Extending Mathematical Thinking and Reasoning (EMTR)

Teacher Lesson Plan

Learning Goals & Success Criteria

Learning Goals

- To develop an understanding of the volume of rectangular prisms
- To work collaboratively by sharing, communicating and listening actively
- To apply step-by-step problem-solving strategies.

Success Criteria
I can:

- **recall** the formula for the volume of rectangular prisms
- **apply** my understanding of volume to **calculate** the volume of rectangular prisms
- **solve** an open-ended problem and **communicate** and **justify** my strategy

Topic & Task Title

Volume of Rectangular Prisms: Pete's Pools

Year Level

7

Pedagogical Considerations

- Students have just completed a unit on Measurement
- Students should be encouraged to take risks, make mistakes and be present in the 'zone of confusion'
- 3 - 4 students per group (mixed ability)
- Equipment – whiteboards, paper, calculator, pens, desks

Warm-up

Strike it Out (5 mins)

This is a two-player game.

The first player picks two numbers, crosses them out and circles either their sum, difference, product or divident. The second player crosses out the circled number and another number that's still left, and again circle the sum or difference.

E.g. Player 1 makes the move 1 + 7 = 8 so he crosses out the 1 and 7 then circles the 8. Player 2 then makes the move 8 + 12 = 20. Player 1 now must start with 20.

It is a bit like chess. The winner is the person who stops their opponent from being able to move! Play a game with a partner on the number line below.

Source: https://nrich.maths.org/6589

Main Task

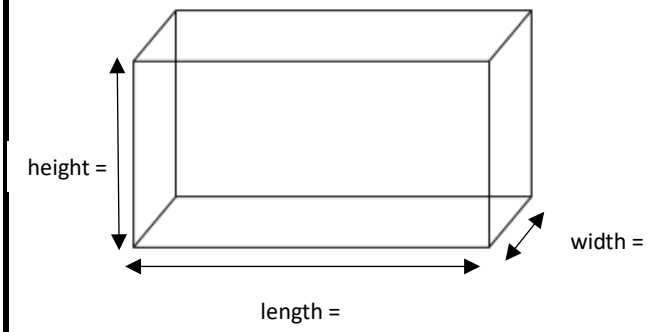
Pete's Pools (10 minutes)

You are the lead builder at Pete's Pool Constructions. Your boss (Pete) has asked you to help with the design of two new pools. You are given the following brief:

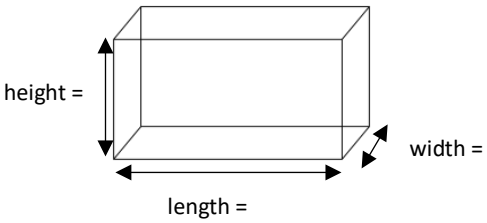
- Both pools must be rectangular-prism shaped
- The volume of the larger pool must be exactly double the volume of the smaller pool
- None of the pool dimensions can be the same
- The length of the large pool can be no more than 9 metres

Determine the possible dimensions (length, width and height) of the large pool and small pool.

Large Pool



Small Pool



Enabling Prompts: listed in order of difficulty

1. How can we find the volume of a rectangular prism? Do you know the formula, or a possible strategy to calculate the volume?
2. The formula for the volume of a rectangular prism is: $V = l \times w \times h$
3. What does it mean for one quantity to be double another's?
4. Try the strategy of trial and error

Extending Prompts: listed in order of difficulty

1. Is there more than one solution to this problem? Explain
2. Can you work out a pattern or strategy? Explain.
3. Is your solution realistic? Explain.

Possible Student Solutions

This problem is open-ended meaning. Below are some examples of practical solutions.

E.g. 1

Large Pool	Small Pool
V = l x w x h	V = l x w x h
= 9 x 8 x 2	= 6 x 4 x 3
= 144 m^3	= 72 m^3

E.g. 2

Large Pool	Small Pool
V = l x w x h	V = l x w x h
= 8 x 6 x 1	= 4 x 3 x 2
= 48 m^3	= 24 m^3

The problem did not ask for integer (whole number) dimensions, therefore, the dimensions could be decimals. Students could use algebra to solve for the unknown dimension.

E.g. 3. Let the small pool have the following dimensions and volume:

V = l x w x h
= 4 x 3 x 1.5
= 18 m^3

The large pool must be exactly double the volume of the small pool, therefore the large pool must have the following volume:

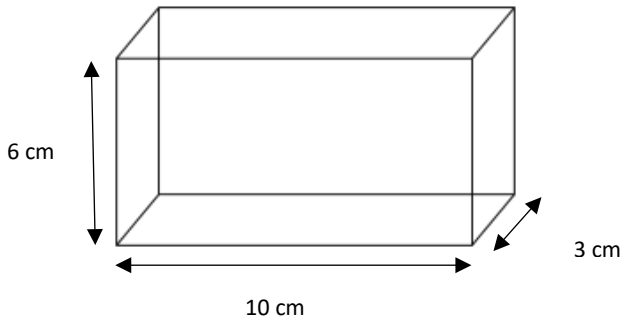
V = 18 x 2
= 36 m^3

Let the large pool have a length of 6 m and a width of 3.5 m. Let's now determine the height:

V = l x w x h
36 = 6 x 3.5 x h
36 = 21h
h = 36 / 21
h = 1.71 m (rounded to 2 decimal places)

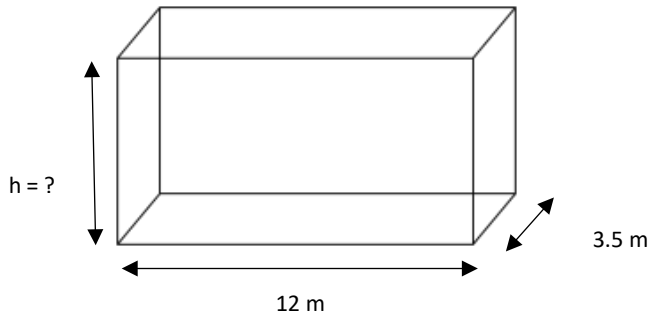
Consolidating Task(s)

Q1. **Calculate** the volume of the following rectangular in cm^3.



V = l x w x h
= 10 x 3 x 6
= 180 cm^3

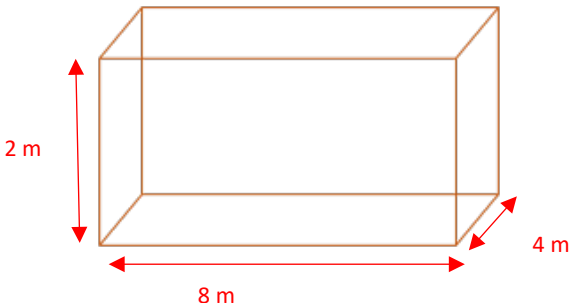
Q2. The volume of the prism below is 128 m^3. **Calculate** its height.



V = l x w x h
128 = 12 x 3.5 x h
128 = 42 x h
h = 128 / 42
h = 3.05m (rounded to 2 decimal places)

Q3. **Sketch** a rectangular prism that has a volume of 64 cubic units.

This is an open-ended question. One possible solution is:



Teaching Notes

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Student Handout

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Warm-up

Strike it Out (10 mins)

Player 1 Moves	Player 2 Moves

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Main Task

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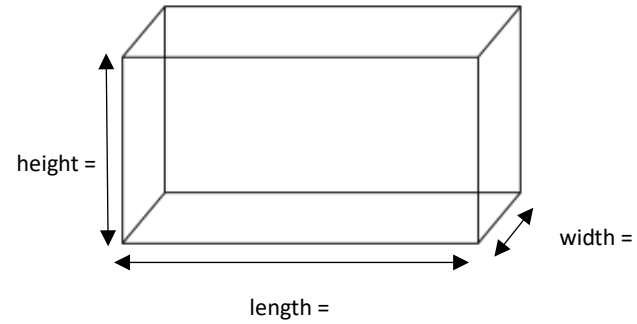
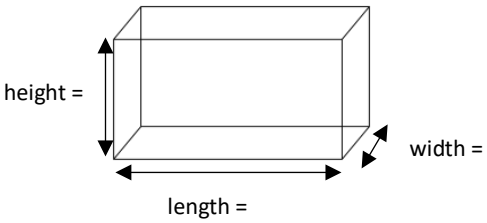


Small Pool



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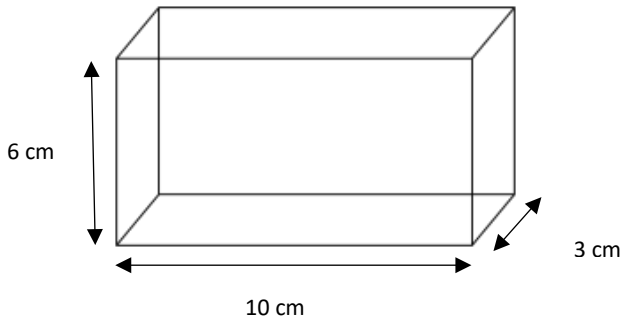
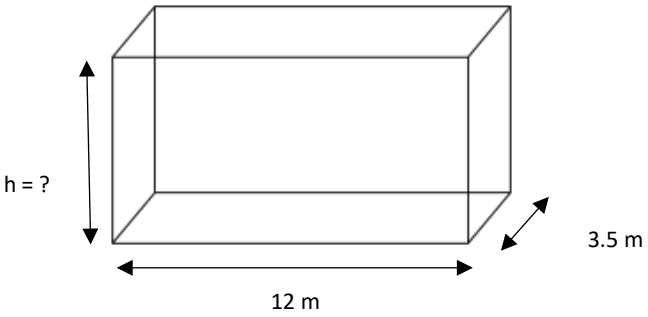


Q2. The volume of the prism below is 128 m^3. **Calculate** its height.



Q3. **Sketch** a rectangular prism that has a volume of 64 cubic units.

Reflection

Using short sentences and examples, answer the following questions.

1. **Describe** a new *strategy* you used today.

2. **Describe** a *mistake* you made and what you *learned* from it.

3. **Explain** how you *challenged* yourself today.

4. **Explain** how you *interacted* with your group members.