

The background is a dark, textured surface featuring faint, light-colored sketches of various mathematical and scientific concepts. These include a globe in the upper left, a large letter 'V' in the top left, a microscope on the left side, a stack of books at the bottom left, a plus sign, a compass, a percentage sign, and a less-than sign in the bottom right. A large white rectangle is positioned in the upper right, and a yellow horizontal bar is located below it.

Dilations

Introduction to Scale Factor

LESSON OBJECTIVE

- Define dilation, identify center and scale factor.

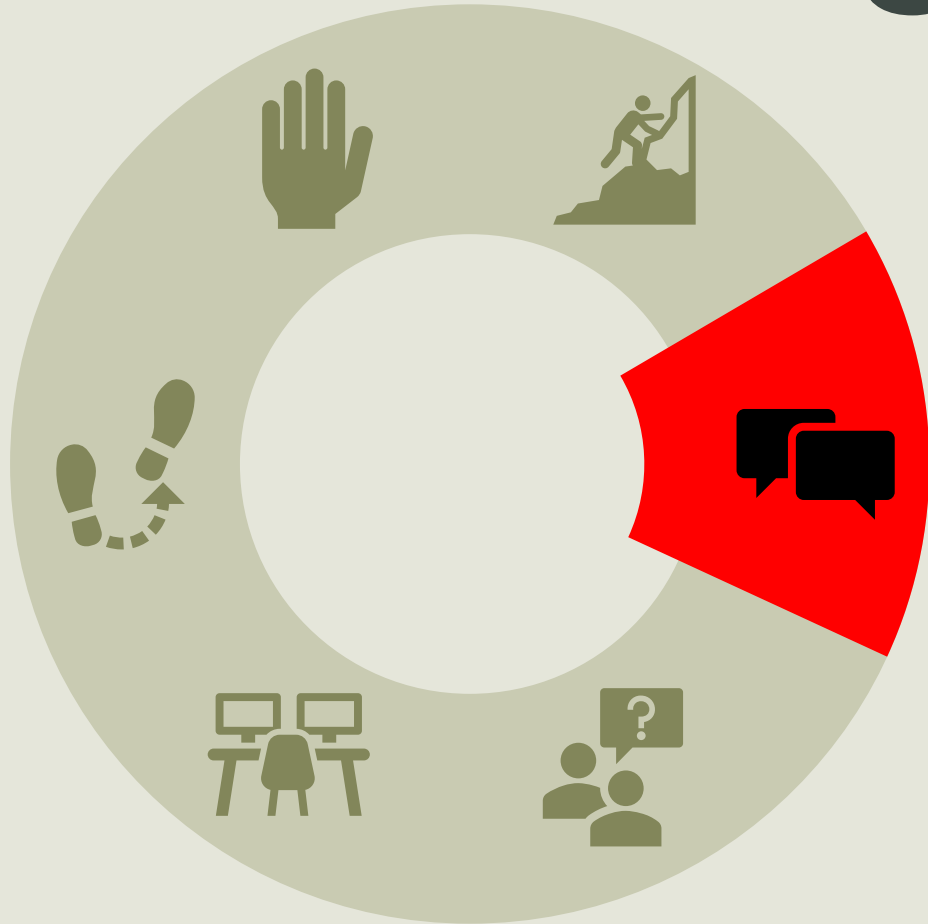
LEARNING GOALS

- Understand what dilation is and how it affects figures.

The background is a soft-focus photograph of a classroom. Several students are visible, with their hands raised in the air, suggesting an interactive lesson or a Q&A session. The lighting is warm and natural, creating a positive and engaged atmosphere. The text 'CHAMPS' is superimposed over the center of the image, with the letters acting as a frame for the background scene.

CHAMPS

CONVERSATION



0 – No Voice

1 – Whisper

2 – Table Talk

3 – Teacher Voice

4 – Outside Voice

CONVERSATION

0 – No Voice

1 – Whisper

2 – Table Talk

3 – Teacher Voice

4 – Outside Voice



HELP



Raise Hand

Ask 2 Before Me

Ask Partner

Clipboard



HELP

Raise Hand

Ask 2 Before Me

Ask Partner

Clipboard

ACTIVITY

Independent Work

Buddy

Group Work

Whole Group

Stations



ACTIVITY

Independent Work



Buddy

Group Work

Whole Group

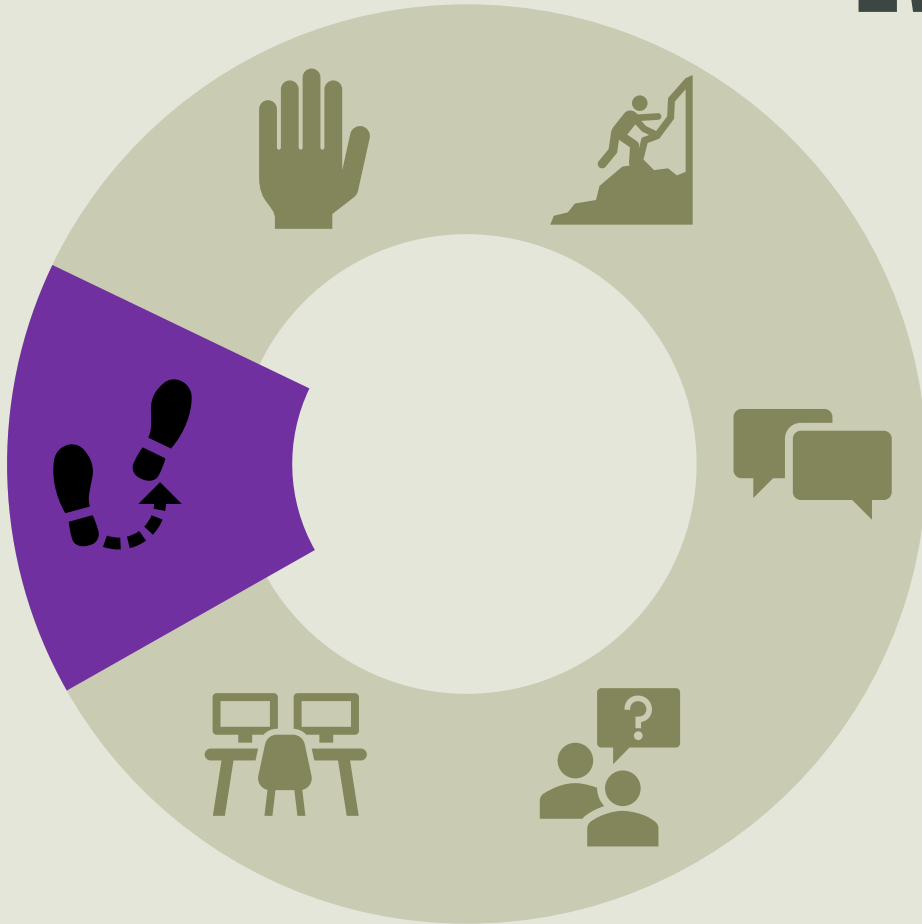
Stations

MOVEMENT

Stay Seated

Move with Permission

Move with a Partner



MOVEMENT

Stay Seated

Move with Permission

Move with a Partner



PARTICIPATION



Listen

Full Cooperation

Work as A Team

Work as Directed

Work with Teacher's Help

PARTICIPATION

Listen

Full Cooperation

Work as A Team

Work as Directed

Work with Teacher's Help



SUCCESS

100% Lesson Participation

Follow CHAMPS Rules

Follow Expectations



SUCCESS

100% Lesson Participation

Follow CHAMPS Rules

Follow Expectations



CHAMPS RULES

C
1 – Whisper

H
Raise Hand

A
**Independent
Work**

M
Stay Seated

P
**Full
Cooperation**

S
**Follow
Expectations**

The background features a dark, textured collage of white line-art icons representing various educational fields: a globe, a microscope, a book, a percentage sign, a ruler, and a compass.

What is Dilation?

What is Dilation?

- In math, a dilation is a geometric transformation that enlarges or shrinks a figure but keeps its original shape. This transformation is defined by a center of dilation (a fixed point) and a scale factor. Each point of the original figure is multiplied by the scale factor and moved in the same direction from the center of dilation to find its new position. A scale factor greater than 1 results in an enlarged image, while a scale factor between 0 and 1 results in a reduced image.

A dark grey background featuring a collage of white, hand-drawn educational icons. These include a globe, a stack of books, a microscope, a compass, a ruler, and various geometric shapes like circles and triangles.

Introduction to Scale Factor

Understanding the Basics

What is a Scale Factor?

- A scale factor is a numerical ratio used to increase or decrease the size of an object while preserving its proportions. It provides a mathematical framework for comparing dimensions of similar figures.

Core Idea

- The concept centers on multiplication. Each dimension of the figure is multiplied by the same number, ensuring proportional scaling without distortion.

Why it matters?

- Scale factor form a basis of resizing shapes, creating accurate models, interpreting maps, and solving geometric problems in both academics and real-world applications.

The background features a dark, textured collage of white line-art icons. These include a globe, a stack of books, a microscope, a compass, a ruler, a pencil, and various geometric shapes like triangles and circles. The icons are scattered across the entire background, creating a scholarly or educational atmosphere.

Definition and Representation of Scale Factor

Ratios and Their Meanings

Mathematical Definition

- A scale factor is expressed as a ratio that compares corresponding measurements of two similar figures. Example, 1:2 indicates the second figure is twice as large as the first.

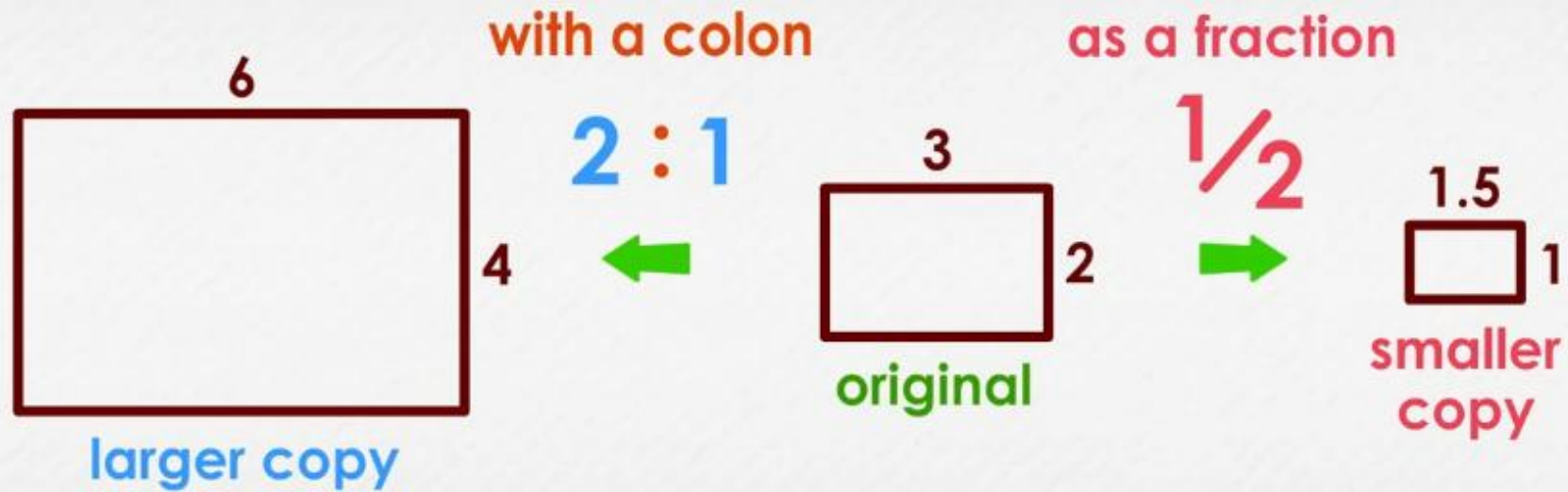
Fraction or Decimal Form

- Scale factors can be written as fractions, decimals, or whole numbers. A factor greater than 1 enlarges a shape, while factor between 0 and 1 reduces it.

Symbolic Representation

- If the original dimension is ' x ' and the scale factor is ' k ,' then the new dimension is given by ' kx .' This simple expression underlies all applications of scaling.

Representations of Scale Factor



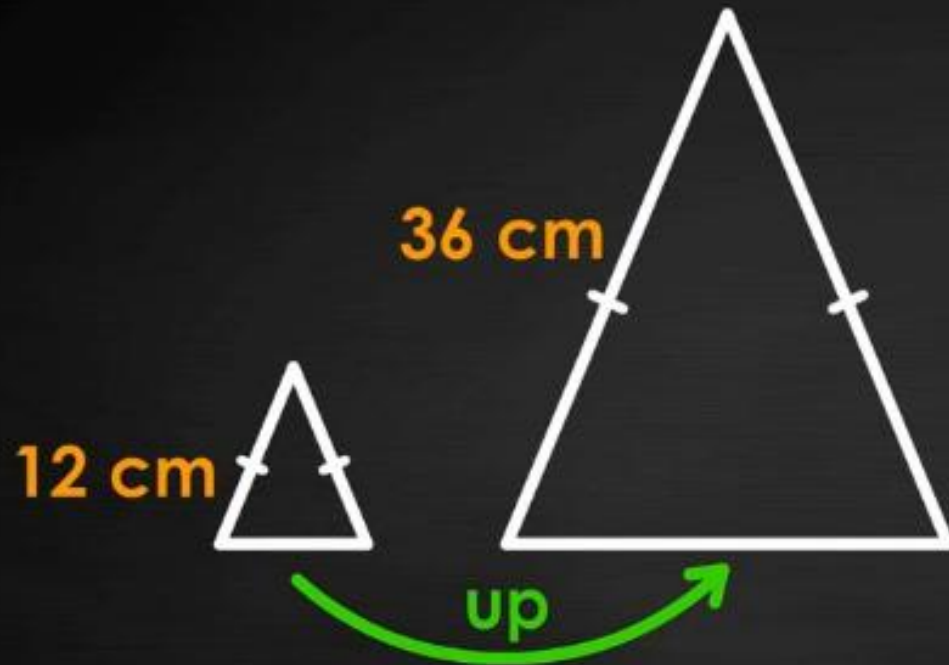
A dark grey background with a collage of white line-art sketches of school supplies. Visible items include a globe, a stack of books, a microscope, a ruler, a compass, and various geometric shapes like circles and triangles.

How to Find a Scale Factor

Scaling Up vs. Scaling Down

Scaling Up

- To enlarge a figure, divide the dimensions of the new (larger) shape by the corresponding dimensions of the original. This gives a scale factor greater than 1.



$$12 \text{ cm} \cdot 3 = 36 \text{ cm}$$

Scale Up

$$\frac{36}{12} = \frac{3}{1} = 3$$

The scale factor is 3

Scaling Down

- To reduce a figure, divide the dimensions of the smaller figure by the corresponding dimensions of the larger figure. This results in a scale factor between 0 and 1, or less than 1.



$$21 \text{ ft} \cdot \frac{1}{7} = 3 \text{ ft}$$

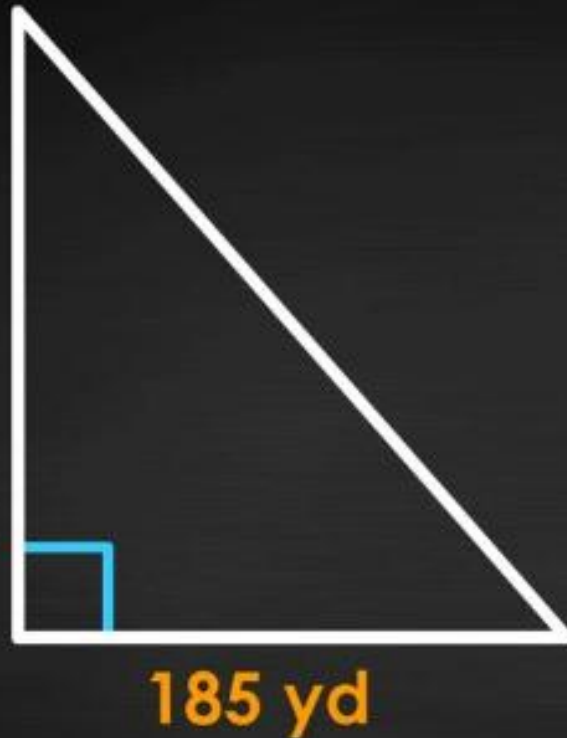
Scale Down

$$\frac{3}{21} = \frac{1}{7}$$

The scale factor is $\frac{1}{7}$

Consistency in Ratios

- Regardless of scaling up or scaling down, each pair of corresponding dimensions should yield the same ratio. This confirms the similarity between figures.



Scale Up

$$185 / 37 = 5$$

The scale factor is 5

Scale Down

$$37 / 185 = 1/5 = \underline{\underline{1 : 5}}$$

Every other linear measure is
multiplied times $1/5$ or divided by 5



Scale Factor in Similar Figures

Triangles and Polygons

Similar Triangles

- In Geometry, triangles are considered similar if their corresponding angles are equal and their side lengths are proportional. The scale factor quantifies this proportionality.

Polygons and Beyond

- The principle of similarity extends to all polygons. If each side of one polygon is proportional to the corresponding side of another, the shapes are similar and related by a scale factor.

Practical Example

- If a triangle has sides 3, 4, 5 and another has 6, 8, 10, the scale factor is 2. Every side length is multiplied by the same ratio, confirming similarity.



Scale Factor in Geometry

Expanding Applications

Two-Dimensional Shapes

- Scale factors are applied to plane figures such as circles, rectangles, and polygons. All dimensions including diagonals, are scaled by the same ratio.

Three-Dimensional Figures

- In solids, such as cubes, spheres, and cones, the scale factor affects not only on linear dimensions but also surface area and volume. Area scales by the square, volume scales by the cube of the factor.

Predictive Power

- By applying a scale factor, one can predict unknown dimensions, surface areas, and volumes, making it an essential tool in both theoretical and applied geometry.

A dark grey background featuring a collage of white line-drawn school supplies. Visible items include a globe, a stack of books, a microscope, a ruler, and various geometric shapes like circles and rectangles.

Reducing a Shape by a Scale Factor

Understanding Shrinking Transformation

Scale Factor Less Than 1

- When the scale factor is between 0 and 1, the resulting figure becomes smaller while maintaining its proportions. For example, a factor of 0.5 halves all dimensions.

Visual Representation

- Reduction produces a miniature version of the original figure. Each length decreases by the same multiplier, ensuring that the overall shape is preserved.

Applications

- Reducing with a scale factor is used in map-making, technical drawings, and models where the large objects must be presented on a manageable scale.



Creating Scale Models

From Blueprints to Reality

Blueprints and Prototypes

- Architects and engineers use scale factors to create manageable models of structures. A 1:100 scale blueprint means 1 unit on paper represents 100 in reality.

Miniatures and Replicas

- In education and industry, scale models allow people to study large objects in small form, such as airplanes cars, or even molecules.

Accuracy and Communication

- Scale models ensure stakeholders understand design concepts, dimensions, and proportions before construction or manufacturing begins.



Real-World Applications of Scale Factor

Maps, Architecture, and Engineering

Cartography

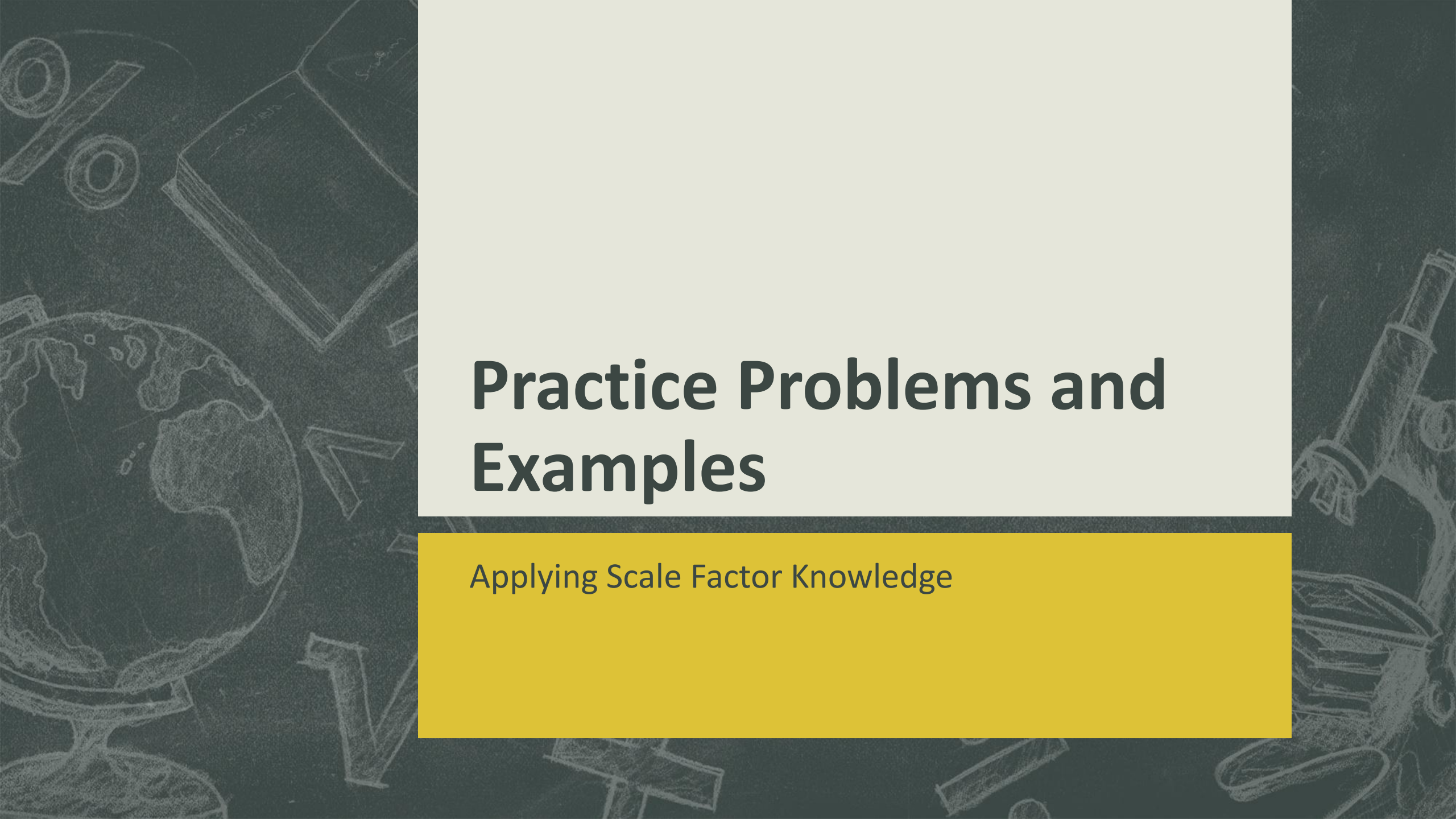
- Mapmakers use scale factors to compress vast geographic regions into manageable formats. A map scale of 1:50,000 means 1 unit on the map equals 50,000 on the ground.

Architecture

- Architects apply scale factors in blueprints and models, ensuring designs can be visualized and tested before full-scale construction.

Engineering and Manufacturing

- Engineers use scale factors in product design, model testing, and simulations, where scaled prototypes predict real-world performance.

The background of the slide is a dark grey collage of white line drawings. On the left, there is a large globe showing continents. Above it are two circular diagrams with internal lines, possibly representing orbits or lenses. To the right of the globe are several rectangular shapes, some with internal lines, resembling books or architectural elements. On the far right, there is a detailed drawing of a microscope. The central part of the slide is a white rectangle containing the title, and below it is a yellow rectangle containing the subtitle.

Practice Problems and Examples

Applying Scale Factor Knowledge

Scaling Up Example

- A rectangle with sides 3 cm and 5 cm is scaled by a factor of 4. What would be the new dimensions of the scaled rectangle?

12 cm and 20 cm

Scaling Down Example

- A triangle with sides 12 cm, 16 cm, and 20 cm is reduced by a factor of 0.5.
What would be the new dimension of the scaled triangle?

6 cm, 8 cm, 10 cm

Real-Life Problem

- If a map uses a scale of 1:100,000 a 2 cm distance on the map would be _____ in reality. This showcase how math connects to geography.

200,000 cm or
2,000 m or 2 km



Conclusion and Key Takeaways

The Power of Scale Factors

Definition

- A scale factor is a ratio that enlarges or reduces figures while preserving their proportion

Mathematical Versatility

- It applies equally to 2D and 3D shapes equally 2D and 3D shapes, influencing length, area, and volume relationships.

Real-World Relevance

- From maps and blueprints to prototypes and models, scale factors bridge mathematical theory and practical application.

A Ratio

measures the relationship between two things.



You could create a ratio of left-handed students to all students, but that ratio is **not a scale factor**.

GEOMETRY DILATIONS EXPLAINED!

$O(-4, 1)$ $M(3, 2)$ $G(2, -2)$
 $O'(-8, 2)$ $M'(6, 4)$ $G'(4, -4)$

D_2

