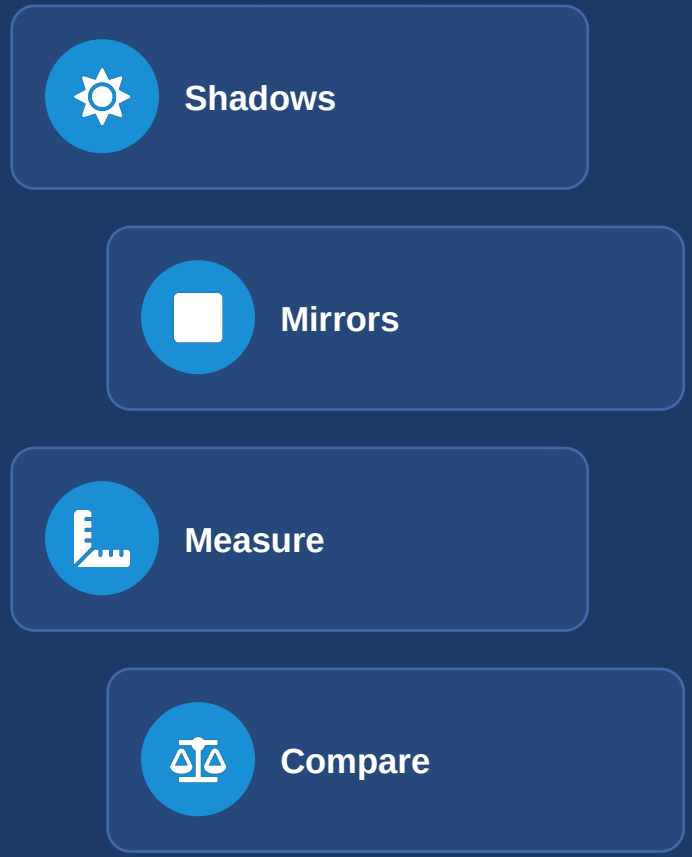
MPM2D Similar and Right Triangles, Lesson 4

Indirect Measurement Lab

Measuring outside



Today's goals

We are learning…

- To use similar triangles to measure a real object.
- To compare methods and explain error.

I can…

- Collect accurate measurements.
- Calculate a height with similar triangles.
- Compare two methods.
- Explain sources of error.

Today's plan

Time	What we're doing	You will…
0–10 min	**Hook**	Plan
10–20 min	**Safety and roles**	Note
20–50 min	**Measure**	Collect data
50–70 min	**Analysis**	Calculate; compare
70–75 min	**Exit**	Respond

Warm-up: plan the lab



Your group will measure a tall object two ways. What will you measure for each method? What could go wrong?

Sentence starters

“For shadows we need…”

“For the mirror we need…”

How it works

- Groups: 4 minutes.

Big idea

Real measurements are never perfect. Using two methods (shadows and a mirror) to measure the same tall object, then comparing the results, shows how similar triangles work in practice and how measurement error affects the answer.

Lab roles

Measurer

Uses the tape carefully.

Recorder

Writes every reading.

Spotter

Stands in place for the shadow, or looks into the mirror.

Checker

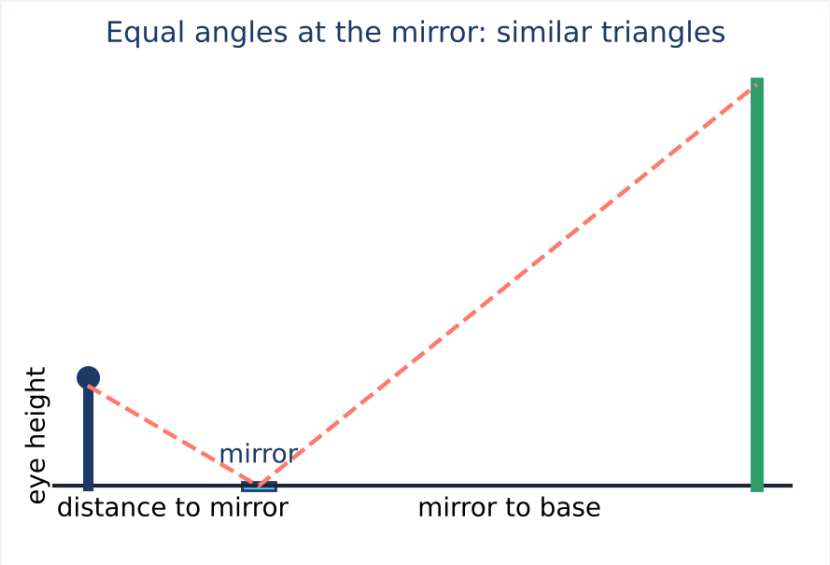
Repeats each measurement.

Safety first

Outside:

1. Stay in the marked area.
2. Never look at the sun.
3. Keep mirrors flat on the ground.
4. Walk, and watch for traffic.

The mirror method



- Mirror flat on the ground.
- Move until you see the top.
- Measure eye height.
- Measure both distances.

Outside: page 1

In your group:

1. Shadow method: two trials.
2. Mirror method: two trials.
3. Record every reading.
4. Find the means.

Model: percent difference

Task: Two methods give 8.2 m and 8.6 m. Find the percent difference.

Difference: 8.6 − 8.2 = 0.4 m.
Mean: (8.2 + 8.6) ÷ 2 = 8.4 m.
Percent difference: 0.4 ÷ 8.4 × 100% ≈ 4.8%.
The methods agree within about 5%.

Why it works

Uses the mean.

Rounds sensibly.

Interprets.

Independent: page 2

On your own:

1. Calculate both heights.
2. Find the percent difference.
3. Name sources of error.
4. Suggest improvements.

Quick check

- Why take two trials?
- Which method was easier? Why?
- Name one error source.

Check yourself

Be honest. This helps you choose what to work on next.

Success criteria	Not yet	Almost	Got it
I can collect accurate data.			
I can calculate a height.			
I can compare methods.			
I can explain error.			

Exit ticket

1. Your two heights and the percent difference.

2. The biggest source of error in your group.

3. How would you improve the lab?

Next class: The Primary Trigonometric Ratios.

Teacher reveal

Answers: pages 1 and 2

Page 1: Data and results vary by group.

Page 2, 1. Shadow (rainy-day data): $h \div 12.6 = 1.70 \div 2.55$: $h = 8.40$ m.

2. Mirror: $h \div 6.5 = 1.55 \div 1.25$: $h \approx 8.06$ m.

3. Compare: 8.40 m and 8.06 m differ by 0.34 m; the mean is 8.23 m, so the percent difference is about 4.1%.

4. Errors: For example, the mirror not being level, finding the exact end of a fuzzy shadow, eye height measured to the wrong point, the ground not being level.

5. Improve: Repeat measurements and average; mark shadow ends with chalk; use a level.