**NZQA**

**Approved**

Achievement standard: 91030 Version 3

Standard title: Apply measurement in solving problems

Level: 1

Credits: 3

Resource title: Filling the pond

Resource reference: Mathematics and Statistics VP-1.5 v2

Vocational pathway: Primary Industries

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| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-02-2015-91030-02-7270 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.  Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

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Learner instructions

# Introduction

This assessment activity requires you to apply measurement in solving problems by making calculations to find out how long it takes to fill an empty storage pond.

You are going to be assessed on how you apply measurement, using extended abstract thinking, to establish how long it takes to fill an empty storage pond. You are required to communicate your solutions clearly and accurately.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners.

# Task

A farmer wants to use the local river to fill an empty storage pond. You need to determine how long it will take to fill the empty pond by using the river water without breaking Regional Council restrictions on water usage.

This activity is in two parts. In the first you work as a group and in the second you work individually.

## Part 1: Field trip

Take a field trip to a local river. Working in groups of three to four learners, measure:

* the depth of a set of evenly spaced points across the river; along a straight line at right angles to the bank (a perpendicular transect)
* the time it takes a floating object to travel 20 m down the river.

## Part 2: Independent analysis

The Regional Council will only permit the farmer to take water from the river if its flow-rate, after they have taken any water from it, remains above 2.8 m**3**/s. He cannot take more than 120 L/s at any time.

A typical storage pond is shown in the photograph. A sketch of the storage pond is also shown.



68.5 m

176.0 m

168.0 m

5.0 m

6.4 m

You need to calculate:

* the velocity of the river
* the area of the cross-section of the river
* the river’s flow-rate in m3/s
* the volume of water, if any, the farmer can take from the river under current conditions
* the time, assuming the flow of the river remains at this rate, that it would take to fill the empty pond.

Write a formula or general expression that the farmer can use to determine the time to fill the empty pond for any calculated flow-rate in m3/s.

Show all calculations that you have used and clearly communicate your method using appropriate mathematical statements. Identify any assumptions you need to make and discuss how they might affect your calculations of how long it takes to fill the empty pond.

## Formulae sheet

Area of circle = 

Circumference of circle = 

Area of trapezium = 

Area of parallelogram = 

Area of triangle = 

Volume of prism = base area × *h*

Volume of pyramid =  × base area × *h*

Volume of cylinder = 

Volume of cone = 

Volume of sphere =

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to measure, using extended abstract thinking, the depth and water velocity of a river, and then use their data to calculate other measurements in order to find out how long it takes to fill an empty storage pond.

Make sure you consider risk management policies before doing this activity.

# Conditions

Learners may work in groups for the field trip but need to conduct their analysis independently. They may use any appropriate technology.

# Resource requirements

Appropriate measuring devices, for example metre rulers, stop watches and tape measures.

Provide learners with a sheet of formulae.

# Additional information

Taking measurements is not a requirement of the standard. It is acceptable for learners to complete this activity using provided measurements. If this is done, assessors/educators will need to change some of the learners’ instructions.

The figures used in this task will need to be altered for a given river. Assessors/educators need to ensure that they are such that the farmer can take some water to fill the empty pond.

Assessors/educators need to ensure learners are familiar with any context specific vocabulary used in this task.

## Other possible contexts for this vocational pathway

Any situation where water needs to be extracted for a specific purpose relating to a primary industry.

# Assessment schedule: Mathematics and Statistics 91030 – Filling the pond

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner applies measurement in solving problems by:   * selecting and using a range of methods in solving problems * demonstrating knowledge of measurement concepts and terms * communicating solutions which would usually require only one or two steps   The learner selects and correctly uses at least three different methods when determining how long it will take to fill the pond  For example, the learner has:   * calculated the velocity of the water * calculated the volume for a given length of river or the pond * correctly used units in measurements and calculations at a level of precision appropriate to the task.   The learner has clearly identified what is being calculated.  *The examples above are indicative of the evidence that is required.* | The learner applies measurement, using relational thinking, in solving problems by involving one or more of:   * selecting and carrying out a logical sequence of steps * connecting different concepts and representations * demonstrating understanding of concepts * forming and using a model   and also relating findings to a context, or communicating thinking using appropriate mathematical statements  For example:  The learner has shown the method of finding the flow using the area (as the sum of trapeziums) and water velocity. They have established the permitted take and linked this to a correct calculation of the time it would take to fill the pond.  Working is shown and correct units used.  *The examples above are indicative of the evidence that is required.* | The learner applies measurement, using extended abstract thinking, in solving problems by involving one or more of:   * devising a strategy to investigate or solve a problem * identifying relevant concepts in context * developing a chain of logical reasoning, or proof * forming a generalisation   and also using correct mathematical statements, or communicating mathematical insight  For example:  The learner has completed all calculations required to establish the time required to fill the pond under current conditions. They have generalised using a formula or statements for different calculated flows. The learner has considered the three situations and indicated how the time to fill the pond can be calculated in each case, clearly explaining their reasoning. The three situations are:   * maximum take of 120 L/s if the calculated flow is above 2.92 m3/s * partial take if the flow is between 2.8 m3/s and 2.92 m3/s. In this case the permitted take would be the difference between the calculated flow and 2.8 m3/s * no take if the measured flow is below 2.8 m3/s.   The learner has considered at least one assumption, for example varying flow rates or the effects of evaporation, and discussed how this would impact on time calculations.  The strategy used is clear, working and units are shown and reasoning is clearly communicated.  *The examples above are indicative of the evidence that is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.