# Measurement, Perimeter & Area

by:
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Grade 7, 8, 9
E 105.15

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# I.   TOPIC:  LINEAR MEASUREMENT

# II.   FOUNDATIONAL OBJECTIVES:

The student should demonstrate:

- a sense of spatial awareness and familiarity with two- and three-dimensional shapes and recognize relationships between geometry and the environment;
- an ability to measure and use appropriate measurement techniques and to apply measurement to real life;

# III.   SPECIFIC LEARNING OBJECTIVES:

The student should be able to:

- solve a variety of problems involving length
- compare, estimate, then measure and record lengths/distances
- recognize and use the appropriate unit of measure length or distance given a real world measurement situation
- understand the relationships between kilometres, metres, decimetres, centimetres and millimetres
- convert metric units of length

## IV.     STRATEGIES:

- Interactive Instruction
- Independent Learning
- Experiential Learning

## V.   METHODS:

- Peer Practice
- Research project
- Field Observations
- Co-operative Learning

## VI.   DESCRIPTION:

A.     Students construct a "Personal Data Sheet" containing individual body measurements. Students can use cloth tapes and work in groups or in pairs.  Room can be left on the card for students to add other measurements suggested by the teacher.

| PERSONAL DATA SHEET | |
|---|---|
| Height ............................................. | _____ cm |
| Finger tip to finger tip ...................... | _____ cm |
| Top of head to chin.......................... | _____ cm |
| Top of head to eyes.......................... | _____ cm |
| Around neck .................................... | _____ cm |
| Around bisceps ................................ | _____ cm |
| Length of foot ................................. | _____ cm |
| Elbow to wrist ................................. | _____ cm |

Students may find it interesting to explore the ratios between the various measurements.

B.     Scavenger hunt.  Students are given a list of objects to measure both within the school and the classroom and outside the school.  Groups are supplied with record sheets, tape measures and trundle wheels.  The results can be shared, not so much to ensure accuracy as to ensure the use of appropriate units.

C.     To reinforce the metric ladder conversion method, large colorful signs can be constructed. Place these signs on a staircase and having students move from one step to another while announcing the change in the original value.   Students gain a working knowledge of how  the ladder is used to convert metric units.

# VII. ASSESSMENT TECHNIQUES:

- Performance Assessment: (samples provided in appendices)
  - rating scale
  - observation checklist
  - anecdotal records
- Written Assignments:
  - contracts
  - self and peer assessments

# VIII. CELs:

Students should develop their abilities to:

- discover relationships and patterns, propose generalizations that explain the relationships, and apply the conclusions and generalizations to new situations (CCT);
- understand the benefits and limitations of measuring tools and calculating devices and use technological innovations as helpful learning tools (TL);
- work cooperatively, contribute positively in group learning activities and treat with respect themselves, others and the learning materials used (PSVS);

# I.   TOPIC:  PERIMETER

# II.   FOUNDATIONAL OBJECTIVES:

The student should demonstrate:

- a sense of spatial awareness and familiarity with two- and three-dimensional shapes and recognize relationships between geometry and the environment:

- an ability to measure and use appropriate measurement techniques and to apply measurement to real life;

# III.   SPECIFIC LEARNING OBJECTIVES:

The student should be able to:

- compare, estimate, then measure and record lengths/distances

- locate and calculate the perimeter of regular polygons, irregular polygons and composite figures

- calculate the perimeter of a figure given the a) length of all sides and b) partial, but sufficient information

- explore the relationship between the radius, diameter and the circumference of a circle

- find the radius or diameter of a circle, given the circumference

# IV.   STRATEGIES:

- Independent Learning
- Experiential Learning

# V.   METHODS:

Learning Activity Package
Model Building
Field Observations

# VI.   DESCRIPTION:

A.   Have students, perhaps during art classes, construct mobiles out of coat hangers or other wire. The shapes could vary.  All, or selected ones, could be hung from the ceiling to act as a reminder and reference when the topic changes to area.

B.   Students are given geo-boards and asked to construct shapes with given perimeters. There may be a variety of correct answers depending upon the number chosen for the perimeter. Students can exchange their work and examine the variety of shapes constructed.  Discuss the various

figures created. Encourage the use of shapes with 90 degree angles or be prepared to handle questions that arise regarding sloping distances. This limits it to rectangles or squares.

C.    Have students cut out a square, 25 cm. X 25 cm., and find the perimeter of the square. Have them cut another square, 10 cm. X 10 cm., from the top right corner of the first square. Have them find the perimeter of the new shape formed when the smaller square is removed. Ask the students to cut out other squares of their choice and cut from the top right corner, squares of different sizes. Have them find the perimeter. Ask students to list any observations that they see. Note that the loss of the area as the square removed does not affect the perimeter. This should point out that perimeter is not related to the area of the figure.

D.    Students use string, cloth tape and/or a trundle wheel to measure the circumference of various circles (cup, can, barrels, jump circle in gym etc.). They also record the diameter of the circles. This information can be recorded in a chart which when brought back to the class can be shared using a chart on the board. Students are asked to determine the relationship between the two to gain an understanding of the value of pi and it role in the formula for the circumference of a circle.

E.    Students cut circles out of paper. (Encourage students to use circles with diameters which are whole numbers....this will make the connection between diameter and area more easily observed.) They then cut the circles in half by cutting along the diameter. Each half is then cut into small slices running from the circles center to the outside edge. When finished the edges of the circle are laid side by side and measured to arrive at an approximation of the circumference.

## VI.    ASSESSMENT (samples provided in appendix):

- Performance Assessment:
    - assessment station
    - data collection checklist
    - anecdotal records
    - self assessment
- Written Assignments:
    - contracts
    - portfolios
    - rating scales

## VII.    CELs:

Students should develop their abilities to:

- show their understanding of ideas presented by providing an alternate rephrasing, drawing a diagram, making a model, etc. (C);
- understand the benefits and limitations of measuring tools and calculating devices and use technological innovations as helpful learning tools (TL);
- work cooperatively, contribute positively in group learning activities and treat themselves, others and the environment with respect (PSVS);

# I. TOPIC: AREA

# II. FOUNDATIONAL OBJECTIVES:

The student should demonstrate:

- a sense of spatial awareness and familiarity with two- and three-dimensional shapes and recognize relationships between geometry and the environment:

- an ability to measure and use appropriate measurement techniques and to apply measurement to real life;

# III. SPECIFIC LEARNING OBJECTIVES:

Student should develop their abilities to:

- solve a variety of problems involving area

- compare, estimate and then measure the area of regions using square centimetres and square metres

- discuss the relationships between the length, width and area of a rectangle (including squares)

- estimate and find the area (using a formula) of squares, rectangles, triangles, parallelograms, rhombuses, trapezoids, composite figures and circles

# IV. STRATEGIES:

- Experiential Learning
- Direct Instruction
- Interactive (from chart)

# V. METHODS:

- Model Building
- Demonstration
- Cooperative Learning

# VI. DESCRIPTION:

A.   Have students, perhaps during art classes, cut flat shapes out of cardboard.  These shapes would be covered with paper mâché and painted with bright acrylic paint.  Coating the shapes with varnish will add to their visual impact.  All, or selected ones could be hung in a region of the room (perhaps hung from the ceiling) to act as visual reference.  If done in conjunction with the coat hanger mobiles, it will make a valuable contrast between the two concepts.  Formulae could be attached to the side of each shape.  A variety of shapes (triangles, rectangles, parallelograms) should be displayed.
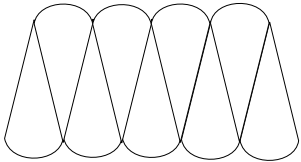
B.      Students are given geo-boards.  Students are asked to create shapes with various given areas.  Students chart the  length  and width of the shapes as well as the perimeter along with the area that was given to them.  Students can be asked to draw conclusions about the relationship between the length, width and the area.  Relationships between area and perimeter can also be discussed.  This same activity could be accomplished with building cubes (base ten blocks).

C.      Students cut out rectangles and then calculate and record the area using the formula.  A sloping vertical line is drawn across the rectangle.  Students cut along this line dividing the shape in two.  The right and left sides are reversed creating a parallelogram.  The area has not changed.  Students record the dimensions of the new shape.  During the discussion that follows students should be led to the understanding that  a new formula (not LxW) is required to find the area of the parallelogram, and that base and height are now more appropriate.

D.  Students cut parallelograms out of squared paper.  The parallelogram is cut into triangles.  Both the areas of the parallelogram and the triangles are recorded (use formula for the parallelogram and counting for the triangle).  By using different methods, students may arrive at slightly different answers.  Students share their results in a chart on the board and are led to the conclusion that the areas of the triangles are half of the area of the original parallelogram and thus to the formula for the area of the triangle.
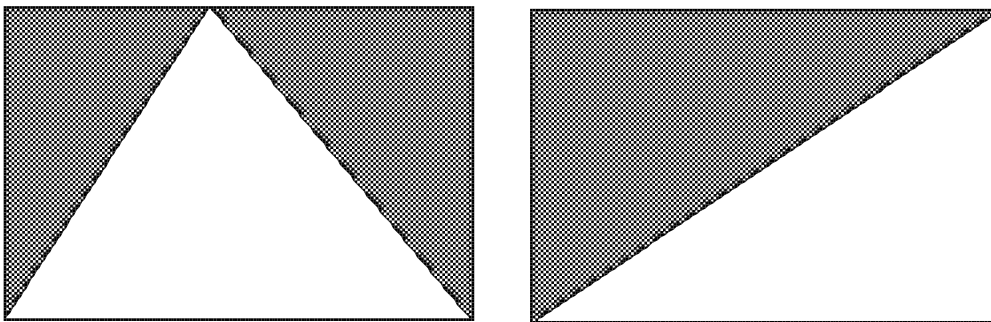


E.      To help students better understand the method of calculating the area of rectangular shapes, have the students draw the images on grid paper.  Students can then cut out the shapes, calculate the area of individual areas and then paste them together again.  The total area is then seen to be the total of the individual areas.

F.      Students are given a sheet of grid paper containing an irregular polygon.  They calculate the area and the perimeter.  Students are then asked to draw a shape on a second sheet of grid paper where the perimeter remains the same but the area is the largest possible.  Similarly,  with the same perimeter but the smallest area possible.  Calculating the area of an irregular polygon could be interesting. How might they do this? Geoboards, or by counting or dividing into triangles, calculations and sums? Their written description of the process might be worthwhile.

G.      Each student is given an orange (or other round edible item...ie pizza, bannock) and asked to record dimensions associated with the item (see chart below).  Cut a slice about one centimetre thick from the center of an orange.  Lay the slice on a piece of paper.  Measure and record the radius of the slice.  Cut the slice in half.  Separate the sections in each half.  This can be done easily if the students did not cut through any of the triangular sections inside the orange.  Arrange the sections as shown below.  Use the formula for the area of a parallelogram to

calculate the area of the constructed shape. Student results are recorded on the board and students, through trial and error are encouraged to determine any relationships between the various elements. After much foraging students will see the constant connection (pi) between the area and the radius. An alternate method would be to have students work in groups to arrive at an appropriate formula and then present their findings to the rest of the class.

| Name | Radius | Diameter | Area | A/d | A/r | A/rxr | etc. |
|------|--------|----------|------|-----|-----|-------|------|
|      |        |          |      |     |     |       |      |
|      |        |          |      |     |     |       |      |
|      |        |          |      |     |     |       |      |
|      |        |          |      |     |     |       |      |

F.     Papers containing the following shapes are distributed to the students. Either individually or in groups, the students calculate the area of the white regions in each dark square and the dark area surrounding them. This should give the student experience in subtracting to arrive at the area of a specific region. The results showing the areas to be the same in each of the squares will be very interesting.
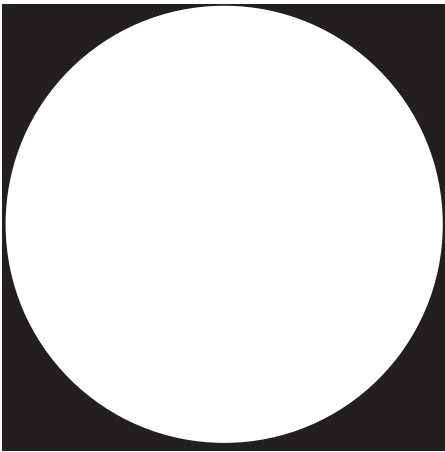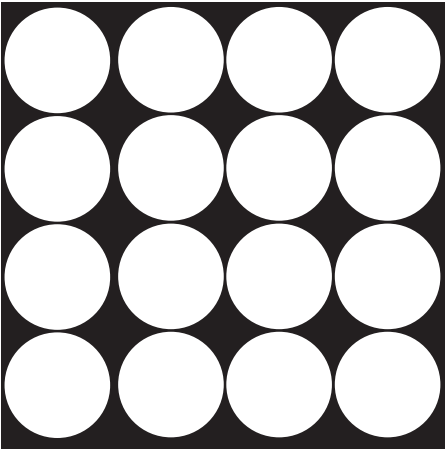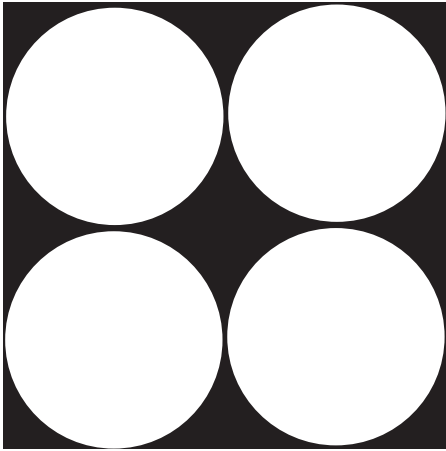
# VI. ASSESSMENT (samples provided in appendices):

- Performance Assessment:
    - ancecdotal records
    - observation checklist

- Written Assignments:
    - portfolios
    - observation checklist

- Presentations
    - anecdotal records
    - observation checklist

# VII. CELs:

Students should develop their abilities to:

- show their understanding of ideas presented by providing an alternate rephrasing, drawing a diagram, making a model, etc. (C);
- discover relationships and patterns, propose generalizations that explain the relationships, and apply the conclusions and generalizations to new situations (CCT);

## REFERENCES:

*A Teacher's Guide to Math Works*, Agency for Instructional Technology, 1985

*Daily Mathematics, Critical Thinking and Problem Solving*, McDougal, Littel & Co.

*Intermediate Math 1,* Dottori D., Knill G., et. al., McGraw-Hill Ryerson Ltd., 1981

*Math In Context,* Ebos F., McKillop D., et. al., Nelson Canada, 1992

*Math Quest,* Alexander B., Folk S., & Worth J., Addison-Wesley Publisher, Ltd., 1989

# Checklist to Assess Student's Ability to Use Information

**Student Name:** _____

**Date or Time Period of Assessment:** _____


## Check (✓) applicable criteria.

1. Student is able to state the purpose for the collection of the information.    _____

2. Student is able to gather information from own recall of past learning.    _____

3. Student is able to identify main elements needed in information.    _____

4. Student is able to organize information into usable units.    _____

5. Student is able to identify related details.    _____

6. Student is able to recognize relationship of information gathered to information remembered.    _____

7. Students is able to clearly state ideas that fit with the topic being addressed.    _____

8. Student is able to give evidence of checking information for accuracy.    _____

> This instrument may be adapted for use as rating scale.

Student Evaluation Handbook, 1991

The following rating scale could be used to record observations of a group involved in a collaborative project. Teachers could use this scale to describe each student's contribution to the group and the development of co-operative skills.

# Co-operative Group Learning (Teacher Assessment)

Date _____

Group _____

Task _____

| 5   4   3   2   1<br>High            Low | Names of Group Members | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Negotiates roles and responsibilities of each group member | | | | | | | | |
| Contributes ideas and suggestions | | | | | | | | |
| Encourages the involvement of all group members | | | | | | | | |
| Is receptive to peer questions and criticism | | | | | | | | |
| Listens to the suggestions of others | | | | | | | | |
| Modifies personal thinking to incorporate the ideas of others or new information | | | | | | | | |
| Respects and accepts the contributions of each group member | | | | | | | | |
| Completes individual commitment to the group | | | | | | | | |

**Additional Comments:**

Students could discuss questions such as the following to assess the group's ability to work co-operatively.

# Co-operative Group Learning (Group Assessment)

1. Was your group successful in working together? What co-operative skills did the group use to make working together enjoyable?

2. What co-operative skills improved as the group project progressed?

3. What co-operative skills need to be further developed?

4. What was the most important thing your group learned about working together during this project?

# Assessment of Cooperative Learning

❏ **Individual**            ❏ **Pair**            ❏ **Group**

Student Name: _____

Partner/Group Members: _____

_____

_____

_____

Date: _____

DIRECTIONS:

Please meet with your group and use the rating scale below as a basis for discussing how effectively your group is working. Complete the rating scale and return it to your instructor.

| DID YOUR GROUP: | POORLY | | | | | EXTREMELY WELL |
|---|---|---|---|---|---|---|
| • identify specific goals? | 1 | 2 | 3 | 4 | 5 | 6 |
| • make noticeable progress towards those goals? | 1 | 2 | 3 | 4 | 5 | 6 |
| • share information, ideas, and opinions with each other | 1 | 2 | 3 | 4 | 5 | 6 |
| • make decisions that were based on the views of all members? | 1 | 2 | 3 | 4 | 5 | 6 |
| • listen with attention to each other? | 1 | 2 | 3 | 4 | 5 | 6 |
| • actively encourage each other to participate in the group activities? | 1 | 2 | 3 | 4 | 5 | 6 |

Some suggestions for improving our group work next time:

_____

_____

_____

_____

From Business Education Accounting 16, 26, 36
Saskatchewan Education 1992
Student Evaluation: A Teacher Handbook, 1993

# Rating Scale for Cooperative Group Learning

Student Name: _____

Date or Time Period of Assessment: _____

| | | | | | |
|---|---|---|---|---|---|
| 1. The student works with a wide range of peers, not just with close friends. | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |
| 2. The student willingly shares materials and ideas with others. | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |
| 3. In group work the student shows respect for others by listening and considering other points of view | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |
| 4. The student follows group work rules as established for the activity. | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |
| 5. The student fulfills her/his work responsibilities in the group | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |
| 6. The student exhibits appropriate work behaviors during time set aside for groups. | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |
| 7. The student participates in discussions during the time set aside for group work. | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |
| 8. The student contributes ideas to the the group efforts during the discussions in the time set aside for group work. | 1<br>never | 2 | 3<br>sometimes | 4 | 5<br>always |

This instrument may be adapted for use as a checklist.

Student Evaluation Handbook, 1991

# Anecdotal Record

Student Name: _____

Class: _____

Term _____

After an anecdotal notion is written on a pre-pasted note, the teacher may add it to this anecdotal record sheet. The teacher will circle the focus for each anecdotal entry.

Date: _____

Focus:     Knowledge          Application          Technical Skills          Attitude

Date: _____

Focus:     Knowledge          Application          Technical Skills          Attitude

Date: _____

Focus:     Knowledge          Application          Technical Skills          Attitude

**Template 1**

# Anecdotal Record-Keeping Form

Date: _____  Unit _____

| Student's Names | Criteria/Objectives | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Special Comments:**

# Data Collection/Notebook Checklist*

**Name:** _____

**Date:** _____

A checkmark indicates that the criterion is satisfactory. No mark indicates that the criterion is either missing or unsatisfactory.

| | |
|---|---|
| Documentation is complete | |
| The information or data collected is accurate. | |
| Written work is neat and legible. | |
| Tables and diagrams are completed neatly. | |
| Each new section begins with an appropriate heading. | |
| Errors are crossed out but not erased. | |
| Spelling and language usage are edited and corrected. | |
| Information is recorded in a logical sequence. | |
| Technological aids are used appropriately. | |
| Notes are collected in a folder or binder. | |
| Color or graphics are used to enhance the appearance. | |
| Rough work is done separately. | |

**Comments/Overall Impressions:**

_____

_____

_____

* This checklist may be used by teachers, or by students for self-evaluation. It may be used to evaluate notebooks, laboratory data collection done during investigations, or more formal written laboratory reports. Students should be made aware of these criteria at the start of the term.