Significant Figures

And Mathematical Calculations

Significant Figures

At the conclusion of our time together, you should be able to:

1. Determine the number of significant figures needed for an answer involving calculations.
2. Round math problems properly

Significant Figure Math Rules

- Addition / Subtraction Problem:

Penny Example = 0.019 m using meter stick

0.0192 m using ruler

0.0191 m using calipers

0.019046 m using micrometer

To find the total = 0.076346 m

But most of my measurements have fewer decimal places than my best tool!!!

Significant Figure Math Rules

- Addition / Subtraction:

Answers can't have more numbers to the right of the decimal point than the number in the problem with the least amount of numbers to the right of the decimal point.

Example = 24.1 m + 3.35 m + 2.23 m

Calculator says:29.68 m (wrong)

Answer:29.7 m

Adding and Subtracting

The answer has the same number of decimal places as the measurement with the fewest decimal places.

25.2 m ***one decimal place***

+ 1.34 m ***two decimal places***

26.54 m

answer 26.5 m (*one decimal place*)

Significant Figure Math Rules

- Multiplication / Division Problem:

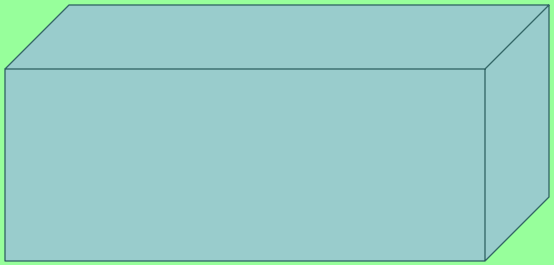
$14.1\ \text{cm} \times 3.3\ \text{cm} = 4.23\ \text{cm}^2 = 42.3\ \text{cm}^2$

$46.53\ \text{cm}^2$

What should my answer be??

Significant Figure Math Rules

- Another Multiplication / Division Problem: Find the volume?



0.041 m high

× 0.091 m wide

× 0.034 m deep

0.0001269 m^3

What should my answer be??

Significant Figure Math Rules

- Multiplication / Division:

Your answer can't have more sig figs than the number in the problem with the least amount of sig figs

Example = 60.562278**9**2 cm x 35.2**5** cm

Calculator says: 213**4.890832** cm^2 (wrong)

Answer: 2135 cm^2

Significant Figures

Lets' see if you can:

1. Determine the number of significant figures needed for an answer involving calculations.
2. Round math problems properly

Significant Figure Math Rules

- Remember this Problem:

Penny Example = 0.019 m using meter stick

0.0192 m using ruler

0.0191 m using calipers

0.019046 m using micrometer

To find the total = 0.076346 m

0.076 m

Significant Figure Math Rules

- Remember This One:

14.1 cm

3.3 cm ×

4.23 cm^2

42.3 cm^2

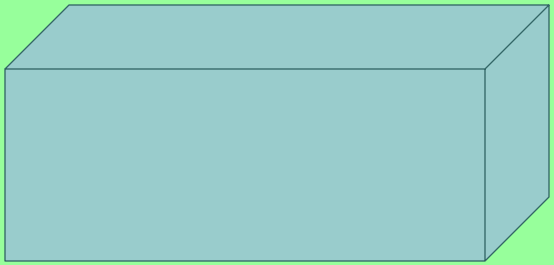
46.53 cm^2

What should my answer be??

47 cm^2

Significant Figure Math Rules

- How About This One: Find the volume?



0.041m high

× 0.091 m wide

× 0.034 m deep

0.0001269 m^3

What should my answer be??

0.00013 m^3

Learning Check

1. 2.19 m X 4.2 m =

A) 9 m^2 B) 9.2 m^2 C) 9.198 m^2

2. 4.311 m ÷ 0.07 m =

A) 61.58 B) 62 C) 60

3. 2.54 m X 0.0028 m=

0.0105 m X 0.060 m

A) 11.3 B) 11 C) 10

Learning Check

In each calculation, round the answer to the correct number of significant figures.

1. 235.05 m + 19.6 m + 2.1 m =

A) 256.75 m B) 256.8 m C) 257 m

2. 58.925 m - 18.2 m=

A) 40.725 m B) 40.73 m C) 40.7 m

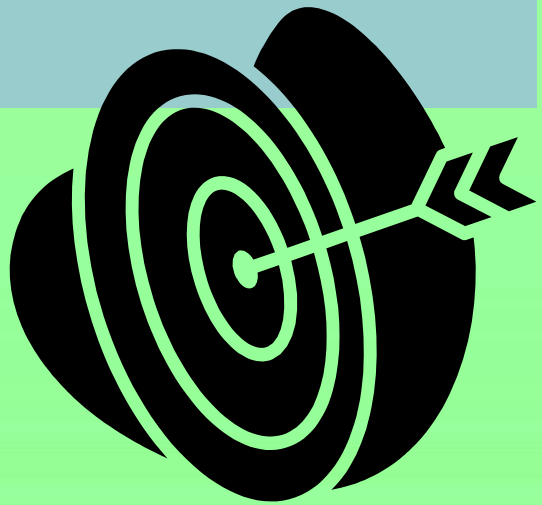
A ***measurement*** always has two parts:

- A value (this is the number)
- A unit of measure (this tells what you have)

- Example:
- 200 meters; 15 ml; 13.98 grams

Accuracy

- a measure of how close a measurement is to the true value of the quantity being measured.



ACCURACY

- Examples:
  - Number 2.09 is accurate to 3 significant digits
  - Number 0.1250 is accurate to 4 significant digits
  - Number 0.0087 is accurate to 2 significant digits
  - Number 50,000 is accurate to 1 significant digit
  - Number 68.9520 is accurate to 6 significant digits
    - Note: When measurement numbers have the same number of significant digits, the number that begins with the largest digit is the most accurate

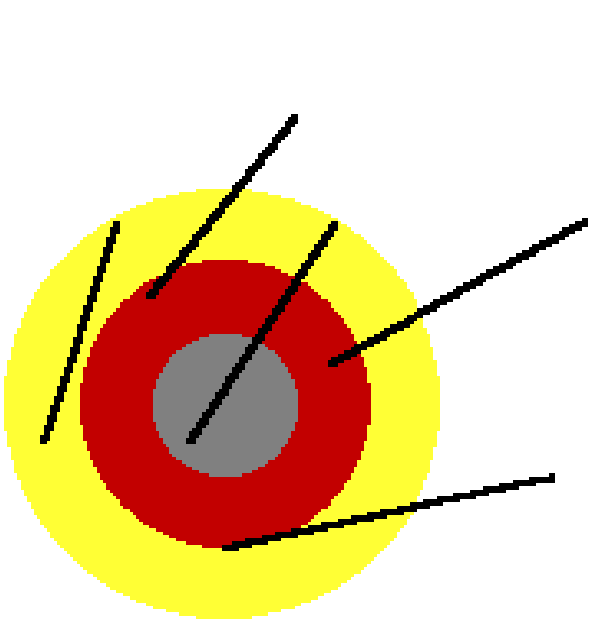
ACCURACY

- Examples:
  - Product of 3.896 in × 63.6 in = 247.7856, but since least accurate number is 63.6, answer must be rounded to 3 significant digits, or 248 in
  - Quotient of 0.009 mm ÷ 0.4876 mm = 0.018457752 mm, but since least accurate number is 0.009, answer must be rounded to 1 significant digits, or 0.02 mm

Precision

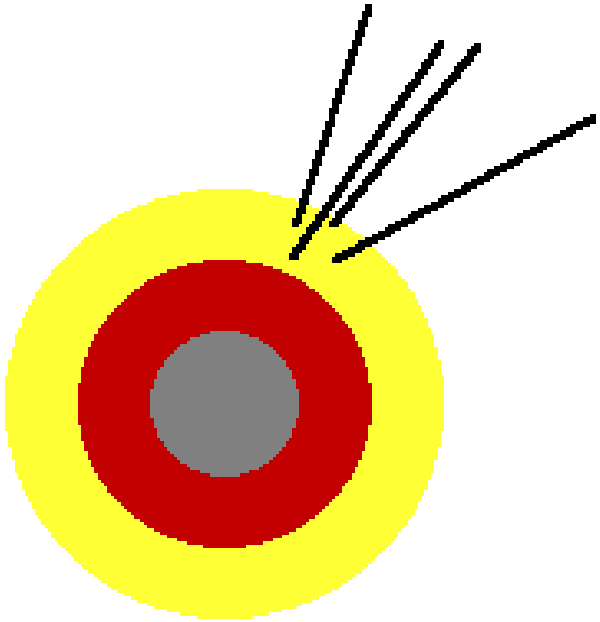
- a measure of how close a series of measurements are to one another. A measure of how exact a measurement is.

Example: Evaluate whether the following are precise, accurate or both.



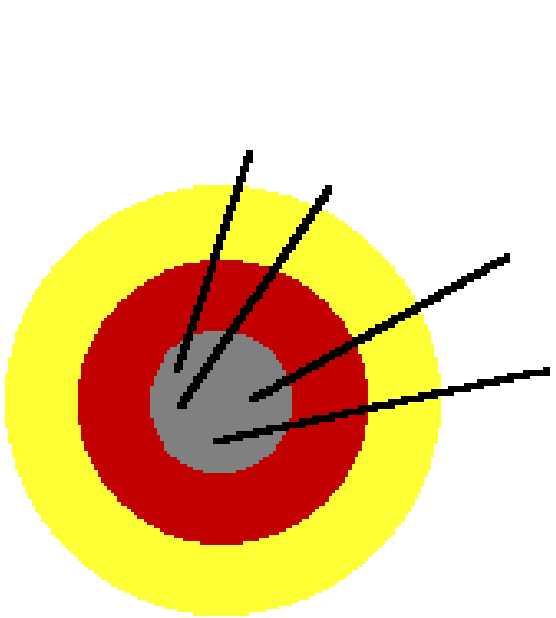
Accurate

Not Precise



Not Accurate

Precise



Accurate

Precise