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PHOTOCOPY MASTERS

## For Ages 10+

# Measure Up

## Using measurement concepts to solve open-ended tasks.

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# Contents

# Teachers' Notes

This book is directed towards developing process skills using a sound content base and so is directly in tune with outcomes-based courses. The aim of this book is to provide teachers with a plan for presenting outcomes-based, open-ended tasks to mathematics students of Years 5 - 7. The conceptual outcome chosen for this book is Measurement.

Each measurement concept (basic units, conversions, perimeter, area, surface area and capacity) is presented as a series of four types of questions:

1. Knowledge and understanding of mathematical concepts can be achieved by rigour-based exercises.
2. Adaptation of such concepts to more difficult situations, seemingly non-mathematical, can be learnt through tackling word problems.
3. Mini tasks are long word problems that often require multiple steps. They usually have a definite answer though it may be achieved through a variety of methods.
4. The open-ended tasks in this book can be achieved on a variety of levels and cover a range of student outcomes. The final answer is generally not important. The purpose of such questions is to test not only mathematical skill, but also for students to achieve the outcomes related to problem solving, logic, lateral thinking, working in groups, creativity, testing options amongst others.

**More on open-ended tasks**:

- This book is generic and so outcomes for specific curricula have not been specified. Teachers can attach their own outcomes to each open-ended task.
- The tasks can be presented as classroom/homework activities or assessments. It is recommended that initial tasks be non-assessed until students become more confident with them. If done as an assessment, an appropriate rubric should accompany the task sheet.
- Tasks are designed to be carried out in groups or individually. If the task is to be assessed as a group activity, it should be accompanied by a rubric that clearly states the role of each member of the group.
- The very nature of open-ended tasks implies they have no one correct answer. Some of the tasks presented may have a 'best' answer, but if students can give logical and valid details as to how they arrived at their solution, the aim has been achieved.
- The tasks have been chosen such that nearly all students should achieve, at some level. Teachers can expect to see a wide range of problem solving abilities revealed in their classroom.

**NB:** The initial 'measurement open-ended task' is more traditional (a research assignment) although it is multi-levelled.

As each measurement topic will be presented using the above progression, students will become familiar with the procedure. Thus, the teacher should be able to incorporate more student-directed lessons.

Some of the specific outcomes that will be addressed in the book include:

- appreciating the role of mathematics in society;
- working mathematically using particular skills and processes;
- content-based outcomes (measurement).

**Some extra pointers:**

- All answers involving the use of pi ($\pi$) were calculated using 3.14.
- There are miscellaneous exercises and word problems at the end of the book.
- Answers have been included for all the exercises and word problems. Some of the mini tasks have answers. There are not specific answers to the open-ended tasks.
- It is important that students set out their work in a clear manner. This not only helps them to follow a method logically, it makes it easier for teachers to follow students' thought patterns. To this end, it may be necessary for some of the word problems to be done on lined paper. Most of the mini tasks and open-ended tasks should also be done on lined paper.

Teachers should encourage discussion before beginning preliminary open-ended tasks so students are given some direction and inspiration. If progression during the task is stilted, gentle guidance, brainstorming and group-work are useful tools to help re-ignite interest and confidence. Post-completion feedback is also vital to ensure continued improvement and success.

Teachers and students sometimes find that the idea of tackling an open-ended task is somewhat daunting. Hopefully, this book, with its definite structure, will guide them to an achievable end.

**Name:** _____

# Basic Measurement

## Exercises

❑ Try these exercises without any help.

**1. a)** Name some units that we use to measure length. _____

_____

_____

**b)** Name some units that we use to measure mass. _____

_____

_____

**c)** Name some units that we use to measure volume. _____

_____

_____

**d)** How many centimetres in 2.3 metres? _____

**e)** Which is smaller, 2 litres or 200 millilitres? (*circle correct answer*)

**f)** How many kilolitres in 534 litres? _____

**g)** Which is bigger, 45 millimetres or 45 centimetres? (*circle correct answer*)

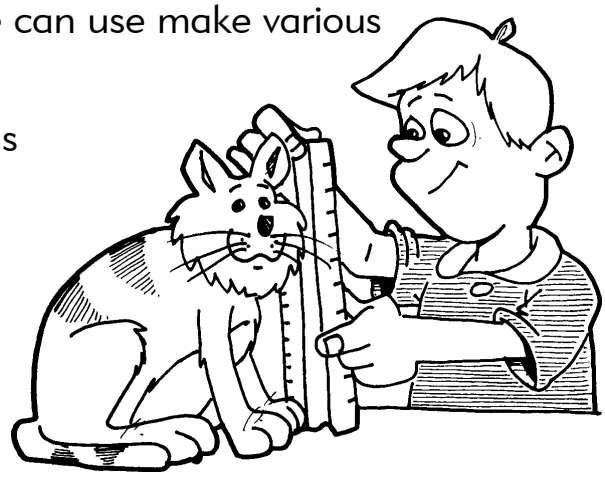
**h)** How many milligrams in one gram? _____



## How did you go?

❑ If you answered some or all of questions a) to c) correctly then you know something about what **type of units** we can use make various measurements.

❑ If you answered some or all of questions d) to h) correctly then you know something about the **size of units**.

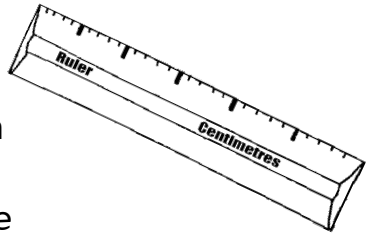


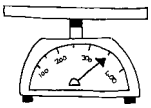
**Name:** _____

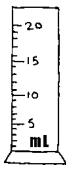
# What Unit Is That?

❑ For the remaining work on measurement, we will use the **metric system**. The **basic** unit for measuring length or distance is a metre.

**1.** Link these measurements with their basic units






| | |
|---|---|
| length | gram |
| volume | metre |
| mass | litre |

❑ Sometimes the basic units are not the best to use because the numbers might be too large or too small.

For example, you wouldn't measure the distance from Perth to Sydney in metres or the mass of an ant in kilograms!

Instead, you'd use *prefixes* to the basic units.

**2.** What units would you use to measure the following objects?

❑ Choose from:

*millimetres*, *millilitres*, *milligrams*, *centimetres*, *metres*, *litres*, *grams*, *kilometres*, *kilolitres*, *kilograms*

Length of a pencil _____

Amount of cordial in a glass _____

Mass of a flea _____

Distance from home to school _____

Length of your classroom _____

Amount of water in a pool _____

Mass of an exercise book _____

Height of an ant _____

Mass of a dog _____

Amount of milk in a full carton _____

**Name:** _____

# Measurement

## Word Problems

**1.** A chemist needs to weigh 0.085 kg of a chemical but has a scale that only measures in grams. What would the reading on the scale say?

_____

_____

**2.** Sally measured 400 m using a trundle wheel. How far is this in kilometres?

_____

_____

**3.** How many litres of milk would you have if you combined five, 600 mL containers?

_____

_____

**4.** What would be the total mass of six 120 g chocolate bars? Give your answer in kilograms.

_____

_____

**5.** Tarlie ran five times around a 400 m track. How many kilometres did she run?

_____

_____

**6.** Jamie had five items in her pencil case. Her two biros weighed 80 g each, her calculator weighed 150 g, the eraser was 50 g and her ruler was 15 g. What was the total mass of the objects in her pencil case in grams and kilograms?

_____

_____

**7.** To dilute cordial, Stacie's dad added 50 mL of cordial to 450 mL of water. How many litres of diluted cordial did he make?

_____

_____

**Name:** _____

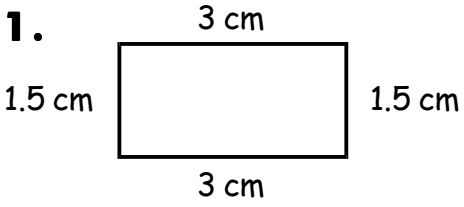
# Perimeter

## Exercises

❑ The perimeter of an object is the length or distance around it. For most objects, you can just add up the lengths of the sides to find the perimeter.

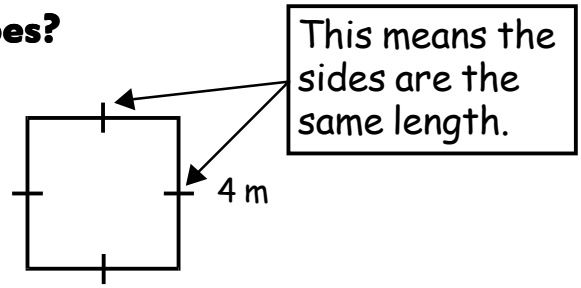
**What is the perimeter of these shapes?**

**1.**



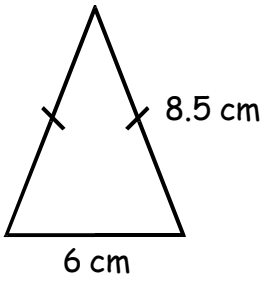

Answer: _____

**2.**



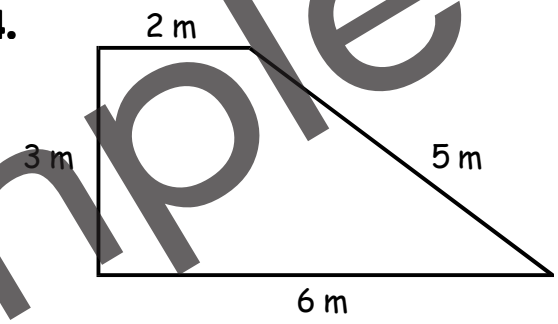

Answer: _____

**3.**



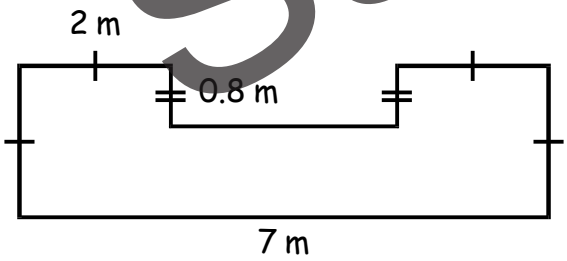

Answer: _____

**4.**



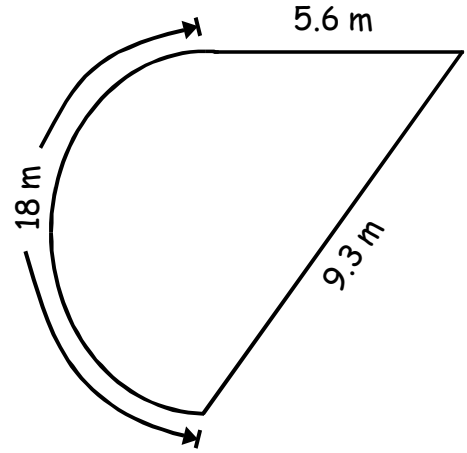

Answer: _____

**5.**




Answer: _____

**6.**




Answer: _____

**Name:** _____

# Circumference

## Exercises

❑ If you know the diameter of a circle you can find out the circumference by multiplying the diameter by pi (π).

This formula is:

**circumference = π x D**

Sometimes, the radius of a circle is given instead of the diameter. The radius is the line from the edge of the circle to the middle. So, the radius multiplied by two will give the diameter.

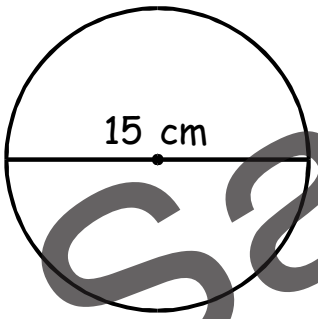
If the radius is given, we can use the formula:

**circumference = 2 x π x r**

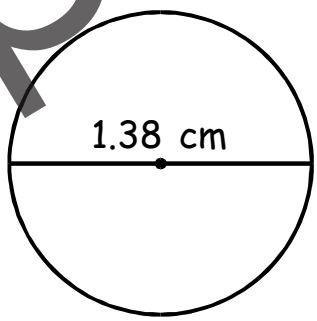
Some calculators have π written on them. Does yours? If not, use the approximation of 3.14.

❑ Find the circumference of these circles, semi-circles or quarter circles.

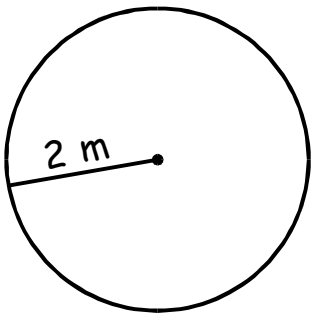
**1.**



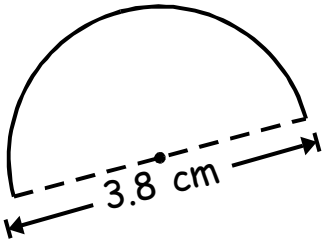

**2.**



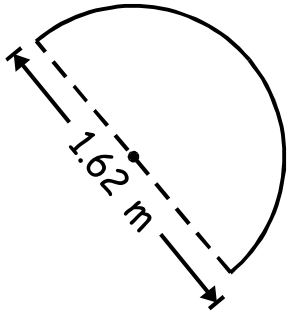

**3.**



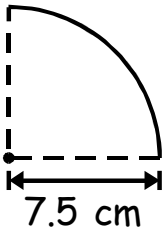

**4.**




**5.**



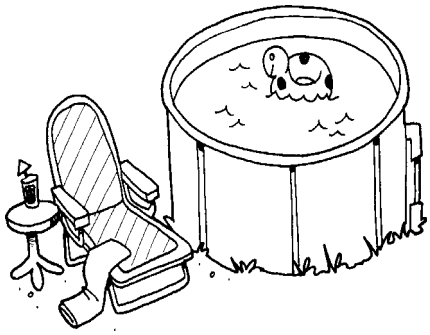

**6.**



**Name:** _____

# Perimeter and Circumference

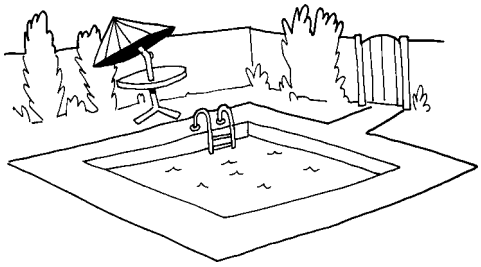
## Word Problems



❑ Some of these are tricky! Take your time to think about them and draw a diagram if it will help.

**1.** Sally's circular above-ground swimming pool is in the shape of a circle with a diameter of 3 m. What is its circumference?

_____

**2.** 

Irene has a rectangular pool. If its length is 8 m and its width is 7 m, what is its perimeter?

_____

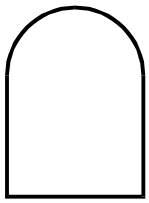
_____

**Extension:** A path has been put around Irene's pool. If the path is 1 m wide, what is its outer perimeter? Hint: Use the diagram.

_____

_____

**3.** Mrs Hunter wanted to put a herb garden in her yard in the shape drawn below. If the square down the bottom had a length of 3 m and the top shape is a semi-circle, what was the total perimeter of the shape? Mrs Hunter decided to put a small fence around the herb garden to keep the rabbits out. If fencing costs $8.95 per metre, how much will it cost in total?

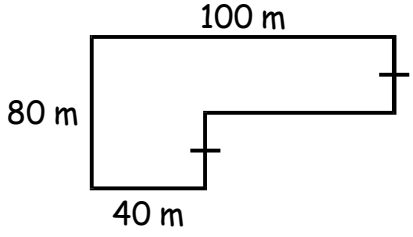


_____

_____

_____

**4.** John decided to do some exercise. First he ran 5 laps of the school playing field. The field was actually a circle with a diameter of 110 m. Then he ran three times around the school that was in the shape shown below. What was the total distance that John ran?




_____

_____

_____