10 000 Centicubes
Lesson 3: Develop

Australian Curriculum: Mathematics (Year 4)

ACMNA073: Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems.

ACMNA076: Develop efficient mental and written strategies and use appropriate digital technologies for multiplication and division where there is no remainder.

Lesson abstract

Groups agree on their 'best' container to use and determine the dimensions for each face. Plans for the best containers are swapped to provide feedback on whether sufficient mathematical evidence has been recorded to enable the container to be constructed easily. The models of the containers are then constructed.

Mathematical purpose (for students)

To construct the container, it is necessary to record the shape and dimensions for all its faces.

Mathematical purpose (for teachers)

Iterative sharing of container plans has the potential to improve the mathematical evidence gathered. Grid paper, cut to size and partitioned with tracings of MAB blocks to represent the container base (and its area) provides clear visual mathematical evidence that can be verified by others in the Defend Phase. Rulers are a useful tool to ensure the calculated dimensions of the remaining faces are accurately drawn.

At the end of the Develop phase, students/ groups will be able to:

- Display a model of their container that has been constructed accurately from the calculated dimensions.
- Provide mathematical evidence justifying the size of the base layer to answer the inquiry question.

Lesson Length 90-120 minutes

Vocabulary Encountered

Lesson Materials

- Planning sheets partially completed by groups in Devise Phase
- Poster of good container attributes made in Devise Phase
- A3 sheets of grid paper- allow at least one per group
- MAB – 1 set per group if possible
- Construction materials – paper, light card, tape, rulers

We value your feedback after these lessons via https://www.surveymonkey.com/r/CV2TXTT

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Refine Plans

Inquiry Question: What is the best container to hold 10 000 centicubes?

Choose container dimensions and complete the plan

1. Inform students that today in the Develop Phase they will be refining and completing their 'best' container plans, then construct their container. Refer to the class poster constructed in the beginning of the Devise Phase that listed attributes of a suitable container for the cubes. Review with students that containers need to be a suitable size and shape.

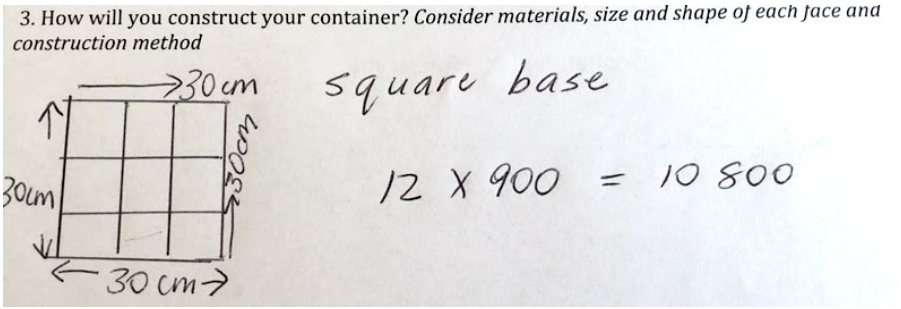
2. To assist students to work out the dimension of the faces from the length, width and height of a container, measure a box with them recording the length, width and height. A box without a lid is preferable. Ask students what they notice about the faces (For example: *two pairs of rectangular faces that are the same and a base),* then measure them. Model how students can write dimensions for the base and other faces on a container plan.

3. Provide 20 minutes for groups revisit their plans to:

    - Improve and add to ideas for container shapes and base sizes in Q1 and Q2 on the planning sheet from the previous lesson.
    - Agree on the 'best' dimensions for the container they will construct.
    - Plan how to construct the 'best' container by considering the size and shape of the base and the other faces, the materials to use and the method they will use to construct it. Have groups record their ideas under Q3 on the Planning Sheet, Reiterate the importance of drawing each face and recording the dimensions.

4. Circulate and engage with groups as they work and monitor each groups' progress. Use questioning and prompts to ensure all groups find appropriate dimensions for all the faces of their container.

Example container plan: Insufficient detail to construct container model



Possible prompts to group to assist them to improve the plan:

T. *You have clearly indicated the shape and dimensions of your base. What do you know about the size and shape of the other faces?*

S. They will all be rectangles with a length of 30 centimetres.

T. *How wide will they be?*

S. We thought 12 centimetres.

T. *I can see from your plan that you choose 12 layers but that gave you a total number greater than 10 000. Can you explain why you choose 12 layers?*

S. When we divided 10 000 by 900, we got 11.111 which was not a whole number of layers. If we chose 11 layers the container would only hold 9 900 centicubes which would not be enough. We chose 12 layers because then the container could hold 10 000.

T. *Great. On your plan add that extra information on faces and how you worked out 12 layers was best.*

Checkpoint

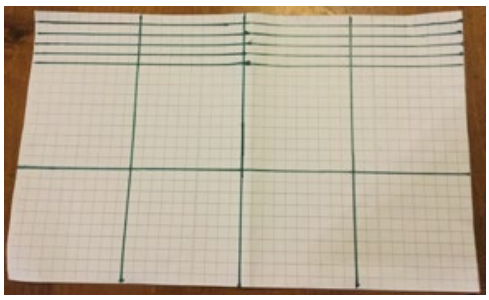
5. After the twenty minutes, bring the class together even if some groups still have incomplete plans. Inform groups they will now provide written feedback to others, focusing on whether container plans contain sufficient mathematical detail about the size and shape of the container faces to enable models to be easily constructed from the plan.

6. Remind students that all feedback provided needs to be **respectful** and ***focus on the mathematics*** used. Model examples of helpful feedback (e.g. *"You have written 26 x 40 = 1000. Check your calculation"*. OR *"You have only given details on the size of the base. How high and long will each of the faces be?")* and unhelpful feedback (e.g. *"We like your choice of materials.")* Elicit from students why modelled examples are helpful or unhelpful.

7. Have groups swap their plans with another group and allow 10 minutes for groups to provide feedback on exchanged plans, recording it under Q4 on the Planning Sheet (or workbook). Once plans are returned, have groups address any requests for further detail before commencing construction.

Construct Physical Models of Containers

8. Provide groups with grid paper to construct the base of their container. To make it easier for others to check the number of centicubes on the base layer, have groups represent their base in tens (as if they were using MAB hundreds and tens).



Check groups have accurately drawn the base before they commence construction of the remaining faces. Groups should use use a ruler to measure and draw the faces to ensure the dimensions are correct.

The model is unlikely to be perfectly constructed but it is important that students construct it as accurately as possible. For example, they might use a protractor, or even a ruler as a right-angle tester, or grid paper to draw right angles.

This time to construct is important here to maintain engagement after students have been doing written work. This may take the rest of the lesson.

9. In groups, students discuss and record ideas they could use to justify why their container is the 'best' container to hold 10 000 centicubes. Refer them to the poster of desirable attributes used earlier in this lesson for ideas.

Teacher Notes

- Groups are not required to construct their container using a net. Edges can just be taped together along their full length. However, they can use a net if they know how.
- Similarly, allow groups to make the dimensions a little bit larger than the exact space filled by the centicubes if they can justify why.