# 11   The Calculator

**By studying this lesson you will be able to,**
- identify and use the keys of $=$, $\%$, x^2 and $\sqrt{x}$ in the scientific calculator.

The Calculator

Since ancient times, humans have used various devices to perform calculations. During the period when animal husbandry commenced, men used pebbles to count the number of animals they owned. There is evidence to show that counting was done by drawing lines on clay tablets during a later period. The Egyptians started using a device known as the abacus for calculations in 1000 B.C. The modern day abacus was invented by the Chinese in the 15th century. John Napier who lived in the 17th century invented "Napier's bones" which is a device that was used to calculate products and quotients of numbers.
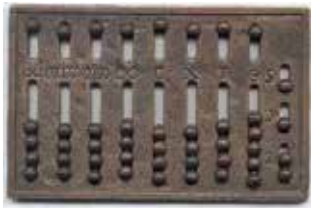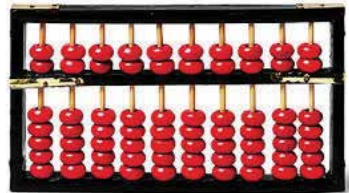
Egyptian abacus   Modern abacus

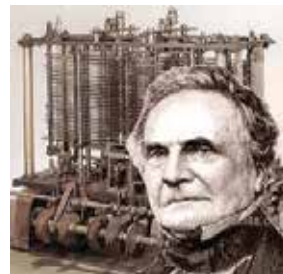The first mechanical calculator was invented by the French mathematician Blaise Pascal(1623-1662). In the year 1883, the Englishman Charles Babbage (1791-1871) introduced a more advanced calculator. Based on this, the electrically operated computer was invented. The production of the modern compact calculators commenced with the development of electronics.
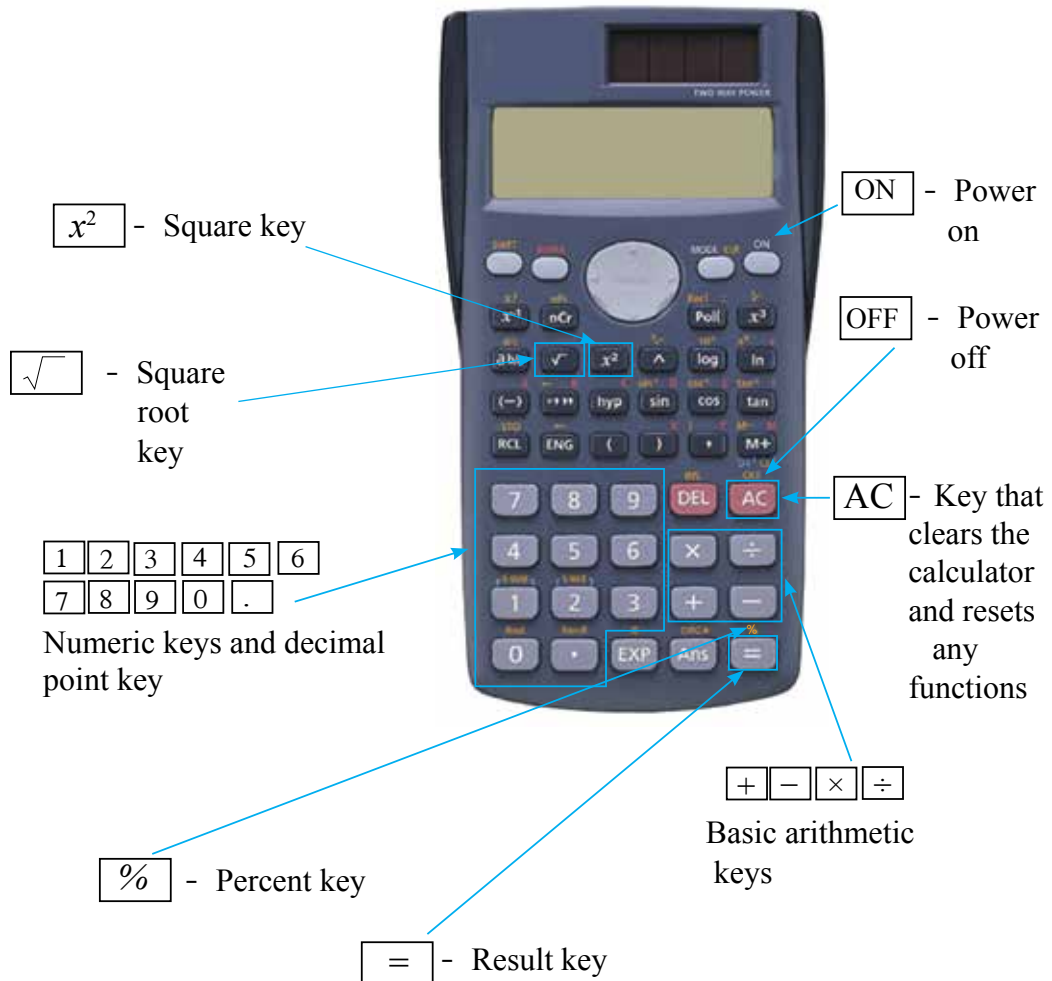

Blaise Pascal   Charles Babbage

Nowadays, two types of calculators are manufactured. They are the ordinary calculators and the scientific calculators. Ordinary calculators can perform only normal mathematical operations such as addition, subtraction, multiplication, division and square roots. However, by using a scientific calculator, operations such as x^2, x^3 $\sqrt[x]{y}$, 10^x can be performed.

The Scientific Calculator

The scientific calculator, like the ordinary calculator, consists of a key pad to enter data and a screen to display results. However, the number of keys on the keypad and the number of digits that can be displayed on the screen of a scientific calculator are greater than those of an ordinary calculator.

Let us identify the keys on the keypad of a scientific calculator.

$\boxed{x^2}$ - Square key

$\boxed{\sqrt{}}$ - Square root key

$\boxed{1}\ \boxed{2}\ \boxed{3}\ \boxed{4}\ \boxed{5}\ \boxed{6}$
$\boxed{7}\ \boxed{8}\ \boxed{9}\ \boxed{0}\ \boxed{.}$
Numeric keys and decimal point key

$\boxed{ON}$ - Power on

$\boxed{OFF}$ - Power off

$\boxed{AC}$ - Key that clears the calculator and resets any functions

$\boxed{+}\ \boxed{-}\ \boxed{\times}\ \boxed{\div}$
Basic arithmetic keys

$\boxed{\%}$ - Percent key

$\boxed{=}$ - Result key

11.1 Performing calculations using a calculator

When performing calculations using a calculator, the keys need to be pressed in a specific order.

Example 1

The order in which the keys need to be pressed to obtain the value of $27 + 35$ is the following.

$\boxed{\text{ON}} \to \boxed{2} \to \boxed{7} \to \boxed{+} \to \boxed{3} \to \boxed{5} \to \boxed{=} \quad \vdots\,62\,\vdots$

Example 2

The order in which the keys need to be pressed to obtain the value of $208 - 159$ is the following.

$\boxed{\text{ON}} \to \boxed{2} \to \boxed{0} \to \boxed{8} \to \boxed{-} \to \boxed{1} \to \boxed{5} \to \boxed{9} \to \boxed{=} \quad \vdots\,49\,\vdots$

Example 3

The order in which the keys need to be pressed to obtain the value of 5.25×35.4 is the following.

$\boxed{\text{ON}} \to \boxed{5} \to \boxed{.} \to \boxed{2} \to \boxed{5} \to \boxed{\times} \to \boxed{3} \to \boxed{5} \to \boxed{.} \to \boxed{4} \to \boxed{=} \quad \vdots\,185.85\,\vdots$

Example 4

The order in which the keys need to be pressed to obtain the value of $5.52 \div 6$ is the following.

$\boxed{\text{ON}} \to \boxed{5} \to \boxed{.} \to \boxed{5} \to \boxed{2} \to \boxed{\div} \to \boxed{6} \to \boxed{=} \quad \vdots\,0.92\,\vdots$

To switch the calculator off after a calculation is done, press the $\boxed{\text{OFF}}$ key. If you wish to start another calculation without switching the calculator off, use the $\boxed{AC}$ key to clear the screen and reset the functions.

Example 5

Write the order in which the keys need to be pressed to do the following simplifications.

(i) $53 + 42 - 25$ (ii) $35 \times 45 \div 21$

$\boxed{\text{ON}} \to \boxed{5} \to \boxed{3} \to \boxed{+} \to \boxed{4} \to \boxed{2} \to \boxed{-} \to \boxed{2} \to \boxed{5} \to \boxed{=} \quad \vdots\,70\,\vdots$

$\boxed{\text{AC}} \to \boxed{3} \to \boxed{5} \to \boxed{\times} \to \boxed{4} \to \boxed{5} \to \boxed{\div} \to \boxed{2} \to \boxed{1} \to \boxed{=} \quad \vdots\,75\,\vdots$

Simplify each of the following using a calculator. Indicate the order in which the keys need to be pressed to obtain the correct answer.

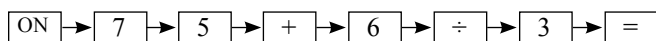|					
a.	$45 + 205$	e.	$3.52 + 27.7$	i.	$12.5 \div 50 \times 4.63$
b.	$350 - 74$	f.	$43.5 - 1.45$	j.	$15.84 - 6.75 \times 3.52$
c.	824×95	g.	7.35×6.2	k.	$120.82 \div 0.0021 \times 5$
d.	$3780 \div 35$	h.	$134.784 \div 31.2$	l.	$0.006 \div 0.33 \times 0.12$

Performing calculations using an ordinary calculator or a scientific calculator

Let us consider how simplifications are done using a calculator when more than one operation is involved.

In simplifying $75 + 6 \div 3$ using an ordinary calculator, when the keys are pressed in the order

$\boxed{\text{ON}} \rightarrow \boxed{7} \rightarrow \boxed{5} \rightarrow \boxed{+} \rightarrow \boxed{6} \rightarrow \boxed{\div} \rightarrow \boxed{3} \rightarrow \boxed{=}$, the operations are performed in the order that they have been entered and 27 is obtained as the answer. That is, a wrong answer is obtained by $75 + 6 \div 3 = 81 \div 3 = 27$.
(This is wrong according to the "BODMAS Rule".)

When we enter the above data in a scientific calculator in the same order, the operations are performed according to the accepted order of performing mathematical operations and the answer 77 is obtain by performing the operations as follows: $75 + 6 \div 3 = 75 + 2 = 77$.
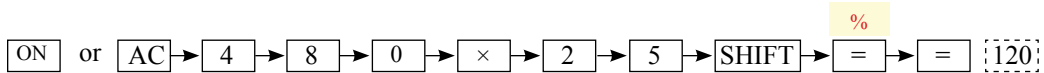
Note: When performing calculations using an ordinary calculator, the order in which data is entered should be chosen with care. However, the correct answer can be obtained when data is entered into a scientific calculator in the order in which they appear. Most manufacturers of calculators follow the BODMAS rule when programming their products. However, there are some calculators that do not perform the operations according to this rule. The order in which data should be entered into these calculators is indicated in the instruction booklet that is provided. If such a booklet is not available, an understanding of how the calculator operates can be gained by performing a few simple calculations. Otherwise, the operations that need to be performed initially have to be enclosed within brackets. For example, if the data in the expression $1 - 5 + 12 \div 3 \times 2$ is entered in the given order, some calculators may perform the multiplication before the division. However, according to the BODMAS rule, since multiplication and division have the same priority, moving from left to right, the division should be peformed first.

11.2 Using the $\boxed{\%}$ key in the scientific calculator

The % key is used to calculate percentages. Both the symbols "=" and "%" appear on the same key in most calculators. To activate the % key, press the $\boxed{\text{Shift}}$ key and then the $\boxed{=}$ key.
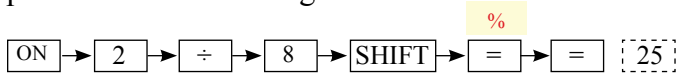
Example 1

The keys of the calculator need to be pressed in the following order to find 25% of 480.

$\boxed{\text{ON}}$ or $\boxed{\text{AC}}$ → $\boxed{4}$ → $\boxed{8}$ → $\boxed{0}$ → $\boxed{\times}$ → $\boxed{2}$ → $\boxed{5}$ → $\boxed{\text{SHIFT}}$ → $\boxed{=}^{\%}$ → $\boxed{=}$ ⟦120⟧
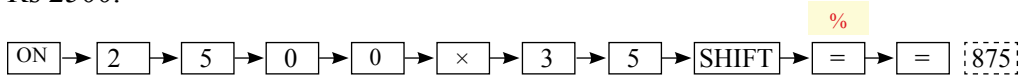
Example 2

Let us express $\dfrac{2}{8}$ as a percentage. To do this, the keys of the calculator need to be pressed in the following order.
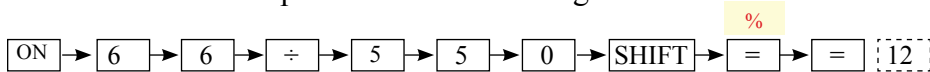
$\boxed{\text{ON}}$ → $\boxed{2}$ → $\boxed{\div}$ → $\boxed{8}$ → $\boxed{\text{SHIFT}}$ → $\boxed{=}^{\%}$ → $\boxed{=}$ ⟦25⟧

Example 3

The keys of the calculator need to be pressed in the following order to find 35% of Rs 2500.

$\boxed{\text{ON}}$ → $\boxed{2}$ → $\boxed{5}$ → $\boxed{0}$ → $\boxed{0}$ → $\boxed{\times}$ → $\boxed{3}$ → $\boxed{5}$ → $\boxed{\text{SHIFT}}$ → $\boxed{=}^{\%}$ → $\boxed{=}$ ⟦875⟧

Example 4

The population of a certain village is 550. Of this number, 66 are school children. To find what percentage of the population are school children, the keys of the calculator need to be pressed in the following order.

$\boxed{\text{ON}}$ → $\boxed{6}$ → $\boxed{6}$ → $\boxed{\div}$ → $\boxed{5}$ → $\boxed{5}$ → $\boxed{0}$ → $\boxed{\text{SHIFT}}$ → $\boxed{=}^{\%}$ → $\boxed{=}$ ⟦12⟧

Exercise 11.2

1. Simplify each of the following using a calculator. Indicate the order in which the keys of the calculator need to be pressed to get the correct answer.

    a. $\;\;350 \times 3\%$ **b.** $\;\;7520 \times 60\%$ **c.** $\;\;75.3 \times 5\%$

2. Using a calculator, express each of the following as a percentage.

    a. $\dfrac{1}{5}$ **b.** $\dfrac{12}{25}$ **c.** $\dfrac{7}{20}$

Use a calculator to find the solution to each of the following problems.

3. A chair which was produced at a cost of Rs 450 was sold at a profit of 22%. What was the profit?

4. Of the 750 pupils in a certain school, 20% travel to school by bus. How many pupils travel to school by bus?

5. Nimal's monthly salary is Rs 35 000. Of this amount, he deposits Rs 7000 in a savings account. What percentage of his salary does he save?

6. Of the 650 students in a certain school, 143 learn music. Express the number of students who learn music as a percentage of the total number of students in the school.

7. It was stated that the amount of unfilled grain in a stock of paddy is less than 2%. There were 6 kg of unfilled grain in 350 kg of that stock. Was the statement that was made true?

11.3 Performing calculations using the x^2 key

To find the value of powers with index two such as 2^2, 5^2 and 3.21^2, we use the x^2 key.

Example 1

The order in which the keys need to be pressed to obtain the value of 3^2 is the following.

ON → 3 → x^2 → = → 9

Example 2

The order in which the keys need to be pressed to obtain the value of 4.1^2 is the following.

AC → 4 → · → 1 → x^2 → = → 16.81

Example 3

The order in which the keys need to be pressed to obtain the value of $5^2 \times 12^2$ is the following.

AC → 5 → x^2 → × → 1 → 2 → x^2 → = → 3600

Example 4

The order in which the keys need to be pressed to find the area of a square of side length 6 cm is the following.

Since the area of the square $= 6 \times 6$ cm²

$$\boxed{\text{ON}} \rightarrow \boxed{6} \rightarrow \boxed{x^2} \rightarrow \boxed{=} \rightarrow \boxed{36}$$

$\therefore$ The area of the square is 36 cm².

Exercise 11.3

1. Find the value of each of the following powers using a scientific calculator. Indicate the order in which the keys of the calculator need to be pressed to obtain the correct answer.

   a. 2^2
   b. 8^2
   c. 127^2
   d. 3532^2
   e. 3.5^2
   f. 6.03^2

2. Find the value of each of the following using a scientific calculator. Indicate the order in which the keys of the calculator need to be pressed to obtain the correct answer.

   a. 3×5^2
   b. $3^2 \times 4^2$
   c. $(3.5)^2$
   d. $4^2 + 3^2$
   e. $10^2 - 6^2$
   f. $10^2 - 3^2 \times 5$

11.4 Performing calculations using the $\boxed{\sqrt{}}$ key in a scientific calculator

To find the value of the square root of a number we use the $\boxed{\sqrt{}}$ key.

Example 1

The order in which the keys of a scientific calculator need to be pressed to find the value of $\sqrt{25}$ is the following.

$$\boxed{\text{ON}} \rightarrow \boxed{\sqrt{}} \rightarrow \boxed{2} \rightarrow \boxed{5} \rightarrow \boxed{=} \quad \boxed{5}$$

Example 2

The order in which the keys of a scientific calculator need to be pressed to find the value of $\sqrt{44\ 521}$ is the following.

$$\boxed{\text{ON}} \rightarrow \boxed{\sqrt{}} \rightarrow \boxed{4} \rightarrow \boxed{4} \rightarrow \boxed{5} \rightarrow \boxed{2} \rightarrow \boxed{1} \rightarrow \boxed{=} \quad \boxed{211}$$

Example 3

The order in which the keys of a scientific calculator need to be pressed to find the value of $\sqrt{5.29}$ is the following.

$\boxed{\text{ON}} \to \boxed{\sqrt{}} \to \boxed{5} \to \boxed{.} \to \boxed{2} \to \boxed{9} \to \boxed{=} \quad \vdots 2.3 \vdots$

Exercise 11.4

1. Find the square root of each of the following numbers using a scientific calculator. Indicate the order in which the keys of the calculator need to be pressed to obtain the correct answer.

   a. 64   **b.** 81   **c.** 2704
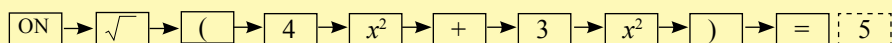   **d.** 3356   **e.** 3500   **f.** 362404

2. Find the value of each of the following using a scientific calculator. Indicate the order in which the keys of the calculator need to be pressed to obtain the correct answer.

   a. $\sqrt{49}$ **b.** $\sqrt{121}$ **c.** $\sqrt{625}$
   d. $\sqrt{20.25}$ **e.** $\sqrt{5.76}$ **f.** $\sqrt{0.1225}$

For further knowledge

The order in which the keys of a calculator need to be pressed to find the value of $\sqrt{4^2 + 3^2}$ is the following.

$\boxed{\text{ON}} \to \boxed{\sqrt{}} \to \boxed{(} \to \boxed{4} \to \boxed{x^2} \to \boxed{+} \to \boxed{3} \to \boxed{x^2} \to \boxed{)} \to \boxed{=} \quad \vdots 5 \vdots$

Miscellaneous Exercise

1. Simplify using a scientific calculator. Indicate the order in which the keys need to be pressed to obtain the correct answer.

   a. $5 + 6 \div 2 + 4 \times 5$ **b.** $6225 + 37 \times 0.25$ **c.** $42.48 \div 5.31$
   d. $428 + 627 \times 5\%$ **e.** $5.3^2 \div 6.01$ **f.** $\dfrac{7}{130} \times 2\% + 560$

2. Of the 35 seeds that Saman planted, 21 germinated. Using a scientific calculator, find what percentage of the seeds that were planted germinated.

3. Nimal received a salary increment of 12%. If his salary before the increment was Rs 45 200, how much was his salary after the increment?

4. Find the value of a if $a = 1.33^2$.

5. Find the value of p if $p = \sqrt{18.49 - 2}$.