UNIT THREE:
SCALE
YEAR ONE
UNIT THREE: SCALE

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Lesson #1: Introduction to Scale and Ratio

Objectives

Students will be able to...

- Understand that a ratio is a comparison between two numbers.
- Understand that a proportion is an equivalent relation between two ratios.
- That scale drawings are ratios.

Common Core Standards

Problem Solving and Critical Thinking 5.1
Responsibility & Flexibility 7.5
CTE Pathway D3.1, 3.2
Leadership & Teamwork 9.3
RSIT 11-12.2
RLST 11-12.2

Materials

YouTube video https://www.youtube.com/watch?v=X_th_9jKodY&t=72s
Scale Drawings Using Ratios Worksheet
Solving Proportions Worksheet

Lesson Sequence

- Introduce that a ratio is a comparison of two like quantities that are expressed in the same units of measure. A ratio takes on the form of a fraction; however, the final form of a ratio is not left as a fraction. It is written as a statement of the ratio relationship (this to that). (5 minutes).

- Watch the YouTube video on scale drawings using ratios. https://www.youtube.com/watch?v=X_th_9jKodY&t=72s (7 minutes)

- Work together as a class to complete Scale drawings using ratios worksheet. (15-20 minutes)

- Pass out Solving Proportions Worksheet and collect before students leave.
### Assessment

Check for understanding during whole class work. Grade the solving proportions worksheet to assess student knowledge on finding proportions.

### Accommodations/ Modifications

- Multiplication Chart
- Calculator
- One-on-One Support
- Check for Understanding
**Scale Drawings using Ratios Worksheet**

In a scale drawing or a scale model, all the dimensions of the actual object are reduced or enlarged proportionally.

A map is a scale drawing in which actual distance is reduced.

The towns of Hagerstown and Annapolis are on a map with a scale of 1 cm = 24 miles. If the map distance between Hagerstown and Annapolis is 4 cm, what is the actual distance?

\[
\frac{\text{cm}}{\text{mi}} = \frac{1}{24} = \frac{4}{x}
\]

A graphic artist is creating an advertisement for this cell phone. If she uses a scale of 5 inches = 1 inch, what is the length of the cell phone on the advertisement?

\[
\frac{\text{Drawing}}{\text{Actual}} = \frac{5}{1} = \frac{x}{4}
\]

The actual distance between two towns is 175 km. If the distance between them on a map is 7 cm, what is the map scale?

\[
\frac{\text{Drawing}}{\text{Actual}}
\]

**Scale** drawing has a scale of 3 in: 10ft.

**Drawing:** 24in.  **Actual:** 25ft.

**Scale** model has a scale of: ½ in: 3ft.

**Drawing:** 4.5in.  **Actual:** 25.5ft.
1. The Statue of Liberty is approximately 305 feet tall. A scale model of the statue is 5 inches tall. The scale of the model is 1 in = ___________ ft.

2. The right arm of the Statue of Liberty is 42 feet long. How long is the right arm of the Statue of Liberty model described in question 1?

3. The diameter of the steering wheel of the actual car is 15 inches. What is the diameter of a toy car’s steering wheel if the toy is a 1:40 scale model of the real car?
   A. 3/8 in     B. 1 1/2 in     C. 1/2 in     D. 2 2/3 in

6. The diameter of the toy car’s tire is 5/8 in. What is the diameter of the tire of the actual car?
   A. 12 1/2 in   B. 25 in    C. 16 in   D. 64 in

7. On a scale drawing, a 14-ft room is depicted as 3.5 inches. What is the scale of the drawing?
   A. 1:48    B. 1/4:14  C. 1:4  D. 1:56

8. On a scale drawing of a computer component, 1/4 in = 4 in. On the drawing, a piece is 3/8 in long. How long is the actual piece?
   A. 1.5 in   B. 6 in   C. 3 in   D. 7.5 in

9. A scale drawing has a 1/4 inch scale. The width of a 12-foot room is going to be increased by 4 feet. How much wider will the room be on the drawing?
   A. 1/4 in   B. 1 in   C. 1/2 in  D. 4 in
Solving Proportions Worksheet

1. What should the JOLLY GREEN GIANT receive?

2. Why did it take the GOAT more than 3 hours to finish a 20-page book?

Solve each proportion and find your answer in the code. Each time the answer appears, write the letter of the exercise above it. Show your work.

I \( \frac{2}{5} = \frac{12}{n} \)

S \( \frac{3}{4} = \frac{9}{n} \)

G \( \frac{6}{2} = \frac{21}{n} \)

O \( \frac{10}{4} = \frac{n}{6} \)

Y \( \frac{5}{15} = \frac{n}{9} \)

T \( \frac{12}{8} = \frac{n}{4} \)

U \( \frac{2}{n} = \frac{5}{25} \)

A \( \frac{33}{n} = \frac{11}{3} \)

L \( \frac{49}{n} = \frac{7}{10} \)

V \( \frac{n}{6} = \frac{6}{9} \)

Z \( \frac{n}{4} = \frac{18}{72} \)

H \( \frac{n}{2} = \frac{50}{20} \)

W \( \frac{14}{n} = \frac{7}{4} \)

E \( \frac{8}{12} = \frac{12}{n} \)

B \( \frac{n}{13} = \frac{4}{1} \)

R \( \frac{24}{6} = \frac{n}{5} \)

N \( \frac{n}{10} = \frac{40}{25} \)

P \( \frac{24}{n} = \frac{30}{100} \)
Lesson #2: The Architect’s Scale and Scale Measurement

Objectives

Students will be able to...

- Measure given lengths using architect’s rule/scale.

Common Core Standards

Problem Solving and Critical Thinking 5.1
Responsibility & Flexibility 7.5
CTE Pathway D3.1, 3.2
Leadership & Teamwork 9.3
RSIT 11-12.2
RLST 11-12.2

Materials

YouTube video https://www.youtube.com/watch?v=5t-fJ6w7QtY
Reading an Architect’s Scale Ruler Worksheet
Exit Ticket: The Door Problem Worksheet

Lesson Sequence

- Introduce scale units to the class. You may consider including that in order to measure in scale, it helps to have a special type of rule(r). In this class, that special ruler is known as an Architects rule. It is very similar to an Engineer’s ruler, except as we will see, the units of measure are standard/fractional English (like our tape measures and yardsticks) instead of hundredths, thousandths, or metrics. (5 minutes)

- Watch the YouTube video https://www.youtube.com/watch?v=5t-fJ6w7QtY (7 minutes)

- Answer any questions/clarify anything. (5-10 minutes)

- Work through Reading an Architect’s scale ruler worksheet. Model a few problems and then have students complete a few on their own. Review problems as a class. (20 minutes).

- Pass out Exit Ticket: The door problem worksheet. Have students work...
- independently on this problem and turn in before leaving. (10 minutes)

### Assessment

Check for understanding during whole class instruction. Call on random students to answer questions. Use Exit Ticket data results as an assessment of student understanding of the skill.

### Accommodations/ Modifications

- Check for Understanding
- One-On-One Support
- Peer Support
Reading an Architect’s Scale Ruler - Video Worksheet

Directions: Determine the readings indicated and print your answers in feet and inches.

1. _________

2. _________

3. _________

4. _________

5. _________

6. _________

7. _________

8. _________

SHEET 002
Exit Ticket: The Door Problem

Scale to Actual Measurements

I need your help to buy a door for my house. I have a scale drawing for the door I want but I am not sure of the true size. In the scale drawing the length is 4 in and the width as 7 in. The scale for the door is: 1 in = 1.5 ft. What are the actual measurements of the door?

Show all your work below.

Scale

1 inch = 1.5 ft

4 inches

7 inches
## Lesson #3: Drawing to Scale

### Objectives

Students will be able to...

- Read a scale drawing.
- Identify where scale factors are used in the real world.
- Find a scaling factor when scaling an object.

### Common Core Standards

- Problem Solving and Critical Thinking 5.1
- Responsibility & Flexibility 7.5
- CTE Pathway D3.1, 3.2
- Leadership & Teamwork 9.3
- RSIT 11-12.2
- RLST 11-12.2

### Materials

- You tube video [https://www.youtube.com/watch?v=5HU_LCR5C7s&nohtml5=False](https://www.youtube.com/watch?v=5HU_LCR5C7s&nohtml5=False)
- Scale Factor and Scale Worksheet
- Exit Ticket: Too Small, Too Big

### Lesson Sequence

- Introduce the concept of scaled drawings. Measuring the length of a line on each can be used to define the scaling factor. Show examples (e.g., simple blueprint). (5 minutes)
- Go over vocabulary (5 minutes):
  - **Scale**: the ratio of the size of a model or other representation, to the actual size of the object represented.
  - **Ratio**: essentially a comparison between two numbers equal to one divided by the other.
  - **Proportion**: 2 ratios that are equal
  - **Scale Factor**: the number by which each dimension of the model is multiplied to modeled objects actual size. A scale factor is a number used as a multiplier in scaling.
- Watch *YouTube* video
  https://www.youtube.com/watch?v=5HU_LCR5C7s&nohtml5=False (16 minutes)
- Work as a class on the *Scale Factor and Scale Worksheet*. Answer any questions as needed. (15 minutes)
- Pass out the *Exit Ticket: Too Small, Too Big*. Have students complete and turn in before leaving class. (5 minutes)

### Assessment

Check for understanding during whole class instruction. Call on random students to answer questions. Use Exit Ticket data results as an assessment of student understanding of the skill.

### Accommodations/ Modifications

- Check for Understanding
- One-on-One Support
- Peer Support
Scale Factor and Scale Worksheet

Let 1 unit on the grid paper represent 2 feet. So, 4 units = 8 feet. Convert all your measurements to units.

A) How long are the actual bleachers?

B) What are the actual dimensions of the door?

MAP: If the distance on a map is 2 cm represents 50 meters, what is the scale factor?

DECKS: On a blueprint of the deck, each square has a side length of \( \frac{1}{2} \) inch. What is the actual width?
Exit Ticket: Too Small, Too Big

A scientist invented a machine that shrinks an object to half its original size. The pictures below show Classy before she was shrunk and after she was shrunk one, two, and three times.

| 2 ft | 1 ft | ½ ft | ¼ ft |

1. How tall would Classy be if she shrunk one more time? Five more times?

2. If you were 6 feet tall and shrunk 10 times by the machine, how tall would you be?

3. Write an expression for Classy’s size after she has been shrunk $N$ times.
Lesson #4: Scale Factor and Scale Drawings

**Objectives**

Students will be able to...

- Read a scale drawing.
- Identify where scale factors are used in the real world.
- Find a scaling factor when scaling an object.

**Common Core Standards**

- Problem Solving and Critical Thinking 5.1
- Responsibility & Flexibility 7.5
- CTE Pathway D3.1, 3.2
- Leadership & Teamwork 9.3
- RSIT 11-12.2
- RLST 11-12.2

**Materials**

- You tube video [https://www.youtube.com/watch?v=Gcwhq_5ApbA](https://www.youtube.com/watch?v=Gcwhq_5ApbA)
- Scale Drawings-Yard Plans Worksheet
- Exit Ticket: Scale Drawing for a little house

**Lesson Sequence**

- Review Scale vocabulary from yesterday. (5 minutes)
- Watch *You tube video* [https://www.youtube.com/watch?v=Gcwhq_5ApbA](https://www.youtube.com/watch?v=Gcwhq_5ApbA) (8 minutes).
- Pass out and work on the *Scale Drawings-Yard Plans Worksheet* as a class. Answer any questions (15-20 minutes).
- Pass out the *Exit Ticket: Scale Drawing for a little house*. Collect from students before they leave (10 minutes).
### Assessment

Check for understanding during whole class instruction.  
Call on random students to answer questions.  
Use Exit Ticket data results as an assessment of student understanding of the skill.

### Accommodations/Modifications

- One-on-One Support  
- Check for Understanding  
- Peer Support
Scale Drawings-Yard Plans Worksheet

Yukon has made a scale drawing of his yard. The scale of his drawing is \(1\text{cm} = 0.5\text{m}\).

1. If the actual length of the patio is 4.5 cm in the drawing, find the actual length.

2. The actual distance between the water faucet and the pear tree is 11.2 meters. Find the corresponding distance of the drawing.

3. Find the scale factor for the drawing.
Exit Ticket: Scale Drawing for a Little House

Little House

When two ratios can be set equal to each other, a proportion is formed. This activity will help you understand the relationship between ratios and proportion as a way to communicate information and make decisions.

4. Orientate the paper in landscape (11” sides being the top and bottom of the page).

5. Draw a “legend” in the bottom right hand corner on each side of the paper, with these different scales:
   - Side One: 1/4” = 1’0” (most graph paper boxes equal 1/4”)
   - Side Two: 1/4” = 5’0”

6. Draw a basic, one story house “shell” plan (exterior walls only) to these different scales/ratios, with the final shell dimensions matching in both drawings (square footage, placement of windows and doors, etc.).

7. Determine the overall square footage and shape you want for your house, but you need to use these perimeters:
   - Front door opening = 36”
   - A sliding glass door = 6’ in width
   - At least five windows = 28”
Lesson #5: Scale Drawing Project (3-day Project)

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<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will be able to...</td>
</tr>
<tr>
<td>▪ Apply ratios and proportions to make a scale drawing of their classroom.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Core Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Solving and Critical Thinking 5.1</td>
</tr>
<tr>
<td>Responsibility &amp; Flexibility 7.5</td>
</tr>
<tr>
<td>CTE Pathway D1.1, 1.3, &amp; 4.1</td>
</tr>
<tr>
<td>Leadership &amp; Teamwork 9.3</td>
</tr>
<tr>
<td>RSIT 11-12.2</td>
</tr>
<tr>
<td>RLST 11-12.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale Drawing Project Guidelines</td>
</tr>
<tr>
<td>Measuring Tapes</td>
</tr>
<tr>
<td>Graph paper</td>
</tr>
<tr>
<td>Rulers</td>
</tr>
<tr>
<td>Calculators</td>
</tr>
<tr>
<td>Group Planning Self-Assessment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesson Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Day 1: Review ratio and scale. (5 minutes)</td>
</tr>
<tr>
<td>▪ Go over Scale Drawing Project Guidelines and answer any questions about the project.</td>
</tr>
<tr>
<td>▪ Divide students up into teams of 2-3 students.</td>
</tr>
<tr>
<td>▪ Day 1 and 2 students work together on project.</td>
</tr>
<tr>
<td>▪ Day 3: Have group members exchange room drawings with one another and check the labeled dimensions of the drawings by using the designated scale.</td>
</tr>
<tr>
<td>▪ Each student will fill out Group Planning Self-Assessment.</td>
</tr>
</tbody>
</table>
### Assessment

Daily monitor student participation and understanding of scale drawings. Check for understanding through questioning and informal observations. Use student self-assessment for grading group work. Grade students on effective scale drawings through the activity of student are checking each other’s scale drawings.

### Accommodations/ Modifications

- Check for Understanding
- One-on-One Support
- Strategic Pairing
- Extra Time If Needed
Scale Drawing Project Guidelines

You will apply ratios and proportions to help you make a scale drawing of our classroom.

**Materials needed:**
Measuring tape, millimeter graph paper (graph paper provided is millimeter squares), ruler, calculator, and pencil.

You are trying to convince your teacher to rearrange their classroom. With your partner, make a scale drawing (blueprint) to show how your classroom will look after you have reorganized it. Use proportions to draw a scale drawing of your classroom and **at least 8 items** in your classroom. (five items will be given, and you can choose the other three).

**Five mandatory items are:** teacher's desk, 3 student desks, cabinet, work area and the student cubbies or area to hang up backpacks.

For this project you will need to:

1. Sketch a map of the classroom's shape and the location of its walls, windows, and doorways.
2. Measure the size of the classroom (length and width). Include the width of windows and doorways, and the distance to walls from each side of the windows and doorways. (Round to the nearest half-inch).
3. Measure the eight items currently in your classroom (length and width to the nearest half inch).
4. Convert these measurements to scale measurements using a scale factor of .5cm = 10 in.

  2 BLOCKS=CM

5. Create a table listing the following:
   - Object
   - Dimension of the object
     Example: desk measures 18 in by 24 in
   - Proportion used to determine the scaled size of each object in your blueprint.
     Example: desk measures 18 in wide – scale .5 cm = 10 in  \[
     \frac{.5cm}{10\text{ in}} = \frac{x}{18\text{ in}} \quad \text{Remember} \quad \frac{\text{Drawing}}{\text{Actual}} \]
   - ALL work used to solve proportion. (Keep your work neat and organized.)
   - Round your measurements to the nearest half cm.
   - Size of Objects on Blueprint – List the size you will draw each object on your blueprint

6. Using graph paper, pencil and a ruler, make a blueprint of your classroom to scale. Make sure to use a ruler and label the measurements on your blueprint.
Table - Proportions to Make Blueprint (Use separate sheet of paper for your work).

<table>
<thead>
<tr>
<th>Objects</th>
<th>Dimensions</th>
<th>Proportion used to determine scaled size of objects</th>
<th>Work to solve Proportion</th>
<th>Size of Objects in Blueprint</th>
</tr>
</thead>
</table>
| 1. Student Desk  | Length – 24 inches  | \[
\frac{x}{24\text{in}} = \frac{5\text{cm}}{10\text{in}}
\]
|                  | Width – 18 inches   |                                                     | Show all steps!          |                             |
| 2. Room          | Length –            |                                                     |                          |                             |
|                  | Width –             |                                                     |                          |                             |
| 3. Teacher Desk  | Length –            |                                                     |                          |                             |
|                  | Width –             |                                                     |                          |                             |
| 4. Cabinet       | Length –            |                                                     |                          |                             |
| 5. Student Cubbies | Length –           |                                                     |                          |                             |
|                  | Width –             |                                                     |                          |                             |
| 6.               |                     |                                                     |                          |                             |
| 7.               |                     |                                                     |                          |                             |
| 8.               |                     |                                                     |                          |                             |
# Group Planning: Self-Assessment - Rubric

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working with Others</strong></td>
<td>Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.</td>
<td>Usually listens to, shares with, and supports the efforts of others. Does not cause &quot;waves&quot; in the group.</td>
<td>Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.</td>
<td>Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.</td>
</tr>
<tr>
<td><strong>Preparedness</strong></td>
<td>Brings needed materials to class and is always ready to work.</td>
<td>Almost always brings needed materials to class and is ready to work.</td>
<td>Almost always brings needed materials but sometimes needs to settle down and get to work</td>
<td>Often forgets needed materials or is rarely ready to get to work.</td>
</tr>
<tr>
<td><strong>Focus on the task</strong></td>
<td>Consistently stays focused on the task and what needs to be done. Very self-directed.</td>
<td>Focuses on the task and what needs to be done most of the time. Other group members can count on this person.</td>
<td>Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.</td>
<td>Rarely focuses on the task and what needs to be done. Let's others do the work.</td>
</tr>
<tr>
<td><strong>Time-management</strong></td>
<td>Routinely uses time well throughout the project to ensure things get done on time. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.</td>
<td>Usually uses time well throughout the project but may have procrastinated on one thing. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.</td>
<td>Tends to procrastinate, but always gets things done by the deadlines. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.</td>
<td>Rarely gets things done by the deadlines AND group must adjust deadlines or work responsibilities because of this person's inadequate time management.</td>
</tr>
<tr>
<td>CATEGORY</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
</tr>
<tr>
<td>Group Timeline</td>
<td>Group independently develops a reasonable, complete timeline</td>
<td>Group independently develops a timeline</td>
<td>Group independently develops a timeline</td>
<td>Group needs adult help to develop a timeline AND/OR several</td>
</tr>
<tr>
<td></td>
<td>describing when different parts of the work will be done. All</td>
<td>describing when most parts of the work will be done. All students</td>
<td>describing when most parts of the work will be done. Most students</td>
<td>students in the group cannot independently describe the high</td>
</tr>
<tr>
<td></td>
<td>students in group can independently describe the high points of</td>
<td>in-group can independently describe the high points of the</td>
<td>can independently describe the high points of the timeline.</td>
<td>points of the timeline.</td>
</tr>
<tr>
<td></td>
<td>the timeline.</td>
<td>timeline.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delegation of</td>
<td>Each student in the group can clearly explain what information</td>
<td>Each student in the group can clearly explain what information</td>
<td>Each student in the group can, with minimal prompting from peers,</td>
<td></td>
</tr>
<tr>
<td>Responsibility</td>
<td>the group needs, what information s/he is responsible for locating,</td>
<td>s/he is responsible for locating.</td>
<td>clearly explain what information s/he is responsible for locating.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and when the information is needed.</td>
<td></td>
<td></td>
<td>One or more students in the group cannot clearly explain what</td>
</tr>
<tr>
<td>Plan for Organizing</td>
<td>Students have developed a clear plan for organizing the information</td>
<td>Students have developed a clear plan for organizing the</td>
<td>Students have no clear plan for organizing the information AND/</td>
<td></td>
</tr>
<tr>
<td>Information</td>
<td>as it is gathered and in the final product. All students can</td>
<td>information as it is gathered. All students can independently</td>
<td>OR students in the group cannot explain their organizational</td>
<td></td>
</tr>
<tr>
<td></td>
<td>independently explain the planned organization of the work.</td>
<td>explain this plan.</td>
<td>plan.</td>
<td>plan.</td>
</tr>
</tbody>
</table>

Total Points ________