Simple Interest

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

- Simple interest (*I*) is given by this formula

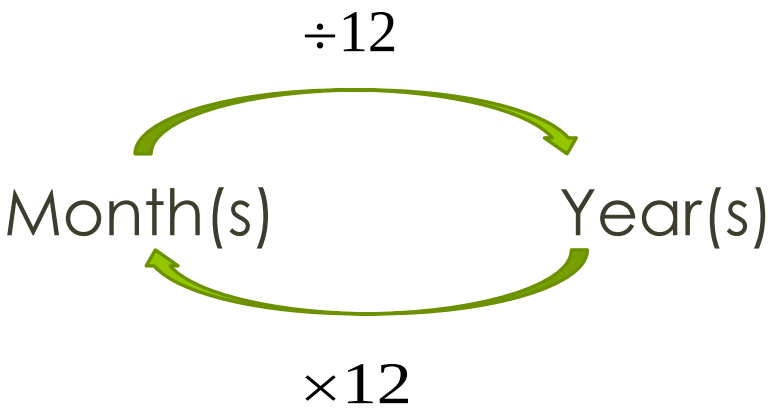
$$I = Prt$$

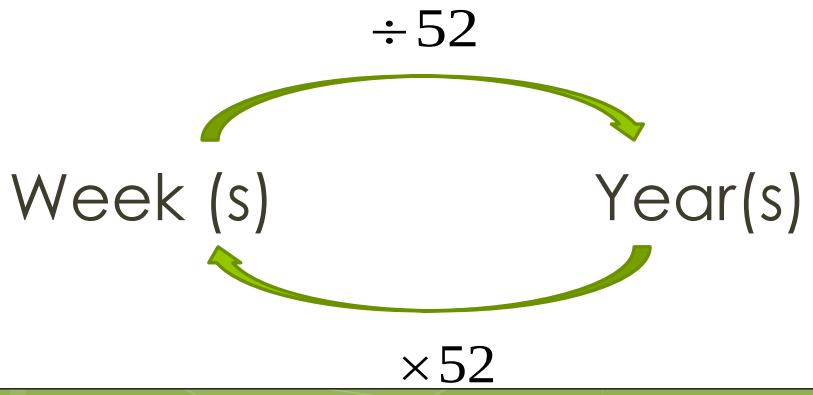
P is the principal

r is the annual interest rate

t is the time in years

- Determine t





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

$$P = 1500$$

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

$$t = 25 - 18 = 7$$

$$I = \mathrm{Pr}\, t$$

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

$$= \mathrm{RM}509.25$$

- Balance – when an interest is earned, the interest is added to the money in the account
- The balance (simple amount) is actually the sum of the principal *P* and the interest *I*
- 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

$$S = 35809.66$$

$$r = 0.085$$

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

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

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

$$35809.66 = P(1.40375)$$

$$P = RM\,25510$$

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

$$P = 1400$$

$$S = 1421$$

$$t = \frac{9}{12}$$

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

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

$$\mathrm{r} = 0.02$$

$$= 2\%$$

Calculating the period

- Exact Time
  - use the calendar

- Approximate Time
  - assume 30 days in each month.

Example 4

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

i) 2 July 2014 ~ 30 Oct 2014
ii) 30 Jan 2012 ~ 17 May 2012

Solution

i) Exact Time

2 Jul 2014	(31 - 2) = 29
Aug	= 31
Sept	= 30
30 Oct 2014	= 30
	120 days

Approximate Time

2 Jul 2014	(30 - 2) = 28
Aug	= 30
Sept	= 30
30 Oct 2014	= 30
	118 days

ii) Exact Time

30 Jan 2012	(31 - 30) = 1
Feb	= 29
Mar	= 31
Apr	= 30
17 May 2012	= 17
	108 days

Approximate Time

30 Jan 2012	(30 - 30) = 0
Feb	= 30
Mar	= 30
Apr	= 30
17 May 2012	= 17
	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 Date = 20 Nov 2012

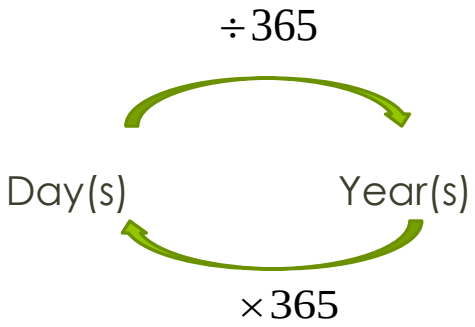
ii)

		80
30 Jun 2014		-30
		50
May		-31
		19
Apr	(30-19)	=11

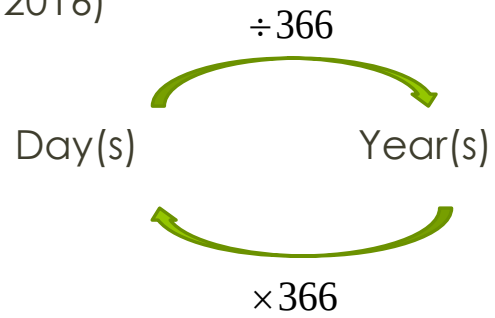
Initial Date = 11 Apr 2014

Changing days into years

- Exact Simple Interest
  normal year – 365 days

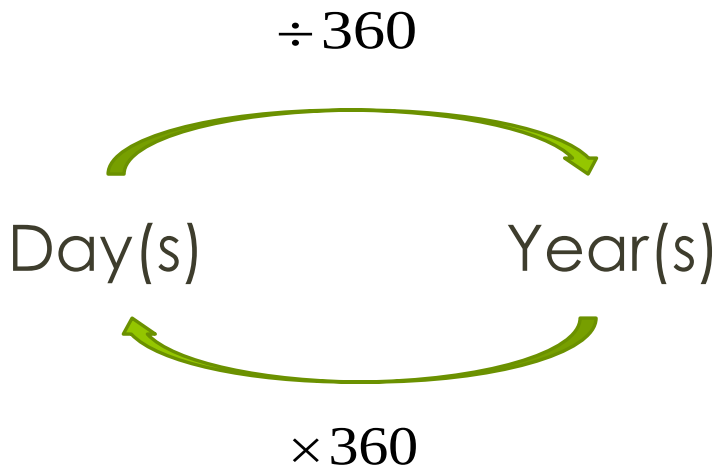


leap year – 366 days (2008, 2012, 2016)



- Ordinary Simple Interest
  normal/leap year – 360 days

- Banker's Rule $= \dfrac{\text{Exact Time}}{360}$



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

$$P = 6000$$

$$r = 0.08$$

$$\begin{aligned}
&15 \text{ May } 2012 \quad (30-15) = 15\\
&\quad \text{Jun} \qquad\qquad\quad = 30\\
&\quad \text{Jul} \qquad\qquad\quad = 30\\
&\quad \text{Aug} \qquad\qquad\quad = 30\\
&\quad \text{Sep} \qquad\qquad\quad = 30\\
&\quad \text{Oct} \qquad\qquad\quad = 30\\
&\quad \text{Nov} \qquad\qquad\quad = 30\\
&1 \quad \text{Dec} \qquad\qquad\quad = \quad 1\\
&\qquad\qquad\qquad\qquad\quad 196 \text{ days}
\end{aligned}$$

$$t = \frac{196}{366}$$

$$\begin{aligned}
S &= P(1+rt)\\
&= 6000\left(1+0.08\left(\frac{196}{366}\right)\right)\\
&= \text{RM}6257.05
\end{aligned}$$

Example 7

Raju paid RM8200 on 12 September2011 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.

Solution

$$S = 8200$$
$$P = 8000$$
$$r = 0.05$$

$$S = P(1+rt)$$
$$8200 = 8000(1+0.05t)$$
$$\frac{8200}{8000} = 1+0.05t$$
$$1.025 = 1+0.05t$$
$$1.025-1 = 0.05t$$
$$t = \frac{0.025}{0.05} = 0.5 \text{ year}$$

Banker's Rule

$$\text{term} = 0.5 \times 360$$
$$= 180 \text{ days}$$

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

Conclusion

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