some sort (yard stick) since distance is usually measured in a straight line.

For measuring amount of turning, a circular measuring instrument could be made. Such instruments are used and are called protractors. Obtain a protractor and discover how you can use it to measure angles. Can you construct a protractor of your own?

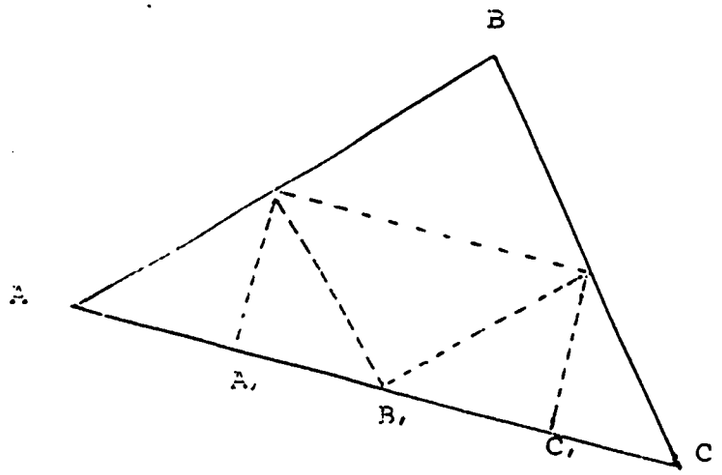
Draw models of 15 angles.

Make 5 right angles. See if you can make them all different in some way.

Make 5 angles smaller than right angles. Make them all different.

Make 5 angles larger than right angles that are all different.

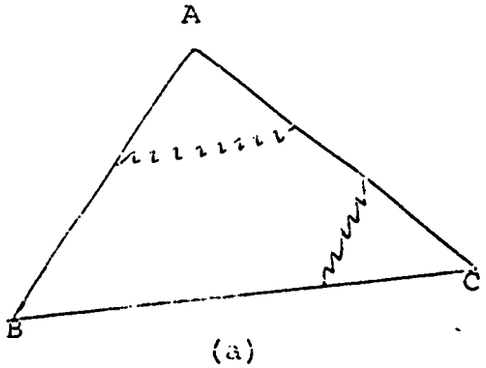
G-13.4/



1. In triangle A B C fold vertex (point) B to B, A to A, and C to C.

   What can you conclude about the angles at A, B and C.

2. Make another triangle and cut of the vertices (points) and fit them together as shown on diagram (b).



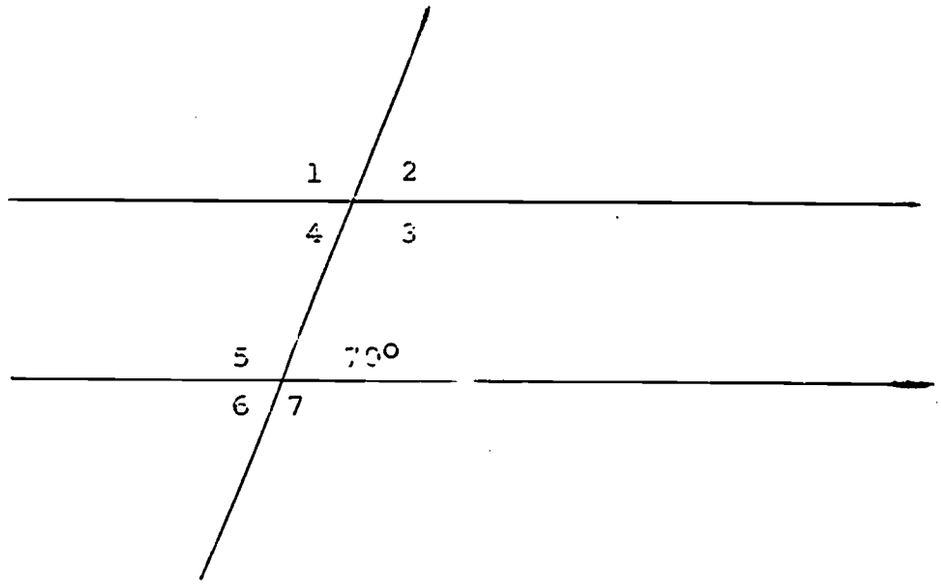
(a)

(b)

What did you discover?

3. Try the same for a four sided shape.

G-13.5



One angle is given. Without measuring can you give the measure of the other seven angles?

Angle 1 = _____ degrees

2 = _____ degrees

3 = _____ degrees

4 = _____ degrees

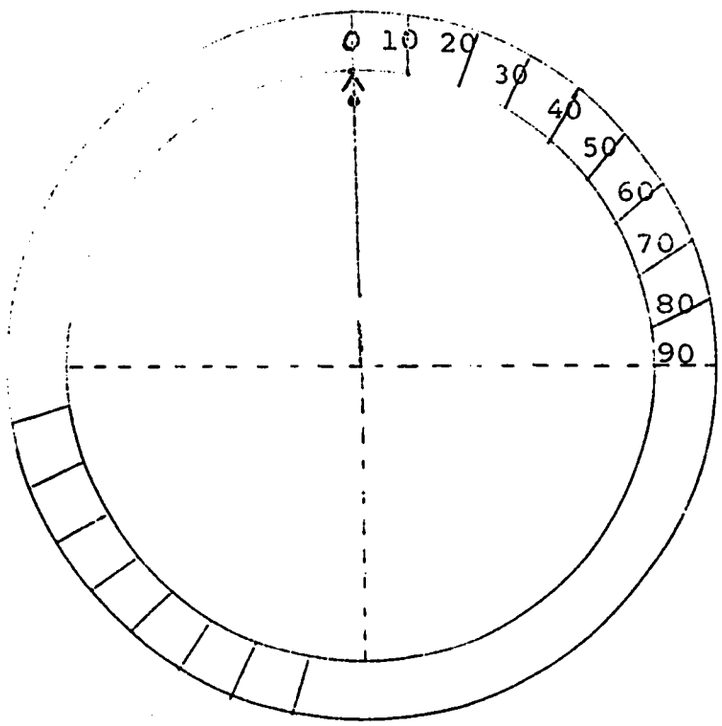
5 = _____ degrees

6 = _____ degrees

7 = _____ degrees

G-13.6

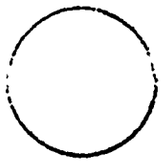
Making an instrument for measuring angles.



Cut out a bristol board circular disc with a diameter of 5 inches and draw a radius line from the centre of the disc to about ½ inch from the edge. Draw an inner circle as shown above.

Complete the above diagram showing division of 10 around the face of the circle.

1. Find objects or solids with faces shaped like this drawing.

2.  Now, using this drawing, repeat #1.

Measure the diameter and circumference of a set of food cans of various sizes and construct the following record of your measurements.

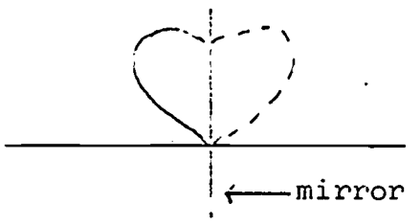
Can	Diameter	Circumference	Circumference ÷ Diameter
1			
2			
3			
4			
5			

Write a brief paragraph on the relationship you have discovered.

G-15-a/

Activities in Symmetry

Mirrors and Images

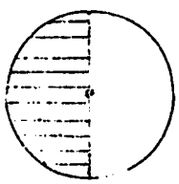


---1

The figure on the above diagram which lies to the left of the mirror is reflected in the mirror as shown by the broken line.

Many shapes can be drawn such that one half of it is a mirror image of the other half. Try some of the following experiments.

1. Draw a circle and cut out the circular region, fold it over so that the crease passes through the centre

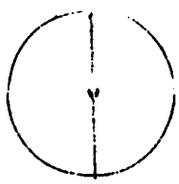


---2

Is the shaded half of the circular disc in the diagram a mirror image of the other half? Use a mirror to test your conclusions.

G-15-b

2. A circle is shown in the diagram below



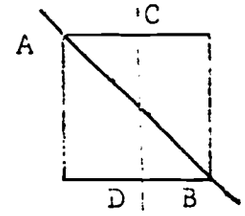
---3

The line drawn through the centre is the position a mirror could be placed to reflect half of the circle in the mirror. Such a line is called a line of symmetry.

G-15./ cont'd...

How many lines of symmetry does a circle have?

3.

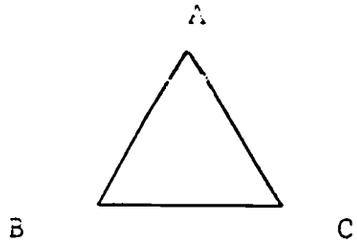


---4

a) In diagram 4 two lines of symmetry have been drawn. Use a mirror to check whether the part of the square and its reflection form a square.

b) How many more lines of symmetry can you find in diagram 4?

G-15-C



---5

4. Diagram 5 is a picture of an equilateral triangle.

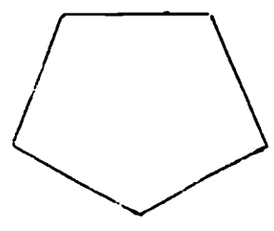
a) Check in your mathematics resource books what an equilateral triangle is.

b) Measure line segments AB, BC and CA, what can you conclude.

c) How many lines of symmetry does an equilateral triangle have? Use a mirror to check your work.

5. Draw a rectangle and find out how many lines of symmetry it has.

6.



---6

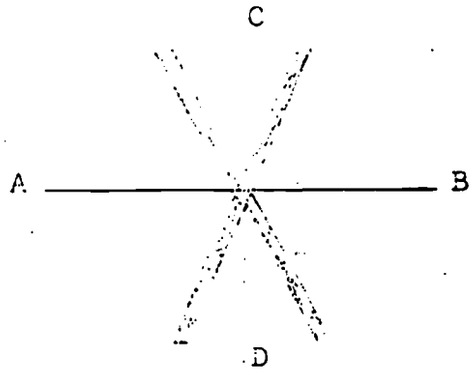
Diagram 6 is a picture of a pentagon. How many lines of symmetry does this shape have?

7.

---7

Diagram 7 is a picture of the letter H. If the paper were folded along the line of the vertical arrow would the two halfs of the letter H match?

Can you find another line of symmetry? How many does the letter have?



---8

The letter X has two axes of symmetry AB and CD.

AB is called an axis of horizontal symmetry.
CD is called an axis of vertical symmetry.

a) Print out the set of all letters of the alphabet.
b) Find the letters of the alphabet which have a vertical axis of symmetry.
c) Find the members of the set of letters of the alphabet which have a horizontal axis of symmetry.
d) Find those which have both horizontal and vertical axis of symmetry.
e) Find examples in architecture and nature which are examples of symmetric shapes.

G-15./ cont'd...

8. f)

Examples: leaves, flowers, sea shells

Are the shapes shown symmetric? Draw the line(s) of symmetry for each shape which is symmetric.

(i)

(ii)

(iii)

(iv)

Symmetry

Using a line of symmetry draw a moon crescent, a heart and a diamond. Use scissors to cut out the complete figures.

Symmetry

1. Fold a piece of paper in half.

2. Tear a shape leaving some of the fold of the peper connected.

3. Open your shape. What do you notice?

4. Fold a square piece of paper twice so that you have a smaller square.

5. Cut a shape leaving some of both folds connected.

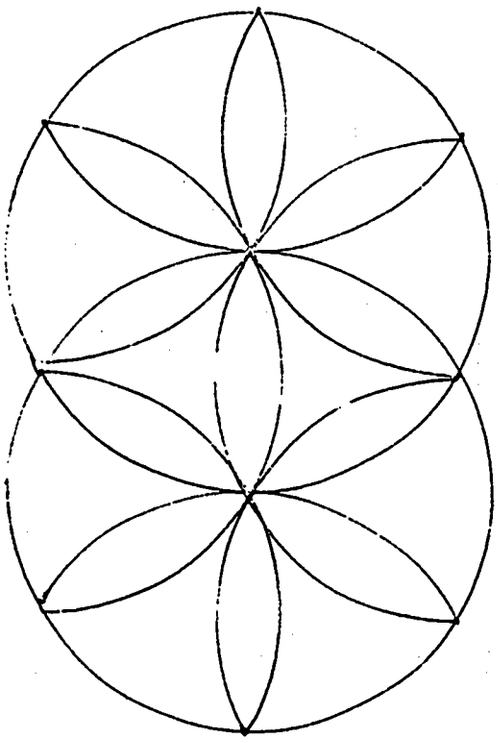
6. Open the shape. What do you notice about the shape? Test to see if you are correct.

Symmetry

Using the capital letters of the alphabet, name the letters which have a line of symmetry and determine how many each letter has.

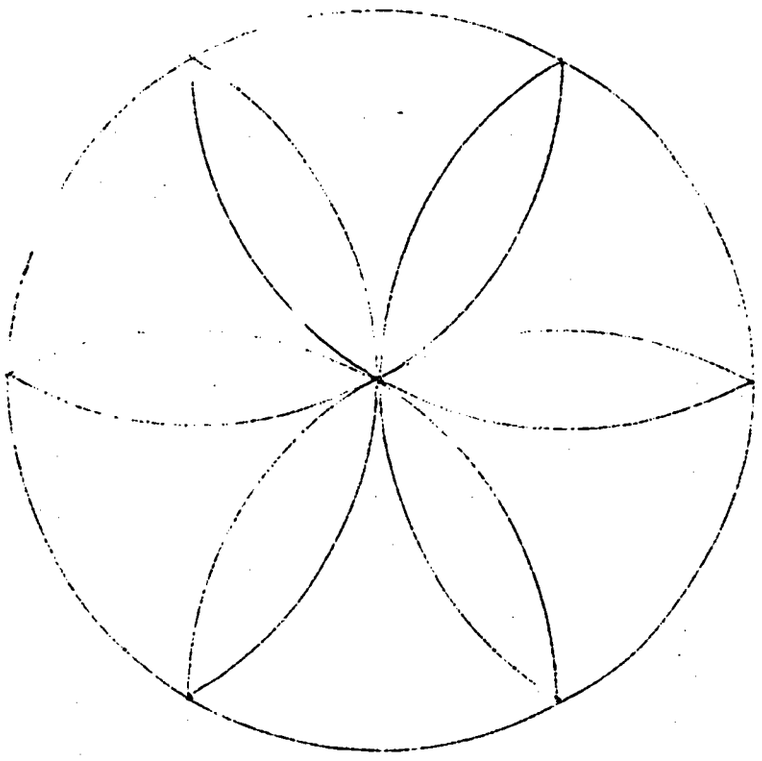
There should be 12 with just one line of symmetry, three with two lines of symmetry and one with many lines of symmetry.

G-16./



Using a pair of compasses construct this pattern.

G-16.4



Use a pair of compasses to construct this pattern.