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Subject: - Maths

4th Quarter Note 2

Exercise

1. A pair of shoes costs Birr 110 and sells for Birr 155. Find the mark up and the mark up percent based on the retail (selling price).
2. What is the percent mark up on cost, if the markup on retail is 37%?
3. If W/ro Chaltu purchased a gallon of oil at Birr 258 and sold it at Birr 288, find
 - a) Markup
 - b) markup percent with respect to selling price
4. Ato Dechassa wants to sell his ox at Birr 3,652 with a 10% markup on his cost find the cost of the ox.
5. Martha bought a shoe for Birr 280 and wants to sell it at 24% markup. Find
 - a) Markup
 - b) selling price of the shoe
6. Abebe sold a quintal of Teff at Birr 1,068 with 45% markup on selling price. Find the cost.
7. Find the percent markup on cost, if mark-up on selling price is 30%.

11.2 Compound Interest and Depreciation simple interest.

When money is borrowed, or you deposit money in an account, a fee is paid for the use of the money. A fee paid for the use of money is called **interest**. From the investment point of view, interest is income from invested capital. The capital originally invested is called the principal (or present value). The sum of the principal and interest due (or paid) is called the amount (or future value or accumulated value)

Simple interest: $I = prt$

Where I is the simple interest, p is the principal, r is the interest rate per year on annual interest rate, and t is the time in years.

- ✓ In general, if a principal p is borrowed at a rate r of simple interest per year for t years, then the borrower will pay back the lender an amount A that include the principal plus the amount of interest I.

$A = P + T = P + prt = P(1 + rt)$

The future value of a simple interest

$$A = p(1 + rt)$$

Where A is the future value, p is the principal, r is the simple interest rate per year, and t is the time in years.

Example. If birr 2,500 is invested with a simple interest rate of 2% per month, find the amount of the interest and future value at the end of the fourth month.

Solution: $P = 2,500$ Birr
Interest rate $r = 0.02$
time $t = 4$ months
 $I = prt = 2500 \times 0.02 \times 4$
 $= \underline{\text{Birr } 200}$

The value of the investment after 4 month is
 $A = P + I = P + prt = (2500 + 200) \text{ Birr}$
 $= \underline{2700 \text{ Birr}}$

Example: Zenebech wants to buy an electric stove priced at Birr 2,500 and agreed to pay 700 initially and the remaining amount to be equally paid monthly on simple interest rate of 13% per year in 9 months lie the remaining amount plus its interest). What is the monthly payment she has to do?

Solution: The amount of loan = Birr 2,500 – Birr 700
 $= \text{Birr } 1,800$

Hence, the principal will be 1,800 Birr

interest rate $r = 0.13$, time $t = \frac{9}{12}$ years and the number of times payment is made in $n = mxt$

$$n = 12 \times \frac{9}{12} = 9 \text{ times.}$$

$$\begin{aligned} \text{Therefore the periodic payment is } \text{periodic payment} &= \frac{P+I}{n} = \frac{P(1+rt)}{mt} \\ &= \frac{1800(1+(0.13)\frac{9}{12})}{9} \\ &= \frac{1975.5}{9} = \underline{\underline{\text{Birr } 219.5}} \end{aligned}$$

11.2.1 Compound interest.

If at the end of a payment period the interest due is reinvested at the same rate, the interest as well as the original principal will earn interest during the next payment period. Interest paid on interest reinvested is called **compound interest**.

✓ If p is the principal earning interest compounded annually at a rate of r per year for n years, then the amount at the end of one year can be calculated from the simple interest relation.

$$A = p(1+rt)$$

- the amount at the end of the first years

$$A_1 = P(1+rt)$$

- at the end of the second year

$$A_2 = P(1+rt)(1+rt) = P(1+rt)^2$$

- at the end of the third year

$$A_3 = P(1+rt)^2(1+rt) = P(1+rt)^3$$

Therefore, the total amount A after n years will be given by

$A = P(1+r)^n$

- The interval of time between successive interest calculations is called conversion period or compounded period.

Example: Find the amount of interest on a deposit of Birr 1000 in an account compounded annually with annual interest rate of 6% for 5 years.

Solution: $A = p(1+rl)^n$

$$= 1000 (1+0.06 \times 1)^5$$

$$= 1000 (1.06)^5$$

$$= \underline{\underline{\text{Birr } 138.28}}$$

Hence the amount of the compound interest of the deposit is

$$I = A - P = 1338.23 - 1000 = 338.23 \text{ Birr}$$

- ✓ If interest at an annual rate of r per year is compounded m times a year on a principal p , then the simple interest rate per conversion period is

$$i = \frac{\text{annual interest rate}}{\text{number of periods per year}} = \frac{r}{m}$$

Now, if the interest is compounded for t years, then there will be $n = mt$ conversion periods in t years. Thus if you put $n = mt$ and replace r by the expression of interest rate per each conversion period $i = \frac{r}{m}$.

Future value of a compound interest.

$$A = P \left(1 + \frac{r}{m}\right)^{mt}$$

Where A is amount or future value, p is principal or present value, r is annual or nominal rate, t is time in years, and m is the number of conversion periods per year

- Annually means once a year, i.e $m = 1$
- Semi-annually means twice a year, i.e $m = 2$
- Quarterly means four times a year, i.e $m = 4$
- Monthly means 12 times a year, i.e $m = 12$

Example: If birr 100 is deposited in the commercial Bank of Ethiopia with interest rate of 10% per annum, find the amount if it is compounded annually, semi annually, quarterly, monthly and weekly at the end of one year.

Solution: you are given the principal $p = \text{Birr } 100$, the annual interest rate $r = 0.1$, for a period of time $t = 1$ years, and compounded period of $n = mt$.

- a) Annually means $m = 1$, so the amount at the end of the year is

$$\begin{aligned} A &= p \left(1 + \frac{r}{m}\right)^{mt} = 100 \left(1 + \frac{0.1}{1}\right)^{1 \times 1} \\ &= 100 (1.01) \\ &= \underline{\underline{\text{Birr } 110}}} \end{aligned}$$

- b) Semi-annually means $m = 2$, so that the amount at the end of the year is

$$\begin{aligned} A &= p \left(1 + \frac{r}{m}\right)^{mt} = 100 \left(1 + \frac{0.1}{2}\right)^2 \\ &= 100 (1+0.05)^2 \\ &= 100 (1.05)^2 \\ &= \underline{\underline{\text{Birr } 110.25}}} \end{aligned}$$

c) Quarterly means $m = 4$, so that the amount at the end of the year is

$$A = P\left(1 + \frac{r}{m}\right)^{mt} = 100 \left(1 + \frac{0.1}{4}\right)^{4(1)}$$

$$= \underline{\underline{\text{Birr } 110.38}}$$

d) Monthly means $m = 12$, so that the amount at the end of the year is

$$A = p\left(1 + \frac{r}{m}\right)^{mt} = 100 \left(1 + \frac{0.1}{12}\right)^{12 \times 1}$$

$$= \underline{\underline{\text{Birr } 110.47}}$$

e) Weekly means $m = 52$, so that the amount at the end of the year is

$$A = p\left(1 + \frac{r}{m}\right)^{mt} = 100 \left(1 + \frac{0.1}{52}\right)^{52 \times 1}$$

$$= \underline{\underline{\text{Birr } 110.51}}$$

From the future value of a compound investment, you can get a formula for the present value. If p is the present value of Birr A to be received after t years at annual interest rate r compounded m times a year then

$$A = p \left(1 + \frac{r}{m}\right)^{mt}$$

To solve for p , divide both sides by $\left(1 + \frac{r}{m}\right)^{mt}$ and we obtain the present value of a compounded interest

$$P = A \left(1 + \frac{r}{m}\right)^{-mt}$$

Example: Find the present value of an investment that will grow to Birr 600 after two years compounded quarterly at the interest rate of 9% pr year.

$$A = 600 \text{ Birr}, t = 2 \text{ years}, r = 0.09, m = 4$$

$$P = A \left(1 + \frac{r}{m}\right)^{-mt} = 600 \left(1 + \frac{0.09}{4}\right)^{-4 \times 2}$$

$$= 600 \left(1 + \frac{0.09}{4}\right)^{-8}$$

$$= \underline{\underline{\text{Birr } 502.16}}$$

Ordinary annuity (Best example the regular payment of money for condominium)

- ✓ Money people are not in a position to deposit a large amount of money at a time in an account. Most people save money by depositing relatively small amount at different times. If a depositor makes equal deposits at regular interval, he/she is contributing to an annuity. The deposits may be made weekly, monthly, yearly or any other period of time.

The future value of an ordinary annuity is given by

$$S = R \left(\frac{(1 + i)^n - 1}{i} \right)$$

Where R is the periodic payment, i is the interest rate per period and n is the number of periods.

- ✓ The amount of interest of an ordinary annuity is

$$I = S - nR$$

$i = \frac{r}{m}$ and $n = mt$, in which r is the interest rate per year, m is the number of times interest is compounded per year and t is time in years.

Example: Elizabeth deposits Birr 350 at the end of every month into a saving account that pays an interest rate of 12% per year compounded monthly. How much money is in her account at the end of 5 years? What is the amount of interest?

Solution: you are given $R = \text{Birr } 350$, $r = 0.12$, $m = 12$ and $t = 5$ years $i = \frac{r}{m} = \frac{0.12}{12} = 0.01$ and $n = mt = 12 \times 5 = 60$

a) The accumulated balance is given by

$$\begin{aligned} S &= R \left(\frac{(1+i)^n - 1}{i} \right) \\ &= 350 \left(\frac{(1.01)^{60} - 1}{0.01} \right) \\ &= \underline{\underline{\text{Birr } 28,584.38}} \end{aligned}$$

b) The amount of interest is $I = S - nR$
 $= 28,584.38 - 60 \times 350$
 $= \underline{\underline{\text{Birr } 7,584.38}}$

11.2.2 Depreciation

- Asset is any physical thing whether tangible or intangible that has money value.
- Intangible assets are patents, copyrights and good will
- There are two groups of assets known as current assets (financial assets) and plant assets (or fixed assets)
- Plant assets (fixed asset) are of a permanent or relatively fixed nature.

Example: Plant assets, land, building furniture's, automobiles etc.

The decrease in usefulness is a business expense, called depreciation. Plant assets include equipment, machinery, building, and land. With the exception of land the rest will depreciate.

Since we are interested in this subsection how plant assets depreciate.

The depreciation of an asset is caused mainly due to.

a) **Physical depreciation:**—wear out from use and deterioration from the action of the element.

Example: the cost of a new car and the cost of the car after 20 years is completely different because after 20 years the money value of the car decreases that is its usefulness decreases or it depreciates this depreciation is physical depreciation.

b) **Functional depreciation:** inadequacy and obsolescence inadequacy results if the capacity does not meet the demand of increased production, while obsolescence results, if the commodity produced is no longer in demand with respect of quality and cost of production.

Example: Best example of functional depreciation is type writer. It is inadequate because of better technology.

- ✓ Factors to be considered in computing the periodic depreciation of an asset are its original cost, its recoverable cost at the time it is retired from service, and the length of life of the asset.
- ✓ The estimated recoverable cost of depreciable asset at the time its removal from service is variously termed as residual value, scrap value, salvage value, or trade-in value.

In this grade we consider two methods of computing depreciation that are

- i) The fixed installment method and
- ii) Reducing – balance method

i) The fixed installment method

The fixed installment method (or cost method or the straight-line method) quite simple to apply.

$$\text{Depreciation} = \frac{\text{cost} - \text{salvage value}}{\text{estimated life in years}}$$

Example: A machine costing Birr 35000 is estimated to have a useful life time of 8 years and a salvage value of Birr 3000. What is the accumulated depreciation at the end of 5 years? Find the book value of the asset at that time.

$$\text{Book value} = \text{cost} - \text{accumulated depreciation}$$

$$\begin{aligned}\text{Depreciation} &= \frac{\text{cost} - \text{salvage value}}{\text{estimated life in years}} = \frac{35000 - 3000}{8} \\ &= \underline{\underline{\text{Birr } 4000}}\end{aligned}$$

Hence the accumulated depreciation in creases by Birr 4000 every year. $5 \times 4000 = 20,000$

- The accumulated depreciation at the end of 5 years will be

$$\begin{aligned}\text{Book value} &= \text{cost} - \text{accumulated depreciation} \\ &= 35000 - 20,000 \\ &= \underline{\underline{15,000 \text{ Birr}}}\end{aligned}$$

Reducing balance method

The reducing balance method (or declining – balance method) yields a declining periodic depreciation charge over the estimated life of the asset of the several variant techniques the most common is to apply double straight-line depreciation rate, computed by:

$$\text{Annual percentage rate of depreciation} = \frac{\frac{2 \times 100\%}{\text{Estimated lifetime}}}{\frac{200\%}{\text{Estimated life time}}}$$

Example: Using the double reducing balance method of depreciate determine the book value at the end of the second year of an item that was bought on may 5for Birr 30,000 and estimated useful life of 40 years.

Solution: The depreciation rate per year is $\frac{200\%}{40} = 0.05$

The depreciation for the first full year is $30,000 \times 0.05 = \text{Birr } 1,500$ Hence the depreciation per month is

$\text{Birr } 1500 \text{ per year} \div 12 \text{ month per year} = \text{Birr } 125 \text{ per month.}$

- ✓ Since the item is bought on may 5, it is close to may 1. Hence at the end of the first year the depreciation is $\text{Birr } 1250 \times 8 = \underline{\underline{\text{Birr } 1000}}$

the book value at the end of the first year is

$$30,000 - 1000 = 29,000 \text{ Birr}$$

Therefore the depreciation for the second year is $29,000 \times 0.05 = \text{Birr } 1450$

- ✓ The book value at the end of the second year is

$$\text{Birr } 29,000 - \text{Birr } 1450 = \underline{\underline{\text{Birr } 27,550}}$$