

Straight line depreciation

- 1 A 2012 Holden Commodore is priced at \$33 000 and depreciates by approximately \$4000 per year.

- a Complete the following table:
- b Will the car ever be worth nothing?
- c What depreciation method is being used?

Year	Price (dollars)
0	33 000
1	
2	
3	
4	
5	

- 2 The spectator attendance at an annual sporting event was recorded for four consecutive years from its first year of running as follows:

44 500, 43 800, 43 100, 42 400

- a By how much did the attendance decrease each year?
 - b If the attendance continues to decrease at the same annual rate, what will the expected attendance be in its fifth year?
- 3 It is estimated that a house purchased for \$254 500 will depreciate by an average of \$9400 each year.
- a How much will the house be worth after 1 year?
 - b How much will the house be worth after 6 years?
- 4 A car cost \$44 000 initially. The car then depreciated at \$4000 per annum. Now the car is worth \$32 000.
- a How old is the car?
 - b Find the annual percentage rate of depreciation for the first year, to two decimal places.
- 5 Production robots to be used in a car manufacturing plant were purchased for \$4 455 000. After 5 years, they depreciated to a value of \$4 385 000.
- a What was the annual depreciation using the straight-line method?
 - b After 7 years, the robots are sold. If they continue to depreciate at the same rate, how much were they sold for?

- 6 The recursive rule which can be used to describe the depreciation of an asset is given by:

$$P_{n+1} = P_n - 4500, P_0 = 25\,000$$

- a What type of depreciation is this an example of?
- b Calculate the value of the asset after 4 years.

- 7 A recursive rule which can be used to describe the depreciation of an asset is given by:

$$A_{n+1} = A_n - 1400, A_1 = 100\,000$$

- a What type of depreciation is this an example of?
- b What was the initial purchase price of the asset?
- c Calculate the number of whole years the asset will last before it is traded in when its value falls below \$15 000.

-  8 A new lounge suite depreciates by a constant amount each year and its value is modelled by the recurrence relation $V_n = V_{n-1} - 700, V_0 = 4\,700$, where V_n is the value of the lounge suite after n years.

- a State the initial cost of the lounge suite.
- b State the amount of value lost each year.

- 9 A car is purchased for \$28 000 and depreciates by \$1 500 each year. The value of the car is modelled by $V_n = V_{n-1} - 1500, V_0 = 28\,000$, where V_n is the value of the car in dollars after n years.

- a Determine the value of the car after 1 year.
- b Determine the value of the car after 6 years.
- c By how much has the value of the car dropped after 6 years?

- 10 A car is initially purchased for \$29 000 depreciates by \$1300 each year.

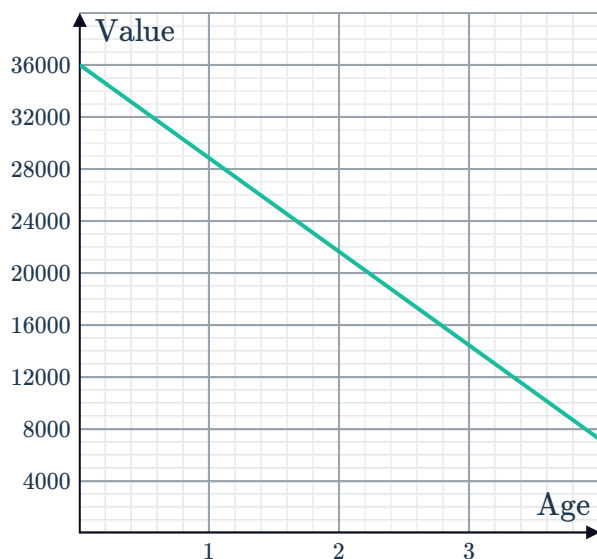
- a Write a recursive rule for V_n in terms of V_{n-1} and an initial condition for V_0 , that gives the value of the car in dollars after n years.
- b Use the sequence facility of your calculator to determine the book value of the car after 5 years.
- c After how many whole years will the book value of the car first fall below \$18 300?

- 11** A motorbike purchased for \$8000 depreciates annually by \$900. The value of the motorbike is modelled by $V_n = V_{n-1} - 900$, $V_0 = 8\,000$, where V_n is the value of the motorbike after n years.
- a** After how many whole years will the value of the motorbike first drop below \$1000?
 - b** After how many whole years will the motorbike first lose more than half its value?
- 12** A photocopier depreciates by a constant amount for every 100 pages printed. The value of the photocopier is modelled by the recurrence relation $V_n = V_{n-1} - 11$, $V_0 = 2\,200$, where V_n is the value of the photocopier after n hundreds of pages printed.
- a** State the initial value of the photocopier.
 - b** State the constant rate of depreciation.
 - c** Use the sequence facility of your calculator to determine the value of the photocopier after 2300 copies have been made.
 - d** The firm using the photocopier will replace it with a new one when its value drops below \$1780. After how many copies will this happen?
- 13** A photocopier depreciates by a constant amount for every 100 pages printed. The value of the photocopier is modelled by the recurrence relation $V_{n+1} = V_n - 14$, $V_0 = 2\,800$, where V_n is the value of the photocopier after n hundreds of pages printed.
- a** State the initial value of the photocopier.
 - b** State the constant rate of depreciation.
 - c** Use the sequence facility of your calculator to determine the value of the photocopier after 2400 copies have been made.
 - d** The firm using the photocopier will replace it with a new one when its value drops below \$2365. After how many copies will this happen?
- 14** A bobcat, initially purchased for \$70 000, depreciates at a rate of \$12 for every day of use.
- a** Write a recursive rule, V_{n+1} , that gives the value of the bobcat after $(n + 1)$ days of use.
 - b** How much value is lost over a five-week period, if the bobcat is used 6 days a week?
 - c** The owner of the bobcat will replace the tyres when the value drops below \$59 209. After how many whole days of operation is he first due to change the tyres?

- 15** A courier van, initially purchased for \$48 000, depreciates at a rate of \$190 for every 1000 km of use.
- a** Write a recursive rule, V_{n+1} , that gives the value of the van after $(n + 1)$ thousand kilometres.
 - b** Use the sequence facility of your calculator to determine the value of the van after it has travelled 12 000 km.
 - c** Use the sequence facility of your calculator to determine after how many kilometres the van will first fall below \$47 049 in value.
- 16** A piece of machinery purchased for \$470 000 is expected to produce 500 000 units in its lifetime.
- a** Calculate the depreciation cost per unit.
 - b** What will be the book value of the machine after one year if the machine makes 25 000 units per year?
 - c** What will be the book value of the machinery after 8 years if it is expected to make 25 000 units per year?
- 17** A glass cutter purchased for \$34 800 is expected to be worth \$11 600 after cutting 80 000 pieces of glass.
- a** Calculate the depreciation cost in dollars per unit.
 - b** Find the book value of the glass cutter after one year if 10 000 pieces of glass are cut.
 - c** The glass cutter must be replaced when its value reaches \$2000. If 10 000 pieces of glass can be cut per year, how many years will the glass cutter last? Round your answer to two decimal places.

Straight line depreciation graphs

18 The graph shows the depreciation of a car's value over 4 years:



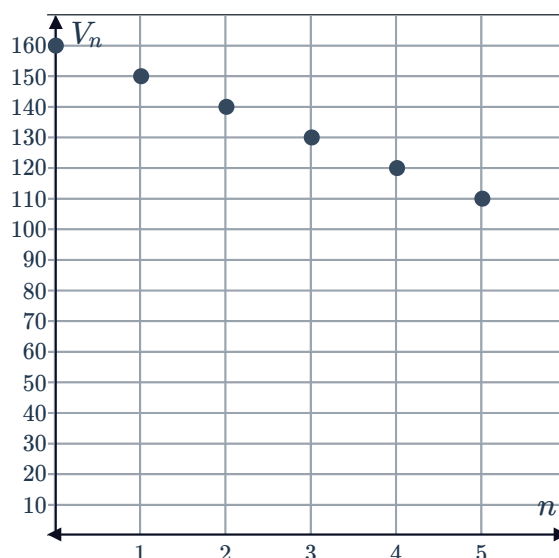
- What is the initial value of the car?
- By how much did the car depreciate each year?
- After how many years will the car be worth \$14 400?
- Find the value of the car after 4 years.

19 Marge purchased shares at a total value of \$99 800. After 6 months, the shares had dropped in value to \$99 200.

- What is the monthly depreciation using the straight-line method?
- Draw a graph showing the depreciation of the value of the shares over 6 years.
- What is the gradient of the line?
- What does the gradient represent?
- What is the value of the y -intercept of the line?
- What does the y -intercept represent?
- Let V represent the value of the shares after n months. Write the equation of the line.
- Use the graph or the equation to find the value of the shares after $5\frac{1}{2}$ years.

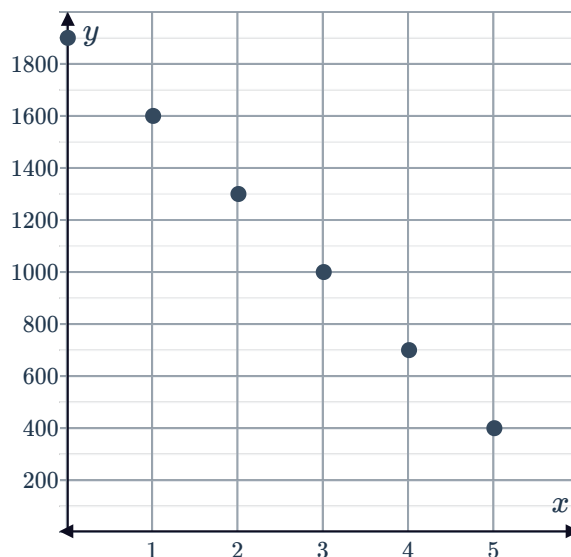
20 A TV depreciates at a constant rate each year. The value of the TV after n years is represented by the given graph:

- State the initial value of the TV.
- By how much does the value of the TV drop each year?
- Write a recursive rule, V_n , that gives the value of the TV after n years.



- 21** A tablet depreciates at a constant rate each year. The value of the tablet after n years is represented by the given graph:

- a Write a recursive rule, V_n , that gives the value of the tablet after n years.
- b After how many whole years the value of the tablet is first worth less than half of its initial value.
- c After how many whole years is the tablet considered worthless?



- 22** The value of a fridge depreciates by a constant amount each year and is modelled by the recurrence relation $V_n = V_{n-1} - 200$, $V_0 = 1\,800$, where V_n is the value of the fridge after n years.
Plot the values for the first five years, including year 0 on a number plane.

Reducing balance depreciation

- 23** A car was originally purchased for \$3000, and depreciates at 14% p.a. Use the depreciation formula to calculate its expected value after 8 years.
- 24** Eileen purchased a Kindle for \$400, which depreciates at 14% p.a. What is its book value after 6 years?
- 25** Ursula deposited \$7500 into a stock portfolio. This amount decreased by 2% each year for 5 consecutive years. Find the book value of the portfolio after 5 years.
- 26** The government wants to decrease its spending on job creation. Currently it is spending \$19 million and will decrease it by 5.25% p.a. over the next 7 years.
Calculate the government's spending in 7 years time. Round your answer to the nearest dollar.

- 27** A car salesman received a total commission of \$3319 at the beginning of the month. He expects that since fewer cars are being purchased, his commission will decrease by 3% each month over the next few months.
- According to his prediction, what will be his commission in 13 months time? Give your answer to the nearest dollar.
 - Find the decrease in the salesman's monthly commission over the 13 months.
- 28** After one year, the value of a company's machinery had decreased by \$3900 from \$65 000.
- At what rate did the machinery depreciate in the first year?
 - If the value of the machinery continues to decrease at this rate every year, what will it be worth in another 19 years?
- 29** A laptop depreciated by 21% p.a. and was valued at \$700 after 9 years. Find its original price.
- 30** A laptop currently worth \$1719 was purchased 4 years ago for \$2000. Find the annual depreciation rate, as a percentage to two decimal places.
- 31** A car depreciated in value from \$20 000 to \$17 530 in 3 years. Find the annual depreciation rate, as a percentage to two decimal places.
- 32** A machine purchased for \$23 400 depreciates at a rate of 17% p.a. After how many whole years will the machine have a book value less than \$11 500?
- 33** After one year, the value of a company's machinery had decreased by \$16 020 from \$89 000. The value of the machinery depreciates by a constant percentage each year.
- At what rate did the machinery depreciate in the first year?
 - What will the machinery be worth at the end of the second year?
 - Write a recursive rule, V_n , that gives the value of the machinery at the end of year n .
 - The company bought this machinery at the end of 2011. When the value of the machinery falls below \$3000, they will invest in new machinery. In which year will this occur?

- 34** A dishwasher selling for \$800, depreciates at 11% p.a.
- a** What percentage of the original value will remain after 1 year?
 - b** What percentage of the original value will remain after 2 years? Round your answer to two decimal places.
 - c** What percentage of the original value will remain after 3 years? Round your answer to two decimal places.
 - d** How many full years will it take for the dishwasher to lose half its original value?
 - e** How many years will it take for the dishwasher to lose 90% of its original value?
- 35** Neil purchased a \$1300 motorbike which depreciates at a compounded rate of 10% p.a.
- a** Find the total depreciation over the two years.
 - b** Find the percentage of the original value remaining after two years. Round your answer to the nearest percentage.
- 36** A microwave that costs \$700 depreciates at 10% p.a. After how many full years will the value of the microwave be less than:
- a** \$525 **b** \$350 **c** \$70
- 37** The recursive rule which can be used to describe the depreciation of an asset is given by $P_{n+1} = P_n \times 0.91$, $P_0 = 65\,000$.
- a** What type of depreciation is this an example of?
 - b** Calculate the book value of the asset after 5 years.
- 38** Derek purchased a \$3800 laptop that depreciates at the rate of 12% per annum.
- a** What will be the depreciation over the first year?
 - b** What will the value of the laptop be at the end of the first year?
 - c** Write a recursive rule, V_n , that gives the value of the laptop at the end of year n .
 - d** Use the sequence facility on your calculator to determine after how many years the laptop will first be worth less than half its initial value.
- 39** A microwave currently selling for \$400 depreciates at 19% per annum.
- a** What percentage of the original value of the microwave will remain after 1 year?
 - b** How much of the original value will remain after one year?
 - c** Write a recursive rule, V_n , that gives the value of the microwave at the end of year n .
 - d** Use the sequence facility on your calculator to determine the value of the microwave after 8 years.

40 A brand new car depreciates in value each year and its value is modelled by the rule

$$V_n = 0.89V_{n-1}, V_0 = 21\,000$$

where V_n is the value of the car after n years.

- a** How much was the car originally purchased for?
- b** As a percentage, what is the annual depreciation rate?
- c** Use the sequence facility of your calculator to calculate the value of the car after 9 years.
- d** When a car is worth less than \$500 it is deemed only useful for parts. At the end of which year is the car only useful for parts?

41 A brand new phone depreciates in value each year and its value is modelled by

$$V_n = 0.72V_{n-1}, V_0 = 900$$

where V_n is the value of the phone after n years.

- a** How much was the phone purchased for?
- b** State the annual depreciation rate as a percentage.
- c** Use the sequence facility of your calculator to determine the value of the phone after 4 years.
- d** Ellie purchased this phone at the end of 2012. She will purchase a new phone once this phone has lost 55% of its value. In which year will she buy a new phone?

42 A television currently worth \$960 was purchased 5 years ago for \$2600.

- a** The television depreciated by a constant percentage, r , each year. Find r to the nearest percent.
- b** Hence write a recursive rule, V_{n+1} , that gives the value of the television at the end of year $n + 1$.
- c** Use the sequence facility on your calculator to determine after how many years the television will first be worth less than 15% of its original value.

43 Han's share portfolio of \$83 000 decreased in value by 14% per month for the first 4 months of the Global Financial Crisis and then 3% per month for the 5 months after that. Find the value of his portfolio after 9 months.

- 44** Ivan's share portfolio of \$390 000 fell 4% per month for the first 5 months of the global financial crisis, and then fell 8% per month for the 7 months after that.
- Write a recursive rule, V_n , that gives the value of the portfolio n months after the start of the financial crisis, where n is less than or equal to 5.
 - Find the value of his shares at the end of the 5 months.
 - Hence write a recursive rule, V_n , that gives the value of the portfolio at the end of month n , where $n = 0$ is 5 months after the start of the financial crisis.
 - How much are his shares worth a year after the start of the financial crisis?
- 45** A car depreciated in value from \$40 000, when it was originally purchased, to \$21 880 in 4 years.
- The car depreciated by a constant percentage r each year. Find the value of r to two decimal places.
 - Write a recursive rule, V_n , that gives the value of the car at the end of year n , where n is the number of years since the original purchase.
 - Use the sequence facility on your calculator to find how many years it will take for the car be worth less than 20% of its original value.
- 46** Paul has been losing money on two of his share portfolios. The value of each portfolio n years after the beginning of 2015 is modelled by the following recurrence relations:
- Portfolio A: $A_n = 0.91A_{n-1}$, $A_0 = 26\,000$
 - Portfolio B: $B_n = 0.87B_{n-1}$, $B_0 = 46\,000$
- Which portfolio was worth more at the beginning of 2015?
 - Which portfolio was losing more money rapidly?
 - Use the sequence facility on your calculator to determine which year the two portfolios are worth the same amount.
- 47** Before purchasing a car, Skye analyses the predicted depreciation rates of the two cars she is interested in:
- Car A can be purchased for \$19 000 and will depreciate by 12% per year.
 - Car B can be purchased for \$22 000 and will depreciate by 14% per year.
- Write a recursive rule, A_{n+1} , that gives the value of car A at the end of n years.
 - Write a recursive rule, B_{n+1} , that gives the value of car B at the end of n years.
 - Use the sequence facility of your calculator to determine the value of car A after 6 years.
 - Use the sequence facility of your calculator to determine the value of car B after 6 years.
 - After 6 years Skye wants to sell her car and maximise the amount of revenue she receives from the sale. Which car should she purchase?

- 48** A new car purchased for \$38 200 depreciates at a rate $r\%$ each year. The value of the care for the first two years is shown in the table below:

years passed (n)	0	1	2
value of car (\$ A)	38 200	37 818	37 439.82

- a** Find the value of r .
- b** Write the rule for A , the value of the car n years after it is purchased.
- c** Assuming the rate of depreciation remains constant, how much can the car be sold for after 6 years?
- d** A new motorbike purchased for the same amount depreciates according to the model $V = 38\,200 \times 0.97^n$. Which vehicle depreciates more rapidly?