National Certificate in Building, Construction and Allied Trades Skills (BCATS)

Teacher Information & Resources

Apply mathematical processes to BCATS projects

Unit Standard – 24361

Level 2, Credit 3

Teaching and assessment tips

Intent – The intent of the unit standard is that the learner is able to

- decide which mathematical method should be used to solve a problem and
- then use that method accurately to achieve an acceptable outcome.

A variety of maths skills are required and should be spread throughout 2 different projects.

Unit standard Interpretation

Mathematical methods must be selected and used for at least 2 different projects. These projects may be in the worksheet provided or from actual projects that the student is completing as part of the BConstructive programme. The worksheets would, ideally, be used to support the practical projects undertaken.

The skills and knowledge required for this unit standard may be assessed using a variety of practical projects where the student has used mathematical processes, the worksheet provided or a combination of both of these.

We would encourage you to use the practical projects that your student is completing as part of the BConstructive programme. If you choose this method of assessment then the calculation sheets and cutting lists must be attached as evidence.

Whatever method used, the projects must cover **2** mathematical skills (numerical calculation, measurement, geometry or trigonometry) and over the 2 projects the information calculated must be presented in at least **3** different ways such as cutting list, job [requirements] sheet, diagram).

Assessment

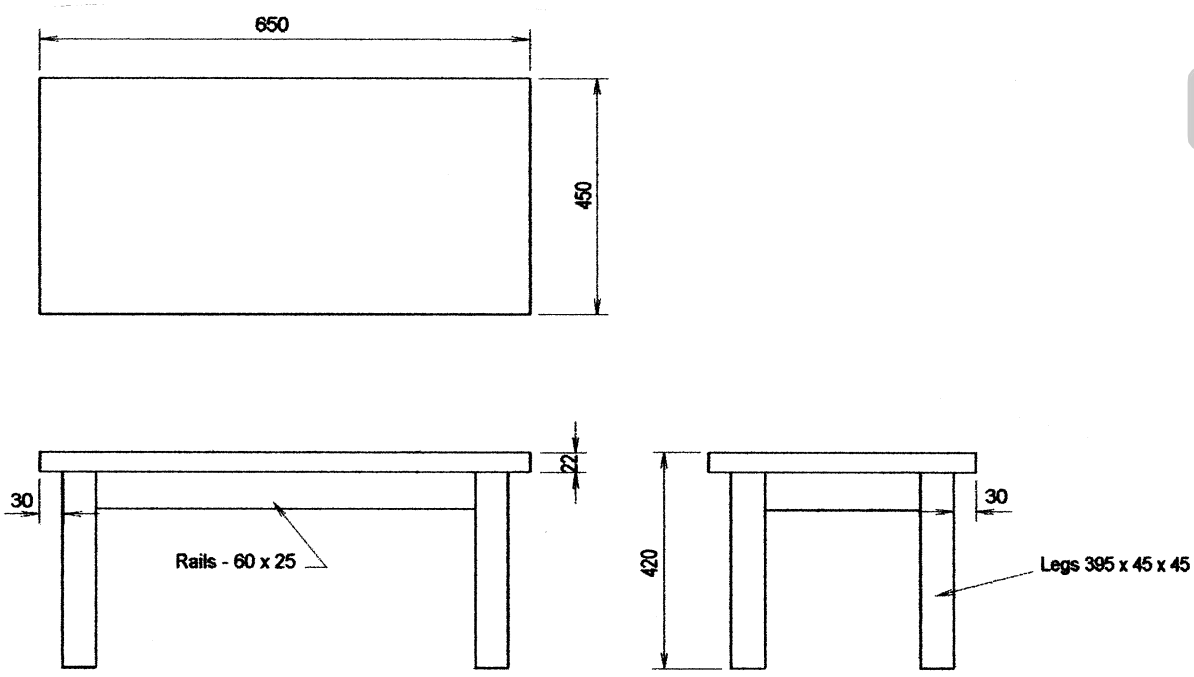
Assessment of this unit standard consists of:

- Completion of the worksheet OR
- Completion of selecting and using a variety of mathematical methods to solve problems on 2 different practical projects OR
- Completion of a combination of worksheet and practical projects equalling 2 different projects.

Worksheet US 24361

Student Name:

1. **Situation** – You have been given the following specifications and asked to construct a coffee table. The tabletop is to be constructed out of solid rimu – ex 160 x 25



Work out the amount of timber (quantities, sizes etc) required. Show your working and calculations.

From your calculations, complete the following order list for the timber for the coffee table.

Part	Number of	Length	Width	Thickness	Total length
Top					
Side rails					
End rails					
Legs					

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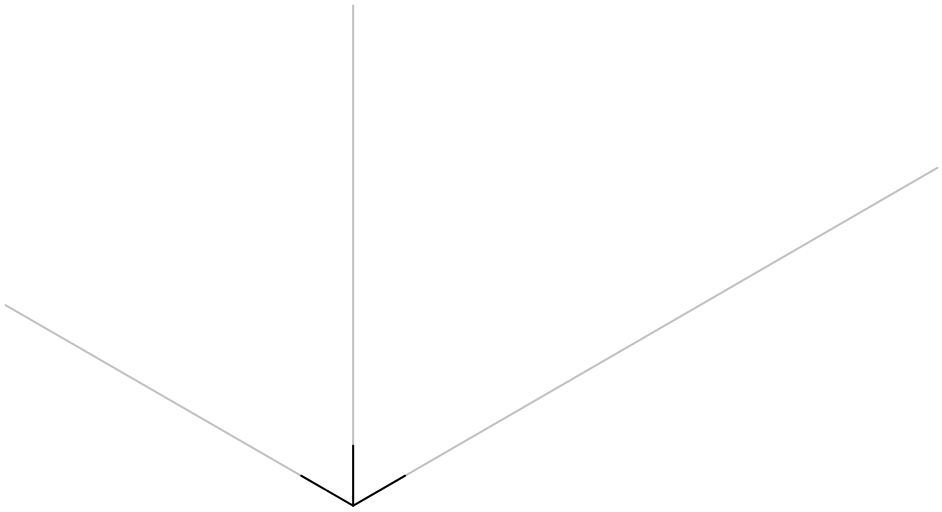
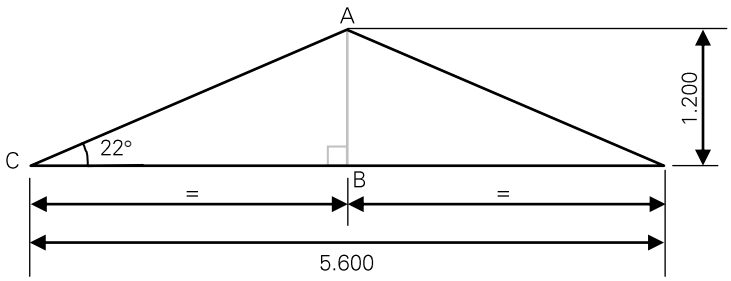
Using the given isometric grid, prepare a pictorial freehand sketch of the table and dimension the side and end rails. Your sketch does not have to be to scale.



2. The drawing below shows the outline of a roof section. From the information given answer the following and show your working.



Using Pythagoras theorem, calculate the length of the rafter A – C.

Using the triangle theorem, calculate the angle CAB.

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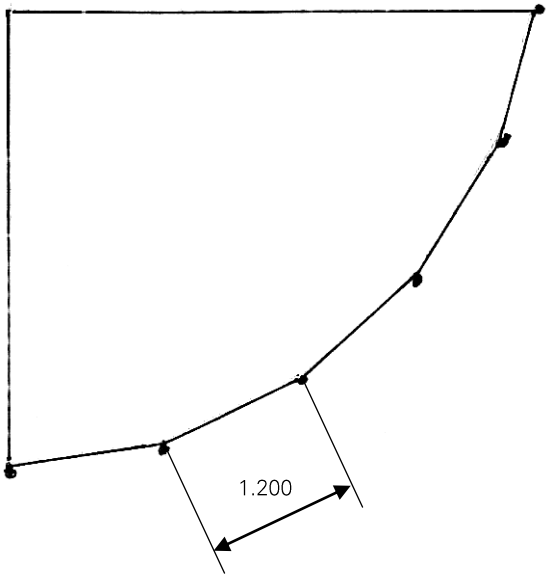
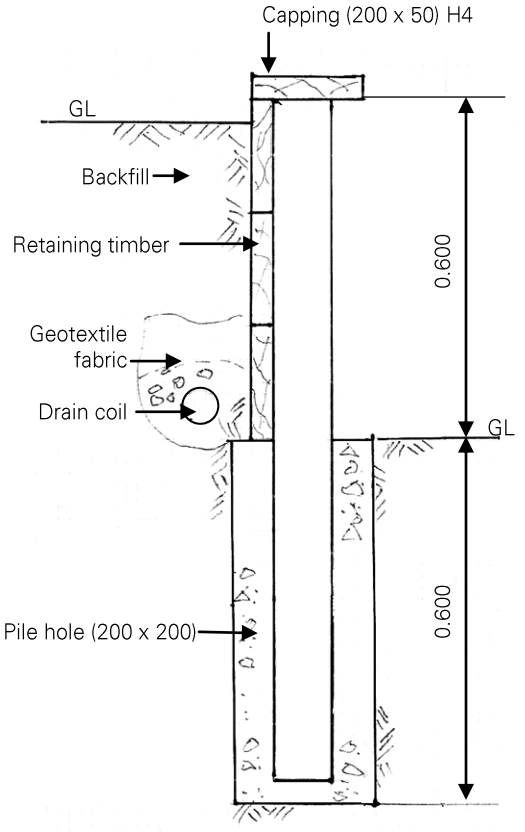
3. The curved section of a residential garden is to be retained using a simple timber post and rail retaining wall.



Job specifications

Posts	100 x 100 D45 H4 treated
Retaining timber	200 x 50 D45 H4 treated
Concrete	Will be purchased

Using the given job specifications calculate the quantity of timber and concrete materials required. Show your working.



From your calculations complete the following materials list.

Part	No. Required	Size	Totals
Rails			
Capping			
Posts			

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4. A rectangular area that is 3.750m x 5.250m is to be paved with 150 x 150 x 0.40 concrete paving slabs that cost $2.10 each. The edge restraint timber is 150 x 50 and a decorative timber inlay strip is to be inserted diagonally from corner to corner. Show your workings for the following calculations.

Calculate the total number of paver slabs required and how much will they cost.

Calculate the total length of edging timber required.

Calculate the length of decorative inlay strip needed.

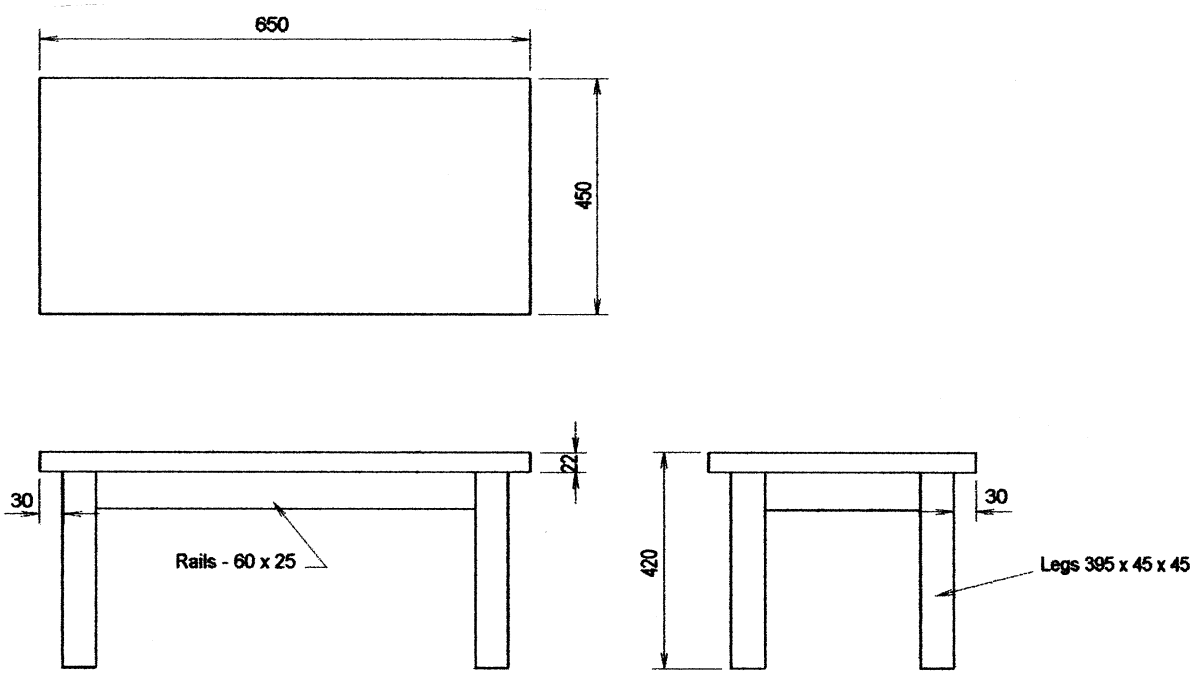
Sketch a plan view of the area to be paved and dimension the sides and decorative inlay strip. The sketch does not have to be to scale.

Assessor Sign off:

Assessor name: ..... Assessor signature: ..... Date:.....	**RESULT:** A = Achieved, N = Not Yet Achieved

Worksheet Model Answers

1. **Situation** – You have been given the following specifications and asked to construct a coffee table. The tabletop is to be constructed out of solid rimu – ex 160 x 25

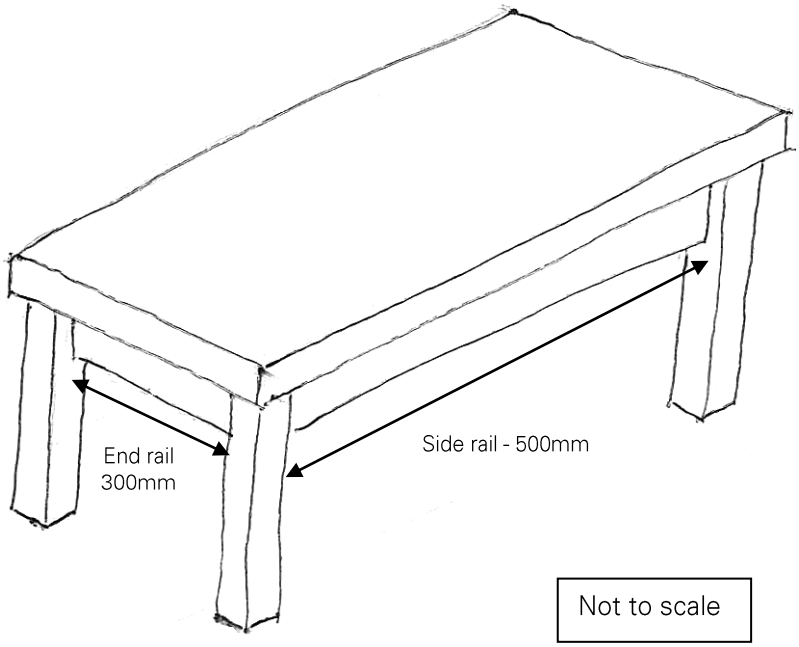


Work out the amount of timber (quantities, sizes etc) required. Show your working and calculations.

From your calculations, complete the following order list for the timber for the coffee table.

Part	Number of	Length	Width	Thickness	Total length
Top	*3*	*650*	*150*	*22*	*1950*
Side rails	*2*	*500*	*60*	*25*	*1000*
End rails	*2*	*300*	*60*	*25*	*600*
Legs	*4*	*395*	*45*	*45*	*1580*

Using the given isometric grid, prepare a pictorial freehand sketch of the table and dimension the side and end rails. Your sketch does not have to be to scale.



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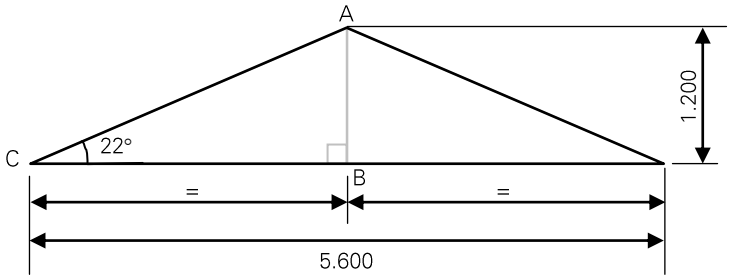
2. The drawing below shows the outline of a roof section. From the information given answer the following and show your working.



Using Pythagoras theorem, calculate the length of the rafter A – C.

$AC^2 = AB^2 + BC^2$

$AC = \sqrt{AB^2 + BC^2}$

$= \sqrt{1.200^2 + 2.800^2}$

$= \sqrt{1.44 + 7.840}$

$= \sqrt{9.280}$

Rafter length = 3.046m

Using the triangle theorem, calculate the angle CAN

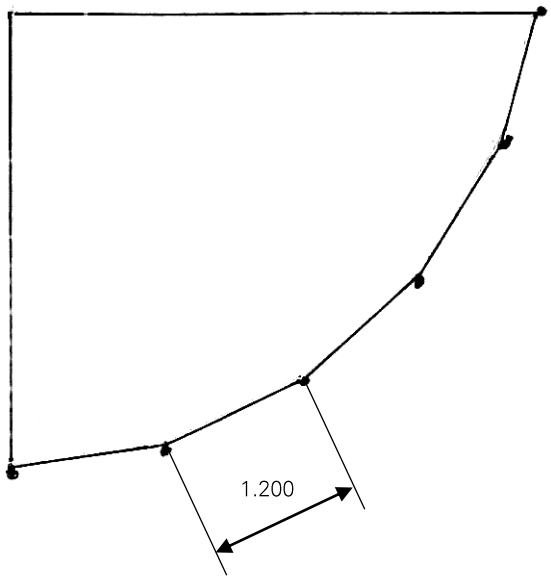
$ACB = 180° - (ACB + ABC)$

$= 180° - (22 + 90)$

$= 180° - 112°$

= 68°

3. The curved section of a residential garden is to be retained using a simple timber post and rail retaining wall.



Job specifications

Posts 100 x 100 D45 H4 treated

Retaining timber 200 x 50 D45 H4 treated

Concrete mix ready mix will be purchased

Using the given job specifications calculate the quantity and concrete materials required. Show your working.

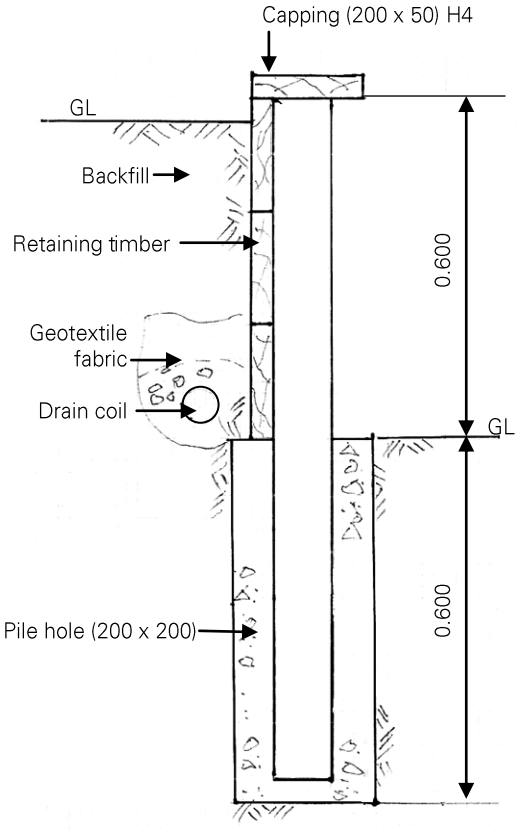
Retaining timber

= No. of bays x no. of lengths/bay

= 5 x 3

= 15 lengths at 1.200m

= 18.00 lm



Concrete

= (vol of holes - vol of posts)

Vol of hole

= (vol of hole x no. of holes) x 6

= (0.200 x 0.200 x 0.600) x 6

= 0.144

Vol of post

= (0.1 x 0.1 x 0.6) x 6

= 0.036

Vol of concrete

= 0.144 - 0.036

= 0.108 m³

Capping

= 1.200 x 5

= 6.000lm

From your calculations complete the following materials list.

Part	No. Required	Size	Totals
Rails	*15*	*200 x 50*	*18.0m*
Capping	*5*	*200 x 50*	*6.0m*
Posts	*6*	*100 x 100*	*6 @1.200m*

4. A rectangular area that is 3.750m x 5.250m is to be paved with 150 x 150 x 0.40 concrete paving slabs that cost $2.10 (plus GST) each. The edge restraint timber is 150 x 50 and a decorative timber inlay strip is to be inserted diagonally from corner to corner. Show your workings for the following calculations.

Calculate the total number of paver slabs required and how much will they cost (including GST).

Pavers along length of area *Length ÷ size of paver*

= 5.250 ÷ 0.150

= 35 pavers long

Pavers along width of area *width ÷ size of paver*

= 3.750 ÷ 0.150

=25 pavers long

Total pavers required

= 25 x 35

= 875 pavers

Cost of pavers

= $2.10 x 875

= $1837.5 + GST

= $1837.5 + 15%

= $2113.13 inc GST

Calculate the total length of edging timber required.

Edging *= (length + width) x 2*

= (5.250 + 3.750) x 2

= 9.000 x 2

= 18 metres

Calculate the length of decorative inlay strip needed.

$$\text{Inlay length} = \sqrt{\text{lenght}^2 + \text{width}^2}$$

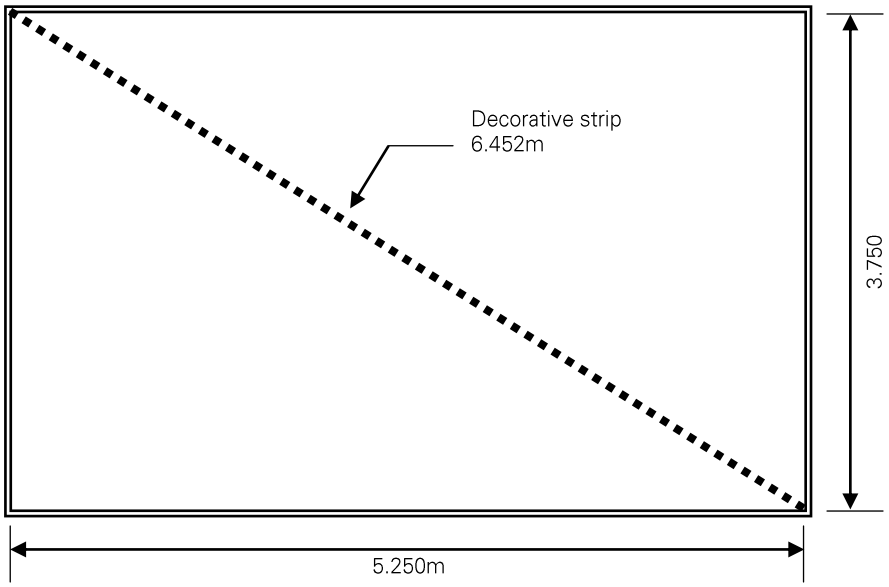
$$= \sqrt{5.250^2 + 3.750^2}$$

$$= \sqrt{27.563 + 14.063}$$

$$= \sqrt{41.626}$$

$$\approx 6.452\text{m}$$

Sketch a plan view of the area to be paved and dimension the sides and decorative inlay strip. The sketch does not have to be to scale.



Not to scale

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Example oral assessment questions & Answers

1. Describe two methods of testing a rectangle for square.

Measuring the diagonals. Use a tape measure, straight edge or string line to assist with measuring. Both diagonal lengths should be the same.

Test a corner for square using Pythagoras or the 3:4:5 ratio.

2. Explain the difference between individual measurements and running measurements.

Individual measurements are the distance between two specific points.

Running measurements are the accumulated distances from one given point.

3. When marking out a building, which method of lineal measurement will produce the most accurate result?

Running measurement.

4. What is the sum of internal angles of a triangle?

180^0

5. What is the formula for the area of a circle?

πr^2

6. What unit of measurement is used when ordering concrete?

Cubic metres.

7. What unit of measurement is used when calculating the coverage of paint?

Square metres.

8. What unit of measurement is used for workshop practices?

mm.

9. What is the formula for the Pythagoras theorem?

$a^2 + b^2 = c^2$

10. Why should measuring tapes be used for linear measurements over 1 metre in length?

Tapes are more accurate than rulers for measuring longer distances.