Exemplar 4 :
Compound Interest

Objective :   To explore the compound interest formula

Key Stage :   3

Learning Unit :   Using Percentages

Materials Required :   Calculators

Prerequisite Knowledge :   Simple Interest

Description of the Activity :

1. The teacher uses examples to revise the calculations of simple interest and the amount at simple interest.

2. The teacher uses examples to illustrate and to generalize the formula for the amount at simple interest.

3. The teacher distributes the worksheet and students work in groups.

4. The teacher encourages students to discuss and follow the questions in the worksheet to obtain a formula for the amount at compound interest.

5. After completing the worksheet, the teacher asks a student to write down the compound interest formula on the board. The teacher then introduces and explains all necessary terms involved in the compound interest formula.

Worksheet

1. Find the simple interest and the amount on $10 000 for 3 years at 6% per annum.

   The simple interest $= \$\ \dfrac{(\qquad)\times(\qquad)\times(\qquad)}{100} = \$(\qquad)$

   The amount $= \$10\ 000 + \$(\qquad) = \$(\qquad)$

2. Find the simple interest on $15 000 for 1 year at 9% p.a.

   _____

3 Find the amount on $15 000 at 9% simple interest p.a. for 1 year.

   _____

4. Find the simple interest $I and the amount $A on $P at R% p.a. for 1 year.

   $$I = \frac{(\qquad)\times(\qquad)\times(\qquad)}{100} = \frac{(\qquad)}{100}$$

   $$A = P + I = P + (\qquad) = P\ \ (\qquad) + \frac{(\qquad)}{100}$$

   i.e. $A = P\ (\underline{\qquad} + \underline{\qquad}\ \%\ )$

5. By applying the results obtained in Question 4, find the amount at compound interest and fill up the details in the following table. All numbers should be corrected to 2 decimal places.

Principal (P)	$100	$5 000	P
Rate (R) (% per annum)	7	6	R
Amount for 1 year	$100(1+7%)= $107		
Amount for 2 years	**$107**(1+7%)=$114.49 or **$100(1+7%)**(1+7%)=$114.49 i.e. $100(1+7\%)^2= $114.49		
Amount for 3 years	**$114.49**(1+7%)=$122.5 or **$100(1+7%)^2**(1+7%)=$122.50 i.e. $100(1+7\%)^3= $122.50		
Amount for 4 years	$100(1+7\%)^4= $_____		
Amount for 5 years			

6. Write down the amount at compound interest on $P at R% p.a. for n years.

   _____

7. Using the result obtained in Question 6, find the amount at compound interest and the interest obtained from $2000 at 5% p.a. for

   a) 20 years

      _____

      _____

   b) 100 years

      _____

      _____

Notes for Teachers :

1. This learning activity is designed to extend students' knowledge on simple interest to explore and deduce the formula on compound interest.

2. The teacher should remind students the following formulas for calculating the simple interest $I and the amount $A on the principal $P for T years at R% per annum:

    $$I = \frac{PRT}{100}$$

    and $A = P + I$

3. The teacher should point out that there is no direct formula in finding the compound interest. Students have to find the amount at compound interest by $A = P(1 + R\%)^n$. They compound interest should be calculated by $I = A - P$.

4. Answers to the worksheet:
    (1) $1 800, $11 800
    (2) $1350
    (3) $16350
    (4) $P(1 + R\%)$
    (5)

Principal (P)	$100	$5000	P
Rate (R) (% per annum)	7	6	R
Amount for 1 year		$5300	$P(1+R\%)$
Amount for 2 years		$5618	$P(1+R\%)^2$
Amount for 3 years		$5955.08	$P(1+R\%)^3$
Amount for 4 years	$131.08	$5000(1+6\%)^4$ $= \$6312.38$	$P(1+R\%)^4$
Amount for 5 years	$100(1+7\%)^5$ $=\$140.26$	$5000(1+6\%)^5$ $= \$6691.13$	$P(1+R\%)^5$

(6) Amount $= \$ P \, (\, 1 + R\% \,)^{\,n}$

(7) (a) Amount $= \$2000(1 + 5\%)^{20}$ Interest $= \$5306.60 - \$2000$
$= \$5306.60$ $= \$3306.60$

(b) Amount $= \$2000(1 + 5\%)^{100}$ Interest $= \$263002.52 - \$2000$
$= \$263002.52$ $= \$261002.52$

5. For the more able students, the teacher guides students to consider cases when the interest period is not in whole years, e.g. half-yearly, quarterly or monthly, etc.

6. If time allows, the teacher may ask students to do one more problem on the difference between simple interest and compound interest on a sum of money invested over the same period of time at a particular rate.

    e.g. Find the difference between the simple interest and the compound interest on a sum of \$10 000 invested at the rate of 5% p.a. for 4 years.

        Answer : \$155.06