Practical Business Math Procedures,
Thirteenth Edition
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Chapter 10
Simple Interest

Learning Unit Objectives

LU 10-1: Calculation of Simple Interest and Maturity Value

1. Calculate simple interest and maturity value for months and years.

2. Calculate simple interest and maturity value by **(a)** exact interest and **(b)** ordinary interest.

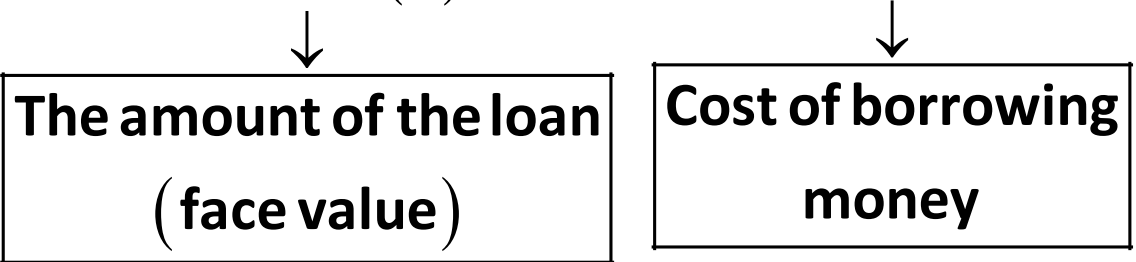**LU 10-2: Finding Unknown in Simple Interest Formula**

1. Using the interest formula, calculate the unknown when the other two (principal, rate, or time) are given.

LU 10-3: U.S. Rule - Making Partial Note Payments before Due Date

1. List the steps to complete the U.S. Rule as well as calculate proper interest credits.

Maturity Value

Maturity Value $(MV) =$ **Principal (P)**   **+**   **Interest (I)**

The amount of the loan $($ face value $)$	Cost of borrowing money

Simple Interest Formula (1 of 3)

$$\text{Sample interest}\,(I) = \text{Principal}\,(P) \times \text{Rate}\,(R) \times \text{Time}\,(T)$$

Stated as a Percent

Stated in Years

Example: Hope Slater borrowed $40,000 for office furniture. The loan was for 6 months at an annual interest rate of 4%. What was Hope's interest and maturity value?

$$\text{Interest} = P \times R \times T = \$40{,}000 \times .04 \times \frac{6}{12} = \textbf{\$800}$$

Maturity Value = *P* + *I* = $40,000 + $800 = **$40,800**

Simple Interest Formula (2 of 3)

Example: Hope borrowed $40,000. The loan was for 1 year at a rate of 4%. What was Hope's interest and maturity value?

Interest = $P \times R \times T$ = $40,000 $\times$ .04 $\times$ 1 = **$1,600**

Maturity Value = $P + I$ = $40,000 + $1,600 = **$41,600**

Simple Interest Formula (3 of 3)

Example: Hope borrowed $40,000. The loan was for 18 months at a rate of 4%. What was Hope's interest and maturity value?

$$\textbf{Interest} = P \times R \times T = \$40,000 \times .04 \times \frac{18}{12} = \textbf{\$2,400}$$

Maturity Value = *P + I* = $40,000 + $2,400 = **$42,400**

Two Methods for Calculating Simple Interest and Maturity Value (1 of 3)

Method 1: Exact Interest

Used by Federal Reserve banks and the federal government

Exact Interest (365 Days)

$$\text{Time} = \frac{\text{Exact number of days}}{365}$$

Method 1: Exact Interest

Example:

On March 4, Joe Bench borrowed $50,000 at 5%. Interest and principal are due on July 6. What are the interest costs and maturity value?

$$\boxed{\textbf{Exact Interest}\left(\textbf{365 Days}\right)}$$

Interest $= P \times R \times T$

$$\$50,000 \times .05 \times \frac{124}{365} = \textbf{\$849.32}$$

Maturity Value = P + I

$50,000 + $849.32 = **$50,849.32**

$Note: Exact\ Number\ of\ days:$

$July\,6 \qquad 187$

$March\,4 \qquad \underline{-63}$

$\qquad\qquad\quad 124$

Two Methods for Calculating Simple Interest and Maturity Value (2 of 3)

Method 2 : Ordinary Interest (Banker's Rule)

Ordinary Interest (360 Days)

$$\text{Time} = \frac{\text{Exact number of days}}{360}$$

Method 2: Ordinary Interest

Example:

On March 4, Joe Bench borrowed $50,000 at 5%. Interest and principal are due on July 6. What are the interest costs and maturity value?

$$\boxed{\text{Ordinary Interest}(360 \text{ Days})}$$

Interest = P × R × T

$$\$50,000 \times .05 \times \frac{124}{360} = \textbf{\$861.11}$$

Maturity Value = P + I

$50,000 + $861.11 = **$50,861.11**

Note: Bank increases the amount of interest collected by $11.79 using ordinary interest.

Two Methods for Calculating Simple Interest and Maturity Value (3 of 3)

On May 4, Dawn Kristal borrowed $15,000 at 8%. Interest and principal are due on August 10.

Compare the interest amounts and maturity value using exact and ordinary interest.

$\boxed{\text{Exact Interest}\,(365\,\text{Days})}$	$\boxed{\text{Ordinary Interest}\,(360\,\text{Days})}$

$$\textbf{\textit{Interest} = \textit{P} \times \textit{R} \times \textit{T}}$$

$$\$15,000 \times .08 \times \frac{98}{365} = \textbf{\$322.19}$$

$$\textbf{\textit{Maturity Value} = \textit{P} + \textit{I}}$$

$$\$15,000 + \$322.19 = \textbf{\$15,322.19}$$

$$\textbf{\textit{Interest} = \textit{P} \times \textit{R} \times \textit{T}}$$

$$\$15,000 \times .08 \times \frac{98}{360} = \textbf{\$326.67}$$

$$\textbf{\textit{Maturity Value} = \textit{P} + \textit{I}}$$

$$\$15,000 + \$326.67 = \textbf{\$15,326.67}$$

$<$

Finding Unknown in Simple Interest Formula: PRINCIPAL

$$\text{Principal} = \frac{\text{Interest}}{\text{Rate} \times \text{Time}}$$

Example: Tim Jarvis paid the bank $19.48 interest at 9.5% for 90 days. How much did Tim borrow using the ordinary interest method?
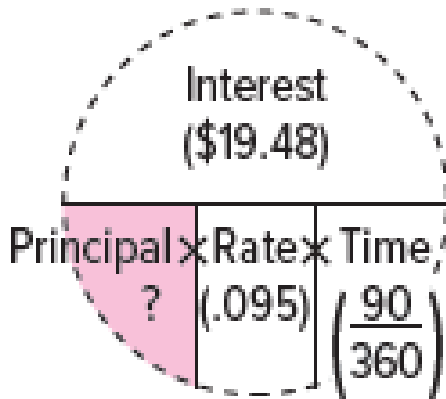
$$P = \frac{\$19.48}{.095 \times (90/360)} = \$820.21$$

.095 times 90 divided by 360. (*Do not round answer.*)

Interest (*I*) = Principal (*P*) ✕ Rate (*R*) ✕ Time (*T*)

Check: 19.48 = 820.21 ✕ .095 ✕ 90/360

19.48 = 19.48

Interest ($19.48)

Principal ✕ Rate ✕ Time
? (.095) $\left(\dfrac{90}{360}\right)$

Finding Unknown in Simple Interest Formula: RATE

$$\text{Rate} = \frac{\text{Interest}}{\text{Principal} \times \text{Time}}$$

Example: Tim Jarvis borrowed $820.21 from a bank. Tim's interest is $19.48 for 90 days. What rate of interest did Tim pay using the ordinary interest method?
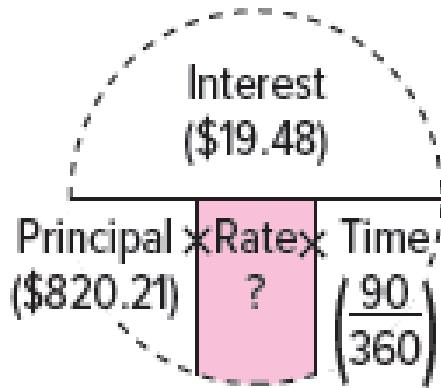
$$R = \frac{\$19.48}{\$820.21 \times (90/360)} = 9.5\%$$

Interest ($19.48)

Principal × Rate × Time
($820.21)   ?   ($\frac{90}{360}$)

Interest (*I*) = Principal (*P*) ✕ Rate (*R*) ✕ Time (*T*)

Check: 19.48 = 820.21 ✕ .095 ✕ 90/360

19.48 = 19.48

Finding Unknown in Simple Interest Formula: TIME

$$\text{Time}\left(\text{years}\right) = \frac{\text{Interest}}{\text{Principle} \times \text{Rate}}$$

Example: Tim Jarvis borrowed $820.21 from a bank. Tim's interest is $19.48 for 90 days. How long was the loan using ordinary interest method?

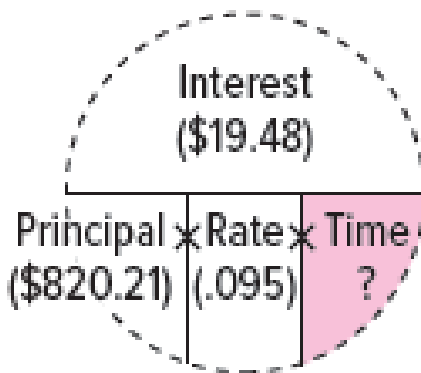$$T = \frac{\$19.48}{\$820.21 \times .095} = .25 \text{ years}$$

$$.25 \times 360 = 90 \text{ days}$$

Convert years to days (*assume 360 days*)

Interest (*I*) = Principal (*P*) ✕ Rate (*R*) ✕ Time (*T*)

Check: 19.48 = 820.21 × .095 × 90/360

19.48 = 19.48

Interest
($19.48)

Principal ✕ Rate ✕ Time
($820.21) (.095) ?

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U.S. Rule - Making Partial Note Payments before Due Date

Any partial loan payment first covers any interest that has built up. The remainder of the partial payment reduces the loan principal.

Allows the borrower to receive proper interest credits.

U.S. Rule (Example) (1 of 2)

Jeff Edsell owes $5,000 on a 4%, 90-day note. On day 50, Joe pays $600 on the note. On day 80, Jeff makes an $800 additional payment. Assume a 360-day year. What is Jeff's adjusted balance after day 50 and after day 80? What is the ending balance due?

To calculate the $600 payment on day 50:

Step 1. Calculate interest on principal from date of loan to date of first principal payment. Round to the nearest cent.

$$\$5,000 \times .04 \times \frac{50}{360} = \$27.78$$

Step 2. Apply partial payment to interest due. Subtract remainder of payment from principal. This is the **adjusted balance** (principal).

$600 − 27.78 = $572.22
$5,000 − 572.22 = **$4,427.78**

U.S. Rule (Example) (2 of 2)

To calculate the $800 payment on day 80:

Step 3. Calculate interest on adjusted balance that starts from previous payment date and goes to new payment date. Then apply Step 2. This is the new adjusted balance.

$$\$4,427.78 \times .04 \times \frac{30}{360} = \$14.76$$

$$\$800 - 14.76 = \$785.24$$

$$\$4,427.78 - 785.24 = \textbf{\$3642.54}$$

Step 4. At maturity, calculate interest from last partial payment. Add this interest to adjusted balance. This is the **balance owed**.

$$\$3,642.54 \times .04 \times \frac{10}{360} = \$4.05$$

$$\$3,642.54 + \$4.05 = \textbf{\$3,646.59}$$

Textbook Problem 10-1

Problem Statement:

Calculate the simple interest and maturity value for the following problem. Round to the nearest cent as needed. *LU 10-1(1)*

Principal	Interest Rate	Time	Simple Interest	Maturity Value
$9,000	2 ¼%	18 mo.	$303.75	$9,303.75

Solution:

$$Interest = P \times R \times T$$

$$\$9,000 \times .0225 \times {}^{18}\!/_{12} = \$303.75$$

$$Maturity\,Value = P + I$$

$$\$9,303.75 = \$9,000 + \$303.75$$

Textbook Problem 10-4

Problem Statement:

Complete the following, using ordinary interest: *LU 10-1(2)*

Principal	Interest Rate	Date Borrowed	Date Repaid	Exact Time	Interest	Maturity Value
$1,000	8%	March 8	June 9	93	$ 20.67	$ 1,020.67

Solution:

$$\text{Exact Number of Days} : 160 - 67 \quad \text{Difference} = 93 \, \text{days}$$

$$T = \text{Exact number of days}/360$$

Interest $= P \times R \times T$

$$\$1,000 \times .08 \times 93/360 = \$20.67$$

Maturity Value = P + I

$1,020.67 = $1,000.00 + $20.67

Textbook Problem 10-7

Problem Statement:

Complete the following, using exact interest: *LU 10-1(2)*

Principal	Interest Rate	Date Borrowed	Date Repaid	Exact Time	Interest	Maturity Value
$1,000	8%	March 8	June 9	93	$ 20.38	$ 1,020.38

Solution:

$$\text{Exact Number of Days}: 160 - 67 \quad \text{Difference} = 93 \text{ days}$$

$$T = \text{Exact number of days} / 365$$

$$\textbf{\textit{Interest}} = \textbf{\textit{P}} \times \textbf{\textit{R}} \times \textbf{\textit{T}}$$

$$\$1,000 \times .08 \times \frac{93}{365} = \$20.38$$

$$\textbf{\textit{Maturity Value = P + I}}$$

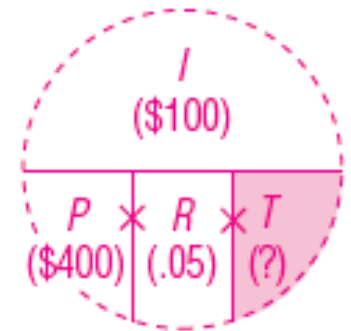$$\$1,020.38 = \$1,000.00 + \$20.38$$

Textbook Problem 10-10

Problem Statement:

Solve for the missing item in the following (round to the nearest hundredth as needed): *LU 10-2(1)*

Principal	Interest Rate	Time (months or years)	Simple Interest
$400.00	5%	?	$100.00

Solution:

$$\frac{\$100}{\$400.00\times.05}=5\,\text{years}$$

Accessibility Content: Text Alternatives For Images

Finding Unknown in Simple Interest Formula: PRINCIPAL Text Alternative

Circle showing interest of $19.48 labeled in the top half. The bottom is split into principal, rate, and time. The rate is 0.095, and time is 90/360. What is the principal?

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Finding Unknown in Simple Interest Formula: RATE Text Alternative

Circle showing interest of $19.48 labeled in the top half. The bottom is split into principal, rate, and time. The principal is $820.21, and time is 90/360. What is the rate?

Finding Unknown in Simple Interest Formula: TIME Text Alternative

Circle showing interest of $19.48 in the top half and principal of $820.21 times a rate of 0.095 and unknown time in the bottom half. What is time?

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Textbook Problem 10-10 Text Alternative

Circle shows interest in the top half of the circle is $100. Principal is $400 times a rate of 0.05 times unknown time. What is the time?

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