

Goals

This week and next week we are going to:

- use technology to investigate the effect of the interest rate and the number of compounding periods on the future value of a loan or investment
- use technology and a recurrence relation to model a reducing balance loan
- investigate the effect of the interest rate and repayment amount on the time taken to repay a loan



Theoretical Components

Resources:

PDF file: Week 14 and 15 Loans

Watch these videos for an introduction to the two types of depreciation:

- https://www.youtube.com/watch?v=RHo_3kWalJo
- <https://www.youtube.com/watch?v=ziayge17w6g>

Knowledge Checklist

- Straight line depreciation
- Reducing balance depreciation
- Saving for a deposit
- Using online calculators
- Repaying a mortgage – long term cost
- Repaying a mortgage – lump sum payment
- Repaying a mortgage – increasing payments
- Reading advertisements for property

Order

1. Work through the Week 14 and 15 booklets
2. Complete the Portfolio task
3. Complete the reflection at the end of the booklet
4. Show your teacher the completed booklet

Practical Components

Work through the exercises and show the completed tasks to your teacher.

Week 14 starts at the 'Percentage Review' section.

Portfolio Task

See the last page of the booklet

Other

Depreciation

As mentioned in the previous brief, items which represent scarce resources such as land, collectables, paintings and antiques normally appreciate in value over time. Most of the goods that we consume, such as household items, cars, electrical and electronic applications, plant machinery and equipment, fixtures and furnishings lose (depreciate in) their value over time.

Depreciation means that items reduce in value from the time they are acquired. The price for which an item was originally bought is called the **purchase price** of the item. The portion of the purchase price an item loses in value due to depreciation is called its **accumulated depreciation**. The value of an item at any given time is called its **book value**. This information may be summarised by the following equation:

$$\text{Book value} = \text{purchase price} - \text{accumulated depreciation}$$

Items used for income producing purposes are called **assets**. **Scrap value** is the value that an asset is expected to have at the end of its useful life. The useful life of some assets is expected to be longer than others. An example of this is that we expect buildings to last 40 years and longer, whereas computers have a life expectancy of about 3 years. This is reflected in the **depreciation rate**, which varies for different assets. The depreciation rate normally is expressed as a percentage of the purchase price.

Straight-line depreciation

The straight-line depreciation method, also known as **flat rate depreciation** or **constant depreciation**, allocates an **equal amount** of depreciation to each time period (normally one year) in the asset's useful life – that is, the asset's value loses the same amount each year. The depreciation is calculated in the same way as simple interest. Thus:

$$D = \frac{PRT}{100}$$

Example 1

A company car purchased for \$39,600 depreciates at 12% per annum by straight-line depreciation.

- Calculate the book value of the car after 3 years.
- Calculate the total depreciation over the first 6 years.

Solution

- a. Using the formula for D with $P = \$39,600$, $R = 12\%$, $T = 3$. This gives a result of \$14,256.
This means the car depreciates by an amount of \$14,256 over 3 years.
The book value is $39600 - 14256 = \$25,344$
- b. Using the formula for D with $P = \$39,600$, $R = 12\%$, $T = 6$. This gives a result of \$28,512.

We could also calculate how long it will take the car to reach its scrap value of \$4,500. A scrap value of \$4,500 means it has depreciated by $39600 - 4500 = \$35,100$.

To calculate time, we can rearrange the depreciation formula to:

$$T = \frac{D \times 100}{PR}$$

By substituting D , P and R , we get $T = 7.4$ years.

We can calculate this to the nearest month by multiplying the decimal part by 12. We could then get 7 years and 5 months.

Exercise 1

1. A machine costing \$286,000 depreciates at 16.5% per annum, by straight-line depreciation.
 - a. Calculate the book value of the machine after the first 2 years of service.

 - b. Calculate the total depreciation over the first 5 years.

 - c. How long will it take until the machine reaches its scrap value of \$10,000?

- b. If George plans to resell the car when it depreciates to \$5,000. What year should he resell his car?
5. Zoe buys a new TV for \$3,000 and she plans to trade in the TV after 4 years. The TV depreciates at 12% per year. How much will the TV be worth when she trades it in?
6. Noah buys a new phone for \$2,500 and the phone depreciates at 20% per year.
- Calculate the total depreciation after 2 years.
 - Noah trades in his phone after 5 years. What is the book value of the phone?

Reducing-balance depreciation

In the previous section, we observed the similarity in calculating straight-line depreciation and simple interest. Both are *fixed percentages* of a fixed amount. The difference is that interest is added to the principle and depreciation is subtracted from the principle.

The reducing-balance method, also known as **diminishing value depreciation** or **reduced value**, can be compared with compound interest. Both are characterised by applying a *fixed percentage* to an amount which *changes at the beginning of each time period*. As the book value of an asset declines from period to period, so does depreciation.

The formula for the **book value** of an asset which depreciates under the reducing balance method is:

$$B.V. = P \left(1 - \frac{R}{100}\right)^n$$

where:

$B.V.$ = book value of depreciated item, \$ (current worth)

P = purchase price, \$

R = allowed annual rate of depreciation, %

n = number of depreciation periods, years

Note: the formula for calculating the book value is similar to the formula of compound interest (only difference is there is minus sign instead of a plus sign)

Example 2

A construction company purchased a new scrapper for \$86,000. It depreciates at 12% per annual reducing-balance.

- a. Calculate the book value of the scrapper after 3 years.
- b. Calculate the total depreciation over the first 5 years of service.

Solution

a. $B.V. = P \left(1 - \frac{R}{100}\right)^n$, $P = \$86,000$, $R = 12\%$, $T = 3$

$$B.V. = 86000 \left(1 - \frac{12}{100}\right)^3$$

$$B.V. = \$58,606.59$$

The scrapper will be worth \$58,606.59 after 3 years

b. $B.V. = P \left(1 - \frac{R}{100}\right)^n$, $P = \$86,000$, $R = 12\%$, $T = 5$

$$B.V. = 86000 \left(1 - \frac{12}{100}\right)^5$$

$$B.V. = \$45,384.94$$

$$D = P - B.V.$$

$$D = 86000 - 45384.94$$

$$D = \$40,615.06$$

The total depreciation over the first 5 years of service is \$40,615.06

Exercise 2

1. A clothing factory purchased a new machine for \$21,600. It depreciates at 16% per annum reducing balance.
 - a. Calculate the book value of the machinery after 4 years.

4. Brae buys a motorbike valued at \$8,950 with a diminishing value of 10% p.a.
 - a. Calculate the book value after 2 years.

 - b. Calculate the amount of depreciation during the fourth year.

5. Jasmine buys robot vacuum for \$1,300 with a diminishing value of 7% p.a. She uses the robot vacuum for 5 years before upgrading to a newer model. What is the trade in value of the robot vacuum?

Buying your first property

Housing deposits

Real estate is expensive, and very few first-home buyers have sufficient money to pay for their first property. Just about everyone needs to borrow money when they buy their first home. While some financial institutions offer loans less than the full price, and the borrower must make up the rest of the price up-front as a deposit. Housing deposits are usually 10% to 20% of the price of a house.

Regular savings

Savings and investment accounts pay investors interest, and most bank websites contain savings calculators to help you plan your savings. You may be surprised at how quickly savings can accumulate and the dream of having a house deposit can eventuate.

Use this website to complete the Exercise 3:

<https://www.infochoice.com.au/calculators/savings-calculator/>

Most banks have their own calculators, and they all work in a similar fashion.

Example 3

Charlize is saving for the deposit for a property. Her special purpose savings account pays 3.5% p.a. interest. At the moment, she has \$500 and is saving \$120 per week.

- a. How much will Charlize have in her savings account in 4 years time?
- b. How long will it take for Charlize to have \$42,000 in her account?

Solution

In the online calculator provided, enter \$500 in *Starting Deposit*, \$120 in *Regular Deposit*, make sure the *Interest* and *Deposit Frequency* is set to *Weekly*, *Interest Rate* is changed to 3.5% and *Savings Term* is set at 4 years.

- a. The calculator shows there is \$27,357.12 in the account. It also tells her the *Amount Deposited* is \$25,460 and *Interest Earned* is \$1,897.12.
- b. By changing the *Savings Term* either by sliding the bar or entering a number, it can be determined that it takes just under 6 years to save \$42,000.

Exercise 3

1. Ella is saving for the deposit for a unit. She has \$400 and each week she saves another \$90. The account pays 2.5% p.a. interest.

- a. How much will Ella have in 3 years time?

- b. How long will it take for Ella to save \$25,000?

2. James has \$725 in his account, which pays 4% p.a. interest. Each month he saves another \$200.

- a. How long will it take James to save \$14,000?

- b. How much interest will be paid into his account?

3. Laura wants to buy a unit, but she doesn't have any savings to use as a deposit. She needs \$24,000. If she starts saving \$135 per fortnight into an account that pays 4.9% p.a. interest. How long will it take her to save the deposit?

4. Lara needs to save \$20,000 in 2 years for a deposit on an apartment. At present, she has only \$200 in her savings account. How much will she need to save per week, at 5% p.a. interest to reach \$20,000 in 2 years time?

5. Jack plans to save \$250 per fortnight, he already has \$100 in his account.
 - a. How long will it take him to save \$40,000 if the interest rate is 2% p.a.?

 - b. How much quicker will it take him to save \$40,000 if the interest rate is 4.5% p.a.?

6. Will needs to save \$25,000 in 2 years.
 - a. How much does he need to save per week if the interest rate is 5.5% p.a.?

 - b. How much extra does he need to save per week if the interest rate falls to 3 % p.a.?

7. Annastacia wants to purchase a house in 5 years. She needs to save \$55,000. She has \$500 in a savings account that pays 3.4% p.a. interest. How much should she need to save each week for the deposit?

Percentage review

Calculations involving percentages are very common in real estate and finance. Real estate agents usually charge a percentage commission, and percentages are used to calculate the amount of deposit required. Percentages are even used to calculate the size of any fine you may be charged if you are late paying government charges or debt!

Example 4

Find 5% of \$56,000.

Solution

$$5\% \text{ of } 56,000 = \frac{5}{100} \times 56,000 = \$2,800$$

You can enter it like this on the calculator: $5 \div 100 \times 56000$

Example 5

Elka borrowed \$120,000 towards the cost of a \$150,000 property. What percentage of the value of the property did she borrow?

Solution

$$\text{Percentage borrowed} = \frac{120000}{150000} \times 100 = 80\%$$

Exercise 4

1. Calculate the following percentage amounts:

a. 5% of \$160,000

b. 8% of \$145,000

c. 3% of \$240,000

d. 6% of \$500,000

2. Erin borrowed \$395,000 at 5.75% p.a. interest over 25 years. Calculate the total amount she will repay the bank.

3. Gemma borrowed \$450,000 at 6.25% p.a. interest for 15 years.
a. How much will she have to repay the bank each month?

b. How much extra will she have to repay the bank each month if interest rates go up to 7.25% p.a.?

4. Rhianna borrowed \$210,000 at 5.5% p.a. interest for 30 years. Explain how you know Rhianna will repay the bank more than 2 times the amount she borrowed.

5. Complete the table of values.

Amount borrowed	Interest rate	Loan term	Monthly repayments	Total amount repaid
\$350,000	6.5%	10 years		
\$350,000	6.5%	15 years		
\$350,000	6.5%	20 years		
\$350,000	6.5%	25 years		
\$350,000	6.5%	30 years		

6. Three years ago, Alif borrowed \$180,000 at 8% p.a. interest over 15 years. Alif has received a \$12,000 work bonus. If Alif uses the bonus to make an additional lump sum payment on the loan, what effect will the payment have on the term of the loan and on the total amount of interest he will pay? Use this website: <https://www.infochoice.com.au/calculators/lump-sum-calculator/>
7. When Shaye borrowed \$250,000 at 7.25% p.a. interest for 15 years, her monthly repayments were \$2,283. Two years after she started repaying the loan, Shaye got a pay rise and she decided that she could afford to increase her repayments by \$700 per month. Use this website to answer the following questions: <https://www.infochoice.com.au/calculators/extra-loan-repayments-calculator/>
- a. How many years quicker will she repay her loan by increasing her repayments by \$700 per month?

 - b. How much interest will she save?

Finding a property

The best way to make a good deal in the property market is to buy below market value. Before you start looking for the right property to buy, there are a few things you can do that will save you money and worry in the future.

- Save as big a deposit as you can. A big deposit makes it easier to get finance and the finance can be cheaper. With a big deposit, you won't have to pay mortgage insurance.
- Work out how much you can afford to spend and, if possible, arrange to have 'pre-approved finance'. When you have pre-approved finance, it is easier to get the person selling the property you want to accept your offer. Pre-approved finance will also help your finance institution to process your final approval more quickly than an approval starting from scratch.

- Take your time and look at a lot of properties. After you know the market, choose about four you like and make a cheap offer on each of them, you never know which vendor needs to sell quickly and you could get a bargain.

Reading advertisements and looking at property

Real estate agents advertise in many different places. Newspapers and local papers regularly include a 'Real Estate Guide', and letterbox ads are common. However, the Internet is rapidly becoming the most popular way to advertise real estate. Using the Internet to advertise real estate means that even in lockdown real estate agents can still sell property and provide updates to buyers.

When you read an advertisement for property, then look at the property, often you wonder whether the advertisement was for the property you saw! Very few real estate advertisements will list, or mention, any poor or undesirable features. Most highlight any good features and try to make the property sound as attractive as possible. Real estate agents have a language of their own. They talk about 'WCs' when they mean toilets or advertise '*lake glimpses*' even if you can only see the lake when standing on your toes on the upstairs balcony.

Example 7

What does this advertisement mean?

'This is a property that boasts potential. Only 150 m from the freeway makes it ideal for commuting to work in the city. Features include 3bdr, 2bths, large lounge, renovated kitchen, and plenty of off-street parking. Great first home.'



Solution

Boasts potential usually means the house needs to be renovated.

150 m from the freeway probably means that there may be a problem with traffic noise.

To work in the city might mean there could be high unemployment in the area.

3 bdr, 2 bths means 3 bedrooms and 2 bathrooms.

Renovated kitchen means the kitchen has been renovated but everything else is probably old.

Great first home means it is probably considered cheap for property.

Exercise 6

1. Match each of the abbreviations in **a** to **g** with its meaning in **A** to **G**.
 - a. WC
 - b. WIR
 - c. BIW
 - d. B/ins
 - e. R/C air con
 - f. 5 mins to CBD
 - g. ens
 - A. built-in wardrobe
 - B. reverse cycle air-conditioning
 - C. ensuite (a small bathroom off a bedroom)
 - D. 5 minutes to the central business district
 - E. built-ins (e.g. cupboards, bar)
 - F. toilet
 - G. walk-in wardrobe
2. Write a sentence to explain what each of these expressions used in real estate advertisements really mean. You may need to research the terms
 - a. In need of TLC
 - b. Renovate or detonate
3. Explain what the following advertisement really means.

This immaculate three bdr plus ens home is on the market for the first time since its completion in 2010. Totalling 170sqm, this spectacular family home offers a wonderful lifestyle opportunity.

This welcoming, light filled terrace home is located across the road from the CBD offering a number of restaurants and general amenities. Ovals, medical centre and childcare are also within walking distance - perfect for young families, downsizers and investors alike.

A separate formal lounge or dining room to the right of the entry leads into a large, bright and open meals/living and kitchen area with a R/C air con. 2.7 metre ceilings and square-set cornices show just some of the quality features of this desirable residence. Stainless steel appliances, stone bench tops and a quality well-designed

*kitchen will appeal to the home chef and provide practical living.
Upstairs encompasses three well-sized bdr, all with BIW and the master with a
generous ens.*

*The low maintenance and spotless backyard has plenty of room for pets or kids and is
secure and private. The double lock-up carport is at the rear of the yard, completing
what is a fantastic residence.*

Portfolio Task Week 14 and 15

You own a car worth \$10,000 and it depreciates at a rate of 20%, would you prefer this depreciation be by straight line depreciation or diminishing value depreciation?

Show and explain which depreciation you prefer.

MARKING RUBRIC

CRITERIA	EXPECTATIONS	POSS	MULT	GIVEN	TOTAL
Practical	Student completes practical work, including exercises of the brief to an acceptable standard set by the teacher.	2	3		/6
Portfolio Task	Student completes the portfolio task of the week to an acceptable standard set by the teacher.	2	2		/4
Reasoning and Communications	Student responses are accurate and appropriate in presentation of mathematical ideas, with clear and logical working out shown.	4	-		/4
Concepts and Techniques	Student submitted work selects and applies appropriate mathematical techniques to solve practical problems and demonstrates proficiency in the use of mathematical facts, techniques and formulae.	4	-		/4
	Submission Guidelines				
Timeliness	Student submits the exercises and portfolio tasks by the set deadline. See scoring guidelines for specific details.	2	-		/2
				FINAL	/20

Student Reflection:

How did you go with this week's work? What was interesting? What did you find easy? What do you need to work on?