The International System of Units (in French, Le Système International d'Unités, where the "SI" comes from) which is the metric standard of units and is based on mks (meter, kilogram, second) units. The fundamental units in the SI system are:

- The meter (m), the fundamental unit of length.
- The second (s), the fundamental unit of time.
- The kilogram (kg), the fundamental unit of mass.
- The degree kelvin (K), the fundamental unit of temperature.
- The mole (mol), the fundamental unit of quantity of particles.
- The ampere (A), the fundamental unit of electric current.

The next table lists several SI units that were named after the scientists who made discoveries in the fields in which these units are used. Note that these unit names do not begin with a capital letter, but their abbreviation is capitalized (e.g., newton, N).

SI units that were named after the scientists		
ampere (A)	joule (J)	siemens (S)
celsius (°C)	kelvin (K)	tesla (T)
coulomb (C)	newton (N)	volt (V)
farad (F)	ohm (Ω)	watt (W)
hertz (Hz)	pascal (Pa)	weber (Wb)

قواعد كتابة الوحدات ---- Rules in writing units

تبدأ أسماء الواحدات المشتقة من اسم علم أم لا، بحرف صغير إلا في بداية الجملة.

عندما يُكتب رمز الواحدة مختصرا، يبدأ بحرف كبير فقط إذا كان مشتقا من اسم علم.

أثناء إجراء بعض العمليات الحسابية إذا احتاج الأمر لذكر واحدة مقدار ما، نضع الواحدة بين معترضتين [...].

Some Derived SI Units.

Quantity	Name	Symbol	Formula	Fundamental Units
Frequency	hertz	Hz	1/s	s^{-1}
Force	newton	N	$kg\,m/s^2$	$m\,kg\,s^{-2}$
Energy	joule	J	Nm	$m^2\,kg\,s^{-2}$
Power	watt	W	J/s	$m^2\,kg\,s^{-3}$
Electric charge	Coulomb	C	As	As
Electric potential	volt	V	W/A	$m^2\,kg\,s^{-3}\,A^{-1}$
Electric resistance	ohm	Ω	V/A	$m^2\,kg\,s^{-3}\,A^{-2}$
Electric capacitance	farad	F	C/V	$m^{-2}\,kg^{-1}\,s^4\,A^2$

SI Unit Prefixes.

Multiples	Prefixes	Symbols	Submultiples	Prefixes	Symbols
10^{18}	exa	E	10^{-1}	deci	D
10^{15}	peta	P	10^{-2}	centi	c
10^{12}	tera	T	10^{-3}	milli	m
10^{9}	giga	G	10^{-6}	micro	μ
10^{6}	mega	M	10^{-9}	nano	n
10^{3}	kilo	k	10^{-12}	pico	p
10^{2}	hecto	h	10^{-15}	femto	f
10^{1}	deka	da	10^{-18}	atto	a

SIGNIFICANT FIGURES --- الأرقام ذات الدلالة

تعطي الآلات الحاسبة نتائج العمليات الحسابية بعدد كبير من الأرقام (يمكن التحكم بذلك). يجب الاحتفاظ بعدد منها فقط، تكون له دلالة (أي معنى واقعي أو فائدة) ويتناسب مع الهدف المراد من التصميم ومع الدقة التي يحتاجها تنفيذ هذا التصميم.

DEFINITION OF A SIGNIFICANT FIGURE

A significant figure is any one of the digits 1, 2, 3, 4, 5, 6, 7, 8, and 9. (0) is a significant except when it is used simply to fix the decimal.

Example: In 0.500 or 0.632000 the zeroes are significant, but in 0.006 or 0.000968 the zeroes are NOT significant.

The number 234 has three significant figures, and the number 7305 has four significant figures, since the zero within the number is a legitimate significant digit.

Leading zeroes before a decimal point are not significant. Thus, the number 0.000,452 has three significant figures (4, 5, and 2), the leading zeroes (including the first one before the decimal point) being place markers rather than significant figures.

EXAMPLES

a. The number of significant figures in 2.2900×10^7? is 5.
b. The number of significant figures in 4.00×10^{-3} ? is 3.
c. The number of significant figures in 0.048? is 2.
d. The value of 345.678–345.912 =? = - 0.234
e. The value of 345.678–345.9 =? =- 0.2.

RULE 4: ONLY APPLY THE SIGNIFICANT FIGURES RULE TO YOUR FINAL ANSWER

For example, suppose you need to calculate the area of a circle and the answer is to be in square meter, but you are given the circle's radius as 22.5 cm. You can convert the radius into meter as R = 22.5[cm]/100 [cm/m] = 0.225 m. Then you would calculate the circle's area as

$A = \pi R^2 = (3.1416) \times (0.225\,[m])^2 = 0.20428254\ m^2 = 0.204\ m^2$ (rounded to 3 significant figures)
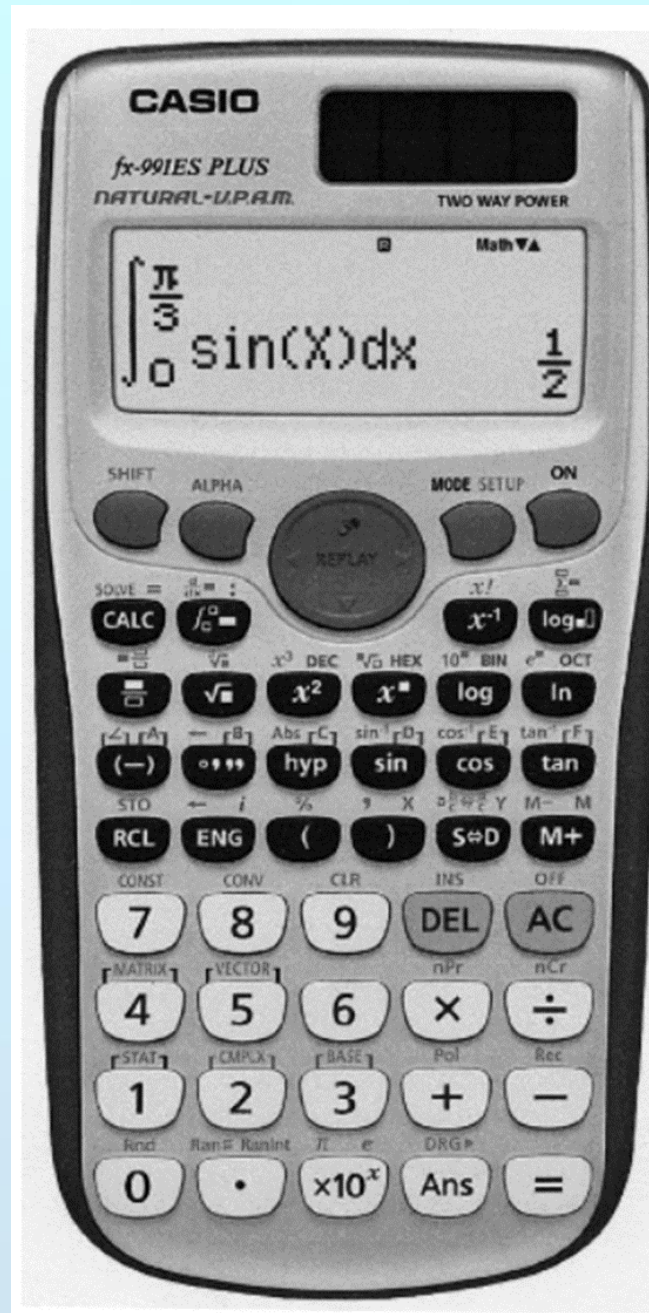
All calculators have **+**, **−**, **x** and **÷** functions and these functions will, no doubt, already have been used in calculations.

Problem 1. Evaluate $364.7 \div 57.5$ correct to 3 decimal places

(i)   Type in 364.7

(ii) Press ÷.

(iii) Type in 57.5

(iv) Press = and the fraction $\dfrac{3647}{575}$ appears.

(v)   Press the $S \Leftrightarrow D$ function and the decimal answer 6.34260869… appears.

Alternatively, after step (iii) press Shift and = and the decimal will appear.
Hence, $364.7 \div 57.5 = 6.343$, **correct to 3 decimal places.**

Problem 2. Evaluate $\dfrac{12.47 \times 31.59}{70.45 \times 0.052}$ correct to 4 significant figures

(i)   Type in 12.47

(ii)   Press ×.

(iii) Type in 31.59

(iv)   Press ÷.

(v)   The denominator must have brackets; i.e. press (.

(vi)   Type in 70.45×0.052 and complete the bracket; i.e. press)

(vii) Press = and the answer 107.530518… appears.

Hence, $\dfrac{12.47 \times 31.59}{70.45 \times 0.052} = 107.5$, **correct to 4 significant figures.**

Now try the following Practice Exercise

Practice Exercise 12   Addition, subtraction, multiplication and division using a calculator (answers on page 1149)

1. Evaluate $378.37 - 298.651 + 45.64 - 94.562$

2. Evaluate 25.63×465.34 correct to 5 significant figures.

3. Evaluate $562.6 \div 41.3$ correct to 2 decimal places.

4. Evaluate $\dfrac{17.35 \times 34.27}{41.53 \div 3.76}$ correct to 3 decimal places.

5. Evaluate $27.48 + 13.72 \times 4.15$ correct to 4 significant figures.

6. Evaluate $\dfrac{(4.527 + 3.63)}{(452.51 \div 34.75)} + 0.468$ correct to 5 significant figures.

7. Evaluate $52.34 - \dfrac{(912.5 \div 41.46)}{(24.6 - 13.652)}$ correct to 3 decimal places.

8. Evaluate $\dfrac{52.14 \times 0.347 \times 11.23}{19.73 \div 3.54}$ correct to 4 significant figures.

9. Evaluate $\dfrac{451.2}{24.57} - \dfrac{363.8}{46.79}$ correct to 4 significant figures.

10. Evaluate $\dfrac{45.6 - 7.35 \times 3.61}{4.672 - 3.125}$ correct to 3 decimal places.

4.3 Further calculator functions

Square and cube functions

Locate the x^2 and x^3 functions on your calculator and then check the following worked examples.

Problem 3. Evaluate 2.4^2

(i) Type in 2.4

(ii) Press x^2 and 2.4^2 appears on the screen.

(iii) Press $=$ and the answer $\dfrac{144}{25}$ appears.

(iv) Press the $S \Leftrightarrow D$ function and the fraction changes to a decimal: 5.76

Alternatively, after step (ii) press Shift and $=$.
Thus, $2.4^2 = 5.76$

Problem 4. Evaluate 0.17^2 in engineering form

(i) Type in 0.17

(ii) Press x^2 and 0.17^2 appears on the screen.

(iii) Press Shift and $=$ and the answer 0.0289 appears.

(iv) Press the ENG function and the answer changes to 28.9×10^{-3}, which is **engineering form**.

Hence, $\mathbf{0.17^2 = 28.9 \times 10^{-3}}$ **in engineering form**. The ENG function is extremely important in engineering calculations.

Problem 5. Change 348620 into engineering form

(i) Type in 348620

(ii) Press = then ENG.

Hence, $348620 = 348.62 \times 10^3$ in engineering form.

Problem 6. Change 0.0000538 into engineering form

(i) Type in 0.0000538

(ii) Press = then ENG.

Hence, $0.0000538 = 53.8 \times 10^{-6}$ in engineering form.

Problem 7. Evaluate 1.4^3

(i) Type in 1.4

(ii) Press x^3 and 1.4^3 appears on the screen.

(iii) Press = and the answer $\dfrac{343}{125}$ appears.

(iv) Press the $S \Leftrightarrow D$ function and the fraction changes to a decimal: 2.744

Thus, $1.4^3 = 2.744$

Now try the following Practice Exercise

Practice Exercise 13   Square and cube functions (answers on page 1149)

1. Evaluate 3.5^2

2. Evaluate 0.19^2

3. Evaluate 6.85^2 correct to 3 decimal places.

4. Evaluate $(0.036)^2$ in engineering form.

5. Evaluate 1.563^2 correct to 5 significant figures.

6. Evaluate 1.3^3

7. Evaluate 3.14^3 correct to 4 significant figures.

8. Evaluate $(0.38)^3$ correct to 4 decimal places.

9. Evaluate $(6.03)^3$ correct to 2 decimal places.

10. Evaluate $(0.018)^3$ in engineering form.

Square and cube functions

Locate the x^2 and x^3 functions on your calculator and then check the following worked examples.

Problem 3. Evaluate 2.4^2

(i)   Type in 2.4

(ii) Press x^2 and 2.4^2 appears on the screen.

(iii) Press $=$ and the answer $\dfrac{144}{25}$ appears.

(iv) Press the $S \Leftrightarrow D$ function and the fraction changes to a decimal: 5.76

Alternatively, after step (ii) press Shift and $=$.
Thus, $2.4^2 = 5.76$

Problem 4. Evaluate 0.17^2 in engineering form

(i)   Type in 0.17

(ii) Press x^2 and 0.17^2 appears on the screen.

(iii) Press Shift and $=$ and the answer 0.0289 appears.

(iv) Press the ENG function and the answer changes to 28.9×10^{-3}, which is **engineering form**.

Hence, $0.17^2 = 28.9 \times 10^{-3}$ in engineering form. The ENG function is extremely important in engineering calculations.

Problem 5. Change 348620 into engineering form

(i)   Type in 348620

(ii) Press $=$ then ENG.

Hence, $\mathbf{348620 = 348.62 \times 10^3}$ in engineering form.

Problem 6. Change 0.0000538 into engineering form

(i)   Type in 0.0000538

(ii) Press $=$ then ENG.

Hence, $\mathbf{0.0000538 = 53.8 \times 10^{-6}}$ in engineering form.

Problem 7. Evaluate 1.4^3

(i)   Type in 1.4

(ii) Press x^3 and 1.4^3 appears on the screen.

(iii) Press $=$ and the answer $\dfrac{343}{125}$ appears.

(iv) Press the $S \Leftrightarrow D$ function and the fraction changes to a decimal: 2.744

Thus, $\mathbf{1.4^3 = 2.744}$

Now try the following Practice Exercise

Practice Exercise 13   Square and cube functions (answers on page 1149)

1. Evaluate 3.5^2

2. Evaluate 0.19^2

3. Evaluate 6.85^2 correct to 3 decimal places.

4. Evaluate $(0.036)^2$ in engineering form.

5. Evaluate 1.563^2 correct to 5 significant figures.

6. Evaluate 1.3^3

7. Evaluate 3.14^3 correct to 4 significant figures.

8. Evaluate $(0.38)^3$ correct to 4 decimal places.

9. Evaluate $(6.03)^3$ correct to 2 decimal places.

10. Evaluate $(0.018)^3$ in engineering form.

Reciprocal and power functions

The reciprocal of 2 is $\frac{1}{2}$, the reciprocal of 9 is $\frac{1}{9}$ and the reciprocal of x is $\frac{1}{x}$, which from indices may be written as x^{-1}. Locate the reciprocal, i.e. x^{-1}, on the calculator. Also, locate the power function, i.e. $x^{\square}$, on your calculator and then check the following worked examples.

Problem 8. Evaluate $\frac{1}{3.2}$

(i) Type in 3.2

(ii) Press x^{-1} and 3.2^{-1} appears on the screen.

(iii) Press = and the answer $\frac{5}{16}$ appears.

(iv) Press the $S \Leftrightarrow D$ function and the fraction changes to a decimal: 0.3125

Thus, $\frac{1}{3.2} = 0.3125$

Problem 9. Evaluate 1.5^5 correct to 4 significant figures

(i) Type in 1.5

(ii) Press $x^{\square}$ and $1.5^{\square}$ appears on the screen.

(iii) Press 5 and 1.5^5 appears on the screen.

(iv) Press Shift and = and the answer 7.59375 appears.

Thus, $1.5^5 = 7.594$, **correct to 4 significant figures.**

Problem 10. Evaluate $2.4^6 - 1.9^4$ correct to 3 decimal places

(i) Type in 2.4

(ii) Press $x^{\square}$ and $2.4^{\square}$ appears on the screen.

(iii) Press 6 and 2.4^6 appears on the screen.

(iv) The cursor now needs to be moved; this is achieved by using the cursor key (the large blue circular function in the top centre of the calculator). Press →

(v) Press −

(vi) Type in 1.9, press $x^{\square}$, then press 4

(vii) Press = and the answer 178.07087... appears.

Thus, $2.4^6 - 1.9^4 = 178.071$, **correct to 3 decimal places.**

Now try the following Practice Exercise

Practice Exercise 14   Reciprocal and power functions (answers on page 1149)

1. Evaluate $\frac{1}{1.75}$ correct to 3 decimal places.

2. Evaluate $\frac{1}{0.0250}$

3. Evaluate $\frac{1}{7.43}$ correct to 5 significant figures.

4. Evaluate $\frac{1}{0.00725}$ correct to 1 decimal place.

5. Evaluate $\frac{1}{0.065} - \frac{1}{2.341}$ correct to 4 significant figures.

6. Evaluate 2.1^4

7. Evaluate $(0.22)^5$ correct to 5 significant figures in engineering form.

8. Evaluate $(1.012)^7$ correct to 4 decimal places.

9. Evaluate $(0.05)^6$ in engineering form.

10. Evaluate $1.1^3 + 2.9^4 - 4.4^2$ correct to 4 significant figures.