SCIENCE FOUNDATIONS

Accuracy versus precision

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you judge measurements, like knowing that a bathroom scale that always reads the same wrong weight is precise but not accurate. A scale that always reads five pounds heavy gives the same number every time, so it is precise, but it is not accurate, since the number is wrong. A clock that is always five minutes fast is the same, and so is a dart player whose darts cluster together but miss the bullseye. Knowing the difference tells you whether to trust a measurement, and what kind of fix it needs.



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Rule

Accuracy versus precision: accuracy is how close a measurement is to the true value. Precision is how close repeated measurements are to each other.

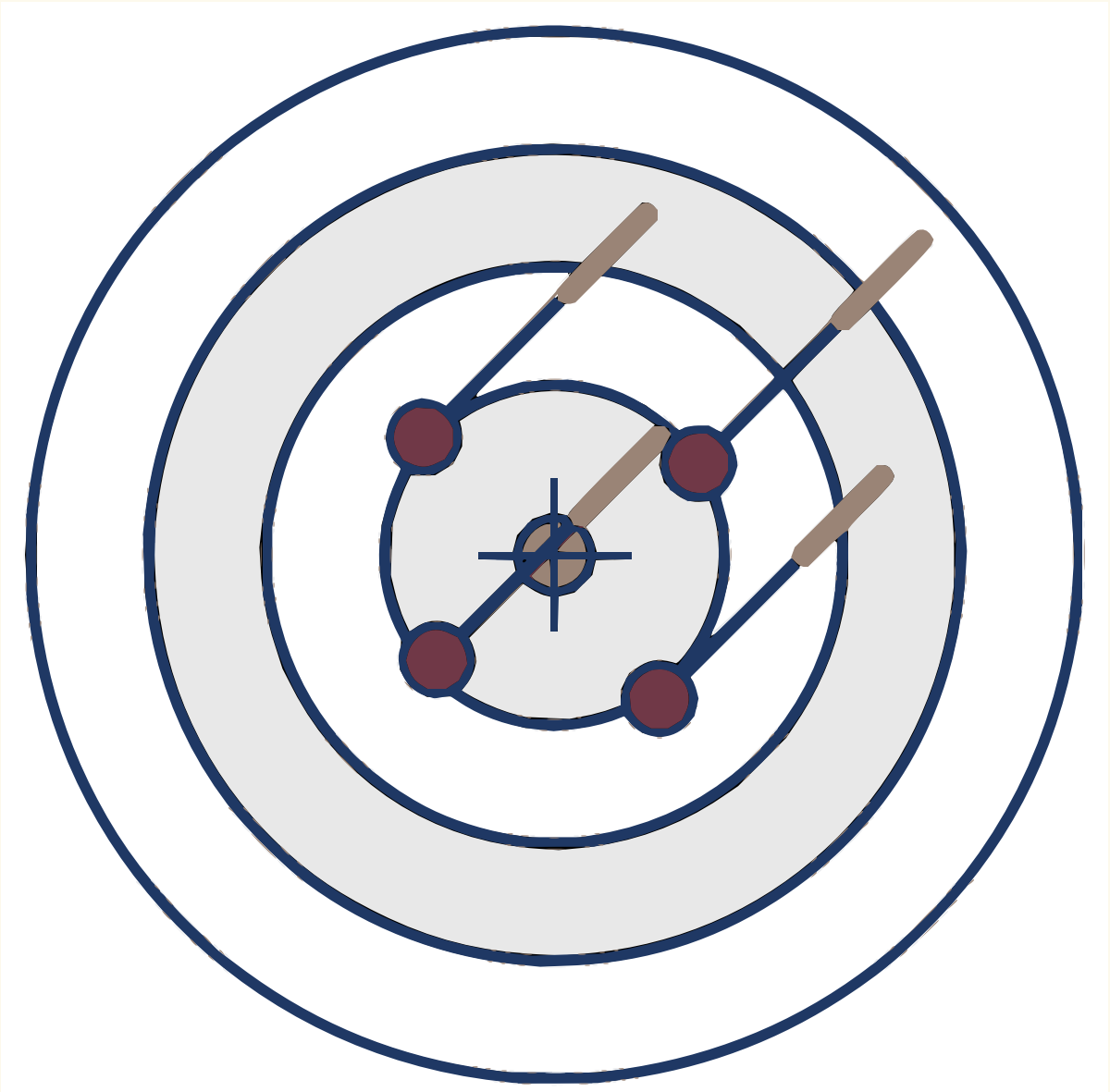
A measurement can be accurate but not precise, precise but not accurate, both, or neither. Check closeness to the true value first, then closeness to each other.

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Worked examples

EXAMPLE 1

Q Four dart throws land near the centre of the board but are scattered. Are they accurate or precise?



SOLUTION

Find the true value: the centre of the board.

Check closeness to the centre: the throws are near it, so they are accurate.

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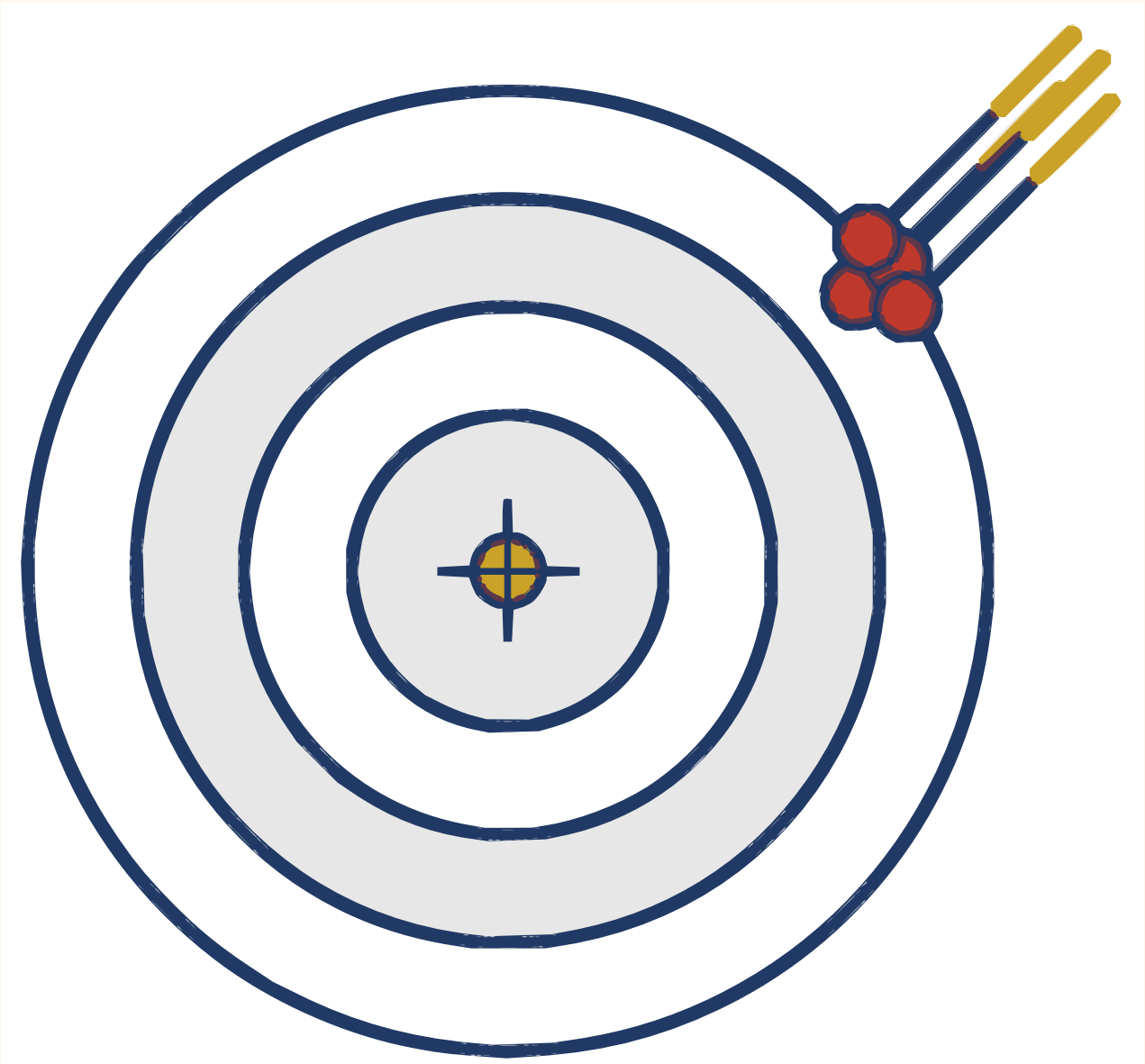
Check closeness to each other: they are scattered, so they are not precise.

The result is accurate but not precise.

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EXAMPLE 2

Q Four dart throws are clustered together far from the centre. Are they accurate or precise?



SOLUTION

Check closeness to the centre: they are far away, so they are not accurate.

Check closeness to each other: they are clustered, so they are precise.

Combine both judgements into one label.

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The result is precise but not accurate.

Practice questions

1 **What does accurate mean?**

A Readings close to each other

B Close to the true value

C The same reading every time

D Far from the true value

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2 What does precise mean?

- A Readings close to each other
- B Close to the true value
- C Readings far apart
- D Exactly the true value every time

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3 Readings are clustered but far from true. Accurate or precise?

- A Precise
- B Accurate
- C Both
- D Neither

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4 Readings are near true but scattered. Accurate or precise?

A Precise

B Accurate

C Both

D Neither

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5 Which is best: accurate and precise, or precise only?

A Precise only

B Accurate only

C Accurate and precise

D Neither

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6

A scale always reads 5 g high. Is it accurate?

A Yes

B No

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7

Repeated readings are 10.1, 10.2, 10.1. Are they precise?

A Yes

B No

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8

The true value is 10.0. The readings are 9.9, 10.0, 10.1. Are the readings accurate and precise?

A Yes

B No

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Can a measurement be accurate but not precise?

A Yes

B No

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10

What causes poor precision?

A A scale that always reads high

B Using the wrong unit

C Reading to too many decimal places

D Random variation between readings

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ANSWER KEY

1. Close to the true value
2. Readings close to each other
3. Precise
4. Accurate
5. Accurate and precise
6. No
7. Yes
8. Yes
9. Yes
10. Random variation between readings

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