6.8 Unit cost depreciation

The **unit cost method** is based upon the maximum output (units) of the item. For example the useful life of a truck could be expressed in terms of the distance travelled rather than number of years. The actual depreciation per year would be a measure of the number of kilometres travelled.

Unit cost depreciation recurrence relation

The future value over time using unit cost depreciation can be expressed by the recurrence relation:

$$V_{n+1} = V_n - d$$

where V_n is the value of the asset after n outputs and d is the depreciation per output.

Worked Example 19

A motorbike purchased for \$12 000 depreciates at a rate of \$14 per 100 km driven.

a) Set up a recurrence relation to represent the depreciation.

$V_0 = \$12000$
$d = 14$ km

$V_{n+1} = V_n - d$

so $V_0 = 12000$, $V_{n+1} = V_n - 14$

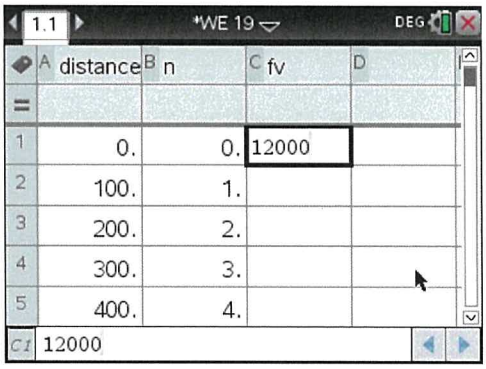
b) Use the recurrence relation to generate a depreciation schedule for the future value of the bike after it has been driven for 100 km, 200 km, 300 km, 400 km and 500 km.

Distance driven (km)	Outputs (n)	Future value V_n (\$)
100	$n = 0$	$V_{0+1} = V_0 - 14$, $V_1 = 12000 - 14 = 11986$
200	$n = 1$	$V_2 = V_1 - 14 = 11986 - 14 = 11972$
300	$n = 2$	$V_3 = V_2 - 14 = 11972 = 11958$
400	$n = 3$	$V_4 = V_3 - 14 = 11958 = 11944$
500	$n = 4$	$V_5 = V_4 - 14 = 11944 = 11930$

Worked Example 19(b) on CAS calculator

On a lists & spreadsheet page

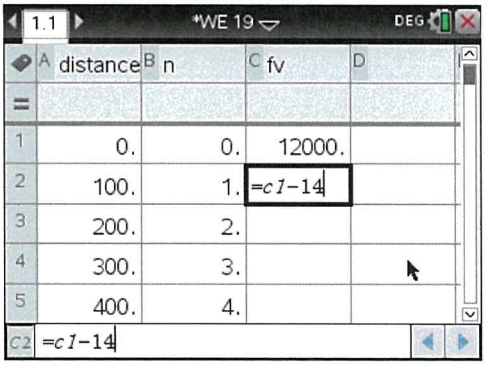
- Label column A "n" and column B "V_n"
- Enter 0 to 5 in the n column and the starting value 15000 (V_0) in cell b1.



In cell b2

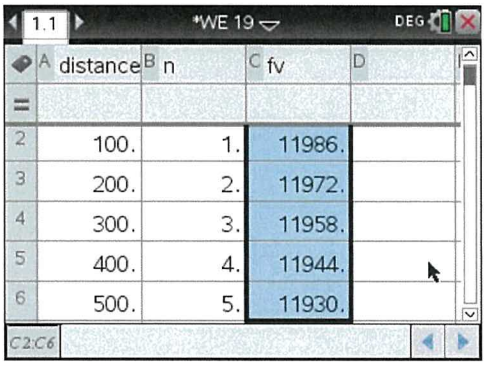
- Enter the equation "=c1–14"

Note: This equation is just $V_{n+1} = V_n - d$
Where V_n is the value of the asset after *n* outputs and *d* is the depreciation per output.



Press enter, then

- fill down (menu 3 3) until n=5



Worked Example 20

A taxi is bought for $31 000 and it depreciated by 28.4 cents per kilometre driven. In one year the car is driven 15 614 km. Find:

a) the annual depreciation for this particular year

depreciation = 15614 × $0.284
= $4434.38
Annual depreciation is $4434.38

b) its useful life if its scrap value is $12 000

to reach the scrap value it needs to drop to $12000 from $31000 or $19000
If 1 km drops its value by $0.284
then x km = $\frac{\$19000}{0.284}$ = 66901 km ← useful life.

Worked Example 21

A photocopier purchased for $10,800 depreciates at a rate of 20 cents for every 100 copies made. In its first year of use 500,000 copies were made and in its second year, 550,000. Find:

a) the depreciation each year

Depreciation = copies made x rate

$D_{1st\ year} = 500000 \times \frac{0.2}{100\ copies}$.

$= \$1000$

$D_{2nd\ year} = 550000 \times \frac{0.2}{100\ copies}$

$= \$1100$

Depreciation in the 1st year is $1000 and in the 2nd year is $1100

b) the future value at the end of the second year.

Total depreciation after 2 years $= \$1000 + \$1100$

$= \$2100$

so after 2 years the Book/future value is

Book Value $= \$10,800 - \$2100$

$= \$8700$

The future or Book value is $8700

Unit cost depreciation equation

A future value after n outputs using unit cost depreciation can be expressed as:

$$V_n = V_0 - nd$$

where V_n is the value of the asset after n outputs and d is the depreciation per output.

If we were to use this equation with worked example 21

The rate d is $\frac{0.20}{100}$ (20 cents per 100 copies)

The number of copies n = 500,000+550,000=1,050,000

And V_0 = 10,800

$$V_n = 10800 - 1{,}050{,}000 \times \frac{0.20}{100}$$

$$V_n = 8{,}700$$

Worked Example 22

The initial cost of a vehicle was $27 850 and its scrap value is $5050. If the vehicle needs to be replaced after travelling 80 000 km (useful life):

a) find the depreciation rate (depreciation ($) per km)

The depreciation rate = $\frac{\text{total depreciation (\$)}}{\text{total distance travelled}}$

The total depreciation is \$27850 − \$5050 = \$22800 and the distance travelled is 80000 km.

so depreciation rate = $\frac{\$22800}{80000}$ = \$0.285 per km or 28.5 cents/km.

b) find the amount of depreciation in a year when 16,497 km were travelled

depreciation = distance × depreciation rate

= 16497 × 0.285

= \$4701.65

c) set up an equation to determine the value of the car after travelling *n* km

$V_n = V_0 - nd$ where $d = \$0.285$

so $V_n = V_0 - n \times 0.285$.

d) find the future value after it has been used for a total of 60 000 km

so $n = 60000$ km

$V_n = \$27850 - 60000 \times 0.285$

= \$10,750

e) set up a schedule table listing future value for every 20 000 km.

Use, *n* (km)	Future value V_n (\$)
0	$V_0 = \$27850$
20 000	$V_1 = 27850 - (20000 \times 0.285) = \$22,150$
40 000	$V_2 = 22150 - (20000 \times 0.285) = \$16450$
60 000	$V_3 = 16450 - (20000 \times 0.285) = \$10750$
80 000	$V_4 = 10750 - (20000 \times 0.285) = \$5050$