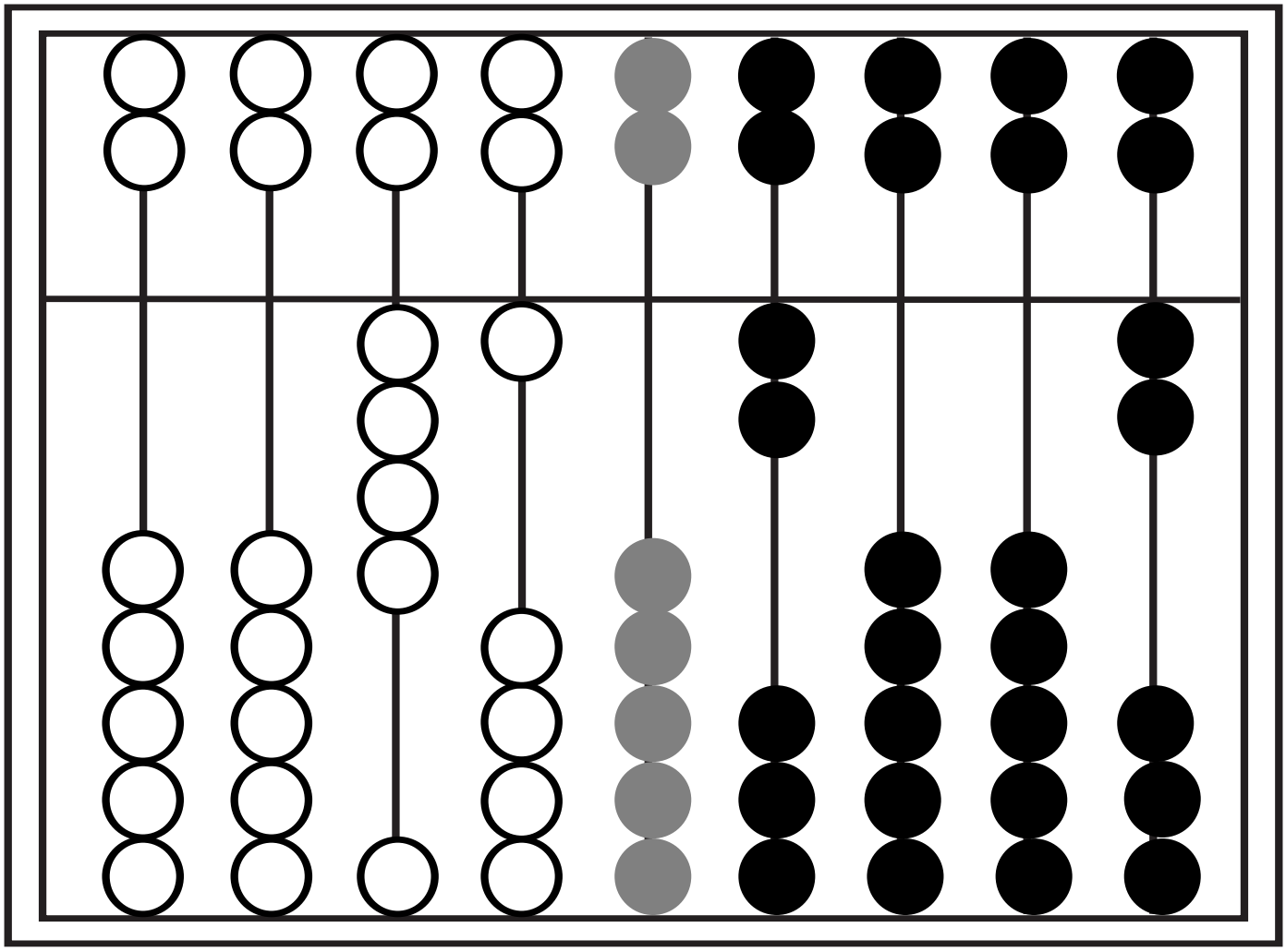
Abacus

Volume 41 2002



ONTARIO ASSOCIATION FOR MATHEMATICS EDUCATORS

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Edited by Frances Schatz

▲ From the Editor's Desk

We live, teach, and learn in a technologically rich information age. There are so many print and electronic resources at our fingertips but no one has found a way to make more hours available in a day to do the research. *Abacus* brings activities that are ready to use in your K-8 classes. I thank all of the contributors for this issue.

Dr. Jim Haines, a professor in the Faculty of Education at Lakehead University, Thunder Bay, Ontario sent his "Mathematics in the Pool". The teacher notes relate the activity to the curriculum strands and give an assessment rubric that can be used with the activity. The activity pages provide the shapes and questions for the students to consider. (Teachers: please note that the shapes need to be enlarged for student use. Each shape uses a full page on the original submission.)

In the September 2002 issue, Mathman's Manipulative Kit was mentioned. In the past two years, this kit has visited over fifty elementary and secondary classrooms. Forty members of SAME, a chapter of OAME, participated in the workshop given by **Gill Dunn**. For classrooms, this workshop has eight stations where the participants spend between five and ten minutes at each station. SIX TRIX given in the September issue is one of these stations. To those students who get all eight ways of solving SIX TRIX, Gill adds the Magic Square puzzle, using the numbers 1 to 9, so that the magic sum is 15. For this issue, Gill presents "Magic Triangles". Enjoy it's simplicity and it's "magic" element (trying to find the magic sum).

The theme of "magic" is continued with "Math Stars" by **Joanne Harris**, an experienced teacher at Centennial Middle School in Georgetown, Ontario, and a professional home economist. Joanne's theme is to let the stars come out in your math class in the week prior to a school break. A focus on STARS during that week provides a change of pace but at the same time includes mathematically-based tasks.

Wendy Vivian, a grade 6 teacher at Harmony Public School, Corbyville, Ontario created a very useful website: http://hpedsb.on.ca/harm/eqaoclassroom.html.

This site gives excellent ideas and illustrations on setting up your classroom for the EQAO assessment week.

Don't forget to visit http://www.oame.on.ca for mathematics education and related links to help us in the classroom.

Do you have a website that you enjoy using? Your editor is always on the lookout for classroom or homework activities or website reviews.

Frances Schatz

Frances Schatz

NCTM's newest book resource is *Navigating Through Data Analysis and Probability* for PreK-2 with CD Rom.

This publication, edited by a panel of elementary teachers, is filled with activities for students.

#12323 CAD price $44.50 (includes CAD handling charged by NCTM) if purchased through me, the OAME-NCTM representative.

NCTM™

▲ Mathematics in the Pool Teaching Notes

by Jim Haines

[Note: each diagram should take up one 8.5x11 standard sheet of paper. The diagrams provided with the activity should be enlarged 150% on the photocopier. "Miniature hands" would create unrealistic math.] The following strands relate to the questions given in the activity.

Number Sense and Numeration:

Grade 3 - Justify in oral or written expression the method chosen for addition and subtraction, estimation, mental computation, concrete materials, algorithms, calculators (Questions 1, 2 and 3)

Grade 4 - Develop proficiency in adding and subtracting decimal numbers to tenths (Questions 2 and 3)

Grade 4 - Solve problems involving whole numbers and decimals, and describe and explain the variety of strategies used (Questions 1, 2 and 3)

Grade 4 - Add and subtract decimal numbers to tenths using concrete materials, drawings, and symbols (Questions 2 and 3)

Grade 4 - Explain their thinking when solving problems involving whole numbers (Questions 6 to 10)

Grade 7 - Solve and explain multi-step problems involving simple fractions, decimals, and percents (Questions 1 to 5)

Grade 7 - Perform three-step problem solving that involves whole numbers and decimals related to real-life experiences, using calculators (Questions 1, 2 and 3)

Grade 7 - Ask "what if" questions; pose problems involving simple fractions, decimals, and percents; investigate solutions (Questions 6 to 10)

Measurement

Grade 3 and 4 - Estimate, measure, and record ... the area of two-dimensional shapes, and compare ... areas (Questions 1, 2 and 3)

Grade 3 - Estimate and measure the area of shapes using uniform non-standard units, and compare and order the shapes by area (Questions 1, 2 and 3)

Grade 4 - Explain the meaning of ... area (Questions 6 to 10)

Grade 5 - Solve problems related to calculation of the ... area of regular and irregular two-dimensional shapes (Questions 1 to 10)

Grade 5 - Estimate the area of irregular polygons and measure the area by dividing the polygons into parts, using grid paper (Question 1)

Grade 5 - Develop methods of using grid paper to track and measure the ... area of irregular two-dimensional shapes (Question 1)

Grade 7 - Solve problems related to the calculation and comparison of the ... area of irregular two-dimensional shapes (Questions 1 and 10)

Mathematics in the Pool Rubric

Criteria	Level 1	Level 2	Level 3	Level 4
Organization of mathematical data	Mathematical data is very unorganized	Mathematical data is sometimes unorganized	Mathematical data is usually organized	Mathematical data is very organized
Accuracy of mathematical calculations	Mathematical calculations are very inaccurate	Mathematical calculations are sometimes inaccurate	Mathematical calculations are usually accurate	Mathematical calculations are very accurate
Appropriate use of mathematical language/vocabulary	Rarely uses mathematical language correctly	Sometimes uses mathematical symbols, etc. correctly	Usually uses mathematical symbols, etc. correctly	Consistently uses mathematical symbols, etc. correctly
Correct use of mathematical symbols, labels, units, and conventions	Rarely uses mathematical symbols, etc. correctly	Sometimes uses mathematical symbols, etc. correctly	Usually uses mathematical symbols, etc. correctly	Consistently uses mathematical symbols, etc. correctly
Degree of clarity in explanations and justification in reporting	Explanations and justifications are very unclear and imprecise.	Explanations and justifications are somewhat unclear and imprecise.	Explanations and justifications are somewhat clear and imprecise.	Explanations and justifications are particularly clear and precise.

▲ Teacher Notes for Magic Triangle

by Gill Dunn

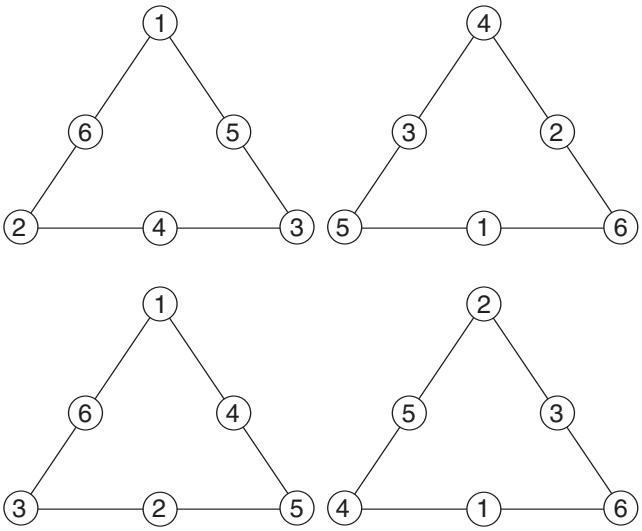
Strand: Number Sense and Numeration

Grade Level: 1-8

Expectation: manipulate numbers to build self-esteem

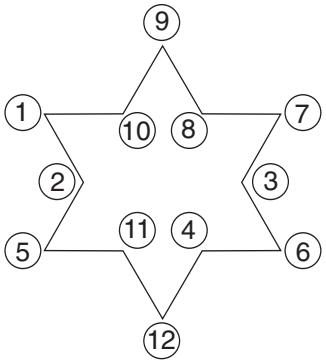
Food for thought: Tell your students that answers will vary for this activity. Does 'answers will vary' cause 'math anxiety' or does it lead to a rich learning activity? Share your thought with the editor.

Answer: There are four magic sums; namely, 9, 10, 11, 12. Are there others?



▲ Teacher Notes for Mathematics Stars Activities

by Joanne Harris



A sample solution for a Magic Star

REFERENCES:

Magic Stars

http://mathforum.org/alejandre/magic.star/msuzuki1.html

http://www.geocities.com/~harveyh/magicstar.htm

http://www.pbs.org/teachersource/mathline/concepts/historyandmathematics/activity2.shtm

Flags with Star Features

http://www.enchantedlearning.com/geography/flags/star.shtml

Quilt Designs with Stars

Paper Throwing Stars

http://www.karber.net/ninja/guides/paper_throwing_stars.htm

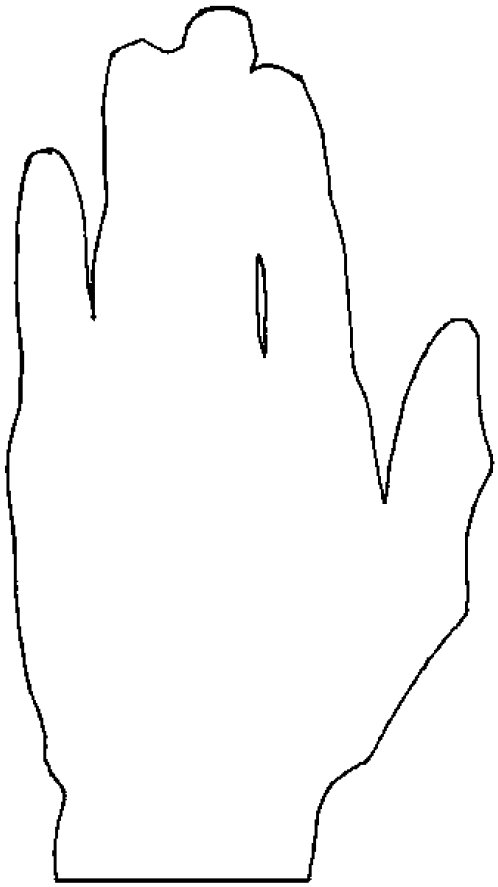
Line Design with a Star feature

How to Enrich Geometry Using String Designs, Pohl, Victoria NCTM, 1906 Association Drive, Reston VA 20191-9988

▲ Mathematics in the Pool

J.J. is a competitive swimmer. During workout sessions, J.J. sometimes swims "bare-handed". At other times, either "webbed gloves" or "paddles" are worn. Each of the three approaches are represented in the accompanying sketches as traced on flat paper.





A tracing of J.J.'s bare hand.

POSSIBLE QUESTIONS

1. Calculate the approximate total area for each diagram. Explain your calculations.

2. Which approach to swimming has the largest area and by how much is it larger than each of the other two? Explain your calculations.

3. Which approach to swimming has the second largest area and by how much is it larger than the smallest area? Explain your calculations.

4. By what percent is the area of the largest greater than the areas of each of the other two? Explain your calculations.

5. By what percent is the area of the second largest area greater than the smallest area? Explain your calculations.

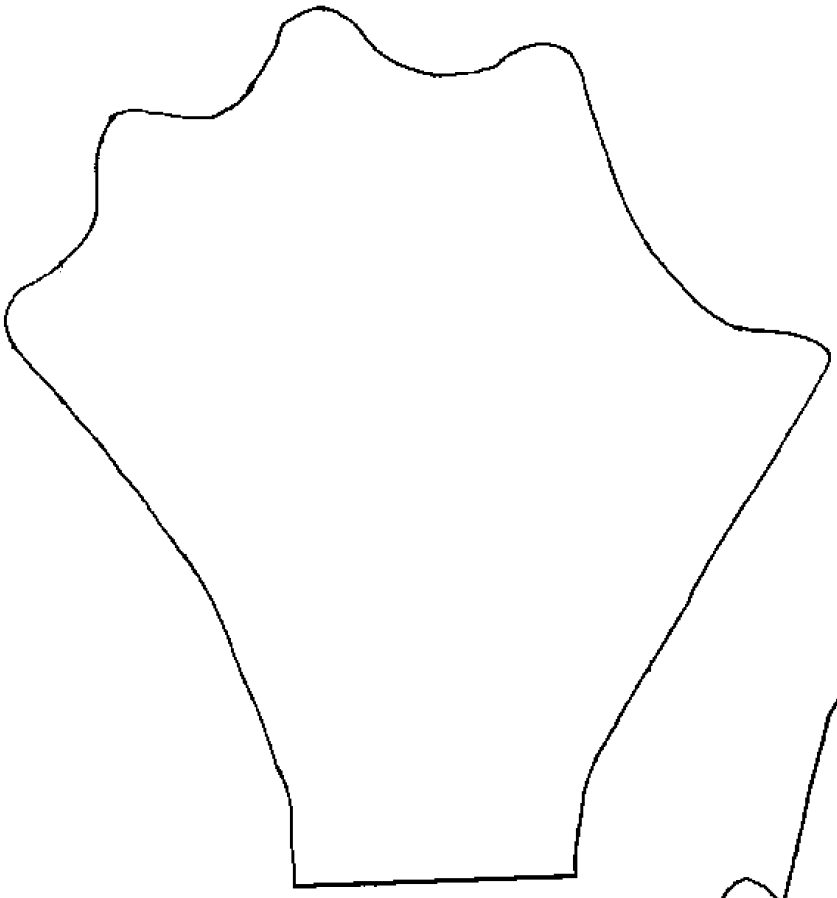
6. What might be advantages and disadvantages of each approach to J.J.'s practice sessions?

7. How might the actual areas differ during practice sessions from the flat tracings?

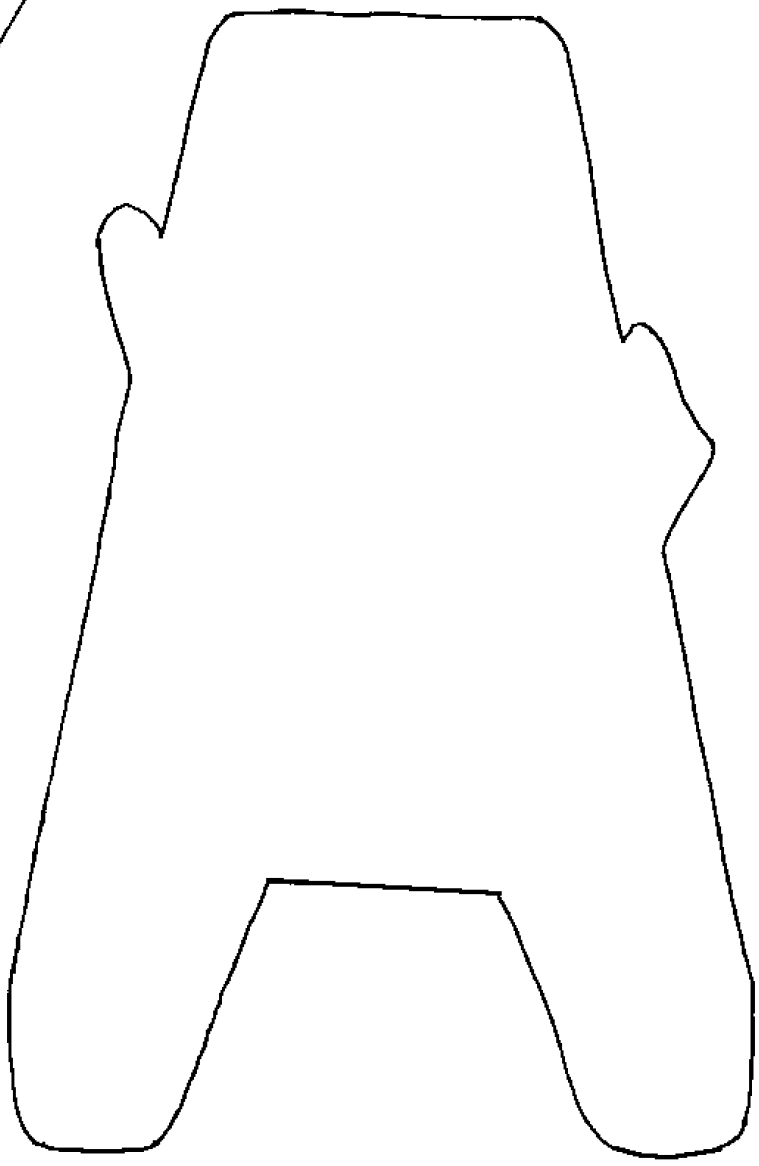
8. Explain why different swimmers would be able to use each approach more or less effectively?

9. What factors might effect the use of each of the three approaches to practising?

10. What might be the effect of continuing to increase, over time, the size of the paddle used in practice?



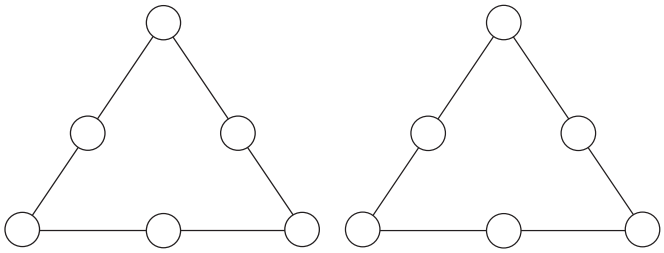
Above: A tracing of J.J.'s hand in a webbed glove. The webbed glove acts in a similar manner to a frog's webbed hand.



Right: A tracing of J.J.'s hand on the swimming paddle. The paddle is a stiff piece of plastic which attaches to the hand with elastic bands.

▲ Magic Triangle

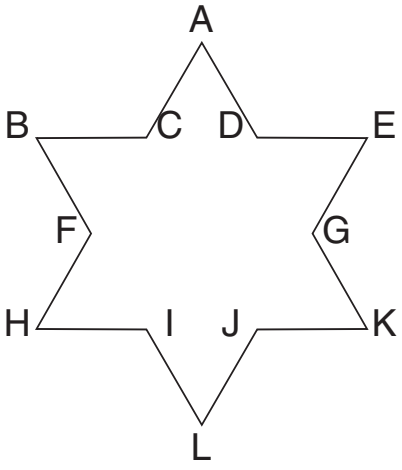
Problem: Use the diagram below and place the numbers 1, 2, 3, 4, 5, 6 in the circles of the triangle so that it becomes a Magic Triangle – that is, all 3 sides have the same total. How many magic sum totals can you find?



▲ Mathematics Stars Activities

Task 1. Magic Stars (A variation of Magic Squares)

A magic star is a six-sided star made up of 12 numbers, one at each vertex. The sum of the



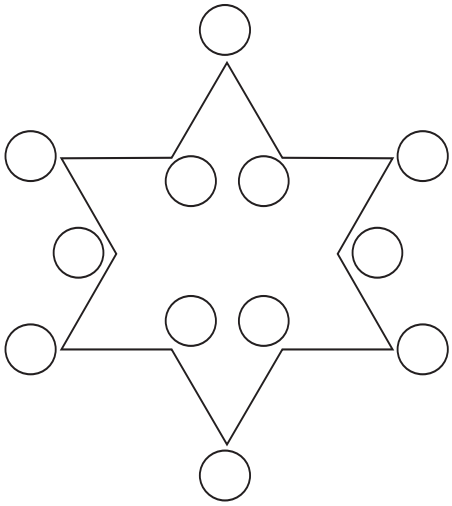
numbers on each edge is the same; call that sum N. Mutsumi Suzuki, a Japanese engineer, is credited with describing how to create and solve a basic magic star.

A basic Magic Star with the vertices labeled

Edge A+C+F+H = edge A+D+G+K = (there are 6 edges for the sum) = N (a constant). The sum of all the numbers between 1 and 12 inclusive is 78.

That means A+B+C+…+K+L = 78 but each vertex is used twice.

Therefore, 2(A+B+C+…+K+L) = 6N. Now, you know that N is what number? Construct a magic star using the sum N you have found.



Each number 1, 2, 3, …11, 12 fits in one circle so that the sum N occurs as indicated above.

Task 2 Stars of the World

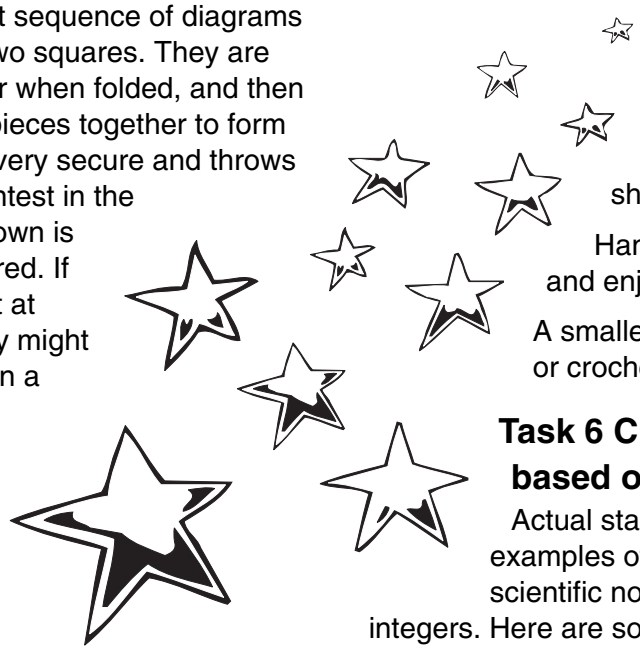
The Flags of many countries as well as some American states and Nunavut feature stars in their designs. Study the flags with a star featured in the design and answer the following questions. Are all the five-pointed stars congruent? If they are not congruent how has the designer varied the form to allow it to be a five pointed star? Most of the flags feature five pointed stars. Create your own five-pointed star. Measure the angles and find the sum. How is this sum related to the sum of the interior angles of a pentagon?

Task 3 Stars found in Quilt Designs

Star designs in quilts are very popular. Specific designs can be found in quilt magazines on web sites such as http://www.topaztiger56273.com . There are many angles and component parts to a quilt block design. Compare some quilt block designs and then try creating your own design. Describe your design using angles and component parts that make the design.

Task 4 Create Paper Throwing Stars

These stars are also referred to as Ninja Stars. They are constructed from two pieces of square paper. Regular photocopier weight paper works well. The size of the square to use can be anywhere from 10 cm square to 25 cm square. A large version of the star may be made from 2 large squares of construction paper, but the end product does not throw well because it is too heavy. The web site http://www.karber.net/ninja/guides/paper_throwing_stars.htm has an excellent sequence of diagrams indicating how to fold the two squares. They are mirror images of each other when folded, and then shows how to put the two pieces together to form a star. The final product is very secure and throws well. Consider having a contest in the hall where the distance thrown is estimated and then measured. If the students become adept at throwing the stars then they might consider throwing to land on a specific location.



Task 5 Use Line Design to Create Geometric Ornaments featuring Star Designs

Construct a regular pentagon with sides measuring 6-12 cm.

Trace this shape onto a heavier piece of cardboard or bristol board.

On the back of the cardboard identify each vertex with a letter (A to E).

Also on the back make a pencil mark at 1 cm spaces and then cut into the cardboard to make a slot at each marking.

Make a small notch at each vertex.

Starting at vertex A secure the end of a long (approximately 10 m in length) piece of string. This can be done with tape or glue. Proceed to wrap the string from vertex A across the front of the pentagon into the first slot on the opposite side and then back to the vertex. Systematically wrap the string around the cardboard until there is a connection from the vertex to each slot on the opposite side. (Hint: you may find it easier if each slot is numbered).

Rotate the pentagon clockwise and repeat for each vertex in order B, then C, then D and finally E.

When the string has been wrapped around all of the pentagon and you are back to vertex A, secure the end of the string with tape or glue. Create a hanger with a 15 cm piece of string and secure this to the back of the star at vertex A.

Cut out a second pentagon shape in construction paper or wrapping paper and glue in place on the back of the pentagon. This covers any joins that had to be made in the string or any pieces of tape that might be showing on the back.

Hang ornament or design in class and enjoy.

A smaller pentagon should use thread or crochet cotton instead of string.

Task 6 Create a Trivia Game based on Star Facts

Actual star data provide real world examples of when someone would use scientific notation or arithmetic with integers. Here are some suggestions to include in a stars trivia challenge:

- distance from Earth to a star
- distance between specific stars
- volume of star
- difference between surface temperature (night vs day)
- diameter
- mass
- ratio of component gases
- age
- colour
- speeds of shooting stars
- co-ordinates to locate them in the night sky.

Students, these trivia questions should demonstrate the use of numbers in real world applications.