C H A P T E R

1

Credit and borrowing

Syllabus topic – FM4 Credit and borrowing

In this chapter you will learn to:

- Calculate the principal, interest and repayments for flat-rate loans
- Calculate the values using a table of home loan repayments
- Calculate future value and present value
- Compare different options for borrowing money
- Calculate credit card payments, interest charges and balances

1.1 Flat-rate loans

Interest is paid for borrowing money. There are different ways of calculating interest. Flat-rate loans use simple interest. Simple interest (or flat interest) is a fixed percentage of the amount borrowed and is calculated on the original amount. For example, if we borrow $10\,000$ from a bank at a simple interest rate of 6% per annum (per year) we would be required to pay $600 each year. That is,

$$\text{Interest} = \$10\,000 \times 0.06 \ (\text{or } \frac{6}{100}) = \$600$$

Flat-rate loans are calculated on the initial amount borrowed or the principal. The amount owed on the loan is calculated by adding the interest to the principal.

Flat-rate loans

$I = Prn$ $\qquad$ $A = P + I$

I – Interest (simple or flat) to be paid for borrowing the money

P – Principal is the initial amount of money borrowed

r – Rate of simple interest per period, expressed as a decimal

n – Number of time periods

A – Amount owed or total to be paid

1.1
1.2
1.5

1

Example 1 ■ Calculating the interest on a flat-rate loan

Abbey applied for a flat-rate loan of $40 000 at 9% per annum simple interest. She plans to repay the loan after two years and six months.

a   How much interest will be paid?

b   What is the total owing at the end of two years and six months?

Solution

1	Write the simple interest formula.	**a**	$I = Prn$
2	Substitute $P = 40\,000$, $r = 0.09$ and $n = 2.5$ into the formula.		$= 40\,000 \times 0.09 \times 2.5$
3	Evaluate.		$= \$9000$
4	Write the answer in words.		Simple interest owed is $9000.
5	Write the amount owed formula.	**b**	$A = P + I$
6	Substitute $P = 40\,000$ and $I = 9000$ into the formula.		$= 40\,000 + 9000$
7	Evaluate.		$= \$49\,000$
8	Write the answer in words.		Amount owed is $49 000.

Example 2 ■ Finding the principal for a flat-rate loan

Noah applied for a flat-rate car loan with an interest rate of 9% p.a. He was told the total simple interest would be $6300 for $3\frac{1}{2}$ years. What was the principal?

Solution

1	Write the simple interest formula.	$I = Prn$
2	Substitute $I = 6300$, $r = 0.09$ and $n = 3.5$ into the formula.	$6300 = P \times 0.09 \times 3.5$
3	Make P the subject of the formula by dividing both sides by (0.09×3.5).	$P = \dfrac{6300}{(0.09 \quad 3.5)}$
4	Evaluate.	$= \$20\,000$
5	Write the answer in words.	Principal is $20 000.

Example 3   ■ **Using a graphics calculator for a flat-rate loan**

Mary and Lucas plan to borrow $300 000 at
$8\frac{1}{2}$% p.a. simple interest for 3 years. Answer
the following questions by using a graphics calculator.

a   How much simple interest will they pay over the
3 years?

b   What is the total amount owed after 3 years?

Solution

1   Select the **TVM** (Time, Value, Money) menu.

2   Select **Simple Interest** (F1).

a

```
Financial(1/2)
F1:Simple Interest
F2:Compound Interest
F3:Cash Flow
F4:Amortization
F5:Conversion
F6:Next Page
SMPL CMPD CASH AMT CNVT ▷
```

3   Enter the time period **n** = 3 × 365 = 1095
(simple interest period is calculated in days).

4   Enter the interest rate **I%** = 8.5.

```
Simple Interest  :365
n  =1095
I% =8.5
PV =300000

SI SFV
```

5   Enter the principal or present value
PV = 300 000. In the TVM mode, all money
we pay out is negative and money we receive is
positive. In this example $300 000 is received.

```
Simple Interest  :365
SI =-76500
```

6   To calculate the simple interest, select **SI**.

7   Write the answer in words.

8   To calculate the total amount owed, select
SFV (Simple Final Value).

They will pay $76 500.

b

```
Simple Interest  :365
SFV=-376500
```

9   Write the answer in words.

Total owed $376 500.

Loan repayments

A loan repayment is the amount of money to be paid at regular intervals over the time period. The interval is often fortnightly or monthly.

Loan repayments
Loan repayment = Total to be paid ÷ Number of repayments

Example 4   ■ **Calculating a loan repayment**

Jessica wishes to buy a lounge suite priced at $2750. She chooses to buy it on terms by paying a 10% deposit and borrowing the balance. Interest is charged at 11.5% p.a. on the amount borrowed. Jessica makes fortnightly repayments over 3 years. Calculate her fortnightly repayments.

Solution

1   Calculate the deposit by multiplying 10% or 0.10 by $2750.

2   Calculate the balance by subtracting the deposit ($275) from the cost price ($2750).

3   Write the simple interest formula.

4   Substitute $P = 2475$, $r = 0.115$ and $n = 3$ into the formula.

5   Evaluate.

6   Write the loan repayment formula.

7   Calculate the total to be paid by adding the balance ($2475) and the interest ($853.875).

8   Calculate the number of repayments by multiplying the fortnights in a year (26) by the number of years (3).

9   Evaluate correct to two decimal places.

10   Write the answer in words.

$$\text{Deposit} = 10\% \text{ of } \$2750$$
$$= 0.10 \times 2750$$
$$= \$275$$
$$\text{Balance} = 2750 - 275$$
$$= \$2475$$
$$I = Prn$$
$$= 2475 \times 0.115 \times 3$$
$$= \$853.875$$

$$\text{Repayment} = \frac{\text{Total to be paid}}{\text{Number of repayments}}$$
$$= \frac{\text{Principal} + \text{Interest}}{\text{Number of repayments}}$$
$$= \frac{(2475 + 853.875)}{(3 \quad 26)}$$
$$= 42.67788462$$
$$= \$42.68$$

Fortnightly repayments are $42.68.

Exercise 1A

1 Calculate the amount of simple interest for each of the following loans:

  a Principal = $25 000, Interest rate = 11% p.a., Time period = 4 years.

  b Principal = $400 000, Interest rate = $8\frac{1}{4}$% p.a., Time period = 5 years.

  c Principal = $560 000, Interest rate = 6.75% p.a., Time period = 15 years.

  d Principal = $7400, Interest rate = 7% p.a., Time period = 18 months.

  e Principal = $80 000, Interest rate = 9.25% p.a., Time period = 30 months.

2 Calculate the amount owed for each of the following loans:

  a Principal = $800, Simple interest rate = 6% p.a., Time period = 3 years.

  b Principal = $5200, Simple interest rate = 16% p.a., Time period = $7\frac{1}{2}$ years.

  c Principal = $12 500, Simple interest rate = 11.4% p.a., Time period = 4.5 years.

  d Principal = $6000, Simple interest rate = $4\frac{1}{2}$% p.a., Time period = 6 months.

  e Principal = $40 000, Simple interest rate = 7.75% p.a., Time period = 42 months.

3 A sum of $170 000 was borrowed for 3 years.

  a Find the simple interest owed if the rate of interest is 6.5% per annum.

  b What is the amount owed at the end of 3 years?

4 Hayley intends to borrow $2700 to build a driveway for her new house. She is offered a flat-rate loan with a simple interest rate of 14.5% per annum. How much interest will be owed after 3 months? Answer correct to the nearest cent.

5 Ethan borrowed $1800 at 6% per annum. What is the simple interest owed between 30 June and 1 September?

6 Ruby borrows $36 000 for $3\frac{1}{2}$ years. What is the rate of simple interest if she will owe $8820 in interest?

7 Chloe has paid $49 500 interest on a $220 000 loan at a flat interest rate of 10%. What was the term of the loan?

8 Create the spreadsheet below.

1A

	A	B	C	D	E
1	**Mathematics General HSC**				
2	Worksheet to calculate the amount owed on a flat-rate loan				
3					
4	*Principal (P)*	*Interest rate (r)*	*Time (n)*	*Interest (I)*	*Amount (A)*
5	$100,000	8%	20	$160,000	$260,000
6	$200,000	8%	20	$320,000	$520,000
7	$300,000	8%	20	$480,000	$780,000
8	$400,000	8%	20	$640,000	$1,040,000

a   Cell D5 has a formula that calculates the simple interest. Enter this formula.

b   Fill down the contents of D6 to D8 using the formula for D5.

c   Cell E5 has a formula that calculates the amount owed. Enter this formula.

d   Fill down the contents of E6 to E8 using the formula for E5.

e   Change the interest rate from 8% to 10%.

f   Change the time period from 20 years to 15 years.

9 Bailey buys a television for $1800. He pays it off monthly over 2 years at a flat interest rate of 12.5% per annum.

a   How many months will it take Bailey to pay for the television?

b   What is the interest charged for the 2 years?

c   How much per month will he pay? Give your answer to the nearest cent.

10 Mitchell approached a bank for a business loan of $22 000. The interest rate is 10.5% p.a. flat. He decides to repay the loan over a period of 4 years.

a   What is the principal?

b   What is the rate of interest?

c   What will be the amount of interest charged over that period?

d   What will be the monthly repayment? Give the answer correct to the nearest cent.

11 Jordan decides to buy a car for $23 000. He has saved $9000 for the deposit and takes out a flat-rate loan over 2 years for the balance. The interest charged is 13% per annum.

a   What is the balance?

b   What is the total amount of interest to be paid?

c   What will be his monthly repayment? Answer correct to the nearest cent.

Development

12 Mia borrowed $400 000 at a flat rate of interest of 8.5% per annum. This rate was fixed for 2 years on the principal. She pays back the interest only over this period.

    a How much interest is to be paid over the 2 years?

    b After paying the fixed rate of interest for the first year, Mia finds the bank will decrease the flat interest rate to 7.5% if she pays a charge of $2000. How much will she save by changing to the lower interest rate for the last year?

13 Cooper plans to borrow money to purchase a car and considers the following fortnightly repayment guide. He decides to borrow $19 000 and pay back the loan in fortnightly instalments over 2 years. What is the flat rate of interest per annum on this loan, correct to two decimal places?

Amount borrowed	Fortnightly repayments		
	1 year	2 years	3 years
$18 000	$755	$427	$305
$18 500	$783	$429	$307
$19 000	$804	$431	$309

Challenge

14 A truck is advertised at $36 000. It can be bought on terms for a 20% deposit and repayments of $276 per week for 3 years. Assume there are 52 weeks in the year.

    a What is the deposit?

    b Calculate the total cost of the truck if bought on these terms.

    c What is the total interest paid?

    d What is the flat interest rate for the loan, correct to one decimal place?

15 Determine the flat rate of interest charged on a painting that has a cash price of $7500. The painting was purchased on terms with a 20% deposit and the balance to be paid at $370 per month for 2 years.

16 Grace takes a loan of $30 000 over 60 months for a swimming pool. The repayment rate is $677.50 per month.

    a How much will Grace pay back altogether?

    b What is the flat interest rate per annum for the loan, correct to one decimal place?

    c Grace would like to increase the loan to $40 000 to landscape the pool. What would be her monthly repayment assuming the same time period and flat interest rate? Answer correct to the nearest cent.

1.2 Table of loan repayments

A home loan or mortgage is a loan given to buy a house or a unit. The interest on a home loan is often calculated per month on the amount of money owing and repayments are made monthly. The amount owing after each month becomes the new principal for the next month. Each calculation results in a smaller amount of interest and is called 'reducible interest'. These calculations are often displayed in a table.

1.5

> **Table of loan repayments**
>
> Amount owed and the interest paid reduce after each loan repayment.

Example 5 ■ **Calculating the values in a table of loan repayments**

Riley has taken out a home loan of $400 000. The flat rate of interest is 9% p.a. and the monthly repayment (R) is $3120. Complete the table below for one month to answer these questions.

a   What interest is owed after one month?
b   Determine the value of $P + I$.
c   Determine the value of $P + I - R$.

Months (n)	Principal (P)	Interest (I)	$P + I$	$P + I + R$
1	$400 000.00	a	b	c

Solution

1   Write the simple interest formula.
2   Substitute $P = 400\,000$, $r = 0.09$ and $n = \dfrac{1}{12}$ into the formula and evaluate.
3   Write the answer in the table.
4   Add the principal ($400 000) and the interest ($3000).
5   Write the answer in the table.
6   Subtract the monthly repayment ($3120) from the amount owing ($P + I$ or $403 000).
7   Write the answer in the table.

a $I = Prn$
     $= 400\,000 \times 0.09 \times \dfrac{1}{12}$
     $= \$3000$
     Interest owed is $3000.

b $P + I = 400\,000 + 3000$
     $= \$403\,000$

c $P + I - R = 400\,000 + 3000 - 3120$
     $= \$399\,880$

Months (n)	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	$400 000.00	$3000	$403 000	$399 880

Example 6 ■ Calculating the values in a table of loan repayments

What are the missing values in the table of home loan repayments shown below?

Amount borrowed	$150 000	This table assumes the same number of days in each month. $I = Prn$ or $I = P\dfrac{r}{12}$
Annual interest rate (r)	7%	
Monthly repayment (R)	$1200	

Month (n)	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	$150 000.00			
2				

Solution

1 Write the simple interest formula.

2 Substitute $P = 150\,000$, $r = 0.07$ and $n = \dfrac{1}{12}$ into the formula.

3 Evaluate.

4 Add the principal ($150 000) and the interest ($875).

5 Subtract the monthly repayment ($1200) from the amount owing ($P + I$ or $150 875$).

6 The answer for $P + I - R$ is the principal for the next month ($149 675$). It is the amount owing after one month. Write it in the table for the second month.

7 Repeat the above steps for the second row to determine the amount owing after 2 months.

8 Notice the amount of interest in the second month ($873.10) is less than the amount of interest in the first month ($875).

First month

$$I = Prn$$
$$= 150\,000 \times 0.07 \times \frac{1}{12}$$
$$= \$875$$
$$P + I = 150\,000 + 875$$
$$= \$150\,875$$
$$P + I - R = 150\,875 - 1200$$
$$= \$149\,675$$

New principal is $149 675.

Second month

$$I = Prn$$
$$= 149\,675 \times 0.07 \times \frac{1}{12}$$
$$= \$873.10$$
$$P + I = 149\,675 + 873.10$$
$$= \$150\,548.10$$
$$P + I - R = 150\,548.10 - 1200$$
$$= \$149\,348.10$$

Month (n)	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	$150 000.00	$875.00	$150 875.00	$149 675.00
2	$149 675.00	$873.10	$150 548.10	$149 348.10

Exercise 1B

1   Kayla borrows $170 000 for a home at an interest rate of 6% p.a. with a monthly repayment of $1000.

Months (n)	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	$170 000.00	a	b	c
2	c	d	e	f
3	f	g	h	i

Answer correct to the nearest cent. Use this approximation in subsequent questions.

a   Determine the interest, I, charged for the first month.
b   Determine the value of $P + I$ for the first month.
c   Determine the value of $P + I - R$ for the first month.
d   Determine the interest, I, charged for the second month.
e   Determine the value of $P + I$ for the second month.
f   Determine the value of $P + I - R$ for the second month.
g   Determine the interest, I, charged for the third month.
h   Determine the value of $P + I$ for the third month.
i   Determine the value of $P + I - R$ for the third month.

2   Chris borrowed $250 000 at 7.2% p.a. for a unit. The interest is charged monthly and the monthly repayment is $1650. Complete the following table.

Months (n)	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	$250 000.00	$1500.00	$251 500.00	$249 850.00
2	$249 850.00	$1499.10	$251 349.10	$249 699.10
3				
4				
5				

Answer correct to the nearest cent. Use this approximation in subsequent questions.

a   What is the principal at the beginning of the third month?
b   Calculate the interest charged for the third month.
c   How much is owed at the end of the third month?
d   What is the principal at the beginning of the fourth month?
e   Calculate the interest charged for the fourth month.
f   How much is owed at the end of the fourth month?
g   What is the principal at the beginning of the fifth month?
h   Calculate the interest charged for the fifth month.
i   How much is owed at the end of the fifth month?