Calculations Involving Significant Digits

12.34 cm

What is the least count?   1mm or 0.1 cm
(smallest division)

What is the uncertain digit?   4

What are the certain digits?   1,2,3

How many significant digits?   4

$\underline{80}9$ g → 3sd
Certain ↑uncertain

$\underline{12.10}0$ mm → 5sd
Certain ↑uncertain

$0.00\underline{57}9$ g   → 3sd
leading   Certain ↑uncertain
zeroes
do not
count

$\underline{3}600$ km → 2sd (?) ?? could be be more
Certain ↑uncertain   depending on
                                the precision of
       * Scientific   the measuring
        Notation would instrument.
         be better to
      Clearly show the precision

NOTE: Exact numbers have no uncertainty
        — Counting numbers
        — conversions factors   1m = 100cm

        Area of   = $\left(\frac{1}{2}\right)$ bh
         triangle

Addition & Subtraction

Ⓐ   12 g

Ⓑ   4.75 g

Ⓒ   52.1 g

$$
\begin{array}{r}
12 \quad\; g \\
4.75 \; g \\
+\; 52.1 \;\; g \\
\hline
68.85 \; g
\end{array}
$$

The answer your write down. → 69 g
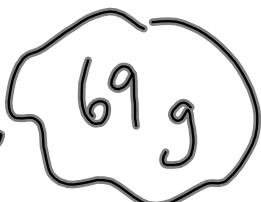
You can only have 1 uncertain digit (round to 1's place)

* Your final answer cannot be any more precise than your least precise measurement used in the calculation => round to the least precise place value.

Multiplication & Division
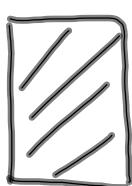
$$12.25 \text{ cm}$$
$$\times \quad 7.1 \text{ cm}$$
$$1225$$
$$8575$$
$$86.975 \text{ cm}^2$$

12.25cm (4sd)

7.1 cm (2sd)

87 cm^2 ← you can only have one uncertain digit

(2sd)

Round the final answer to the least number of significant digits used in the calc.

Summary

+/- ⟹ place value

×/÷ ⟹ sig. dig.

A note about rounding:

Follow rules for rounding

12.2**1**5 g ≐ 12.2 g

12.2**1**5 g ≐ 12.22 g

← round to even #

12.2**2**5 g ≐ 12.22 g

• Round to the <u>even</u> number if there is a 5 after the place value that you need to round to. (and nothing else!)

12.2**2**50001 g ≐ 12.23 g

Measurement and Significant Figures

Least count of ruler is 1 mm or 0.1 cm doubtful digit will be to the nearest 0.01 cm.

Actual length lies between 1.9 cm and 2.0 cm. Estimated length is 1.97 cm. The doubtful digit is "7".
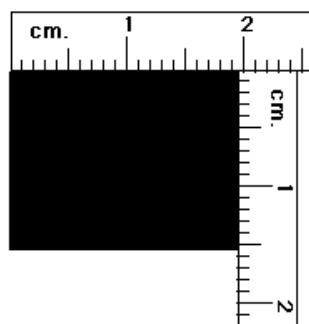
Area Range
Actual area lies between 1.9 x 1.5 and 2.0 x 1.6

1.9 x 1.5 = 2.85
2.0 x 1.6 = 3.2

so the actual area is between 2.85 and 3.2 cm^2

Actual width lies between 1.5 cm and 1.6 cm. Estimated width is 1.51 cm. The doubtful digit is "1".

Calculated Area
1.97 x 1.51 = 2.9747

which rounds to 2.97 (3 significant figures)