Abacus



From the desk of the Abacus editor

My desk has been rather untouched this month. Ron Sauer has greatly contributed to the development of the Abacus in this issue of the Gazette, with direction from the Early and Formative Years Committee of the OAME, writing on the topic of statistics and probability for the elementary years.

Perhaps it was illness in the family, or the cold weather, that kept me from writing. Of course, the present reality of report card time brings out the writer (and soothsayer) in every teacher, and my desk is once more cluttered. Regards, Amy Parker.

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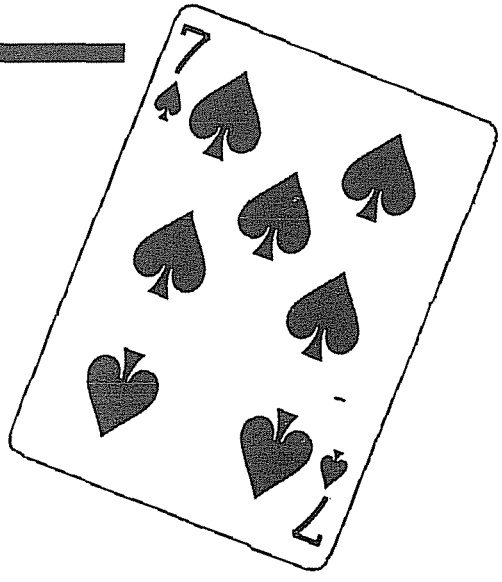
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A DAY AT THE FAIR

Acknowledgements

These activities were developed by the Early Years/Formative Years Committee of OAME. Members are Carmen Durbacz (Chair), Ralph Connely, Shirley Fairfield, Barry Onslow, Peter Saarimaki, and Ron Sauer.



WHAT'S FAIR?

Later in life, a child learns to play games and develops a sense of "fairness", which is related to the notions of equally likely events. Three-year-olds believe that "fair" means that they win. By first grade, children believe that the toss of a coin is a fair way to decide who gets the first choice for a piece of cake. The child's informal method of collecting and analyzing data leads to effective evaluation and judgments about the fairness of a game and the likelihood of winning or losing under specific conditions.

PROBABILITY

Learning Outcomes

The students will:

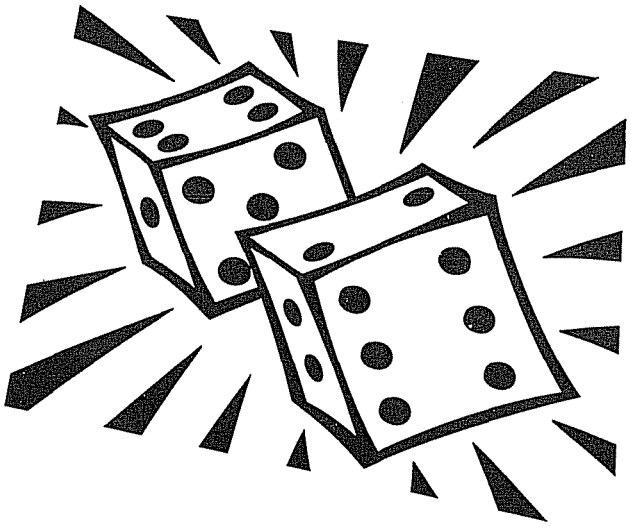
- demonstrate a beginning understanding of the concepts of chance and probability through informal investigations involving data collection and interpretation
- develop an intuitive sense of chance/probability by playing and constructing a variety of games
- discuss chance/probability as it arises in everyday situations

– Provincial Standards (1993), Ministry of Education and Training

Instructions: For Grade Levels 2-6

PLANNING

1. Plan a day where one or several classes will host a fair in the school.
2. Select a time-frame for the unit.
3. Determine availability of materials. Materials may be purchased, donated, made or found in the school.
4. Select activities. Some are provided below and others can be found in the resources suggested at the end of this unit.



DOING

1. Have students advertise the event. (This might include a discussion of value-issues related to advertising, art and design, symbolism and language, techniques in advertising, and so on.)
2. Design and construct materials required (e.g., spinners, game boards, number cubes, bingo chips for counters).
3. Encourage parent and whole-school involvement.
4. Have students predict what will happen at each activity. They can later compare their predictions with the actual outcomes.
5. Provide a tally sheet (see sample) where the students gather data by keeping a record of the outcomes at each activity.
6. Let's have the fair!!

REFLECTING

Students will:

1. write about the outcomes in their math journals
2. compare their results with their predictions
3. repeat an activity, where necessary, to gather additional data
4. examine data gathered, organize it, and "mathematize" the situation
5. communicate the results through visual representations such as graphs and charts to be displayed on central bulletin boards

ASSESSING/ EVALUATING

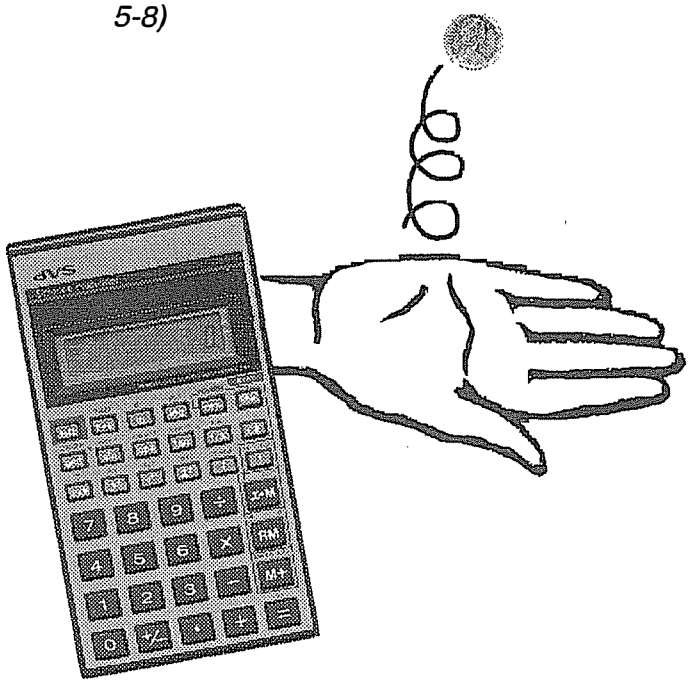
Some techniques that could be used to assess/evaluate are anecdotes, attitudes checklist, skills checklist, forms for peer/self evaluation, journals, and portfolios.

Two useful references are:

- Mathematics Assessment: Myths, Models, Good Questions and Practical Suggestions, NCTM, 1991
- Assessment Alternatives in Mathematics, Lawrence Hall of Science, University of California, Berkeley, 1989

RESOURCES

- Burns, Marilyn, *About Teaching Mathematics: A K-8 Resource*
- Jones, Graham A. & Thorton, Carol A, *Data, Chance and Probability: Grades 4-6 Activity Book,* Jones, Graham A. & Thorton, Carol Data, Chance and Probability: Grades 1-3 Activity Book
- Stenmark, Jean: Thompson, V. & Crossey, R., *Family Math*
- Zawojewskil, Judith S., *Dealing with Data and Chance (NCTM Addenda Series Gr. 5-8)*



ACTIVITIES

1. At each activity calculators are made available to the students to calculate their total score (when necessary).
2. In all of the following activities, the House refers to the person running the game, be it a parent, teacher, or student.

ACTIVITY #1: FAIR PAIRS

MATERIALS:

number cubes/dice, tally sheet

DIRECTIONS:

Students roll the dice ten times. If they roll a double they get 3 points. If they don't, the House gets 1 point. On the tally sheet the students record their points and the House points. As well, they indicate a "+" if they won, a "-" if they lost, and an "=" for a tie.

DISCUSSION:

Younger students can determine if the game was fair or not. Older children can determine theoretical probabilities. One way to do this is to list all possible outcomes and identify those that are doubles.

For example:

11	21	31	41	51	61
12	**22**	32	42	52	62
13	23	**33**	43	53	63
14	24	34	**44**	54	64
15	25	35	45	**55**	65
16	26	36	46	56	**66**

The probability of obtaining a double is

$$\frac{6}{36} \text{ or } \frac{1}{6}$$

The probability of not obtaining a double is 30

$$\frac{30}{36} \text{ or } \frac{5}{6}$$

Therefore the House should win. How can the game be made fair? (The student should get 5 points for rolling a double or make cubes with repeated numbers.)

ACTIVITY #2: SPIN TO WIN

MATERIALS:

2 spinners, tally sheet

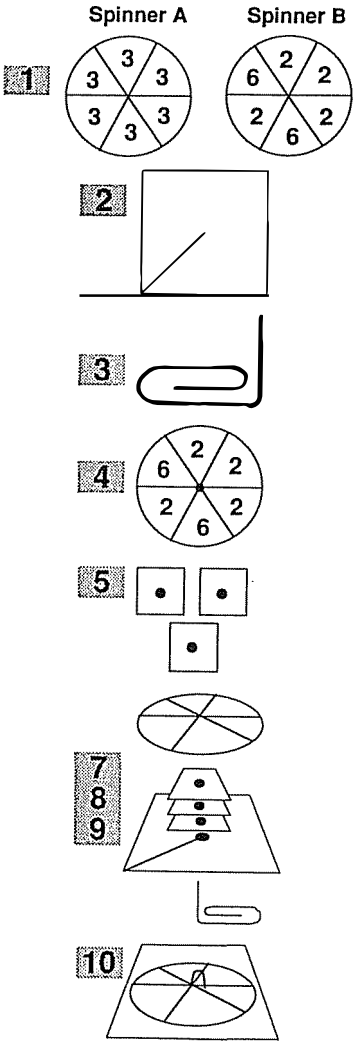
DIRECTIONS FOR MAKING A SPINNER

1. Draw a circle with a 6 cm radius on a piece of Bristol board, and cut it out.
2. Cut out an 18 cm square from Bristol board and draw a line from one corner to the centre.
3. Take a paper clip and bend up just the outside part. This part should point straight up when the paper clip is lying flat on the desk.
4. Poke a hole with a needle in the centre of the circle and the centre of the square.
5. Cut three 2 cm squares of Bristol board, and poke holes in the centre of each square.
6. Cut a piece of masking tape about 3 cm long.
7. Assemble the spinner by first poking the paper clip through the 18 cm square and taping on the bottom to hold it in place.
8. Put the three 2 cm squares (washers) on the part of the paper clip pointing up.
9. Put on the circle.
10. Bend the point of the paperclip down and twist it.

DIRECTIONS:

Students select one of the two spinners. The House takes the other. The students spin their spinner 20 times and keep a record of the sum. The House does the same. On the tally sheet, students record which spinner they used, their sum, and the House's sum.

SPINNERS



Students records a "+" if their sum is greater, a "–" if their sum is less, and an "=" if they are the same.

DISCUSSION:

Students examine the data and determine which spinner won most often. They then give explanations for the difference. For example, spinner A has a total of 18 and spinner B has a total of 20.

ACTIVITY #3
UPSIDE DOWN

MATERIALS:

disposable cups, tally sheet, plasticine

DIRECTIONS:

Students select one of the two following options:

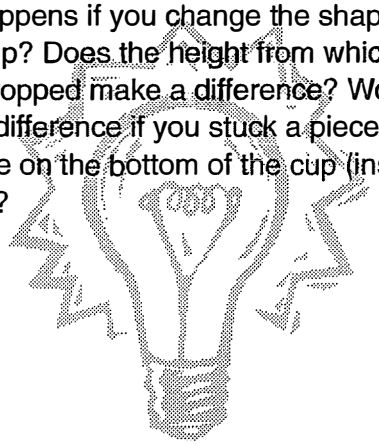
Option #1: the cup lands on its side (one point is awarded).

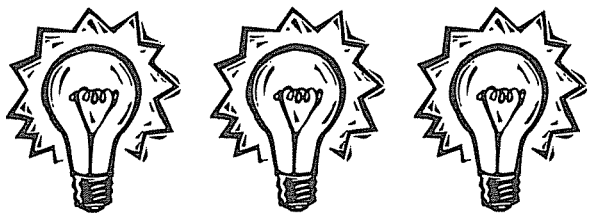
Option #2: the cup lands on its top or bottom (four points are awarded).

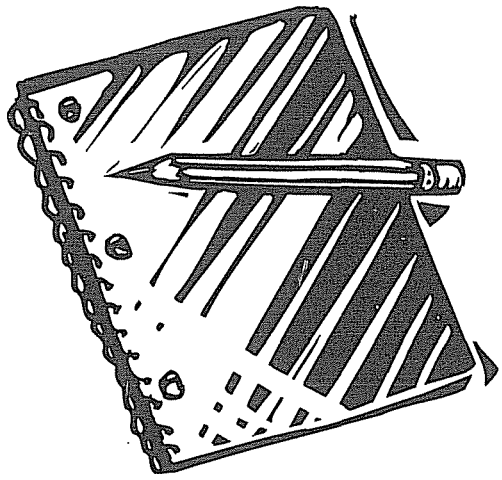
The House is awarded the other option. Students toss the cup 20 times and keep a record of their sum and of the House's sum. Students record a "+" if their sum is greater, a "–" if their sum is less, and an "=" if they are the same.

DISCUSSION:

A discussion could be centred around questions such as the following. Does it make a difference if the cup is tossed or dropped? Does the material of the cup alter the results? What happens if you change the shape or size of the cup? Does the height from which the cup is dropped make a difference? Would it make a difference if you stuck a piece of plasticine on the bottom of the cup (inside or outside)?







ACTIVITY #4
FAIR PLAY

MATERIALS:

tally sheet, 2 counters (One counter is red on both sides. The other counter is red on one side and blue on the other.)

DIRECTIONS:

Students select one of the following options.

Option #1: When tossed, the two counters come up the same colour *(score three points).*

Option #2: When tossed the counters come up different colours *(score three points).*

The House is awarded the other option. Students toss the counters 20 times and keep a record of their sum and of the House's sum. Students record a "+" if their sum is greater, a "–" if their sum is less, and an "=" if they are the same.

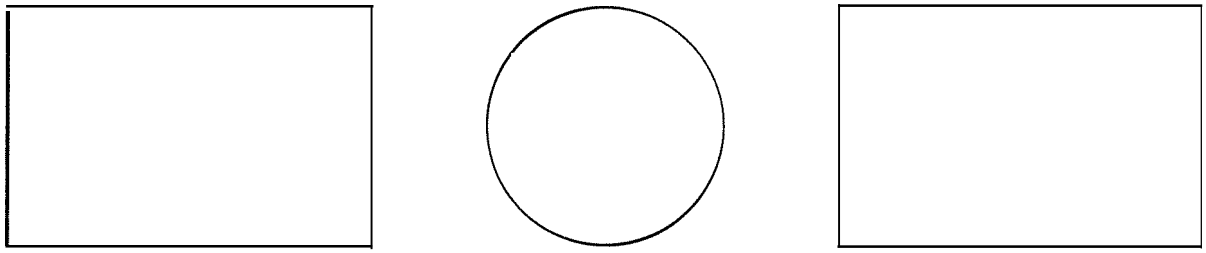
DISCUSSION:

The discussion could be centred around questions such as the following. Was this game fair? *(Yes. The possible outcomes are red/red, red/blue, red/red, and blue/red.)* Suppose you substituted a red/blue counter for a red/red one. Would the game still be fair? *(Yes. The possible outcomes are red/red, red/blue, blue/red, and blue/blue.)*

TALLY SHEET

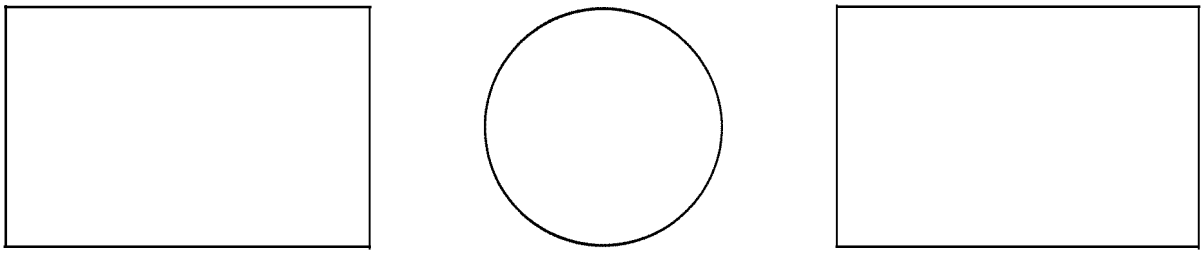
ACTIVITY #1

My Total | +, or – or = | House Total



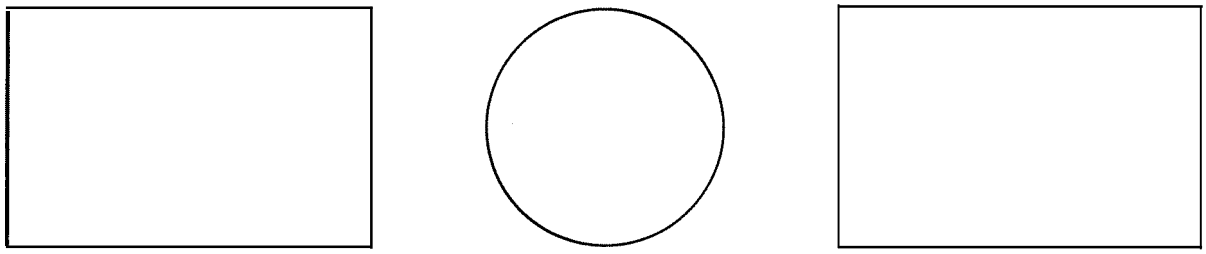
ACTIVITY #2

My Total for Spinner # ____ | +, or – or = | House Total Spinner # ____



ACTIVITY #3

My Total | +, or – or = | House Total



ACTIVITY #4

My Total | +, or – or = | House Total

