National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Exemplar for Internal Achievement Standard

Mathematics and Statistics Level 1

This exemplar supports assessment against:

Achievement Standard 91945

Use mathematical methods to explore problems that relate to life in Aotearoa New Zealand or the Pacific

An annotated exemplar is a sample of student evidence, with a commentary, to explain key aspects of the standard. It assists teachers to make assessment judgements at the grade.

New Zealand Qualifications Authority

To support internal assessment

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Grade: Achieved
For Achieved, the student needs to use mathematical methods to explore problems that relate to life in Aotearoa New Zealand or the Pacific. This involves using mathematical methods that are appropriate to the problems, and communicating accurate mathematical information related to the context of the problems. This student has used four appropriate mathematical methods across two or more areas. The evidence includes using algebra to find the size of the rectangular shape that optimises the area of the garden bed. The composite volume of the garden bed is calculated, taking into account the volume displaced by the water tower. This provides evidence of a measurement method. Converting the amount of garden mix required to litres is evidence of another appropriate measurement method. Evidence of a number method (reasoning with a linear proportion) is provided by finding the GST exclusive price of the timber, and when finding the GST exclusive price of the garden mix. The student has correctly communicated mathematical information by showing how they reached their answer and indicating what their calculated answer represents. The student has made one logical connection linking the composite volume of the garden bed to the volume of soil required in litres. For Merit, the student would need to make a further logical connection linking one process to another as part of a problem or problems. Each part of the connection would need to be completed correctly.

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Achieved
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Garden framing -
Finding out the best option for macrocarpa sleepers:

Option 1:
200mm x 100mm by 2.1m = 20cm x 10cm x 210cm
210cm x 6 = 1260cm
$66.78 x 6 = $400.68
Removing GST: 400.68/1.15 = $348.42

Option 2:
200mm x 100mm x 4m = 20cm x 10cm x 400cm
400cm x 3 = 1200cm
$130 x 3 = $390
Removing GST: 390/1.15 = $339.13

Option one would be best for this scenario because it maximizes the area of the garden whilst only costing $9.29 more. As the primary focus is to maximize area space, this option would be better as it adds 60cm more to the timber while still being less than $350. Option one costs $348.42, and option two costs $339.13. If the price difference was larger than $9.29 I would say that option two is better as it would cost less for not a large change in timber size. But as this difference is under $10, I think it is worth it to have the extra area space as this is one of the main requirements of the garden.

Dimensions:
Maximizing area space

Side 1	Side 3	Area
1m	5m	5m²
2m	4m	8m²
3m	3m	9m²
4m	2m	8m²
5m	1m	5m²

Using this table, I have decided that each side of the garden will be 3 metres long. This area will be 9m². This also means that the garden will be in a square shape. This would look better than a rectangle and is neater.

Gardening mix -
Finding the amount and cost of gardening mix necessary:

Finding the volume of garden needed to fill:
3 x 3 x 0.15 = 1.35m³
I did this because to find the volume it is base x height x depth. I removed 5cm from the top of where it needs to fill as it needs to sit 5cm below the top edge of the garden.

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Removing space for water tank -
Removing part of the gardening mix to make room for the water tank:

Cylinder -
R = 0.25
H = 0.15
Volume: $\pi r^2 h = \pi \times 0.25 \times 0.25 \times 0.15 = 0.029m^3$

Removing the volume of the bottom cylinder from the garden that needs to be filled:
$1.35m^3 - 0.029m^3 = 1.321m^3$
$1.321m^3 = 1321L$
1321/40 = 33.025
Rounded = 34
After removing the volume of the water tank from where the gardening mix needs to be filled, it means the same number of gardening mix needed.

34 x $8.83 = $300.22
Removing GST: $300.22/1.15 = $261.06

Total cost:
348.42 + 261.06 = $609.48

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Grade: Merit
For Merit, the student needs to use mathematical methods to explore problems that relate to life in Aotearoa New Zealand or the Pacific by applying relational thinking. This involves applying mathematical methods using logical connections, and communicating accurate mathematical information related to the context of the problems using appropriate mathematical statements. This student has made the required minimum of two logical connections linking one method to another as part of exploring a problem or problems. Each part of the connection is completed correctly, and the methods used are from two or more areas. The first logical connection made by the student occurs when the algebra methods of quadratic tables and graphs are linked to finding optimal solutions. This student has made a second logical connection by linking the measurement method of using a composite shape to find the volume of garden mix required for the garden to the method of converting the units for the volume of the garden mix from m^3 to litres. Mathematical conventions have been followed correctly. Solutions have been appropriately rounded and linked to the context of the problem, with appropriate mathematical statements. For Excellence, the student would need to extend at least one problem from within the previously chosen mathematical methods. For example, by considering underlying limitation and assumptions and their mathematical impact on any solution found. Mathematical generalisations or predictions, including recommendations for the best model for a garden, would also meet the requirements for Excellence.

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Merit

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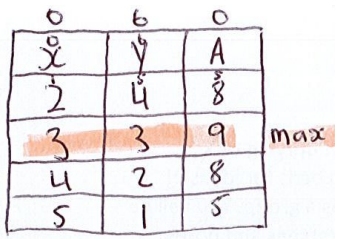
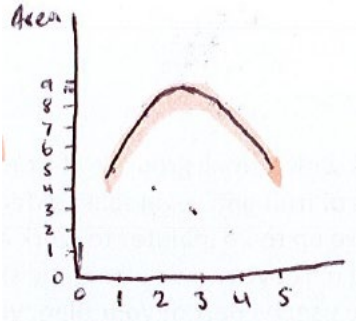


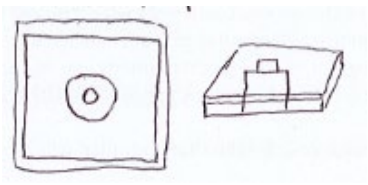


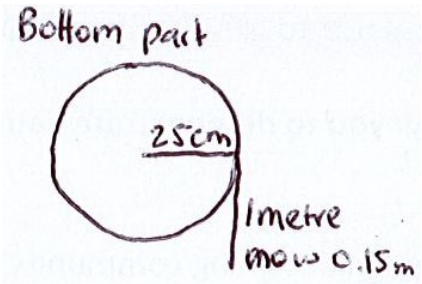
My table and graph has shown me that the maximum area would be 9 m^2 and that to achieve that maximum area, my length and width of my garden box would both have to be 3m long

Volume of inside

To measure the inside, I have to subtract the depth of the timber which will make the equation 2.9 (l) x 2.9(w) x 0.2(h).
But because the soi has to sit below, our new equation becomes 2.9 x 2.9 x (0.2-0.05) = 1.26m^3

Cylinder





Since the soil will only go up 0.15m then the only part of the cylinder water tank that will go in is:
π x 0.25^2 x 0.15 = 0.029m^3
The new volume of the inside will be
1.26 - 0.03 = 1.23m^3
To determine how much soil we will need, I will convert m^3 into litres.
1.23 x 1000 = 1.230 litres
Since the bags of soil come in 40 litres I will need 1230 ÷ 40 = 30.75 bags
Cost of Soil
31 bags of soil x $8.83 = $ 273.73 inc GST
Cost of timber
I will buy 6 200mm x 100mm by 2.1m which will cost me: 6 x 66.78 = $400.68 inc GST
Cost of timber and soil
400.68 + 273.73 = $674.41 inc GST
$573.25 exc GST
Though this might seem cheap, there are unforseen costs that go into this project such as the nails needed to connect the timber, the sharp equipment needed to cut the timber and also the water tank that sits in the middle of this garden.

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