Grade 3: Perimeter

3.SS.5	
Demonstrate an understanding of perimeter of regular and irregular shapes by • estimating perimeter using referents for centimetre or metre • measuring and recording perimeter (cm, m) • constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter	1. Measure and record the perimeter of a regular shape, and explain the strategy used. 2. Measure and record the perimeter of an irregular shape, and explain the strategy used. 3. Construct a shape for a given perimeter (cm, m). 4. Construct or draw more than one shape for the same perimeter. 5. Estimate the perimeter of a shape (cm, m) using personal referents.

Clarification of the outcome:

✦ Concerns introducing and using the term 'perimeter' where distance measurement involves standard units (cm & m).

✦ Does not concern teaching what regular and irregular shapes are (outcome 3.SS.7). Regular shapes have ALL sides equal. Irregular shapes do not. If the teacher has not yet developed the regular and irregular shapes outcome, he/she still uses both types in the perimeter lesson. The teacher simply avoids using the jargon of regular and irregular.

Required close-to-at-hand prior knowledge:

✤ Addition skills (grades 2 & 3 matter).

✤ Understand what length is and how to measure it (grades 2 & 3 matter).

✤ Have a preliminary exposure to perimeter (grade 2 matter without the jargon).

✤ Understand cm and m as standard units of length (grade 3 matter).

SET SCENE stage

The problem task to present to students:

The school principal wants to put a fence around the playground area to keep out dogs.

The teacher poses the following questions about that:

1. *What do you need to know to do the job?*
2. *How can the job be done?*

The teacher discusses the questions by asking students WHAT THEY THINK. The teacher does not tell anything yet. Telling only would happen if students do not provide appropriate answers to the questions. Even then, the teacher should offer hints rather than just tells.

The following should be the result of the question posing:

✤ Some kind of diagram is needed. Organize students into manageable groups. Each group makes up their own diagram. Ensure that there is at least one diagram that involves a regular shape. The diagrams are set aside for the time being.

✤ Some kind of fencing material is needed and that the material would go around the entire playground (with a gate somewhere). The material should be agreed upon in type and length (e.g. lattice fencing that has 2 m long sections).

Once questions 1 and 2 have been answered satisfactorily, the teacher asks: *How do we figure out how much fencing material (<u>refer to the actual agreed-upon material</u>) is needed?*

Students' perimeter experiences from grade 2 should be limited to thinking of perimeter (as distance around. They would have figured out the distance by placing a string around the shape and then measuring the length of the string and/or repeatedly laying a non-standard unit (e.g. paper clip) around the shape and counting how many units around. It is possible that at least one student might suggest measuring parts of the distance and then adding the parts together. While this is unlikely to happen, if it does, acknowledge the idea as a good one, BUT do not use it yet because the large majority of students will have difficulty seeing it that way.

Once the string method and/or laying a non-standard unit method emerge, the teacher says something like: "*Before we solve the problem about the fencing, we need to do some activities that will help you understand the ideas better.*" Then the DEVELOP lesson begins.

Comments:

All students will have seen a fence around something somewhere. In other words, the context should be part of their experience base (a very important requirement of the problem task).

Notice that no diagram was provided in the description of the problem task. It could have been but that would eliminate some thinking that the students need to do. They need to realize that you do need some kind of diagram to deal with the task.

Notice that fencing material (such as boards. logs, chain links, etc.) was not mentioned in the description of the task. This requires students to realize that some kind of material is needed and opens up the task to more possibilities for fencing material.

DEVELOP stage

Activity 1: Revisits prior knowledge and addresses achievement indicators 1, 2, and 5.

Provide students with two diagrams of shapes (fencing) around a playground. One should involve a regular shape and the other an irregular shape. Introduce the word 'perimeter'. Discuss personal referents for cm (e.g. width of a finger).

✦ Ask students to estimate the perimeter by using a personal referent for a centimetre. Tell them to ignore a gate for now. Discuss results.

✦ Ask students to determine the perimeter of the fence by using the string method. The perimeter should be expressed in centimeters. Discuss the estimate and the string method results.

Activity 2: Addresses achievement indicators 1 and 2.

Draw a diagram of an irregular shape fencing around a playground (no measurements on the shape) on the whiteboard (e.g.). Tell them that there is no string available to measure the perimeter of the playground.

★ Ask them how the perimeter could be figured out. The most likely response will be to repeatedly lay a unit around the shape and count the number of times the unit was placed around the shape. Discuss this method as being slow and likely to be very inaccurate. Ask for another method that involves measuring parts of the shape (if this method already arose in the SET SCENE stage, then you can now ask the student to remind the class about that method). Discuss the measure and add method.

★ Provide students with four different diagrams of shapes (fencing) around a playground. Two should involve a regular shape and the other two an irregular shape. Tell students to ignore a gate for now. Ask them to determine the perimeter of the fence by using the measure and add method. The perimeter should be expressed in centimeters. Discuss the results.

Activity 3: Addresses achievement indicators 3 and 4.

✦ Ask students to draw a playground diagram so that the perimeter of the fence is 20 cm. Tell students to ignore a gate for now. There would likely be different answers to the task and the shapes would be irregular. Discuss.

✦ Ask students to draw a playground diagram so that the perimeter of the fence is 40 cm. Tell students to ignore a gate for now. There would likely be different answers to the task. Discuss.

Activity 4: Practice on all achievement indicators. Playground context is absent.

- ✦ Draw a regular shape somewhere. Students estimate the perimeter in cms. Discuss.

- ✦ Draw an irregular shape somewhere. Students estimate the perimeter in cms. Discuss.

- ✦ Ask students to draw a shape having a perimeter of 30 cm. Discuss.

- ✦ Provide students with a regular shape and an irregular shape. Ask students to use the measure and add method to figure out the perimeter. Discuss results.

Activity 5: Practice on all achievement indicators (unit is metre).

- ✦ Organize students into groups. Ask each group to draw a shape on paper whose sides are not the same. Tell them that they will layout the shape in the classroom by placing a small object at each corner of the shape. Some table and chair moving is allowed.

- ✦ Ask the groups, in turn, to layout their shape. For each group, in turn:

    - ✳ Discuss a big step as being a good personal referent for a metre. Ask them to estimate the perimeter of the shape in big steps.

    - ✳ Ask each group in turn to measure the perimeter using a metre stick, and the measure and add method. Tell them that they are only going to use whole metres. [Do not use the language of round off.] Provide a couple of examples (e.g.: If the side length is almost 3 metres, call it 3 metres. If the side length is 2 and a bit metres, call it 2 metres,]

    - ✳ Compare the estimate in big steps to the measured perimeter in metres.

Activity 6: Closure on SET SCENE, practice on indicators 1 and 2, and mode change.

- ✦ Organize students into groups. Ask each group to refer to their diagram from the SET SCENE activity. They use it to construct a model playground (swings, etc.), including the fencing and an opening for a gate.

- ✦ Ask students to determine the perimeter (in cm) of the fence using the measure and add method, taking into account the gate opening.

- ✦ Have the groups present their playground model, for which they also explain how they figured out the perimeter of the fence and the final result, taking into account the gate.

Activity 7: Assessment of teaching (assess critical matter – measure and add method)

Provide students with a worksheet and a 30 cm ruler. The sheet has three tasks:

1. A drawing of a regular shape having no measurements on it. The task is to determine the perimeter of the shape in centimeters. Students are asked to show their work.

2. A drawing of an irregular shape having no measurements on it. The task is to determine the perimeter of the shape in centimeters. Students are asked to show their work.

3. An empty area. The task is to draw a shape whose perimeter is 18 cm. Students are asked to show their work.

If all is well with the assessment of teaching, engage students in PRACTICE (the conclusion to the lesson plan).

Two examples of partially well-designed worksheets follow.

Each worksheet contains a sampling of question types. More questions of each type are needed for a well-designed worksheet.
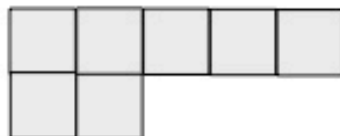
The MAINTAIN stage follows the sample worksheets.

Question 1.

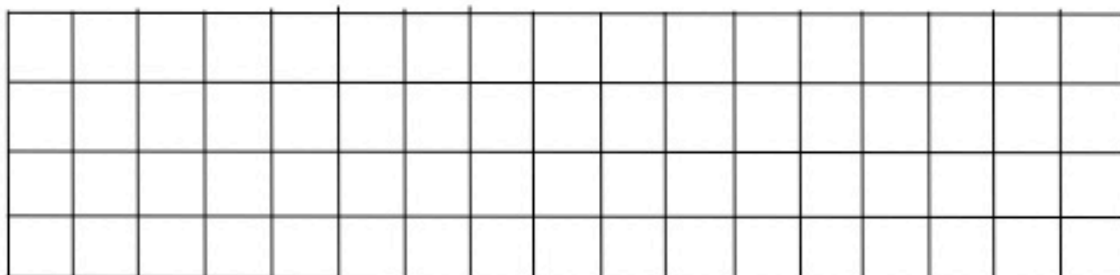Each sidelength of a square is one cm. What is the perimeter of each shape?

Perimeter is: _____

Perimeter is: _____

Question 2.

Draw your own shape made of 1 cm squares. What is its perimeter? _____

Question 3.
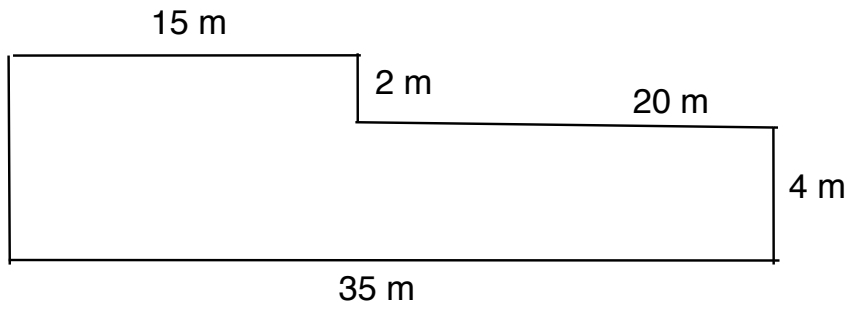
A rectangle is 6 cm wide and 12 cm long. Draw the rectangle.
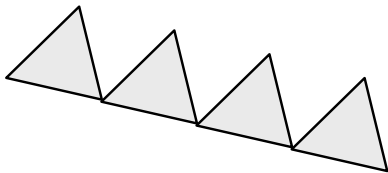
What is its perimeter? _____.

15 m

2 m

20 m

4 m

35 m

What is the perimeter of the shape? _____

Show your work.

The sidelength of each triangle is 2 cm.

What is the perimeter of the shape? _____

Show your work.

MAINTAIN stage

Mini-task example

At calendar time (for example) draw a shape on the whiteboard and ask a couple of students to determine the perimeter. Provide a 30 cm ruler. Discuss.

Rich-task example

Show students with a small box for which the width and height are the same but the length is different. [See sample diagram.] Tell students that the box will have a birthday present inside and that a ribbon is going to be wrapped around the box in two directions (ala how a ribbon is typically placed around a box). Tell them that there must be an additional 30 cm of ribbon for making a bow. The problem is: What is the length of ribbon needed?[8]
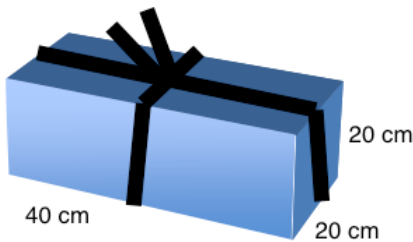
Comments.

This is a rich-task because of the complexity of the problem (from the perspective of grade 3 students). Students must realize that perimeter is involved in two directions: across the width and height of the box (a regular shape) and across the height and length of the box (an irregular shape). As well, they must pay attention to the extra length needed for making the bow.