STD 1: Financial Maths (Std 1), F3 Depreciation and Loans (Y12)

Depreciation - Declining Balance (Std 1)

Teacher: Kirtana Hariharan

Exam Equivalent Time: 55.5 minutes *(based on HSC allocation of 1.5 minutes approx. per mark)*

IMPORTANT FEATURES AND TIPS FROM 2UG EXAM HISTORY

- *MS-F3 Depreciation and Loans* is a Year 12 Standard 1 topic. It is comprised of the declining balance depreciation and loans content found in Standard 2 with some important omissions (more details are provided where applicable).
- We have split this area into its two subtopics for analysis purposes: 1-*Depreciation - Declining Balance* and 2-*Loans and Credit Cards.*
- This analysis looks at the sub-topic *Depreciation - Declining Balance.*

ANALYSIS - What to Expect and Common pitfalls

- *Declining Balance Depreciation* has been tested in Gen2 exams in 8 years of the last decade with a mean allocation of 1.8% per exam. Questions have been worth anywhere from 1 mark to a very chunky 5-6 marks (in 2011 and 2006).
- Examiners required a comparison of declining balance and straight line depreciation on 3 separate occasions between 2009-2013 but not since. These questions should be a core part of revision.
- This subtopic has the attractive revision qualities of being regularly asked and historically well answered. A notable exception to this is *2011 Q28b* where an overlap with the linear relationships topic area and interpretations of gradients caused major problems (a good question to test the very upper level of difficulty of Standard 1 content).

Questions

1. FS Driving, 2UG 2014 HSC 9 MC

   A car is bought for $19 990. It will depreciate at 18% per annum.

   Using the declining balance method, what will be the salvage value of the car after 3 years, to the nearest dollar?

   (A) $8968

   (B) $9195

   (C) $11 022

   (D) $16 392

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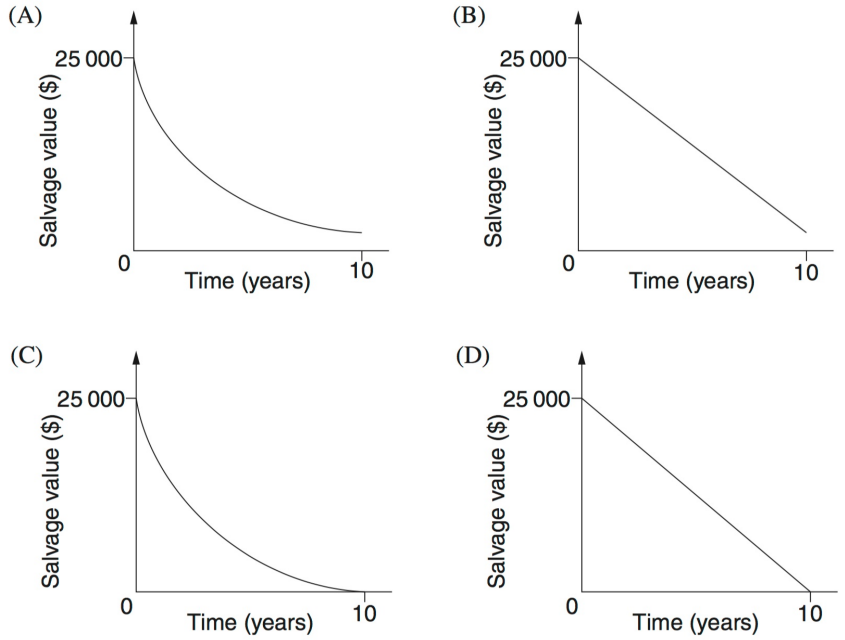
2. FS Driving, 2UG 2012 HSC 16 MC

   RAP Data - Bottom 2%: School result (56%) was -6% below state average (62%)

   A machine was bought for $25 000.

   Which graph best represents the salvage value of the machine over 10 years using the declining balance method of depreciation?



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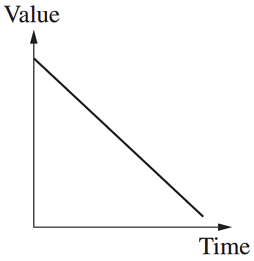
3. FS Driving, 2UG 2007 HSC 12 MC

The value of a car is depreciated using the declining balance method.

Which graph best illustrates the value of the car over time?

(A)



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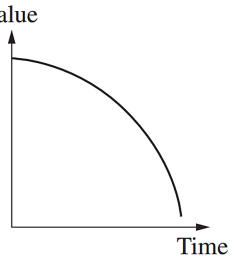
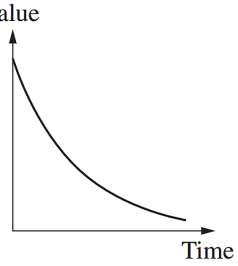
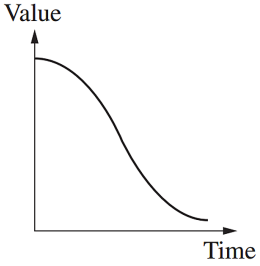


(C)



(D)

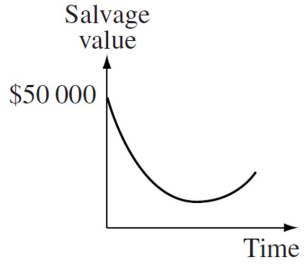


4. FS Driving, 2UG 2005 HSC 15 MC

A car bought for $50 000 is depreciated using the declining balance method.

Which graph best represents the salvage value of the car over time?

(A)



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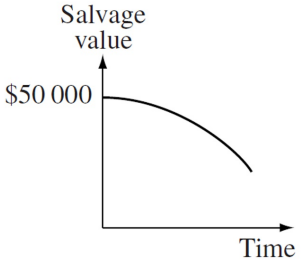

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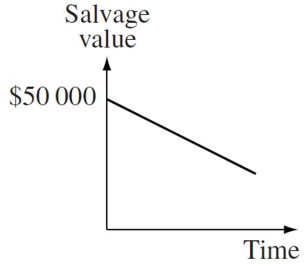

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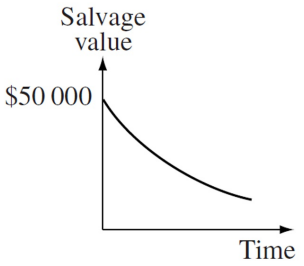


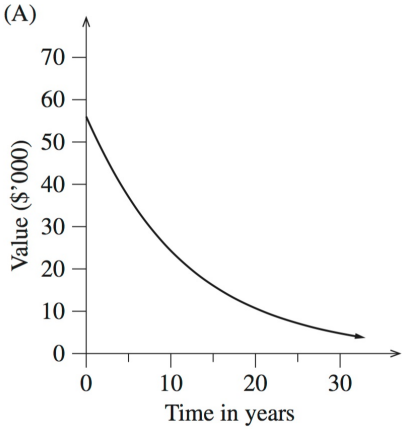
5. FS Driving, 2UG 2015 HSC 10 MC

RAP Data - Bottom 7%: School result (67%) was equal to state average (67%)

A piece of machinery, initially worth $56 000, depreciates at 8% per annum.

Which graph best shows the salvage value of this piece of machinery over time?

(A)



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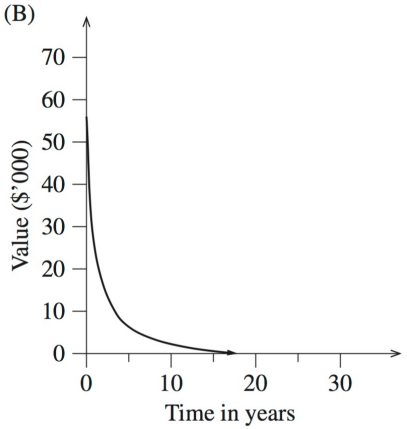
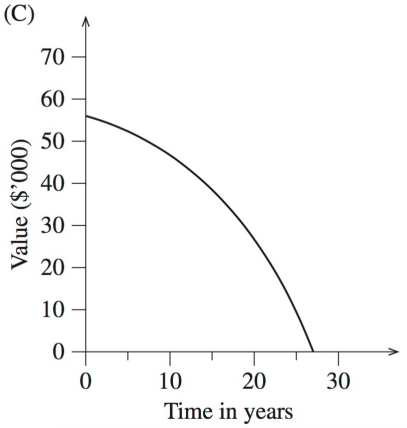
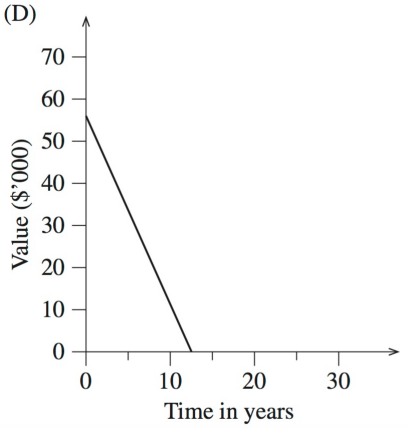


(C)



(D)



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6. FS Driving, 2UG 2017 HSC 11 MC

A new car was bought for $19 900 and one year later its value had depreciated to $16 300.

What is the approximate depreciation, expressed as a percentage of the purchase price?

A. 18%

B. 22%

C. 78%

D. 82%

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7. Financial Maths, 2UG 2018 HSC 26h

A car is purchased for $23 900.

The value of the car is depreciated by 11.5% each year using the declining-balance method.

What is the value of the car after three years? ***(2 marks)***

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8. FS Driving, 2UG 2012 HSC 26b

RAP Data - Bottom 23%: School result (90%) was 7% above state average (83%)

Jim buys a photocopier for $22 000.

Its value is depreciated using the declining balance method at the rate of 15% per annum.

What is its value at the end of 3 years? ***(2 marks)***

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9. FS Driving, 2UG 2004 HSC 25a

Tai uses the declining balance method of depreciation to calculate tax deductions for her business. Tai's computer is valued at $6500 at the start of the 2003 financial year. The rate of depreciation is 40% per annum.

(i) Calculate the value of her tax deduction for the 2003 financial year. ***(1 mark)***

(ii) What is the value of her computer at the start of the 2006 financial year? ***(2 marks)***

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10. FS Driving, 2UG 2013 HSC 28e

Zheng has purchased a computer for $5000 for his company. He wants to compare two different methods of depreciation over two years for the computer.

Method 1: Straight-line with $1250 depreciation per annum.

Method 2: Declining balance with 35% depreciation per annum.

Which method gives the greatest depreciation over the two years? Justify your answer with suitable calculations. ***(3 marks)***

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11. FS Driving, 2UG 2005 HSC 26a

A sports car worth $150 000 is bought in December 2005.

In December each year, beginning in 2006, the value of the sports car is depreciated by 10% using the declining balance method of depreciation.

In which year will the depreciated value first fall below $120 000? ***(2 marks)***

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12. FS Driving, 2UG 2008 HSC 27c

A plasma TV depreciated in value by 15% per annum. Two years after it was purchased it had depreciated to a value of $2023, using the declining balance method.

What was the purchase price of the plasma TV? ***(2 marks)***

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13. FS Driving, 2UG 2009 HSC 24e

Part i: RAP Data - Bottom 22%: School result (91%) was 7% above state average (84%)

Jay bought a computer for $3600. His friend Julie said that all computers are worth nothing (i.e. the value is $0) after 3 years.

(i) Find the amount that the computer would depreciate each year to be worth nothing after 3 years, if the straight line method of depreciation is used. ***(1 mark)***

(ii) Explain why the computer would never be worth nothing if the declining balance method of depreciation is used, with 30% per annum rate of depreciation. Use suitable calculations to support your answer. ***(2 marks)***

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14. FS Driving, 2UG 2006 HSC 27c

Kai purchased a new car for $30 000. It depreciated in value by 2$000 per year for the first three years.

After the end of the third year, Kai changed the method of depreciation to the declining balance method at the rate of 25% per annum.

(i) Calculate the value of the car at the end of the third year. ***(1 mark)***

(ii) Calculate the value of the car seven years after it was purchased. ***(2 marks)***

(iii) Without further calculations, sketch a graph to show the value of the car over the seven years.
Use the horizontal axis to represent time and the vertical axis to represent the value of the car. ***(3 marks)***

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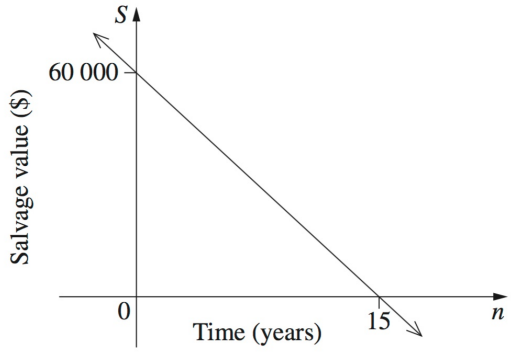
15. FS Driving, 2UG 2011 HSC 28b

Norman and Pat each bought the same type of tractor for $60 000 at the same time. The value of their tractors depreciated over time.

The salvage value S, in dollars, of each tractor, is its depreciated value after n years.

Norman drew a graph to represent the salvage value of his tractor.

Norman's graph of the salvage value of his tractor



(i) Find the gradient of the line shown in the graph. ***(1 mark)***

(ii) What does the value of the gradient represent in this situation? ***(1 mark)***

(iii) Write down the equation of the line shown in the graph. ***(1 mark)***

(iv) Find all the values of n that are not suitable for Norman to use when calculating the salvage value of his tractor. Explain why these values are not suitable. ***(2 marks)***

Pat used the declining balance formula for calculating the salvage value of her tractor. The depreciation rate that she used was 20% per annum.

(v) What did Pat calculate the salvage value of her tractor to be after 14 years? ***(2 marks)***

(vi) Using Pat's method for depreciation, describe what happens to the salvage value of her tractor for all values of n greater than 15. ***(1 mark)***

Worked Solutions

1. FS Driving, 2UG 2014 HSC 9 MC

$$\begin{aligned} S &= V_0(1 - r)^n \\ &= 19\,990\left(1 - \frac{18}{100}\right)^3 \\ &= 19\,990(0.82)^3 \\ &= \$11\,021.85 \end{aligned}$$

$\Rightarrow C$

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2. FS Driving, 2UG 2012 HSC 16 MC

By Elimination

B and D represent straight line depreciation.

C incorrectly has no salvage value after 10 years

$\Rightarrow A$

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3. FS Driving, 2UG 2007 HSC 12 MC

Declining balance depreciates quicker in absolute terms in the early stages, and slower as time goes on and the balance owing decreases.

$\Rightarrow C$

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4. FS Driving, 2UG 2005 HSC 15 MC

Declining Balance Method means that the salvage value of the car drops the most value in the 1st year and then drops less value each following year.

$\Rightarrow D$

Worked Solutions

5. FS Driving, 2UG 2015 HSC 10 MC

By Elimination

A depreciation of 8% per annum depreciates the largest amount in year 1 and then gradually depreciates less each subsequent year.

$\therefore$ Cannot be C or D

Consider when $t = 5$

$$\begin{aligned} \text{Salvage Value} &= V_0(1 - r)^n \\ &= 56\,000(1 - 0.08)^5 \\ &= 36\,908.5\ldots \end{aligned}$$

Graph B depreciates too quickly

$\therefore$ Cannot be B

$\Rightarrow A$

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6. FS Driving, 2UG 2017 HSC 11 MC

$$\begin{aligned} \text{Net Depreciation} &= 19\,900 - 16\,300 \\ &= \$3600 \end{aligned}$$

$$\begin{aligned} \therefore\ \%\ \text{Depreciation} &= \frac{3600}{19\,900} \times 100 \\ &= 18.09\ldots\% \end{aligned}$$

$\Rightarrow A$

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7. Financial Maths, 2UG 2018 HSC 26h

$$\begin{aligned} S &= V_0(1 - r)^n \\ &= 23\,900(1 - 0.115)^3 \\ &= 23\,900(0.885)^3 \\ &= 16\,566.383\ldots \\ &= \$16\,566 \text{ (nearest dollar)} \end{aligned}$$

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8. FS Driving, 2UG 2012 HSC 26b

$$
\begin{aligned}
S &= V_0(1-r)^n \\
&= 22\,000(1-0.15)^3 \\
&= 22\,000(0.85)^3 \\
&= 13\,510.75
\end{aligned}
$$

$\therefore$ After 3 years, it is worth \$13 510.75

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9. FS Driving, 2UG 2004 HSC 25a

(i) $\text{Tax deduction} = 40\% \times \$6500$

$= \$2600$

(ii) Using $S = V_0(1-r)^n$,

Value at the start of 2006 FY

$= 6500(1-0.4)^3$

$= \$1404$

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10. FS Driving, 2UG 2013 HSC 28e

Method 1

$\text{Depreciation over 2 years} = 2 \times 1250$

$= \$2500$

Method 2

$\text{Depreciation (Year 1)} = 35\% \times 5000$

$= \$1750$

$\text{Depreciation (Year 2)} = 35\% \times (5000 - 1750)$

$= \$1137.50$

$\Rightarrow \text{Depreciation over 2 years} = 1750 + 1137.50$

$= \$2887.50$

$\therefore$ Method 2 gives the greater depreciation.

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11. FS Driving, 2UG 2005 HSC 26a

Using $S = V_0(1-r)^n$

where $V_0 = 150\,000, r = 10\%$

If $n = 2$

$$
\begin{aligned}
S &= 150\,000(1-0.1)^2 \\
&= 121\,500
\end{aligned}
$$

If $n = 3$

$$
\begin{aligned}
S &= 150\,000(0-0.1)^3 \\
&= 109\,350
\end{aligned}
$$

$\therefore$ The value falls below \$120 000 in the third year which will be during 2008.

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12. FS Driving, 2UG 2008 HSC 27c

$$
\begin{aligned}
S &= V_0(1-r)^n \\
\Rightarrow 2023 &= V_0(1-0.15)^2 \\
2023 &= V_0(0.85)^2 \\
V_0 &= \frac{2023}{0.85^2} \\
&= 2800
\end{aligned}
$$

$\therefore$ The purchase price $= \$2800$

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13. FS Driving, 2UG 2009 HSC 24e

(i) $S = V_0 - Dn$

$0 = 3600 - D \times 3$

$3D = 3600$

$D = \dfrac{3600}{3}$

$= 1200$

$\therefore$ Annual depreciation $= \$1200$

(ii) Using $S = V_0(1-r)^n$

♦ *Mean mark 45%*

where $r = 30\%$ and $V_0 = 3600$

$S = 3600\left(1 - \dfrac{30}{100}\right)^n$

$= 3600(0.7)^n$

Since $(0.7)^n > 0$ for all n

$\therefore$ Salvage value is always > 0

14. FS Driving, 2UG 2006 HSC 27c

(i) Using $S = V_0 - Dn$

$S = 30\,000 - (2000 \times 3)$

$= \$24\,000$

(ii) Using $S = V_0(1-r)^n$

where $V_0 = 24\,000$

$r = 0.25$

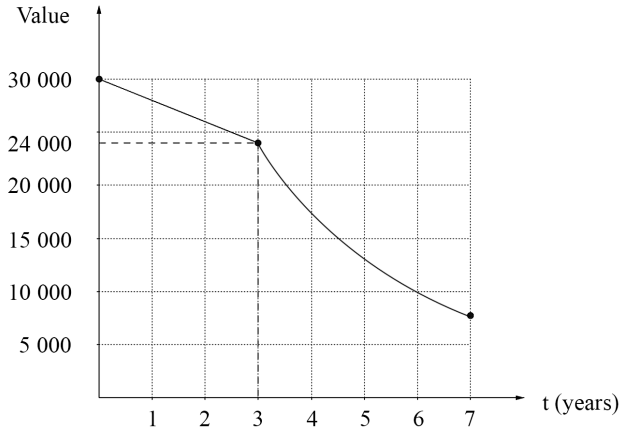
$n = 4$

$S = 24\,000(1 - 0.25)^4$

$= \$7593.75$

$\therefore$ The value of the car after 7 years is $\$7593.75$

(iii)



15. FS Driving, 2UG 2011 HSC 28b

(i) $\text{Gradient} = \dfrac{\text{rise}}{\text{run}}$

$= \dfrac{-60\,000}{15}$

$= -4000$

♦♦♦ *Mean mark 14%*
COMMENT: The intercepts of both axes provide points where the gradient can be quickly found.

(ii) The amount the tractor depreciates each year

♦ *Mean mark 37%*

(iii) Since $S = V_0 - Dn$

$\therefore$ Equation of graph:

$S = 60\,000 - 4000n$

♦♦ *Mean mark 28%*
COMMENT: Using the general form $y = mx + b$ is quick here because you have the gradient (from part (i)) and the y-intercept is obviously $60\,000$.

(iv) It is unsuitable to use

$n < 0$, because time must be positive:

$n > 15$, because it has no more value after 15 years and therefore can't depreciate further.

♦♦♦ *Mean mark 20%*

(v) Using $S = V_0(1-r)^n$ where $r = 20\%$, $n = 14$

$S = 60\,000(1 - 0.2)^{14}$

$= 60\,000(0.8)^{14}$

$= 2\,638.8279...$

$\therefore$ After 14 years, the tractor is worth $2638.83

(vi) As n increases above 15 years, S decreases but remains > 0.

♦ *Mean mark 37%*