

## N3-2 Simple Interest

- simple interest

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### Summary

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When you borrow money on simple interest, you have to pay back the principal plus interest. The interest is a certain percentage (interest rate) of the principal for each year you have the money.

You can work out the interest,  $I$ , the principal,  $P$ , the interest rate,  $r$ , or the term,  $t$ , from the other three by common sense or by using the formula  $I = P r t$ .

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### Learn

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When people borrow money, they usually have to pay it back plus a bit extra. The extra is called **interest**.

Interest can be worked out in two ways: simple interest and compound interest. In this unit, we will look at **simple interest**. Module N4-1 deals with compound interest.

With simple interest, you pay back the money you borrowed plus a certain percentage of the amount you borrowed for each year you have the money. The percentage that you pay each year is called the interest rate. If the interest is 8% per annum (*per annum* is Latin for *per year*) you pay 8% of the amount you borrowed for each year that you have the money. Per annum is often abbreviated to p.a.

Let's suppose you borrow \$500 at 8% p.a. interest and pay it back after a year. You will have to pay back the \$500 plus 8% of \$500, which is \$40. Altogether you will pay back \$540. The \$500 is called the principal; the \$40 is the interest.



If you kept the money for 3 years, you would have to pay back the \$500 plus 3 lots of \$40 for interest – a total of \$620.

If you deposit money in the bank in an account that receives interest, then the bank is borrowing money from you and so they pay you interest the same way. If you deposit \$2000 at 3% p.a. for 5 years, at the end of the 5 years, they would give you back your \$2000 principal plus 5 lots of 3% of \$2000, i.e. \$300 interest.

If you borrow money for just part of a year, then you pay part of a year's interest. For example, if you borrow \$9000 for 7 months at 6% p.a. interest, the interest will be  $\frac{7}{12}$  of 6% of \$9000, i.e. \$315, so you will pay back \$9315. If you invest \$200 at 4% p.a. for  $2\frac{1}{4}$  years, you will get  $2\frac{1}{4}$  lots of 4% of \$200 interest, i.e. \$18. So you will get back \$218.

Tip: To put 3 years 5 months into your calculator enter  $3 + 5 \div 12$ . So to work out the interest on \$600 at 5% p.a. for 3 years 5 months, enter  $600 \times 0.05 \times (3 + 5 \div 12) =$ .

## Practice

- Q1
- (a) If you borrowed \$2000 for a year at 8% p.a. simple interest,
    - (i) How much interest would you pay?
    - (ii) How much would you have to pay back in total?
  - (b) If you invested \$500 for a year at 10% p.a. simple interest,
    - (i) How much interest would you receive?
    - (ii) How much would you get back in total?
  - (c) If you borrowed \$1500 for 2 years at 5% p.a. interest,
    - (i) How much interest would you pay?
    - (ii) How much would you have to pay back in total?
  - (d) If you invested \$12 000 for 6 years at 4% p.a. simple interest,
    - (i) How much interest would you receive?
    - (ii) How much would you get back in total?
  - (e) If you borrowed \$4000 for 3 years at 6% p.a. interest,
    - (i) How much interest would you pay?
    - (ii) How much would you have to pay back in total?
  - (f) If you invested \$900 for 10 years at 14% p.a. simple interest,
    - (i) How much interest would you receive?
    - (ii) How much would you get back in total?
  - (g) If you borrowed \$2400 for  $3\frac{1}{2}$  years at 7% p.a. interest,
    - (i) How much interest would you pay?
    - (ii) How much would you have to pay back in total?
  - (h) If you invested \$9 435 for 5 months at 11% p.a. simple interest,
    - (i) How much interest would you receive?
    - (ii) How much would you get back in total?
  - (i) If you invested \$4 800 for 4 years 7 months at 7% p.a. interest,
    - (i) How much interest would you receive?

- (ii) How much would you get back in total?
- (j) If you invested \$900 for 2 years at 4.5% p.a. simple interest,
  - (i) How much interest would you receive?
  - (ii) How much would you get back in total?
- (k) If you borrowed \$1400 for 4½ years at 7¼% p.a. interest,
  - (i) How much interest would you pay?
  - (ii) How much would you have to pay back in total?

- Q2
- (a) Karpo borrowed \$3000 for 5 years at 8% p.a. simple interest. How much interest did he pay?
  - (b) Sandy invested \$600 for 3 years at 4.5% p.a. simple interest. How much interest did she get?
  - (c) Fifi lent her nephew \$1000 at 5% p.a. simple interest. How much did her nephew have to pay back 1½ years later?
  - (d) Jared invested \$250 000 for 3 months at 12% p.a. simple interest. How much did he have in his account at the end of the 3 months?
  - (e) Jojo lent her grandmother \$2 000 000 at 22.85% p.a. simple interest for 9 years and 11 months. How much did her grandmother have to pay back?

## Formula

There is a formula for working out simple interest. It is  $I = P r t$ , where  $P$  is the principal,  $r$  is the interest rate **as a decimal** and  $t$  is the term, or number of years.

Suppose you invest \$2000 for 5 years at 3% p.a. simple interest.

Then  $P = \$2000$ ,  $r = 0.03$  and  $t = 5$ , so

$$\begin{aligned}
 I &= P r t \\
 &= 2000 \times 0.03 \times 5 \\
 &= 300
 \end{aligned}$$

When working out interest, often the common sense approach is easiest. But when working backwards, e.g. to find the time needed to get \$200 interest from \$1000 invested at 4% p.a., it can be easier to use the formula and the equation solving skills you have learnt in the algebra strand.

In this example,  $I = 200$ ,  $P = 1000$ ,  $r = 0.04$  and  $t = ?$ , so

$$\begin{aligned}
 I &= P r t \\
 200 &= 1000 \times 0.04 \times t \\
 200 &= 40 \times t \\
 \div 40 &\quad \div 40 \\
 5 &= t
 \end{aligned}$$

So it will take 5 years.

## Practice

Q3 Use the simple interest formula for answer these:

- (a) How long would you need to invest \$5 000 at 4% p.a. simple interest to get \$600 interest?
- (b) Sammy invested \$800 for 5 years and got \$360 simple interest. What was the interest rate?
- (c) Josie needs to borrow money. She will pay it back after 4 years. The interest rate is 6% p.a. How much can she borrow if she doesn't want to pay more than \$360 in simple interest?
- (d) Mangle invested \$500 at 12% p.a. simple interest for 8 years. How much interest did he get?
- (e) Seth invested \$2600 getting simple interest for 2 years 3 months. At the end, his \$2600 had grown to \$3009.50. What was the interest rate?
- (f) Maizey borrowed \$4000 at 2.5% p.a. simple interest. How long would it be before she owed \$1000 in interest?
- (g) Gonzo borrowed \$12.50 for 33 months at 34.8% p.a. simple interest. How much did he have to pay back at the end?
- (h) Harmony invested \$2500 at 4.5% p.a. simple interest. How long would it be before she had \$3203.13 in the account?

## *Progressive Payments - Warning*

In the above, it was assumed that the money and interest were paid back in one lump at the end. Sometimes, like when you borrow say \$5000 to buy a car, you will make a repayment every month over maybe a 4-year period.

Contracts for such loans are sometimes written so that the borrower pays interest on the whole \$5000 over the whole 4 years, even when nearly all of it is already paid off. What's more, the borrower may have to pay interest on the whole \$5000 over the whole 4 years even if he pays it all off after 6 months.

When a contract says 'simple interest', it often means this. If the contract says '**reducing interest**' then interest is only paid on the money still owed. Reducing interest loans are generally at a higher interest rate, but can lead to you paying back less in the long run.

Check this out carefully before you sign a finance contract to buy a car or whatever.

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## Solve

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- Q51 Dorothy can borrow money at 5.5% p.a. simple interest. She will pay it back after 3 years 9 months. What is the most she can borrow if she doesn't want to pay back more than \$7500?
- Q52 Kaylee borrowed \$7500 at 12.6% p.a. simple interest to buy a car. The contract said that she had to pay the interest on the whole amount for 4 years. 15 months later, she won some money and used it to pay off the loan. How much would she have saved if she only had to pay interest while she owed money?
- Q53 Roger invested \$1000 at 5% p.a. simple interest. After 1 year, he took his money out and re-invested it, with the interest, still at 5% p.a. simple. He did this for 7 years. How much did he have at the end of the 7 years?

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## Revise

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### Revision Set 1

- Q61 Gerty invested \$500 for 7 years at 6.5% simple interest.  
(i) How much interest did she get?  
(ii) How much did she end up with?
- Q62 How long would it take for \$400 to accumulate \$300 in interest at 6% p.a. simple interest?
- Q63 Jarrod invested \$2000 on simple interest. After 6 years his account had grown to \$7500. What was the interest rate?
- Q64 How much would I need to invest now at 7.8% p.a. interest compounding monthly to end up with \$8000 15 years from now?

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## Answers

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|-----|---|--|---|---|-----------|-----|-----------|
| Q1  | (a) \$160, \$2160<br>(e) \$720, \$4720<br>(i) \$1540, \$63.40 | (b) \$50, \$550<br>(f) \$1260, \$2160<br>(j) \$81, \$981 | (c) \$150, \$1650<br>(g) \$588, \$2988<br>(k) \$456.75, \$1856.75 | (d) \$2880, \$14 880<br>(h) \$432.44, \$9867.44 |           |     |           |
| Q2  | (a) \$1200<br>(e) \$6 531 916.67                              | (b) \$81   | (c) \$1075  | (d) \$257 500                                   |           |     |           |
| Q3  | (a) 3 years<br>(e) 7%   | (b) 9% p.a.<br>(f) 10 years                              | (c) \$1500<br>(g) \$24.46   | (d) \$480<br>(h) 6 years 3 months               |           |     |           |
| Q51 | \$6217.62   | Q52  | \$2598.75   | Q53   | \$1407.10 |     |           |
| Q61 | \$227.50, \$727.50  | Q62  | 12.5 years  | Q63   | 45.83%    | Q64 | \$3686.64 |