

FA Module 9: Accounting for long-lived assets – practice problems (depreciation)

(The attached PDF file has better formatting.)

Exercise 9.1: Double declining balance depreciation

ABC buys equipment on December 31, 20X0, with a 10 year estimated useful life and a salvage value = 20% of the purchase price. ABC uses double declining balance depreciation for this equipment.

- In 20X2, ABC reports depreciation of 100 on the equipment.
- On December 31, 20X3, ABC sells the equipment.
- In 20X3, its pre-tax income from holding the equipment and selling it is 200.

- A. What is the purchase price on December 31, 20X0?
- B. What is the depreciation in 20X1?
- C. What is the carrying value on December 31, 20X1?
- D. What is the carrying value on December 31, 20X2?
- E. What is the depreciation in 20X3?
- F. What is the sale price on December 31, 20X3?

Part A: Let Z be the purchase price. With double declining balance method, the depreciation in the first year is $2 \times 1/(\text{estimated useful life}) \times \text{purchase price} = 2 \times 1/10 \times \text{purchase price} = 1/5 \times \text{purchase price}$.

The carrying value at December 31, 20X1, is $4/5 \times \text{purchase price}$.

The depreciation in the second year (20X2) is $1/5 \times 4/5 \times \text{purchase price} = 100 \Rightarrow$

$\text{purchase price} = 100 \times 5 \times 5/4 = 625$.

Part B: The depreciation in the first year (20X1) is $1/5 \times 625 = 125$.

Part C: The carrying value at December 31, 20X1, is $625 - 125 = 500$.

Part D: The carrying value at December 31, 20X2, is $500 - 100 = 400$.

Part E: Depreciation in 20X3 is $1/5 \times 400 = 80$.

Part F: The income from the equipment in 20X3 is the gain from the sale minus the depreciation:

$$\text{gain} - 80 = 200 \Rightarrow \text{gain} = 280$$

The carrying value right before the sale on December 31, 20X3, is $400 - 80 = 320$.

$$\text{The sale price} = 320 + 280 = 600.$$

Exercise 9.2: Depreciation

A firm buys a corporate jet on December 31, 20X0, for 250,000, which it amortizes over its useful life.

The carrying value of the jet on December 31, 20X2, is 90,000 using double declining balance depreciation and 160,000 using straight line depreciation.

- A. What percentage of the carrying value of the jet is depreciated each year using straight line depreciation?
- B. What is the estimated useful life of the jet?
- C. What is the residual value of the jet after its estimated useful life?
- D. What is the carrying value of the jet on December 31, 20X4, using double declining balance depreciation?
- E. What is the carrying value of the jet on December 31, 20X4, using straight line depreciation?
- F. What is the depreciation of the jet in 20X5 using double declining balance depreciation?

Part A: After two years, the carrying value is $90 / 250 = 36\%$ of the purchase price.

If R = the double declining balance depreciation rate and P = the purchase price:

- the carrying value after one year = $P \times (1 - R)$
- the carrying value after two years = $P \times (1 - R)^2$

⇒ The annual double declining balance depreciation rate is $1 - \sqrt[2]{36\%} = 40\%$.

Part B: The annual straight line depreciation rate is $\frac{1}{2} \times 40\% = 20\%$.

⇒ The estimated useful life is $1 / (20\% \text{ per annum}) = 5 \text{ years}$.

Part C: After two years, the cumulative straight line depreciation is $250,000 - 160,000 = 90,000$.

The annual depreciation is $\frac{1}{2} \times 90,000 = 45,000$.

The cumulative depreciation after 5 years (the useful life) is $5 \times 45,000 = 225,000$.

The residual value after 5 years is $250,000 - 225,000 = 25,000$.

Part D: December 31, 20X4, is four years after the purchase date.

The carrying value at December 31, 20X4, using double declining balance depreciation is

$$250,000 \times (1 - 40\%)^4 = 32,400.$$

Part E: The carrying value at December 31, 20X4, using straight line depreciation is

$$250,000 - 4 \times 45,000 = 70,000.$$

Part F: The double declining balance depreciation method gives $32,400 \times (1 - 40\%) = 19,440$.

This value is less than the residual value, so the carrying value is the residual value of 25,000.

The amortization is $32,400 - 25,000 = 7,400$.

Exercise 9.3: Depreciation methods

A firm has shareholders' equity on December 31, 20X1, of 200 and cash of 200.

The firm buys a long-lived asset (property, plant, and equipment) on December 31, 20X1, for 120, with an estimated useful life of five years and a salvage value (after its estimated useful life) of 20.

The firm has no revenue or expenses besides those stemming from the long-lived asset. The tax rate is 20% and the firm can carry back operating losses against previous years' income.

The firm uses straight line depreciation for financial reporting and double declining balance depreciation for taxable income.

- A. What is depreciation expense on the 20X2 income statement?
- B. What is depreciation expense for 20X2 taxable income?
- C. What is the operating cash flow in 20X2?
- D. What is pre-tax income in 20X2?
- E. What is the deferred tax asset or liability on December 31, 20X2?
- F. What is tax expense on the income statement in 20X2?
- G. What is net (after-tax) income in 20X2?
- H. What is the firm's financial leverage at December 31, 20X2?
- I. What is depreciation expense on the 20X3 income statement?
- J. What is depreciation expense for 20X3 taxable income?
- K. What is the operating cash flow in 20X3?
- L. What is pre-tax income in 20X3?
- M. What is the deferred tax asset or liability on December 31, 20X3?
- N. What is tax expense on the income statement in 20X3?
- O. What is net (after-tax) income in 20X3?
- P. What is the firm's financial leverage at December 31, 20X3?

Part A: Financial statement depreciation expense is $1/5 \times (120 - 20) = 20$.

Part B: Tax basis depreciation expense is $2/5 \times 120 = 48$

Part C: The tax paid is $20\% \times -48 = -9.6$. The operating loss is carried back against previous years' income, so the firm receives a tax refund of 9.60. The operating cash flow is +9.60.

Part D: Pre-tax income on the financial statements is -20 (the financial statement depreciation expense).

Part E: Depreciation expense on the income statement is $48 - 20 = 28$ less than tax basis depreciation. The carrying value of the asset is 28 more than the tax basis of the asset. Applying the 20% tax rate to the carrying value of the asset instead of the tax basis of the asset would generate a tax refund of $20\% \times 20 = 4$.

For all years combined, total depreciation will be $20\% \times (120 - 20) = 20$ for both financial statements and taxable income. Since depreciation expense on the income statement is 28 less than tax basis depreciation in 20X2, in all future years combined, it will be 28 more than tax basis depreciation.

This 28 difference means that future taxable income will be 28 more than future financial statement income. The firm shows a $20\% \times 28 = 5.6$ deferred tax liability.

Part F: Tax expense on the income statement is taxes paid + Δ (deferred tax liability) = $-9.6 + 5.6 = -4$.

Question: Why do we compute the tax basis of the asset and the taxes to be paid in future years? The solution is derived more simply as

- taxable income = -48
- financial statement pre-tax income = -20
- the difference = $-48 - (-20) = -28$
- \Rightarrow the deferred tax asset/(liability) = $20\% \times -28 = -5.6$ (a deferred tax liability).

Answer: The textbook uses the carrying value vs tax basis approach for two reasons:

- Permanent differences between taxable income and financial statement pre-tax income do not reverse in future years and do not affect deferred tax assets and liabilities.
- Some transactions affect the carrying values of assets and liabilities but not pre-tax income. These items appear in other comprehensive income, but they still affect deferred tax assets and liabilities.

Question: The exposition is still clearer if one speaks of pre-tax income, other comprehensive income (before tax), and future reverses.

Answer: Accounting textbooks often use the language in IFRS and GAAP pronouncements. Many terms in the textbook seem round-about expressions, such as “other than temporary impairment losses.” One might expect a term like “permanent impairment losses,” but “other than temporary” is the official term. Similarly, the textbook uses the IFRS and GAAP definitions of deferred tax assets and liabilities. The practice problems on the discussion forum here give simpler explanations of the accounting entries.

The textbook shows an example with financial statement depreciation, tax basis depreciation, and IFRS remeasurement of the asset. The remeasurement causes a direct credit to equity (remeasurement surplus), which is reported net of tax. The example has some of the deferred tax liability affecting net income and some affecting remeasurement surplus.

Part G: Net after-tax income = pre-tax income – tax expense: $-20 - (-4) = -16$. This practice problem is easy, and the net after-tax income = pre-tax income $\times (1 - \text{tax rate})$. Final exam problems have both permanent and temporary tax differences, so one must compute the deferred tax asset or liability.

Part H: We solve for shareholders’ equity by the balance sheet approach and the income statement approach.

Balance sheet approach: Shareholders’ equity = cash + long-lived assets – liabilities.

On December 31, 20X2, the firm has cash of

$$\begin{aligned} & 200 \text{ beginning cash} \\ - & 120 \text{ purchase of long-lived asset} \\ + & 9.6 \text{ tax refund} \\ = & 89.6 \end{aligned}$$

The firm has a long-lived asset of 120 (gross) – 20 (accumulated depreciation) = 100.

The firm has a deferred tax liability of 5.60.

Shareholders’ equity = $89.60 + 100 - 5.60 = 184$.

Income statement approach: Ending equity = beginning equity + net income (revenue – expenses).

- Shareholders’ equity on December 31, 20X1, is 200.
- Net income in 20X2 is -16 , so
 - shareholders’ equity on December 31, 20X2, is $200 - 16 = 184$.

Financial leverage is total assets / shareholders’ equity = $189.60 / 184 = 1.03043$.

Question: How do we interpret this financial leverage?

Answer: financial leverage shows that many assets are financed by borrowing. The money borrowed here is the 5.6 “borrowed” from tax authorities and shown as a deferred tax liability.

Part I: The depreciation expense on the 20X3 income statement is $1/5 \times (120 - 20) = 20$.

Part J: The depreciation expense for 20X3 taxable income is $120 \times (1 - 40\%) \times 40\% = 28.80$

Part K: The operating cash flow is the negative of taxes paid in this exercise: $-20\% \times -28.8 = 5.76$

Part L: Pre-tax income on the financial statements is -20 (the financial statement depreciation expense).

Part M: The tax rate \times the difference between the tax basis depreciation and financial statement depreciation is the *change* in the deferred tax liability: $20\% \times (28.8 - 20) = 1.76$.

The deferred tax liability on December 31, 20X3, is $5.6 + 1.76 = 7.36$.

For the carrying value vs tax basis approach:

- The carrying value of the asset is $120 - 20 - 20 = 80$.
- The tax basis of the asset is $120 - 48 - 28.8 = 43.20$
- The difference is $80 - 43.20 = 36.80$.
- The deferred tax liability is $20\% \times 36.80 = 7.36$.

Part N: The tax expense is the financial statement depreciation of $-20 \times$ the tax rate of $20\% = -4$.

Alternatively, the taxes paid $= -5.76$ and the change in the deferred tax liability is 1.76 , so the tax expense is $-5.76 + 1.76 = -4$.

Part O: Net after-tax income is $-20 - (-4) = -16$.

Part P: We solve for shareholders' equity by the balance sheet approach and the income statement approach.

Balance sheet approach: On December 31, 20X3, the firm has cash of

| | |
|---|----------------------------------|
| | 200 beginning cash |
| – | 120 purchase of long-lived asset |
| + | 9.6 tax refund |
| + | 5.76 tax refund |
| = | 95.36 |

$200 - 120 + 9.6 + 5.76 = 95.36$

- The firm has a long-lived asset of 120 (gross) $-$ 40 (accumulated depreciation) = 80.
- The firm has a deferred tax liability of 7.36.

Shareholders' equity = $95.36 + 80 - 7.36 = 168.00$

Income statement approach: Shareholders' equity on December 31, 20X1, is 200. Net income is -16 in 20X2 and -16 in 20X3, so shareholders' equity on December 31, 20X3, is $200 - 16 - 16 = 168$.

Financial leverage is total assets / shareholders' equity = $(95.36 + 80) / 168 = 1.04381$

Exercise 9.4: Depreciation methods

A firm buys a long-lived asset (property, plant, and equipment) on December 31, 20X1, for 120, with a salvage value after its estimated useful life of 20. The estimated useful life is at least four years.

The depreciation expense in 20X3 using the double declining balance method is 28.80.

- A. What is the depreciation rate for the double declining balance method?
- B. What is the estimated useful life of the asset?
- C. What is the depreciation in 20X5 using the straight line depreciation method?

Part A: Let Z = depreciation rate for the double declining balance method.

The depreciation expense in 20X2 is $120 \times Z$, and the carrying value at December 31, 20X2 is $120 \times (1 - Z)$.

The depreciation expense in 20X3 is $120 \times (1 - Z) \times Z = 28.8 \Rightarrow$

$$Z \times (1 - Z) = 28.8 / 120 = 24.00\% \Rightarrow$$

$$Z^2 - Z + 0.24 = 0 \Rightarrow$$

$$Z = [1 \pm \sqrt{1 - 0.96}] / 2 = [1 \pm 0.2] / 2 =$$

- $1.2 / 2 = 0.6$
- $0.8 / 2 = 0.4$

Part B: We use the two possible depreciation rates from Part A.

- If the depreciation rate for the double declining balance method is 0.6, the depreciation rate for the straight line method is $0.6 / 2 = 0.3$, and the estimated useful life is $1 / 0.3 = 3.333$ years.
- If the depreciation rate for the double declining balance method is 0.4, the depreciation rate for the straight line method is $0.4 / 2 = 0.2$, and the estimated useful life is $1 / 0.2 = 5$ years.

The problem says that the estimated useful life is at least four years, so it is 5 years, and the depreciation rate for the double declining balance method is 40% *per annum*.

Part C: The purchase price is 120, the salvage value is 20, and the estimated useful life is five years, so the straight line depreciation is $(120 - 20) / 5 = 20$ each year for 20X2 - 20X6.

Exercise 9.5: Capitalized interest

On December 31, 20X0, a firm has 100 of shareholders' equity, 100 of cash, and no other assets or liabilities.

On January 1, 20X1, the firm takes a one year loan for 200 at a 10% coupon rate, and it pays the 200 to a contractor to construct a home office, which is completed by December 31, 20X1. The home office has a 10 year estimated useful life and no salvage value, and the firm uses straight line depreciation. The firm has no other revenue or expenses in 20X1.

If the firm expenses the interest costs of the construction loan:

- A. What is the firm's financial leverage on December 31, 20X1?
- B. What is the depreciation on the home office in 20X2?

If the firm capitalizes the interest costs of the construction loan:

- C. What is the firm's financial leverage on December 31, 20X1?
- D. What is the depreciation on the home office in 20X2?

Part A: The interest expense in 20X1 is $10\% \times 200 = 20$.

The firm's total assets on December 31, 20X1, are

cash: 100 (from beginning of the year) – 20 (interest paid) = 80
+ property, plant, and equipment: 200 (the home office)
= total: 280

Shareholders' equity at December 31, 20X1, is

- Income statement: 100 (from beginning of the year) – 20 (interest expense) = 80.
- Balance sheet: 280 (assets) – 200 (long-term debt) = 80.

Financial leverage = $280 / 80 = 3.5$

Part B: Depreciation expense on the home office in 20X2 is $200 / 10 = 20$.

Part C: If the firm capitalizes the interest costs, its assets on December 31, 20X1, are

cash: 100 (from beginning of the year) – 20 (interest paid) = 80
+ property, plant, and equipment: 220 (the home office cost + the capitalized interest)
= total: 300

Shareholders' equity at December 31, 20X1, is

- Income statement: 100 (from beginning of the year) – 0 (interest expense) = 100.
- Balance sheet: 300 (assets) – 200 (long-term debt) = 100.

Financial leverage = $300 / 100 = 3.0$

Part D: Depreciation expense on the home office in 20X2 is $220 / 10 = 22$.

Exercise 9.6: Capitalized interest (IFRS vs GAAP)

On December 31, 20X0, a firm engages a contractor to construct an office building for 100, with half paid on December 31, 20X0, and half paid on December 31, 20X1. The construction will take two years (20X1 and 20X2), after which the office building has an estimated useful life of 20 years with a salvage value of zero. The firm uses straight line depreciation.

On December 31, 20X0, to pay for the construction, the firm takes a ten year loan with a par value of 100 and an annual coupon rate of 12% *per annum* paid at the end of each year. Cash from the loan not paid to the contractor is invested at 6% *per annum*.

The firm capitalizes the interest on the construction loan.

- A. How much interest is capitalized in 20X1?
- B. What is interest expense in 20X1?
- C. How much interest is capitalized in 20X2?
- D. What is interest expense in 20X2?
- E. What is the carrying value of the office building on December 31, 20X2?
- F. What is depreciation expense in 20X3?
- G. What is interest expense in 20X3?
- H. What is the carrying value of the office building on December 31, 20X3?

Part A: The firm pays $\frac{1}{2} \times 100 = 50$ to the contractor on December 31, 20X0, and it invests the remaining 50 at 6% *per annum*. On December 31, 20X1, the firm pays $12\% \times 100 = 12$ to the bank that issues the loan; it pays another 50 to the contractor; and it receives $6\% \times 50 = 3$ as interest income.

- Under GAAP, the interest paid of 12 is capitalized in 20X1.
- Under IFRS, the net interest of $12 - 3 = 9$ is capitalized in 20X1.

Part B: The interest in 20X1 is capitalized, so the interest expense is zero.

Intuition: The interest paid on the loan is part of the cost of constructing the building. Capitalizing interest on the loan matches the revenue and expense from the building.

- The building provides income to the firm over its estimated useful life.
- The cost of acquiring the building – including the interest on the loan – is spread (as depreciation) over its estimated useful life.

Question: What about the interest costs on the loan in subsequent years?

Answer: In subsequent years, the interest expense on the loan is an annual expense that already matches the pattern of income from the building.

Part C: On December 31, 20X2, the firm pays $12\% \times 100 = 12$ to the bank that issues the loan. The building is still being constructed, so the 12 is capitalized.

No cash from the loan is invested in 20X2, so the capitalized interest is the same for IFRS and GAAP.

Part D: The interest in 20X2 is capitalized, so the interest expense is zero.

Part E: The carrying value of the building on December 31, 20X2, differs for IFRS vs GAAP:

- IFRS: The carrying value is $50 + 50$ (paid to the contractor) $+ 9 + 12$ of capitalized interest = 121.
- GAAP: The carrying value is $50 + 50$ (paid to the contractor) $+ 12 + 12$ of capitalized interest = 124.

Part F: Depreciation expense depends on the carrying value:

- IFRS: Depreciation expense in 20X3 is $121 / 20 = 6.05$.
- GAAP: Depreciation expense in 20X3 is $124 / 20 = 6.20$.

Part G: Interest expense in 20X3 is $12\% \times 100 = 12$. The building is already constructed, so no more interest is capitalized.

Part H: The carrying value at each date continues to differ for IFRS vs GAAP.

- IFRS: The carrying value of the building on December 31, 20X3, is $121 - 6.05 = 114.95$.
- GAAP: The carrying value of the building on December 31, 20X3, is $124 - 6.20 = 117.80$.

Exercise 9.7: Revaluation model

A firm reporting under IFRS buys 3 fixed assets on December 31, 20X1, each with a purchase price of 100 and an estimated useful life of 20 years.

- Asset #1 uses double declining balance depreciation
- Assets #2 and #3 use straight line depreciation and the revaluation model.
 - Asset #2: 80 on December 31, 20X2, with a remaining useful life of 10 years, and 90 on December 31, 20X3
 - Asset #3: 120 on December 31, 20X2, with a remaining useful life of 30 years, and 90 on December 31, 20X3

What are the entries in 20X2 and 20X3 for profit/loss and for revaluation surplus for

- A. Asset #1
- B. Asset #2
- C. Asset #3

Part A: The depreciation ratio for double declining balance depreciation is twice the depreciation ratio for straight line depreciation. An asset with a 20 year estimated useful life have a 5% depreciation ratio for straight line depreciation and a 10% depreciation ratio for double declining balance depreciation.

Two differences between straight line depreciation and double declining balance depreciation are

- Straight line depreciation applies the depreciation ratio of the excess of the purchase price over the salvage value. The depreciation expense is the same each year.
- Double declining balance depreciation applies the depreciation ratio to the carrying value at the beginning of the year, so the depreciation expense declines each year.

The double declining balance depreciation for Asset #1 by year is

- 20X2: $100 \times 2 / 20 = 10$
- 20X3: $(100 - 10) \times 2 / 20 = 9$

Depreciation is a debit on the statement of profit and loss (the income statement) and a contra-asset (a credit) called accumulated depreciation on the statement of financial position (the balance sheet).

Part B: The straight line depreciation for Asset #2 in 20X2 is $100 / 20 = 5$. The carrying value for Asset #2 at 12/31/20X2 before the revaluation is $100 - 100 / 20 = 95$.

A revaluation that reduces the value of the long-lived asset flows through the statement of profit and loss (similar to an impairment loss). The 20X2 entries are

- a 5 debit to profit or loss for depreciation (an expense)
- a $95 - 80 = 15$ debit to profit or loss for revaluation (an expense)
- a 20 credit to long-lived assets on the statement of financial position (a reduction in the asset)

The straight line depreciation for Asset #2 in 20X3 is $80/10 = 8$. The carrying value for Asset #2 at 12/31/20X3 before the revaluation is $80 - 80 / 10 = 72$.

The 12/31/20X3 revaluation gain is $90 - 72 = 18$. A revaluation gain that reverses a previous revaluation loss flows through the statement of profit and loss, and any excess becomes revaluation surplus.

Of the 18 revaluation gain at 12/31/20X3:

- 15 reverses the revaluation loss at 12/31/20X2 and is reported as a gain in the statement of profit or loss.
- $18 - 15 = 3$ is reported as revaluation surplus.

The accounting entries for 20X3 are

- debit 8 as depreciation expense in the statement of profit or loss
- credit 15 as revaluation gain in the statement of profit or loss
- credit 3 as revaluation surplus (shareholders' equity)
- debit 10 as the increase in the value of long-lived assets on the statement of financial position

Part C: The carrying value of Asset #3 at 12/31/20X2 before the revaluation is $100 - 100/20 = 95$.

A revaluation that increases the value of the long-lived asset above the capital allocation line does not flow through the statement of profit and loss but is a direct credit to revaluation surplus in shareholders' equity.

The accounting entries for 20X2 are

- debit 5 as depreciation expense in the statement of profit or loss
- credit 25 as revaluation surplus (shareholders' equity)
- debit 20 as the increase in the value of long-lived assets on the statement of financial position

Depreciation in 20X3 uses the new carrying value and remaining useful life.

- The depreciation expense for Asset #3 in 20X3 is $120 / 30 = 4$.
- The carrying value of Asset #3 at 12/31/20X3 before the second revaluation is $120 - 120/30 = 116$.

The revaluation loss at 12/31/20X3 is $116 - 90 = 26$.

Revaluation losses affect first revaluation surplus for that asset and then profit or loss. The 20X3 entries are

- debit 4 as depreciation expense in the statement of profit or loss
- debit 25 revaluation surplus, reducing it to zero (shareholders' equity)
- debit $26 - 25 = 1$ as revaluation loss in the statement of profit or loss
- credit $120 - 90 = 30$ to reduce long-lived assets on the statement of financial position