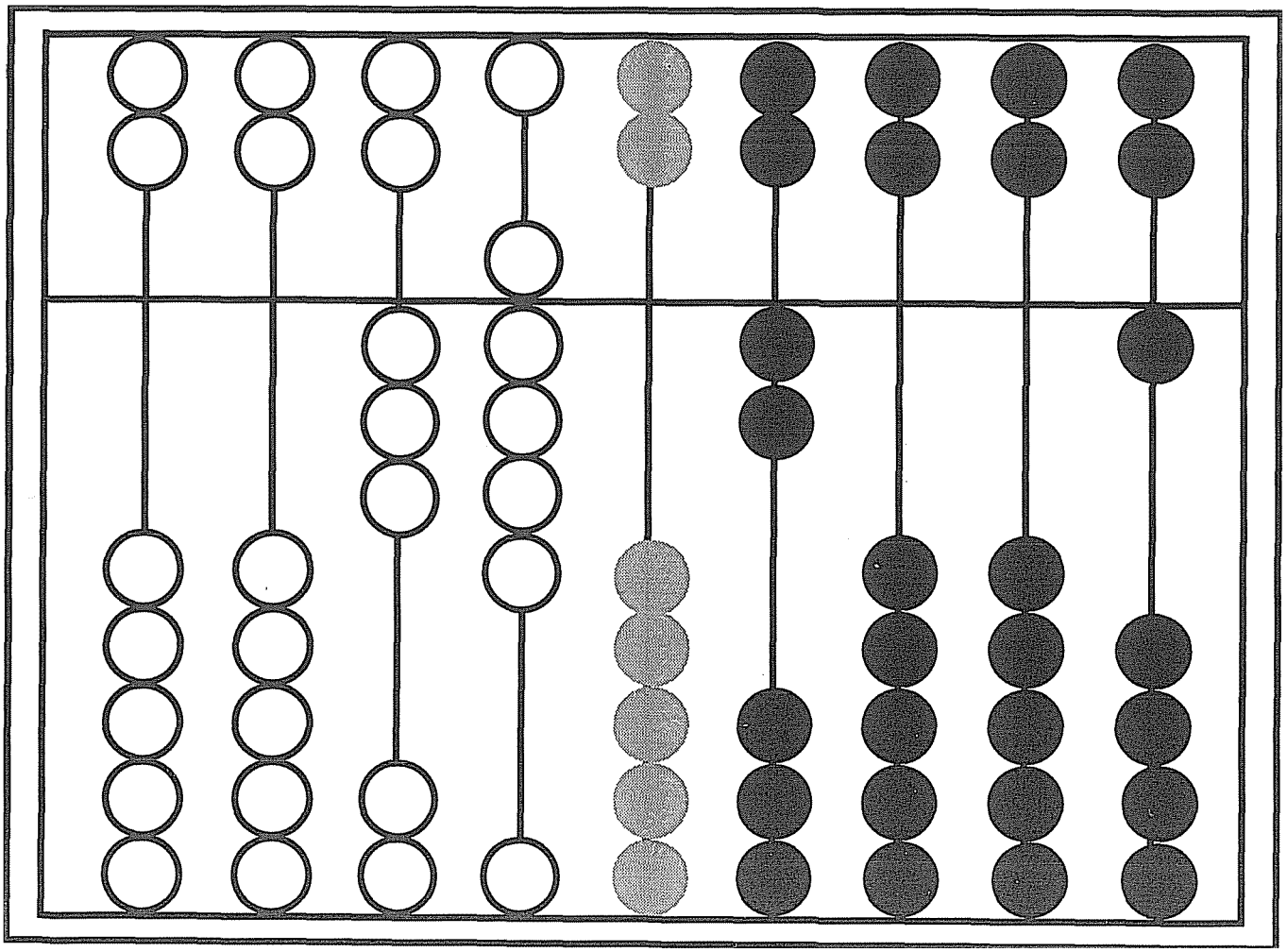
Abacus

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▲ From the Editor's Desk

In February 2001, the Ontario Association for Mathematics Education and the Ontario Mathematics Coordinators Association with financial assistance from NCTM released a new document *'Linking Assessment and Instruction in Mathematics'*. A big thank you to the team of writers who put this fine document together. With permission, I am providing a taste of what is in this document with **Cubey DoobeyDoo Activity One**. For more background information, blackline masters, and assessment rubrics, I refer you to the document. The document ties each activity to the Ontario curriculum and provides lots of information for both students and teachers in assessment and evaluation.

Joanne Harris, a grade 8 mathematics teacher at Centennial Middle School in Georgetown, provides us with another great geometry idea called **Line Design**.

Food, Fun and Fractions by **Marie-Claire Gagné**, St. Clement's School, Toronto describes an interesting way to capture student's interest in fractions via food activities.

Thank you Joanne and Marie-Claire for your thought-provoking ideas for the classroom.

Have you an idea or activity that has worked well in your classroom lately? If so, please send it to me for *Abacus* consideration and I will help you make it ready for publishing in this section of the OAME *Gazette*.

Frances Schatz

▲ Teacher Notes: Cubey Doobey Doo Activity One

Overview: This activity has been designed for students in the latter part of grade 7 and grade 8. Students will develop and apply their understandings of algebraic modeling, algebraic equations, edge length, surface area, volume, and representations of three dimensional objects as they analyze and create cube shape patterns.

Materials: Approximately 30 linking cubes per student; A supply of isometric and square grid dot paper; Pencils, rulers, scissors and glue sticks.

Time: About one forty-minute period.

Explanation: One cube is the basic unit of measure in a cube construction. Edge length refers to the outward and inner edges of the surface of a construction. One cube has volume 1 cubic unit, has surface area 6 square units, and has edge length 12 linear units.

Answer Key

1.

n	VOLUME "V"		n	SURFACE AREA "A"		n	EDGE LENGTH "E"
1	3		1	14		1	20
		> +3			> +8		> +4
2	6		2	22		2	24
		> +3			> +8		> +4
3	9		3	30		3	28
		> +3			> +8		> +4
4	12		4	38		4	32
		> +3			> +8		> +4
5	15		5	46		5	36

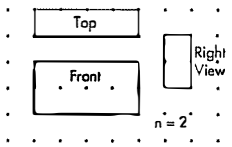
3. V = 3n | A = 8n + 6 | E = 4n + 16

4. 126

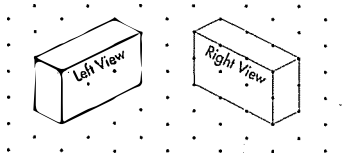
5. 24

6. 4n+16 = 67 , n is not a whole number so E = 67 is not possible.

7.



8.



9. Various answers possible.

▲ Teacher Notes Line Design by Joanne Harris

Excerpts from *Linking Assessment and Instruction in Mathematics in the Middle Years,* pages 64-72.

Line design exercises can be used to reinforce habits of mind and to provide opportunities to use mathematical vocabulary while completing a hands-on task. This fun activity is ideal for snow days, for ski trip days, when there is a half class present, or for the two or three days prior to a holiday period when a change of pace is needed.

A few simple steps will get most students started. Students from grade 4 up can create successful and effective line designs. The student needs to be able to use a ruler (straight edge) to accurately make a series of lines in specific locations. The effect is not achieved if the work is not accurate. For that reason I would not introduce this activity to very young students.

One expectation that is addressed by line design is using mathematical language to describe geometric ideas. Mathematical vocabulary that could be used while constructing a line design figure includes line segment, point, vertex, arms or sides of an angle, right, acute, or reflex angles, polygon, triangle, square, pentagon, circle, reflection, rotation, symmetry, circumference, and perimeter. Expectations regarding some patterning could also be addressed depending on how the activity is structured.

The mathematical manipulatives required are a ruler (straight edge), a compass, a protractor, and a sharp pencil.

There are a number of extensions that can be created for line design. Sometimes students can learn the basics in Mathematics class and then create a more significant design in their Art class.

When the line design activity moves beyond paper and pencil and uses thread or yarn it is referred to as symmography. The design is created on paper and then holes are punched in bristle board or in cardboard that correspond with the points on the arms of the angle. Thread or yarn is used instead of the pencil to create the line that joins the two points. The thread or yard can be secured on the back of the work with tape so that it doesn't come out of the holes that have been punched. Construction paper is difficult to use for this activity as it can tear easily if students pull on their thread or yarn.

Another extension for these designs that produces an interesting result is to create the line design and then to colour in the shapes formed in a checker board design. This is effective done in black and white and can be done with several colours but care needs to be paid to developing a pattern with the colours.

Geometers Sketchpad™ software can also be used to create effective line designs.

The basic principles used to create a line design on an angle or using a circle or polygon can be used to create a line design on a totally random enclosed shape. The shape is drawn. Points are marked evenly around the perimeter of the shape and then the points are joined. Some experimenting will need to be done to decide what pattern will be most effective when joining the points.

The final product created can be assessed based on the accuracy of the work, the visual impact of the final product and on the completion of a student reflection sheet. Some suggested criteria for accuracy, neatness, points evenly spaced, straight edge (ruler) used consistently, pattern is maintained throughout the design (no points missed). Suggested criteria for visual impact: sharp pencil, no smudged lines, the design coloured neatly and within the lines, and the appropriate spaces coloured in (in other words was a patterned created by the colouring?). Suggested starters for the reflection sheet

I wish I had been told more about....

I could have improved on the assignment by....

Next time I would....

What mathematical/artistic problems did I encounter?

References

Line Designs Grade 5 and Up Seymour, Silvey, and Snider 1994, Ideal School Supply Company, ISBN 1-56454-081-6

http://www.montessoriworld.org/Handwork/stitch/stitch1.html

▲ Teacher Notes
Food, Fun and Fractions By Marie-Claire Gagné

"Hey, I think I like math class."

*"I like **this** math class."*

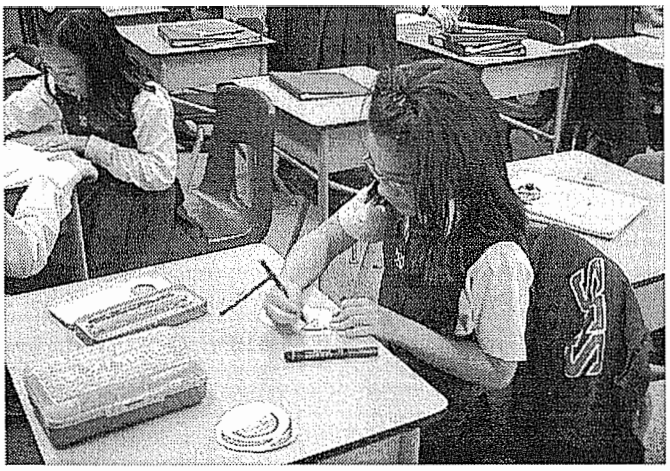
When I overheard this recently in my grade 6 math class I knew that I must have been doing something right that day. These students were the ones who usually grumbled during math class and cringed even at the mention of math. But today, there they were actively involved and enjoying themselves.

The activity that had given them this new found enthusiasm was the Gr. 6 Fraction Lunch. Earlier in the week I had announced that we would be having a lunch to celebrate fractions (grumble, grumble), and that each student would be responsible for preparing food and activities related to fractions (more grumbling). Fortunately, the grumbling didn't last long.

Our lunch guest list included school administrators, special subject teachers and older students who are a part of our class. Once the invitations were sent out, the real work began.

The day before the lunch the class was divided into four activity groups and given the task of creating a game related to fractions that the guests and the rest of the class could play when they were finished eating. This is where the fraction fun began. The groups were very creative and got to their tasks enthusiastically.

One group decided on "Fraction Twister". They created a spinner wheel with fractions written on it and pictures representing fractions that could be taped to the floor. When the wheel was spun the players would have to put their hand or foot on a picture that represented the required fraction. Along with testing flexibility, this game challenged them to recognize fractions visually and offered repeated practice.

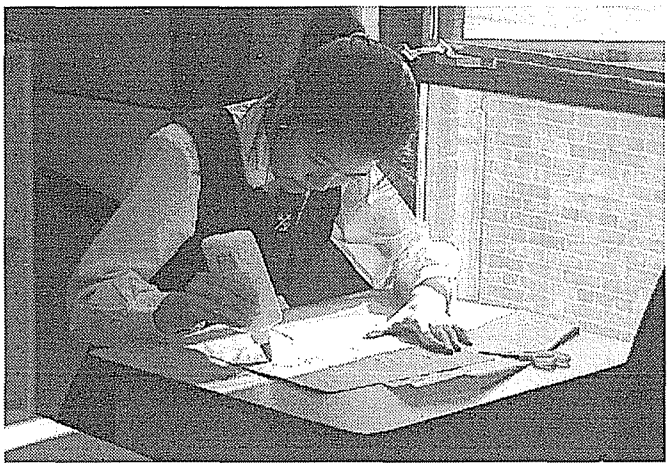


Another group thought that "Fraction Limbo" would be fun. Everyone started out a certain height that was designated as "1". If they made it under successfully they would try ⅞ of that height, then ¾ and moving down from there. The person who made it under the smallest fraction height was declared the winner. One brave and acrobatic student made it under ¼ of the original height. As students tried to test their physical limits, they were also given a new visual perspective on how different fractions related to each other in size.

The third group invented "Musical Fractions". They made a four by two grid of large squares on the floor, outlined with masking tape. In each square was written a fraction in lowest terms. A group of students would stand in the grid and move casually around to the sounds of *N'Sync* and *Britney Spears*. When the music stopped the group running the game would call out an unreduced fraction. The players had to reduce the fraction in their heads, find the equivalent fraction on the floor and move to that square. The last student to make it to the square was out and the game continued until only one player remained. This game challenged both the players and the organizers to mentally manipulate fractions quickly and accurately.

The fourth group decided that they were more artistically inclined and asked if they could decorate the classroom with pictures and words related to fractions. One of their creations was a flip animation of a pie being eaten. The remaining pie was reduced by half each time the card flipped, creating some interesting fractions and a discussion on when the pie would really be gone.

Their responsibilities for the next day were to bring in a sandwich cut into thirds and one and half pieces of fruit each. I supplied pies for the lunch and asked them to describe and illustrate how they would divide up four pies for twenty-five people to ensure that the



division was fair. This would be handed-in in class the next morning.

The lunch the next day was a great success. We found many creative ways to cut a sandwich into thirds and there was lots of delicious fruit to be shared. The students really enjoyed playing each other's games and were proud to describe their games to the teachers and older students who visited. For homework that night they answered the following questions in their journals: Why do you think we had a fraction lunch? What part of it did you enjoy most? What did you learn?

It was in the homework assignments that the real value of the activity was shown. Their solutions to the dividing pies problem allowed me to assess the depth of their understanding of the application of fractions to real problems. Their solutions varied significantly in complexity. Many struggled with having left over pie and trying to decide if that was fair. Some students divided each pie into twenty-five pieces and would give each person a small piece from each pie. This solution shows a good understanding of the meaning of the fractions but in the case of pie would be an impractical one. One student took the total number of degrees present in four circles and divided this number by twenty-five to see how many degrees each person should get. This solution was very accurate and lead to an extremely fair distribution of pieces.

In their journals the students responded that they had never thought that fractions could actually be fun. Some said that they had learned how to convert fractions much faster because they wanted to do well at the games. Others said that the highlight was learning strategies from some of the stronger math students because they were working together to create and run the games. They were also very proud of themselves for showing leadership and creativity in their games and activities. In their own words:

"I [learned] that if you're creative, you can use fractions for anything." ~ Alisa

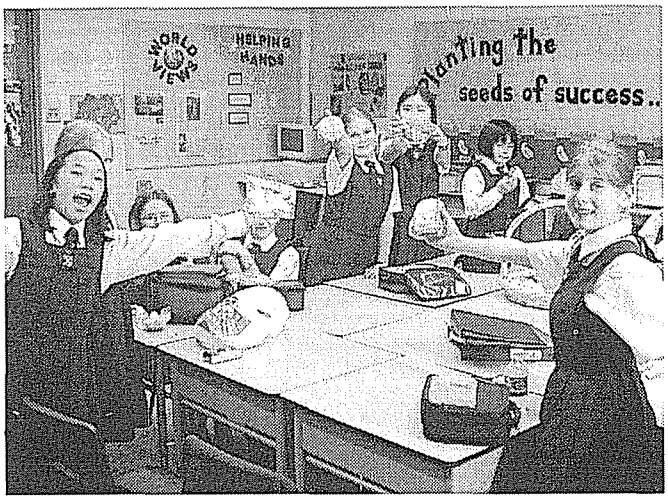
"I liked running an activity the best [and] I especially like it when people said that they enjoyed our activities. I also learned that you should always use a compass to draw pies!" ~ Madison

"I learned the math (yucky!) can be fun if you use games." ~ Sarah

"I think that we had a fraction lunch to learn about fractions in a fun way, not just taking notes and answering questions. By making fractions interesting it was easier to understand [them]." ~ Kelcie

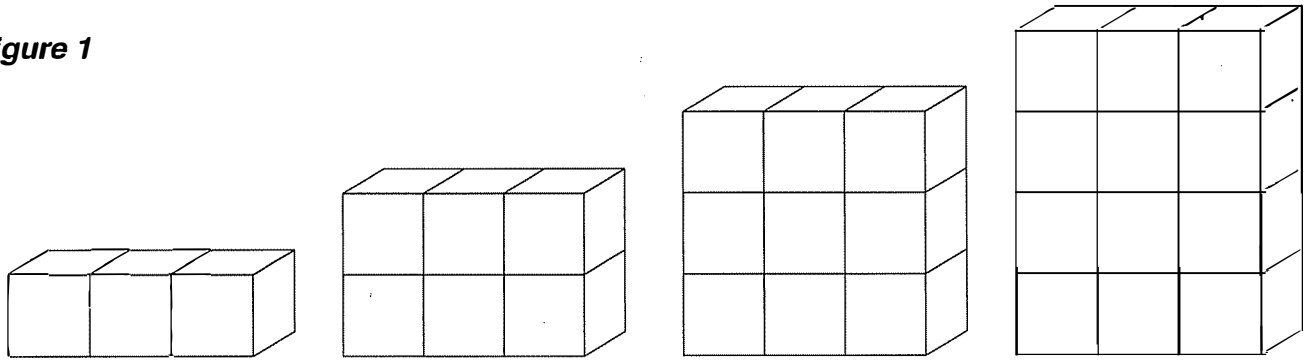
"I learned from Kelcie because she was doing the fraction twister and she helped me with putting my hand on the correct fraction." ~ Heather

We continued the rest of our fraction unit with a food theme but it was the fraction lunch that got the students interested. They were given a reason to want to understand fractions and use them in completely different ways. It also showed them that fractions were not just present in math textbooks and they could be applied to almost any situation. One student told me that she made up some similar games to play with her younger brother who was learning fractions for the first time. What a great learning experience!



▲ CUBEY DOOBEY DOO ACTIVITY I

Figure 1



n = 1 **n = 2** **n = 3** **n = 4**

1. Copy and complete the following tables for the shapes shown in Figure 1. Continue the number sequences on the table where needed.

Table 1

VOLUME "V"	
n	V
1	
2	
3	
4	
5	

SURFACE AREA "A"	
n	A
1	
2	
3	
4	
5	

EDGE LENGTH "E"	
n	E
1	
2	
3	
4	
5	

2. Describe, in words, each of the number patterns for V, A, and E.
3. Write equations to express V, A, and E in terms of n. Write an explanation for each of your equations.
4. If **n** = 15, how would you find the surface area A for this object?
5. If the volume is 72 cubic units, explain how you would find n?
6. Is an edge length of 67 units possible in this pattern? Explain why or why not?
7. Use the Orthographic dot paper to draw the front, top, and right side views for **n** = 2.
8. Use the Isometric dot paper to draw the left and right views of the object for **n** = 2.
9. Draw the net for the object with figure number **n** = 2 and then use it to build the object. Hint: Include flaps for gluing your object.

▲ Line Design Activity

A. Basic Right Angle
(evenly spaced points)

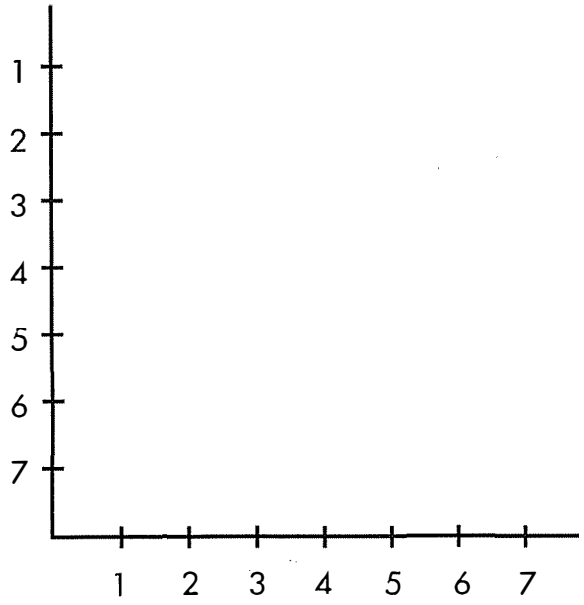
1. Construct a right angle, mark a series of evenly spaced points on each arm of the angle.
2. Letter or number the points so that the numbers increase as they move towards the vertex on one arm and decrease as they move toward the vertex on the other arm of the angle. Do not number or letter the vertex.
3. Construct a line segment to join the same numbers or letters. (Eg. 1 to 1, 2 to 2 etc. or A to A, B to B etc)

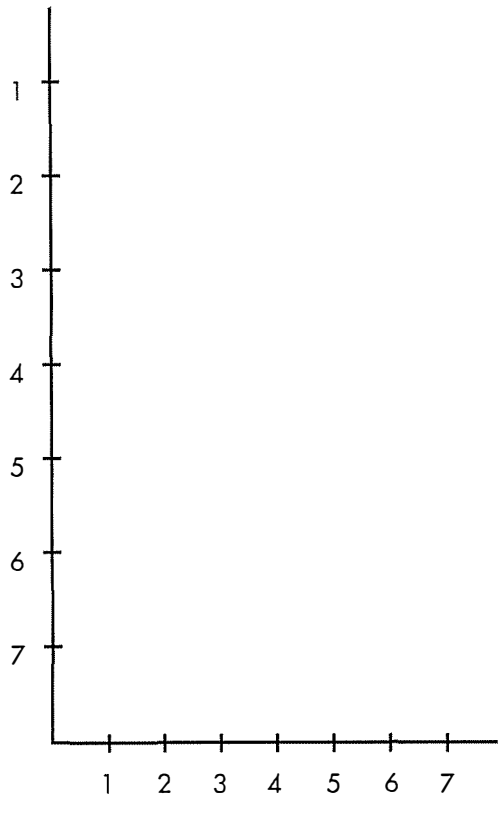
B. Basic Right Angle
(unevenly spaced points)

1. Construct right angle, mark points on one arm of the angle that are 1 cm apart and on the other that are .5 cm apart.
2. Number or letter the points in the same manner as the basic diagram.
3. Construct a line segment to join the same letters or numbers.

C. Basic Acute or Reflex Angle
(evenly spaced points)

1. Repeat the procedure using an acute or a reflex angle.



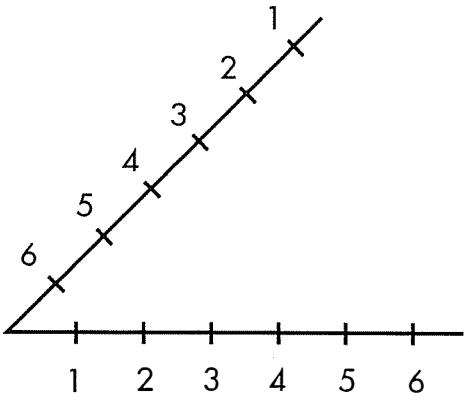


D. Basic Intersecting Lines
(evenly spaced points)

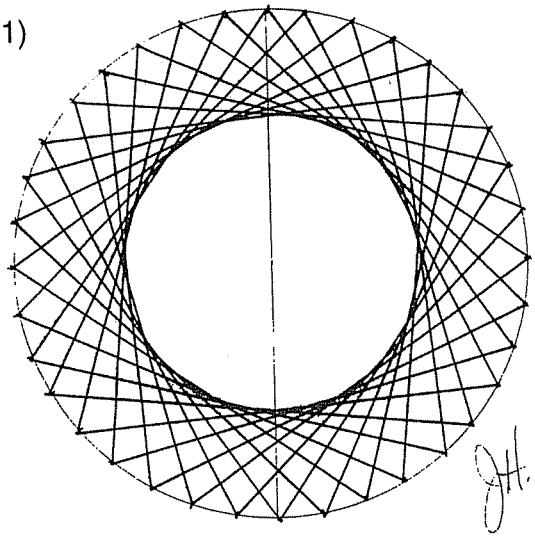
1. Draw two intersecting lines. They may be drawn so that four right angles are created or so that two acute angles and two reflex angles are created.
2. Label the lines as if they were four angles that meet at one vertex.
3. Construct line segments to connect the matching numbers or letters.

E. Basic Circle (evenly spaced points)

1. Use a compass to construct a circle.
2. Use a protractor to mark points at even intervals around the circumference of the circle eg. Every 100.
3. Number the points created and experiment with ways to join the points. Eg. Join every 10th point 1 to 11, 2 to 12, 3 to 13. Another way is to join every single point on the circumference of the circle to every other point.

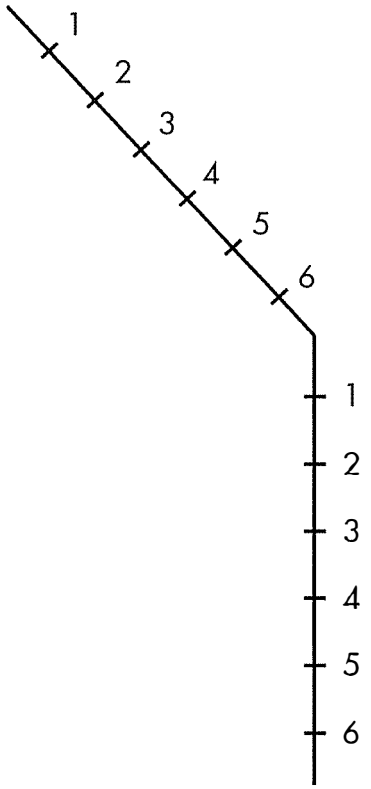


(1)



F. Basic Polygon (evenly spaced points)

1. Construct the basic figure such as a triangle, a square, or a pentagon.
2. Mark the sides of the figure with evenly spaced points.
3. Experiment with ways to join the points. Eg one point to every other point, or every fourth point 1 to 5, 2 to 6, 3 to 7 etc.



(2)

