Ratios, Proportions, and Scale Drawings

v3.0

Applied Mathematics | Student Engineering Workbook

Team Members:

1. _____ 2. _____

Total Points	
Workbook:	..... /12 pts
Challenge:	..... /20 pts

Ratios

Fill in the correct information in the spaces provided.

1. A _____ is a relationship or comparison between two _____. Ratios express how much of one thing there is compared to another.

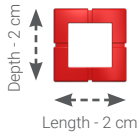
2. _____ ratios are two ratios that express the same value.

3. In example 1, what is the ratio of length to depth? _____.

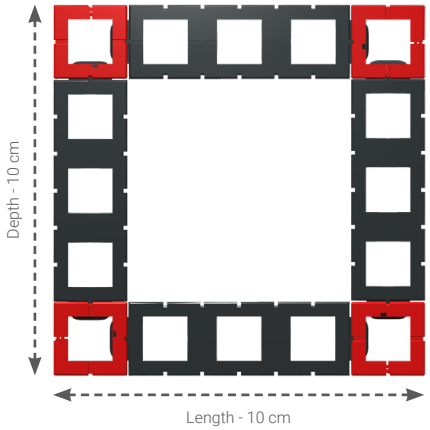
4. In example 2, what is the ratio of length to depth? _____.

5. ☐ Using Kid Spark engineering materials, build a square that has a length and depth that is ten times larger than the square in example 1. Place a check in the box when this step is complete.

Example 1



Example 2



Proportions

Fill in the correct information in the spaces provided.

6. _____ are statements that express two equivalent ratios.

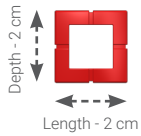
7. Cross multiply the ratios in examples 1 and 2.

Ratio - Example 1		Ratio - Example 2	
length	_____	_____	length
depth			depth

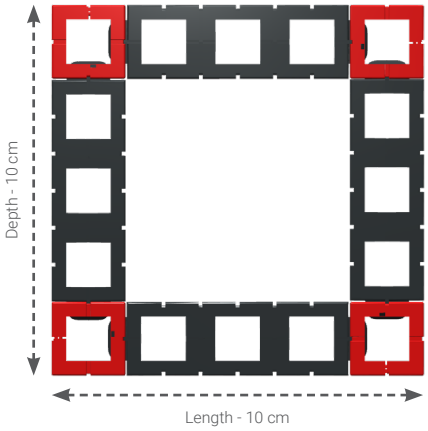
8. Are the ratios in examples 1 and 2 proportional? _____. (Yes or No)

9. In the previous section, each team was challenged to build a square that had a length and depth that was 10 times larger than the square in example 1. Determine the ratio (length to depth) of the new square. Then, make sure the ratio of the new square is proportional to the ratios of the squares in examples 1 and 2 by cross multiplying.

Example 1



Example 2



New Square		Square - Example 1
length _____		2 cm length
depth		2 cm depth

New Square		Square - Example 2
length _____		10 cm length
depth		10 cm depth

10. Are the ratios of all 3 squares proportional? _____. (Yes or No)

Scale Drawings

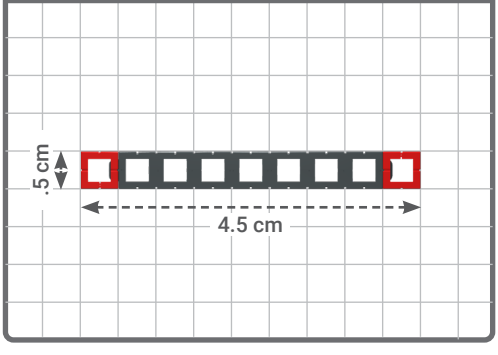
Fill in the correct information in the spaces provided.

11. A _____ _____ is a drawing or illustration of a real object which has been reduced or enlarged from its original size, but still _____ to the real object. The proportion by which the drawing of an object is reduced or enlarged is referred to as the _____ _____.

12. Determine the actual dimensions of the beam shown in example 5.

Example 5

Scale ratio - 1:4 (.5 cm = 2 cm)



= .5 cm

Design & Engineering Challenge

Follow each step in the Design & Engineering Process to develop a solution to the challenge.
Place a check in each box as each step is completed. Fill in the blanks when necessary.

1. Identify The Challenge

   ☐ Challenge: _____

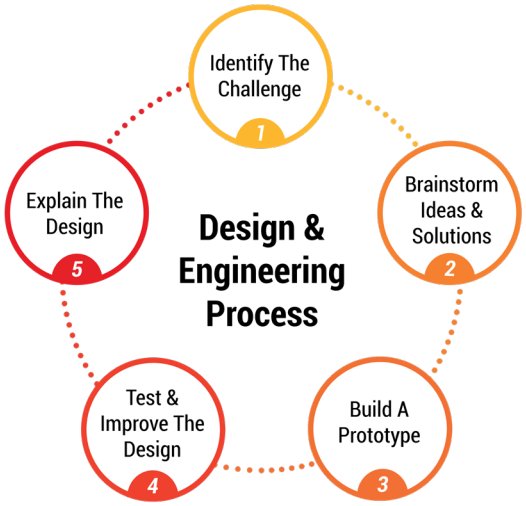
2. Brainstorm Ideas & Solutions

   ☐ Discuss design ideas.

   ☐ Consider building components.

   ☐ Sketch out design ideas on scrap paper.

   ☐ Choose the best design.



3. Build A Prototype

   ☐ Use Kid Spark engineering materials to build a prototype.

4. Test & Improve The Design

   ☐ Look for opportunities to improve the design. (Is it practical, proportional, etc..)

   ☐ Review challenge specifications/criteria and grading rubric.

5. Explain The Design

   ☐ Complete four scale drawings on the provided half-centimeter grids. *Student Engineering Workbook - Page 4*

   ☐ Determine how much the design would need to be scaled up for an average-sized dog to comfortably use the dog house. *Student Engineering Workbook - Page 5*

   ☐ Discuss the following items with your team and be prepared to share with the rest of the class.

      a. How did the team arrive at the final design solution? Discuss how each step in the Design & Engineering Process was used to develop the design.

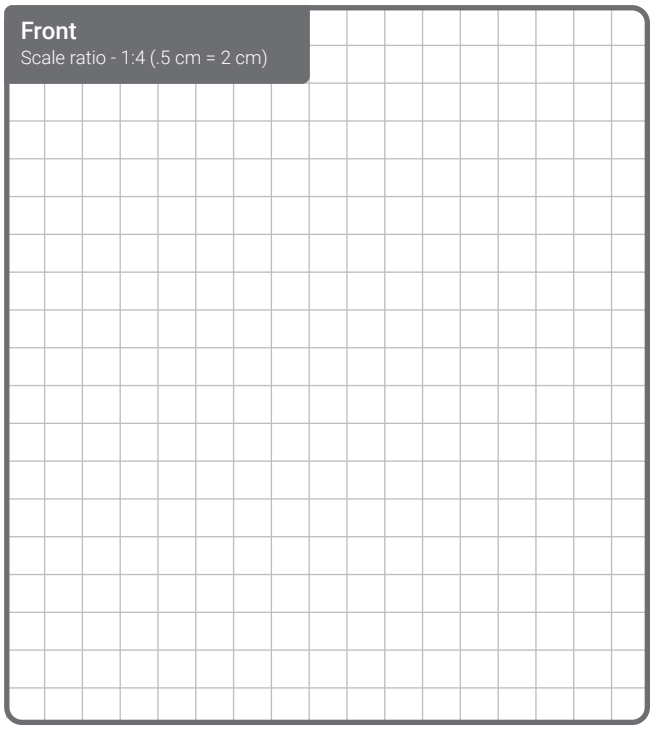
      b. Is the design realistic and well-proportioned? How did each team member contribute towards the overall design? Do you feel like everyone had an equal opportunity to contribute?

      c. Is the team prepared to share detailed specifications of the design to others?

Scale Drawings

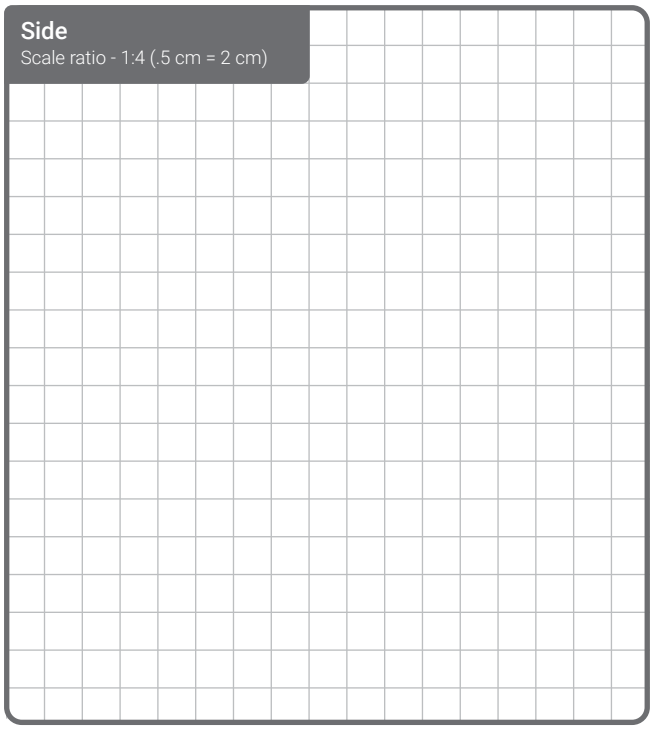
Use the half-centimeter grids to produce scale drawings of the dog house your team designed. Drawings should be simple and to scale.

Front
Scale ratio - 1:4 (.5 cm = 2 cm)



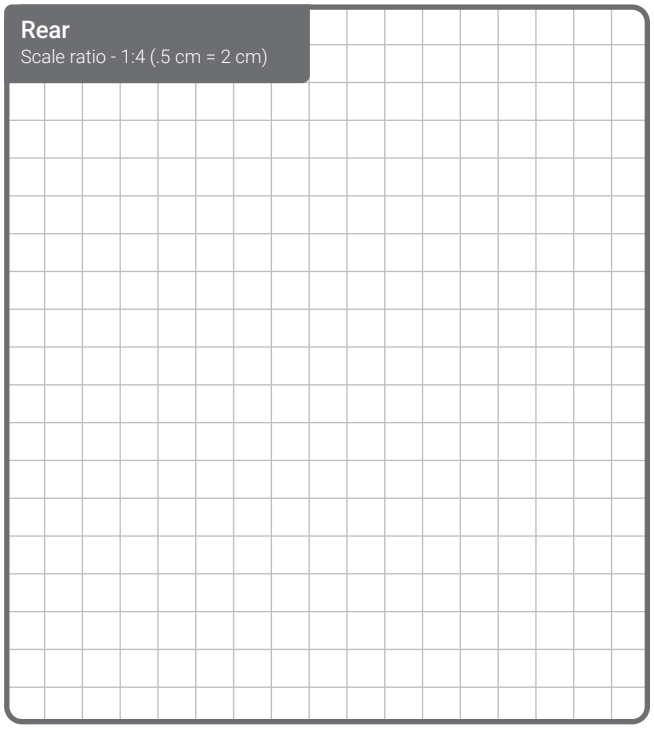
☐ = .5 cm

Side
Scale ratio - 1:4 (.5 cm = 2 cm)



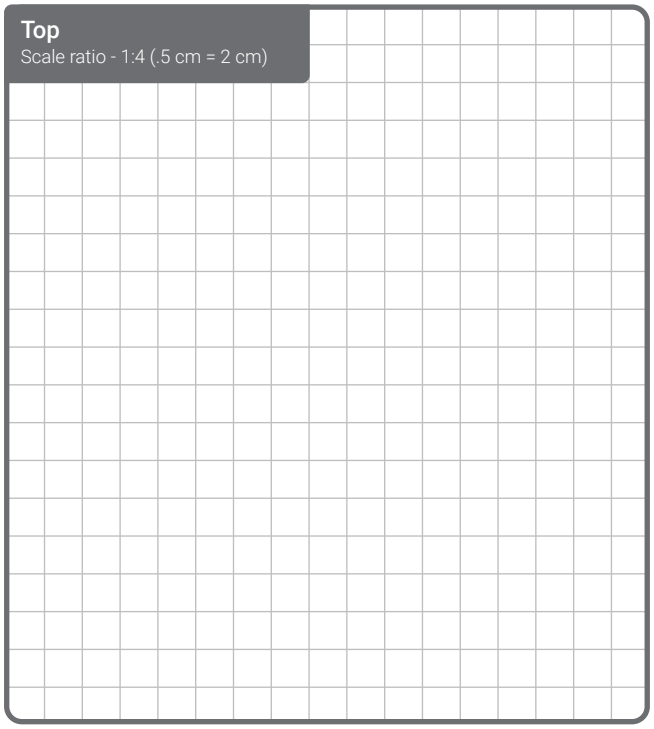
☐ = .5 cm

Rear
Scale ratio - 1:4 (.5 cm = 2 cm)



☐ = .5 cm

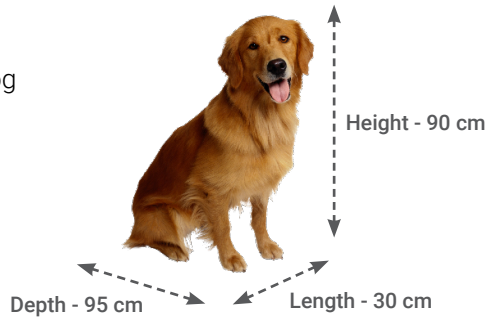
Top
Scale ratio - 1:4 (.5 cm = 2 cm)



☐ = .5 cm

Scaling Up

Determine how much your design would need to be scaled up in order for an average-sized dog (length - 30 cm, depth - 95 cm, height - 90 cm) to comfortably use the dog house. Teams will need to determine the interior dimensions of the dog house that was built in order to complete this section.



Example:

Example Dog House (Interior Dimensions)	Ratio - 1:10	Real Dog House (Interior Dimensions)	Does the dog fit?	Does the dog fit comfortably?
Length - 14 cm	x 10 =	Length - 140 cm	Yes [X] No	Yes [X] No
Depth - 14 cm	x 10 =	Depth - 140 cm	Yes [X] No	Yes [X] No
Height - 14 cm	x 10 =	Height - 140 cm	Yes [X] No	Yes [X] No

Your design:

Prototype Dog House (Interior Dimensions)	Ratio - __ : __	Real Dog House (Interior Dimensions)	Does the dog fit?	Does the dog fit comfortably?
Length - _____	X _____ =	Length - _____	Yes [ ] No	Yes [ ] No
Depth - _____	X _____ =	Depth - _____	Yes [ ] No	Yes [ ] No
Height - _____	X _____ =	Height - _____	Yes [ ] No	Yes [ ] No

Challenge Evaluation

When teams have completed the Design & Engineering Challenge, it should be presented to the teacher and classmates for evaluation. Teams will be graded on the following criteria:

- **Specifications:** Does the design meet all specifications as stated in the design brief?
- **Team Collaboration:** How well did the team work together? Can each student describe how they contributed?
- **Design Quality/Aesthetics:** Is the design of high quality? Is it structurally strong, attractive, and well-proportioned?
- **Presentation:** How well did the team communicate all aspects of the design to others?

Grading Rubric	Advanced 5 Points	Proficient 4 Points	Partially Proficient 3 Points	Not Proficient 0 Points
Specifications	☐ Meets all specifications	☐ Meets most specifications	☐ Meets some specifications	☐ Does not meet specifications
Team Collaboration	☐ Every member of team contributed	☐ Most members of team contributed	☐ Some members of team contributed	☐ Team did not work together
Design Quality/ Aesthetics	☐ Great design/ aesthetics	☐ Good design/ aesthetics	☐ Average design/ aesthetics	☐ Poor design/ aesthetics
Presentation	☐ Great presentation/ well-explained	☐ Good presentation/ well-explained	☐ Poor presentation/ explanation	☐ No presentation/ explanation
Points	.....	.....	.....	.....
Total Points				...../20