Background Notes: Year 9 Simple Interest

Australian Curriculum Link:

Solve problems involving simple interest (ACMNA211)

What does this include?

1. Calculate simple interest using the formula $I = PRT$ where I is the interest, P is the principal, R is the interest rate per time period (expressed as a fraction or decimal) and T is the number of time periods

2. Apply the simple interest formula to solve problems related to investing money at simple interest rates

   - Find the total value of a simple interest investment after a given time period

   - Calculate the principal or time needed to earn a particular amount of interest, given the simple interest rate

Where is Simple Interest used in the real world?

Interest is the 'price' you pay for borrowing money from someone.

If you borrow money (for example, by taking out a loan or buying things on a credit card to pay back later), then you will be *charged* interest – an extra amount 'on top' of what you borrow – as the 'price' charged by whoever has lent you that money.

Similarly, if you put money in a savings or 'investment' account with a bank or other financial institution, essentially you are lending them money. The interest you *earn* on a savings account is what the bank pays you for effectively lending them your hard-earned dollars.

Not really too many places use **simple interest** to calculate interest charges or earnings in Australia today. Mostly, banks and other financial institutions charge – and pay – compound interest on their loans and savings or investment products.

Calculating Simple Interest

Simple interest is calculated using the formula $I = PRT$ where:

- I is the amount of interest paid (or earned) in total;

- P is the principal, in other words, the amount of the initial loan or sum invested. Thus, for a loan of $10,000, P = 10 000;

- R is the interest rate *per time period* (expressed as a fraction or decimal), derived from an interest rate (e.g. a '3.5% per annum' ('per year') interest rate would mean that I = 0.035 per annum); and

- T is the number of time periods in the loan.

Note that if T is not a time period expressed in *years*, then the rate R should also not be expressed as a 'per annum' ('per year') interest rate.

For example, if a loan period T is given as '18 months' but at '3.5% per annum', then we need to convert that rate into a monthly rate to find R. There are 12 months in a year, and so in this case:

T = 18, and

R = (0.035 ÷ 12) = 0.0029$1\dot{6}$

Similarly, if a rate of interest is given as a 'per annum' rate and the time periods T are given in weeks, then R should be the annual rate (expressed as a decimal) divided by '52', because there are 52 weeks in a year.

Example 1:

Calculate the simple interest paid (I) on a $6,500 loan made over 30 months at 4.5% per annum.

Answer:

P = $6 500

R = (0.045 ÷ 12) = 0.00375

T = 30

$I = PRT$

  = 6 500 x 0.00375 x 30

  = $731.25

In many cases, we'll need to find variables other than I (the amount of interest) to solve a simple interest problem.

Because we have our formula $I = PRT$, we can find any of these other variables (P, R or T) simply by rearranging the $I = PRT$ equation and using some careful mathematical reasoning.

Let's look at our second example of calculating simple interest to see how this might be done.

Example 2:

Calculate the *per annum* rate of simple interest (R) I am earning on my savings account if I deposited $2,250 in my account on 1st February 2019, and on 31st May 2020 I had $2,317.50 in my account (without having made any other deposits).

Answer:

Firstly, we need to find out the amount of interest (I) this was. The intial deposit was $2,250 and so the total interest earned was

I = 2 317.50 – 2 250

  = $67.50

Secondly, we need to know the number of months (T) the deposit was in the account.

1st Feb 2019 to 31st Jan 2020 is 12 months, then we have another 4 on top of this to take us to 31st May.

So, T = (12 + 4) = 16 months

Finally, our simple interest formula is $I = PRT$.

We know what I is, and so we need to rearrange this formula to find the rate we've earned, i.e. 'R'.

Rearranging by dividing both sides by P x T (or 'PT'), we get:

$$\frac{I}{PT} = \frac{PRT}{PT}$$

$$\therefore \quad R = \frac{I}{PT}$$

So, in this example,

$R = \dfrac{67.50}{2250 \text{ x } 16}$ = (67.50 ÷ 36 000) = 0.001875 (or 0.1875%)

Note that this rate R is a monthly rate – and were asked for an annual rate (or 'rate per annum).

So, per annum R = 0.001875 x 12

0.0225

Thus, the rate earned was 2.25% per annum.

Apply the simple interest formula to solve problems related to investing money at simple interest rates

In this section, we'll apply the simple interest formula to solve problems such as finding the total value of a simple interest investment after a given time period, or calculating the principal or time needed to earn a particular amount of (simple) interest.

In the questions that follow, you'll need a calculator, some working paper and a pencil or pen for working out.

If you don't get the correct answer, just review your working carefully and, if necessary, go back over the 'Calculating Simple Interest' section.

Simple Interest – The Quiz!

Q1: $2000 is invested at 6.75% p.a. simple interest for three years. How much interest will be earned over the three year period?

- ⬤ $1,000.00
- ⬤ $405.00
- ⬤ $135.10
- ⬤ $450.80

Q2: Tick the statements below that are TRUE:

- ☐ A bond is a type of financial investment product usually made at a fixed interest rate and for a set period of time.

- ☐ Most banks and financial institutions use simple interest to calculate loans and savings products.

- ☐ In simple interest calculations the interest rate 'per time period' must match the time period over which the interest is calculated (e.g. days, months or years).

- ☐ Banks pay higher interest on savings and investment accounts than they charge for loans.

Q3: Mali has taken out a business loan from a finance company for $12,000 repayable over a 36 month period at a rate of 8.5% p.a. simple interest. How much interest will she pay in the first year of the loan?

- ⬤ $3,060.00
- ⬤ $12,240.00
- ⬤ $4,080.00
- ⬤ $1,020.00

Q4: I have placed $1,500 in my *'no fees, no charges'* Super Saver account with the AussieTrust Credit Union. This account is paying a simple interest rate of 2.5% per annum.

If I leave it there with no further deposits and no withdrawals, what will be the amount in my account in 15 months time? *Round your answer to the nearest cent.*

$ [   ]

Q5: Which of the following equations represents a formula for finding the value of T *(the number of time periods over which a loan or investment is made)*, for any given values of R *(simple interest rate)*, P *(Principal sum)* and I *(total interest earned / owed)*?

- ○ $T = PRI$
- ○ $T = I / PR$
- ○ $T = IR / P$
- ○ $T = P / [(R+1) \times 12]$

Q6: Find the principal borrowing amount P in each of these simple interest loans: (Match the answers to the questions by drawing connecting lines) the

Interest of $3,500 at 7% over 10 years	$ 15,000 loan
Interest of $4,320 at 4.8% over 6 years	$ 5,000 loan
Interest of $3,593.75 at 5.75% over 5 years	$ 12,500 loan

Q7: Scout has received $168,000 in total simple interest payments on an investment of $400,000 that she made six years ago. What per annum rate of simple interest has the investment firm been providing? *Round your answer to two decimal places if needed.*

[   ] % p.a.

Q8: Tamara cuts up her credit card but she has a remaining balance of $8,400.

If she pays the balance and the interest off over an 18 month period and the effective simple interest rate has been 6.85% per annum, how much per month has she been paying?

- ○ $ 466.67
- ○ $ 47.95
- ○ $ 514.62
- ○ $ 575.40

Q9:   Max intends to live on the interest on an investment with the bank that as a fixed simple interest rate of 4.5%. He will receive $81,000 simple interest every year from the investment.

How much money must he have invested?

○ $ 1,800,000

○ $ 1,650,755

○ $ 21,600,000

○ $1,084,645

Q10: A bond is a type of fixed-term financial investment.

Use a calculator and complete the table below by matching up the simple interest rates, time periods and dollar amounts into the correct cell.

Principal Bond Value	Simple Interest Rate	Time Invested	Total Interest Earned
$120,000	7.5%	2 years	
$ 50,000		18 months	$ 4,125
$ 1,000,000		7 years	$ 612,500
$80,000	6.25%		$ 25,000
	4.8%	36 months	$ 2,880
$ 5,000	3.45%		$431.25

5.5%   8.75%

30 months   5 years

$20,000 $ 18,000

Quiz Answers:

1. (b) $405.00

2. Only the **first** and **third** statements are true.

   In the second statement, most banks and financial institutions usually use compound interest, not simple interest, for loans and savings accounts.
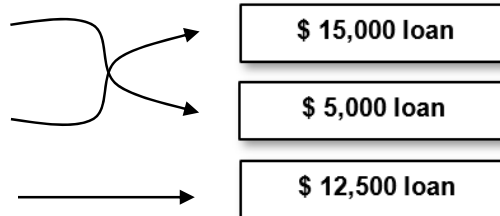
   In the fourth statement, the reverse is true, that is, banks pay lower interest on savings and investment accounts than they charge for loans – and in this way, they make a profit.

3. (d) $1,020.00

4. $1,546.88

5. (b) $T = I / PR$

6. Interest of $3,500 at 7% over 10 years

   Interest of $4,320 at 4.8% over 6 years

   Interest of $3,593.75 at 5.75% over 5 years

   $ 15,000 loan

   $ 5,000 loan

   $ 12,500 loan

7. 7% p.a. (or 7.00% p.a.)

8. (c) $514.62

9. (d) $1,800,000

10.

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