SIMPLE INTEREST

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LEARNING OUTCOMES

By the end of this chapter, student should be able to :

- explain the concept of simple interest,

- use the simple interest formula to calculate interest, interest rate, time and dates with data provided,

- use the simple amount formula to calculate the present and future values of some investments,

- identify four concepts of exact simple interest, ordinary simple interest, exact time and approximate time, and

- apply Banker's Rule to some investments and loan problems.

INTRODUCTION

- Interest – the amount earned or paid for the use of money

- Principal – the amount of money deposited or borrowed

- What is simple interest?
  - Interest that is earned or paid only on the PRINCIPAL
    Annual interest rate – the percent of the principal earned or paid per year
    The amount of interest earned or paid of each year is a constant

SIMPLE INTEREST FORMULA

Simple interest (I) is given by this formula
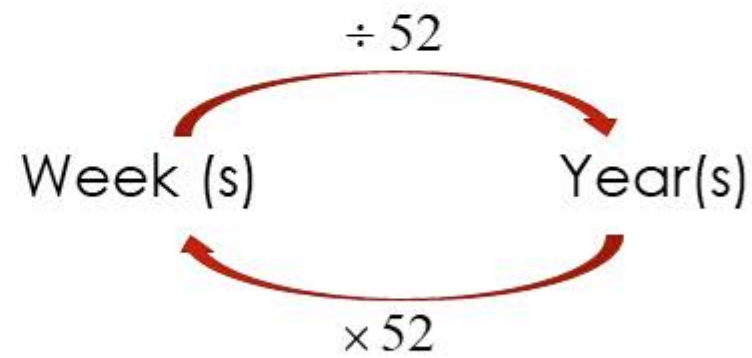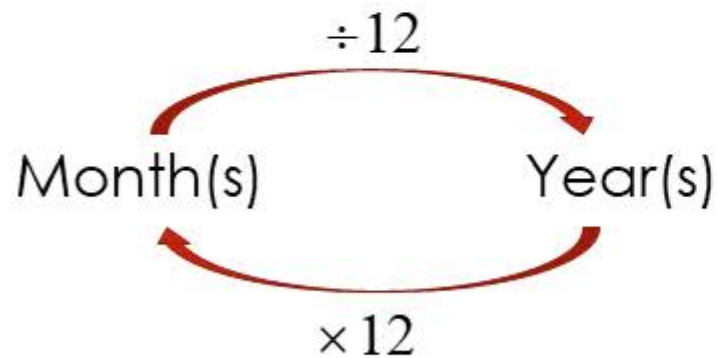
$$I = Prt$$

such that,

P is the principal

r is the annual interest rate

t is the time in years

CHANGING MONTHS AND WEEKS INTO YEARS

How to determine the value of time, t in years if the term is given in months or weeks.

$$\div 12$$

Month(s) — Year(s)

$$\times 12$$

$$\div 52$$

Week (s) — Year(s)

$$\times 52$$

Example 1

A college student deposited RM1500 in an account when he was 18 years old.

The simple interest rate offered was 4.85%.

Calculate the simple interest earned when the college student is 25 years old.

SOLUTION

$$P = 1500$$

$$r = \frac{4.85}{100} = 0.0485$$

$$t = 25 - 18 = 7$$

$$I = \Pr t$$

$$= 1500(0.0485)(7)$$

$$= RM509.25$$

SIMPLE AMOUNT FORMULA

- Balance – when an interest is earned, the interest is added to the money in the account

- The balance (simple amount) after a year is actually the sum of the principal *P* and the interest *I for a year*

- *In the case of the term is more than a year, the amount of interest for a year is multiplied with number of years.*

- The formula of simple amount is

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

Example 2

Suzy took a personal loan with a simple
Interest rate of 8.5%. After 4 years and 9
months she has to pay back RM35, 809.66.
Find the amount of the loan.

SOLUTION

$S = 35809.66$

$r = 0.085$

$t = 4\dfrac{9}{12} = \dfrac{57}{12}$

$S = P(1 + rt)$

$35809.66 = P\left(1 + 0.085\left(\dfrac{57}{12}\right)\right)$

$35809.66 = P(1.40375)$

$P = RM\ 25510$

Example 3

Asri deposited RM1400 into an account that earns r% simple interest. After 9 months, the balance is RM1421. Find the simple interest rate.

SOLUTION

$$P = 1400 \quad ; \quad S = 1421 \quad ; \quad t = \frac{9}{12}$$

$$S = P\left(1 + rt\right)$$

$$1421 = 1400\left(1 + r\left(\frac{9}{12}\right)\right)$$

$$r = 0.02$$

$$= 2\%$$

FOUR CONCEPTS OF INTEREST

Calculating the time:

- Exact Time
  - use the calendar

- Approximate Time
  - assume 30 days in each month.

Calculating the interest:

- Ordinary Simple Interest
  - use 360 days in a year

- Exact Simple interest
  - use either 365 or 366 days in a year.

Example 4

Determine the term between the two dates given by using exact time and approximate time.

i) 2 July 2014 ~ 30 Oct 2014

SOLUTION

Exact Time			Approximate Time	
2 Jul 2014	$(31-2) = 29$		2 Jul 2014 $(30-2) = 28$	
Aug	$= 31$		Aug	$= 30$
Sept	$= 30$		Sept	$= 30$
30 Oct 2014	$= 30$		30 Oct 2014	$= 30$
	120 days			118 days

ii) 30 Jan 2012 ~ 17 May 2012

SOLUTION

Exact Time			Approximate Time	
30 Jan 2012	$(31-30) = 1$		30 Jan 2012 $(30-30) = 0$	
Feb	$= 29$		Feb	$= 30$
Mar	$= 31$		Mar	$= 30$
Apr	$= 30$		Apr	$= 30$
17 May 2012	$= 17$		17 May 2012	$= 17$
	108 days			107 days

Example 5

Fill in the blanks for the following table (use exact time)

	Initial Date	Term (days)	Maturity Date
i)	12 Aug 2012	100	
ii)		80	30 Jun 2014

SOLUTION

i)   100

12 Aug 2012 (31 - 12)   19

                                         81

Sep   - 30

                                         51

Oct   - 31

                                         20

Maturity   = 20 Nov 2012
Date

ii)   80

30 Jun 2014   - 30

                                       50

May   - 31

                                       19

Apr   (30 - 19) = 11

Initial   = 11 Apr 2014
Date

CHANGING DAYS INTO YEARS

- Exact Simple Interest

normal year – 365 days
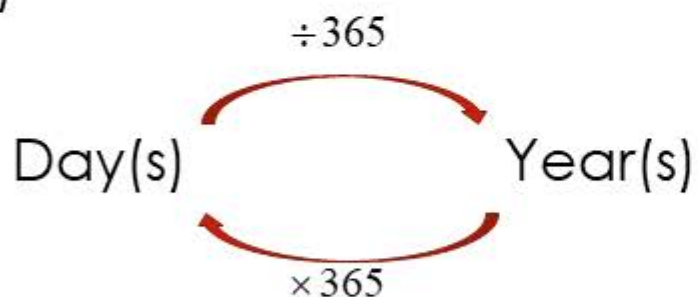
leap year – 366 days (2008, 2012, 2016)

$\div 365$

Day(s)   Year(s)
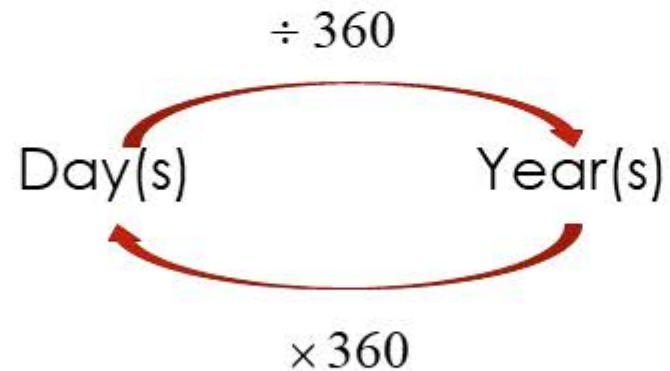
$\times 365$

$\div 366$

Day(s)   Year(s)

$\times 366$
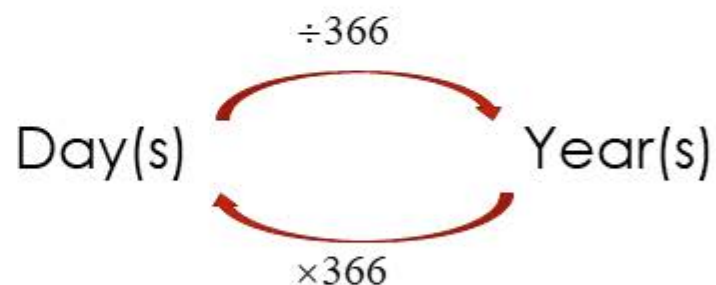
- Ordinary Simple Interest

normal/leap year – 360 days

In Banker's Rule, time t will be written as $= \dfrac{\text{Exact Time}}{360}$

$$\div 360$$

Day(s)   Year(s)

$$\times 360$$

Example 6

On 15th May 2012, Ramasami saved RM6000 in an account which offered a simple interest rate of 8% per annum. Find the amount in the account on 1st December 2012. (use approximate time, exact simple interest)

SOLUTION

$15\,May\,2012\,(30-15)=15$

Jun	$=30$
$July$	$=30$
Aug	$=30$
Sep	$=30$
Oct	$=30$
Nov	$=30$
$1\quad Dec$	$=\ 1$
$196\,days$	

$P = 6000$

$r = 0.08$

$t = \dfrac{196}{366}\,;\,2012\ is\ a\ leap\ year$

$S = P(1 + rt)$

$= 6000\left(1 + 0.08\left(\dfrac{196}{366}\right)\right)$

$= RM\,6,257.05$

Example 7

Raju paid RM8200 on 12 September 2011 for his loan of RM8000 made on certain date. The simple interest rate was 5% per annum. Using Banker's Rule, determine the term of the loan (in days) and the date of the loan.

Exact Time

		180
12 Sep 2011	-12	168
Aug	-31	137
Jul	-31	106
Jun	-30	76
May	-31	45
Apr	-30	15
Mar (31-15) = 16		

Date of the loan

$= 16$ March 2011

$S = 8200$

$P = 8000$

$r = 0.05$

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

$$8200 = 8000\,(1 + 0.05\,t)$$

$$\frac{8200}{8000} = 1 + 0.05\,t$$

$$1.025 - 1 = 0.05\,t$$

$$t = \frac{0.025}{0.05} = 0.5 \text{ year}$$

$$\text{term} = 0.5 \times 360 \text{ days}$$

$$= 180 \text{ days}$$

CONCLUSION

P	S
Amount borrowed	Simple Amount/ Repayment amount
Amount deposited	Accumulated amount/Total savings
Amount invested	Accumulated amount/Total investment