

## FA Module 11: Operating leases and finance leases – practice problems

(The attached PDF file has better formatting.)

Finance leases are also called capital leases. The textbook prefers the term finance lease, and the practice problems also use this term.

The lease obligation is also called the lease liability. The textbook uses both terms, and the practice problems use both terms equivalently.

The textbook considers the lease obligation (lease liability) and any accrued interest as debt (for the debt-to-equity ratio), and the final exam problems do the same.

The textbook uses interest rates in arrears: 5% on a loan of 100 means 5 paid at the end of the year, not 5 paid at the beginning of the year. The arithmetic for finance leases is simpler if the lease payments are also made in arrears: at the end of the year instead of at the beginning of the year. The textbook first shows an example with lease payments at the end of the year, and then shows a more complete example with lease payments at the beginning of the year. The practice problems here do the same.

### Exercise 11.1: Finance lease with lease payments in arrears

- On December 31, 20X0, the firm takes a five-year lease on equipment.
- The lease payments are 100 *per annum*, payable (in arrears) on December 31, 20X1 - 20X5.
- The firm's capitalization rate is 8% *per annum*.

Besides the lease, the firm has assets of 1500 and long-term liabilities of 1000 on both January 1, 20X1, and December 31, 20X1, and it has net revenue of 250 (all in cash) and no expenses in 20X1. The tax rate is 20%.

If the lease is included:

- A. What are assets on December 31, 20X0?
- B. What are liabilities on December 31, 20X0?
- C. What is lease expense in 20X1?
- D. What is depreciation expense in 20X1?
- E. What is interest expense in 20X1?
- F. What is pre-tax income in 20X1?
- G. What are assets on December 31, 20X1?
- H. What are liabilities on December 31, 20X1?
- I. What is the return on assets in 20X1?
- J. What is the debt to asset ratio on December 31, 20X1?
- K. What are pre-tax operating and financing cash flows in 20X1?

**Solution 11.1:** This scenario is simplified. If we are given assets and liabilities on January 1, 20X1, we can derive assets and liabilities on December 31, 20X1, from the revenue, expenses, and other changes in assets and liabilities. The simplified scenario allows us to focus on the effects of the lease.

**Question:** The exercise says that the lease payments are made in arrears, at the end of the year. In truth, lease payments are made in advance, at the beginning of the year.

**Answer:** The accounting for leases with payments in advance under IFRS and GAAP is complicated by the assumption that the interest expense for the year is accrued but not paid until the next year. To simplify, the textbook shows first a lease with payments in arrears and then a lease with payments in advance.

- This exercise (like example 18 in the textbook) has the lease payments at the end of the year.
- Other exercises (like example 19 in the textbook) have lease payments at the beginning of the year.

*Part A:* At inception, for finance leases, the fair value of the equipment = the lease obligation = the present value of the lease payments:

$$100 \times (1.08^{-1} + 1.08^{-2} + 1.08^{-3} + 1.08^{-4} + 1.08^{-5}) = 399.27$$

The firm's assets on December 31, 20X0, for a finance lease =  $1500 + 399.27 = 1,899.27$

For an operating lease, no lease asset is recorded, so the firm's assets on December 31, 20X0 = 1,500.

*Question:* In subsequent years, how does the leased asset change in a finance lease? Is it always the present value of future lease payments?

*Answer:* In subsequent years, the leased asset's carrying value decreases by straight line depreciation, so its carrying value does *not* equal the present value of future lease payments.

*Part B:* At inception, for finance leases, the lease obligation = the lease asset = 399.27, so the firm's liabilities on December 31, 20X0 =  $1000 + 399.27 = 1399.27$

For an operating lease, no lease obligation is reported, so the firm's liabilities on December 31, 20X0 = 1000.

*Question:* In subsequent years, does the lease obligation also decrease by straight line depreciation?

*Answer:* No; the lease obligation decreases by the amount of principal repaid. Another practice problem shows the computations.

*Part C:* Lease expense for operating leases is the annual lease payment = 100. Finance leases do not show lease expense.

*Part D:* Depreciation expense is the lease asset / number of years of the lease.

- For the finance lease, this is  $399.27 / 5 = 79.85$
- An operating lease shows no depreciation expense.

*Part E:* The interest expense is the lease obligation  $\times$  the capitalization rate.

- For the finance lease, this is  $399.27 \times 0.08 = 31.94$
- An operating lease shows no depreciation expense.

*Part F:* Pre-tax income besides the lease is 250. Including the lease, pre-tax income is

- Operating lease:  $250 - 100$  (lease expense) = 150
- Finance lease:  $250 - 79.85$  (depreciation expense) -  $31.94$  (interest expense) = 138.21

*Part G:* Without the lease, assets are 1,500 at December 31, 20X1.

- With an operating lease, the firm has no other assets.
- With a finance lease, the firm has a leased asset with a carrying value of  $399.27 - 399.27 / 5 = 319.42$

*Part H:* An operating lease has no lease obligations, so the liabilities at December 31, 20X1, are 1,000.

For a finance lease, the lease obligation at December 31, 20X1, is the present value of the remaining lease payments:

$$100 \times (1.08^{-1} + 1.08^{-2} + 1.08^{-3} + 1.08^{-4}) = 331.21$$

The total liabilities at December 31, 20X1, are 1,331.21

*Part I:* The return on assets is net income / average assets. Pre-tax income is

- Operating lease:  $250 - 100$  (lease expense) = 150
- Finance lease:  $250 - 79.85$  (depreciation expense) - 31.94 (interest expense) = 138.21

Net income is

- Operating lease:  $150 \times (1 - 20\%) = 120$ .
- Finance lease:  $138.21 \times (1 - 20\%) = 110.5680$

Average assets are

- Operating lease: 1,500
- Finance lease:  $1500 + (399.27 + 319.42)/2 = 1,859.35$

The return on assets is

- Operating lease:  $120 / 1500 = 8.00\%$
- Finance lease:  $110.5680 / 1859.35 = 5.95\%$

*Question:* In example 18 on page 472, the textbook gives net income without the lease and no tax rate. It then subtracts the expenses from the lease without adjusting for taxes.

*Answer:* In the first example for leases, the textbook avoids complexity. The next example gives a tax rate of 30% and all the adjustments.

*Part J:* For an operating lease, the debt to asset ratio is  $1,000 / 1,500 = 66.7\%$

For a finance lease, the lease obligation is considered debt. The debt to asset ratio is

$$1331.21 / 1859.35 = 71.60\%$$

*Part K:* For an operating lease, the lease expense is an operating cash flow. The net revenue in this practice problem is cash, so the operating cash flow is  $250 - 100 = 150$ .

For a finance lease, the portion of the lease payment that reduces the lease obligation is a financing cash flow, and the portion of the lease payment considered to be interest expense is an operating cash flow for GAAP and either an operating cash flow or a financing cash flow for IFRS.

The lease obligation declines from 399.27 on December 31, 20X0, to 331.21 on December 31, 20X1:

$399.27 - 331.21 = 68.06 =$  a financing cash flow for both GAAP and IFRS.

The rest of the lease payment, or  $100 - 68.06 = 31.94$ , is an operating cash flow for GAAP and either a financing cash flow or an operating cash flow for IFRS.

The following exercises explain the textbook illustrations for finance leases and operating leases: accounting entries for the financial statements and the resulting financial ratios. The exhibits after the practice problems have the calculations and figures. Final exam problems change the input data but use the same procedures.

### Exercise 11.2: Finance lease

A firm enters into a four year finance lease on 1/1/20X1.

- Lease payments of 100 are due on January 1 of 20X1, 20X2, 20X3, and 20X4.
- The fair value of the equipment = the present value of the lease payments at the firm's 8% discount rate.
- The useful life of the equipment is four years and the salvage value is zero; use straight line depreciation.

On December 31, 20X0, the firm has

- common stock = 500
- long-term debt = 100
- retained earnings = 0

The firm does not issue or repurchase common stock or issue or redeem debt in 20X1 - 20X4.

The firm has earnings before tax and operating cash flow (*not including expenses related to the lease*) of 250 each year. The tax rate is 20%.

Use the assumptions in the textbook about how the lease payments are divided between interest expense and reduction of the lease liability.

- A. What is the fair value of the equipment on January 1, 20X1?
- B. What is the interest accrued (= interest expense) in 20X1?
- C. What is the lease liability on December 31, 20X1?
- D. What is the interest accrued (= interest expense) in 20X2?
- E. What is the lease liability on December 31, 20X2?
- F. What is depreciation expense in 20X1?
- G. What is pre-tax income in 20X1?
- H. What is net income in 20X1?
- I. What is net income in 20X2?
- J. What are operating cash flow, financing cash flow, and total cash flow in 20X1 for GAAP?
- K. What are operating cash flow, financing cash flow, and total cash flow in 20X2 for GAAP?
- L. What is the return on equity in 20X1?
- M. What is the return on equity in 20X2?
- N. What is the debt-to-equity ratio on 12/31/20X1?
- O. What is the debt-to-equity ratio on 12/31/20X2?

*Part A:* The fair value of the equipment on January 1, 20X1, equals the present value of the lease payments

$$= 100 \times (1.08^{-0} + 1.08^{-1} + 1.08^{-2} + 1.08^{-3}) = 357.7097$$

*Part B:* The lease payment on 1/1/20X1 reduces the lease liability to 257.7097 (= 357.7097 – 100).

The accrued interest (or the interest expense) for 20X1 is  $257.7097 \times 8\% = 20.6168$ .

*Jacob:* Why is the interest accrued instead of paid? The lease payment is made in advance, on January 1.

*Rachel:* The lease payment covers (i) the interest already accrued and then (ii) reduces the lease liability. At inception, no interest has yet been accrued, so the entire lease payment reduces the lease liability. In later

years, part of the lease payment covers the interest accrued in the previous year, and the rest reduces the lease liability. The interest is assumed to be paid in arrears, not in advance.

*Question:* Would the cost of the lease differ if the interest were assumed to be paid in advance?

*Answer:* The cost of the lease depends on the cash flows, not the accounting assumptions. The assumptions affect the allocation of the accounting entries to interest expense or reduction of the lease liability.

*Part C:* The change in the lease liability in 20X1 is the lease payment minus the interest expense =

$$100 - 20.6168 = 79.3832.$$

The lease liability on December 31, 20X1, may be viewed two ways:

- lease liability before the lease payment – change in the lease liability:  $357.7097 - 79.3832 = 278.3265$
- lease liability after the lease payment + the interest expense:  $257.7097 + 20.6168 = 278.3265$

The lease liability on December 31, 20X1, may also be computed directly as:

$$100 \times (1.08^{-0} + 1.08^{-1} + 1.08^{-2}) = 278.3265.$$

*Question:* The accrued interest on a bond is separate from the bond liability. Why is the accrued interest on a lease combined with the lease liability?

*Answer:* The bond has separate principal and interest payments. The lease payment is a combined item and is separated into accrued interest and reduction of the lease liability for accounting purposes only.

*Part D:* The lease payment on 1/1/20X2 reduces the lease liability to 178.3265 (= 278.3265 – 100).

The accrued interest (or the interest expense) for 20X2 is  $178.3265 \times 8\% = 14.2661$

*Part E:* The change in the lease liability in 20X2 is the lease payment minus the interest expense =

$$100 - 14.2661 = 85.7339$$

The lease liability on December 31, 20X2, may be viewed two ways:

- lease liability before the lease payment – change in the lease liability:  $278.3265 - 85.7339 = 192.5926$
- lease liability after the lease payment + the interest expense:  $178.3265 + 14.2661 = 192.5926$

The lease liability on December 31, 20X2, may also be computed directly as:

$$100 \times (1.08^{-0} + 1.08^{-1}) = 192.5926.$$

We continue the same way for 20X3 and 20X4. The lease liability on December 31, 20X3, is 100, and the lease liability on December 31, 20X4, is zero.

*Part F:* A finance lease assumes the firm (the lessee) buys the leased asset and depreciates it. The carrying value of the leased asset at inception = the fair value of the asset = the present value of the lease payments = 357.7097. Annual depreciation =  $357.7097 / 4 = 89.42743$

*Part G:* Earnings before tax excluding the lease transactions are 250. We subtract depreciation expense and interest expense for the lease:  $250 - 89.42743 - 20.6168 = 139.95577$

*Part H:* The tax rate is 20%, so tax expense =  $139.95577 \times 20\% = 27.99115$

Net income in 20X1 =  $139.95577 - 27.99115 = 111.96462$  (or  $139.95577 \times 80\% = 111.96462$ )

*Part I:* Earnings before tax excluding the lease transactions = 250; depreciation expense = 89.42743; interest expense for the lease = 14.26614; so 20X2 pre-tax income =  $250 - 89.42743 - 14.26614 = 146.30643$ .

Net income in 20X2 =  $146.30643 \times 80\% = 117.04514$ .

*Part J:* A finance lease has four expenses or cash payments:

- Depreciation is a non-cash expense.
- Interest paid is an operating cash outflow for GAAP.
- Taxes paid is an operating cash outflow for GAAP.
- The payment to reduce the lease liability is a financing cash outflow for GAAP (similar to repaying the principal on a loan).

In 20X1, interest paid is zero, taxes paid = 27.99114, and the payment to reduce the lease liability is 100.

- Operating cash flow =  $250 - 27.99114 = 222.00886$
- Financing cash flow =  $-100$
- Total cash flow =  $222.00886 - 100 = 122.00886$

*Question:* Net income in 20X1 is 111.96462; how does this reconcile to the total cash flow of 122.00886?

*Answer:* The expenses for the finance lease are not the lease payment:

- Net income of 111.96462 deducts the depreciation of the leased asset and the interest expense.
  - depreciation = 89.42742
  - interest expense = 20.6168
  - $111.96462 + 89.42742 + 20.61678 = 222.00882$
- Total cash flow of 122.00886 deducts the lease payment of 100.
  - $122.00886 + 100 = 222.00886$

(The difference of 0.00004 is a rounding error; on a spread-sheet, both numbers are 222.00884.)

*Part K:* In 20X2, interest paid is 20.6168, taxes paid = 29.26127, and the payment to reduce the lease liability is 79.3832.

*Question:* The interest expense for 20X2 is 14.26614; 20.6168 is the interest expense for 20X1.

*Answer:* Bonds and bank loans have specified interest expense. A finance lease has lease payments, which combine the interest expense and the payment to reduce the lease liability. The textbook assumes that the interest expense for each year is paid on January 1 of the next year.

*Question:* The reduction in the lease liability for 20X2 is 85.7339; 79.3832 is the reduction in the lease liability for 20X1.

*Answer:* The payment to reduce the lease liability is made on January 1; the reduction in the lease liability is as of December 31; the discount rate is 8% *per annum*:  $79.3832 \times 1.08 = 85.7339$

In both 20X1 and 20X2, the interest paid + the payment to reduce the lease liability = the lease payment. The division between interest and reduction in lease liability differs for expenses (the income statement) vs cash flows (the cash flow statement).

- Operating cash flow =  $250 - 20.6168 - 29.26127 = 200.12193$
- Financing cash flow =  $-79.3832$ .
- Total cash flow =  $200.12193 - 79.3832 = 120.73873$

*Part L:* We use the following relations:

- Shareholders' equity = common stock + retained earnings.
- Common stock = 500 each year.
- The change in retained earnings during the year = net income – shareholder dividends.
- Return on equity = net income / average shareholders' equity.

We compute shareholders' equity for December 31, 20X0, and December 31, 20X1.

- Retained earnings are zero at December 31, 20X0, so shareholders' equity = 500.
- Net income in 20X1 = 111.96462, so retained earnings at 12/31/20X1 = 111.9646, and shareholders' equity = 500 + 111.96462 = 611.96462.
- ROE in 20X1 =  $111.96462 / ((500 + 611.96462) / 2) = 20.14\%$

*Part M:* For return on equity in 20X2 we compute

- Retained earnings are zero at December 31, 20X1, is 611.96462
- Net income in 20X2 = 117.0451, so retained earnings at 12/31/20X1 = 111.9646 + 117.0451 = 229.0097
- Shareholders' equity = 500 + 229.0097 = 729.0097
- ROE in 20X1 =  $117.0451 / ((611.96462 + 729.0097) / 2) = 17.46\%$

*Part N:* The firm has long-term debt of 100 at December 31, 20X1, unrelated to the lease.

On December 31, 20X1, the lease liability is 278.3286 and accrued interest is 20.6168, so total liabilities =

$$100 + 20.6168 + 278.3268 = 398.9436$$

Shareholders' equity = 611.9646, so the debt-to-equity ratio =  $398.9436 / 611.9646 = 0.6519$

*Question:* Why do we include accrued interest in the debt-to-equity ratio?

*Answer:* The debt-to-equity ratio is a financial ratio; it is not prescribed by IFRS or GAAP. The textbook uses all interest-bearing debt plus the accrued interest on this debt as the numerator of the ratio. Liabilities that are not related to debt, loans, or leases, and that do not have interest payments are not included; examples are accounts payable or wages payable.

*Part O:* The long-term debt of 100 remains at December 31, 20X2.

On December 31, 20X2, the lease liability is 192.5929 and accrued interest is 14.2661, so total liabilities =

$$100 + 14.2661 + 192.5929 = 306.8590$$

Shareholders' equity = 729.0096, so the debt-to-equity ratio =  $306.8590 / 729.0096 = 0.4209$

The calculations for operating leases are simpler than those for finance leases. An operating lease is like a rental agreement: an operating expense each month or year but no depreciation expense, interest expense, or adjustments to the loan liability.

### Exercise 11.3: Operating lease

A firm enters into a four year operating lease on 1/1/20X1.

- Lease payments of 100 are due on January 1 of 20X1, 20X2, 20X3, and 20X4.
- The fair value of the equipment = the present value of the lease payments at the firm's 8% discount rate.
- The useful life of the equipment is four years and the salvage value is zero; use straight line depreciation.

On December 31, 20X0, the firm has

- common stock = 500
- long-term debt = 100
- retained earnings = 0

The firm does not issue or repurchase common stock or issue or redeem debt in 20X1 - 20X4.

The firm has earnings before tax and operating cash flow *not including any expenses related to the lease* of 250 in each year. The tax rate is 20%.

- A. What is pre-tax income in 20X1?
- B. What is net income in 20X1?
- C. What is net income in 20X2?
- D. What are operating cash flow, financing cash flow, and total cash flow each year?
- E. What is the return on equity in 20X1 and in 20X2?
- F. What is the debt-to-equity ratio on 12/31/20X1 and on 12/31/20X2?

*Part A:* An operating lease has a lease expense equal to the lease payment, and it has no interest expense, depreciation expense, or lease liability.

Earnings before tax excluding the lease transactions are 250. We subtract the lease expense to get pre-tax income =  $250 - 100 = 150$

*Part B:* The tax rate is 20%, so tax expense =  $150 \times 20\% = 30$ . Net income =  $150 - 30 = 120$  (or  $150 \times 80\% = 120$ ).

*Part C:* The figures remain the same for all four years of the lease, so net income = 120.

*Part D:* The operating cash flow unrelated to the lease is 250, the lease payment is 100, and the taxes paid are 30, so the operating cash flow is  $250 - 100 - 30 = 120$  each year. The financing cash flow is zero, so the total cash flow is 120.

*Part E:* We use the following relations:

- Shareholders' equity = common stock + retained earnings.
- Common stock = 500 each year.
- The change in retained earnings each year = net income – shareholder dividends =  $120 - 0 = 120$ .
- Return on equity = net income / average shareholders' equity.

Shareholders' equity = 500 on 12/31/20X0, 620 on 12/31/20X1, and 740 on 12/31/20X2.

- 20X1: ROE =  $120 / ((500 + 620) / 2) = 21.43\%$



- 20X2:  $ROE = 120 / ((620 + 740) / 2) = 17.65\%$

*Part F:* The firm has long-term debt of 100 each year.

- 12/31/20X1: debt-to-equity ratio =  $100 / 620 = 0.1613$
- 12/31/20X2: debt-to-equity ratio =  $100 / 740 = 0.1351$

Final exam problems ask for the interest expense, depreciation, and return on equity in each year and for the lease liability and debt-to-equity ratio at each year-end, using the methods in the textbook. The procedures are explained in the practice problem below.

Exercise 11.4: Finance lease – accounting entries, cash flows, financial ratios

- On December 31, 20X0, the firm takes a four-year lease on equipment.
- The lease payments are 100 *per annum*, payable on January 1, 20X1, 20X2, 20X3, and 20X4.
- The firm's capitalization rate is 8% *per annum*.

The firm has debt of 100 on December 31, 20X0. Each year in 20X1–20X4, it has net revenue minus non-lease expenses of 250. For the cash flow exhibits, assume all non-lease revenue and expenses are cash. The tax rate is 20%. The firm pays no shareholder dividends, so net income accumulates in retained earnings.

On December 31, 20X0, the firm has common stock of 500 and no retained earnings. In subsequent years, retained earnings change from the lease expenses and the other net revenue.

If the lease is included:

- A. What are assets on December 31, 20X0?
- B. What are liabilities on December 31, 20X0?
- C. What is lease expense in 20X1?
- D. What is depreciation expense in 20X1?
- E. What is interest expense in 20X1?
- F. What is accrued interest on December 31, 20X1?
- G. What is pre-tax income in 20X1?
- H. What are assets on December 31, 20X1?
- I. What are liabilities on December 31, 20X1?
- J. What is the return on assets in 20X1?
- K. What is the debt to equity ratio on December 31, 20X1?
- L. What are pre-tax operating and financing cash flows in 20X1?

*Part A:* This exercise (like example 19 in the textbook) has lease payments at the beginning of the year. The present value calculations for the beginning of the year are not a problem for actuarial candidates, but two items are more complex:

- The interest expense each year is accrued interest, which is paid on the first day of the following year.
- The interest expense and the reduction in the lease obligation each year are based on the lease obligation after the payment on January 1.

This exercise covers the simpler parts of lease accounting. A later exercise with the same data covers all the items tested on the final exam.

At inception, for finance leases, the fair value of the equipment = the lease obligation = the present value of the lease payments. The equation below uses four payments at the beginning of the year.

$$100 \times (1.08^{-0} + 1.08^{-1} + 1.08^{-2} + 1.08^{-3}) = 357.71$$

On December 31, 20X0, the firm has liabilities (debt) of 100 and shareholders' equity of 500 (common stock), so its assets on December 31, 20X0 are  $100 + 500 = 600$ .

The firm's assets on December 31, 20X0 =  $600 + 357.71 = 957.71$

*Question:* Why does this practice problem use the lease inception date as December 31, 20X0, but the first lease payment as January 1, 20X1?

*Answer:* In truth, the first lease payment should be the same date as the inception of the lease. The practice problem uses separate days to distinguish

- the lease obligation before the first lease payment from
- the lease obligation after the first lease payment.

For an operating lease, no asset is reported, so the firm's assets on December 31, 20X0 = 600.

*Part B:* At inception, for finance leases, the lease obligation = the lease asset = 357.71, so the firm's liabilities on December 31, 20X0 =  $100 + 357.71 = 457.71$

For an operating lease, no lease obligation is reported, so the firm's liabilities on December 31, 20X0 = 100.

*Part C:* Lease expense for operating leases is the annual lease payment = 100. Finance leases do not show lease expense.

*Question:* Is the lease expense the same whether it is paid at the beginning or end of the year? A payment at the end of the year is worth less than the same payment at the beginning of the year. Should financial statements show the fair value of the payment?

*Answer:* For most accounting entries, IFRS and GAAP do not consider the time of the payment. Even for fair value measurements, a fair value of 100 on 1/1/20X1 is reported the same way as a fair value of 100 on 1/1/20X9. One exception in the textbook is translation adjustments for hyper-inflationary economies.

The accounting boards know that adding values from different dates is not always consistent with economic values. Inventory and equipment may be bought at different times, but the balance sheet shows a single total.

IFRS allows firms to re-measure most assets at fair value. But depreciated cost is simpler than remeasuring assets each year, so most firms use depreciated cost.

The amount of lease payment depends on when it is paid. If the lease payments are made at the beginning of the year instead of at the end of the year, the real values of these payments differ. The accrued interest in these exercises assumes the interest rate is in arrears.

*Part D:* Depreciation expense is the lease asset / number of years of the lease.

- For the finance lease, this is  $357.71 / 4 = 89.43$
- An operating lease shows no depreciation expense.

*Question:* In subsequent years, does the lease obligation also decrease by straight line depreciation?

*Answer:* No; the lease obligation decreases by the amount of principal repaid (as shown below).

*Part E:* An operating lease shows no interest expense. For the finance lease, the interest expense is the lease obligation  $\times$  the discount rate.

The lease obligation on December 31, 20X0, is 357.71. On January 1, 20X1, the firm pays 100, so the lease obligation in 20X1 is  $357.71 - 100 = 257.71$ . The interest expense in 20X1 is  $257.71 \times 0.08 = 20.6168$ .

*Part F:* The interest expense of 20.6168 for the finance lease in 20X1 is not yet paid by December 31, 20X1.

- The accrued interest in 20X0 is zero.
- The accrued interest in 20X1 is 20.6168.
- The interest paid in 20X1 is zero.

The interest expense in 20X1 is the interest paid + the change in the accrued interest = 20.6168.

*Part G:* Pre-tax income besides the lease is 250. Including the lease, pre-tax income is

- Operating lease:  $250 - 100$  (lease expense) = 150
- Finance lease:  $250 - 89.43$  (depreciation expense) – 20.6168 (interest expense) = 139.9532

*Part H:* Without the lease, pre-tax income for 20X1 is 250, so net income is  $250 \times (1 - 20\%) = 200$ , and assets are  $600 + 200 = 800$  at December 31, 20X1.

- With an operating lease, the firm has no other assets.
- With a finance lease, the firm has a leased asset with a carrying value of  $357.71 - 357.71 / 4 = 268.28$

Total assets including the leased asset are  $800 + 268.28 = 1,068.28$

*Question:* What about interest income on the firm's cash balances, interest expense on the firm's debt, and tax effects on these two items?

*Answer:* The exercise assumes the non-lease net revenue minus expenses covers these items.

*Part I:* An operating lease has no lease obligations, so the liabilities at December 31, 20X1, are 100.

For a finance lease, the lease obligation at December 31, 20X1, is the present value of the remaining lease payments:

$$100 \times (1.08^0 + 1.08^{-1} + 1.08^{-2}) = 278.33$$

The accrued interest at December 31, 20X1, is 20.6168.

The total liabilities at December 31, 20X1, are  $100 + 278.33 + 20.6168 = 398.9468$

*Part J:* The return on equity is net income / average shareholders' equity. Pre-tax income is

- Operating lease:  $250 - 100$  (lease expense) = 150
- Finance lease:  $250 - 89.43$  (depreciation expense) – 20.6168 (interest expense) = 139.9532

Net income is

- Operating lease:  $150 \times (1 - 20\%) = 120$ .
- Finance lease:  $139.95 \times (1 - 20\%) = 111.9626$

Shareholders' equity on December 31, 20X1, is

- Operating lease:  $500 + 120 = 620$ .
- Finance lease:  $500 + 111.9626 = 611.9626$

Average shareholders' equity for 20X1 is

- Operating lease:  $(500 + 620) / 2 = 560$
- Finance lease:  $(500 + 611.9626) / 2 = 555.9813$

Return on equity for 20X1 is

- Operating lease:  $120 / 560 = 21.43\%$
- Finance lease:  $111.9626 / 555.9813 = 20.14\%$

The finance lease asset = 357.71 on December 31, 20X0, which depreciates to  $357.71 \times 75\% = 268.28$  on December 31, 20X1. Average assets in 20X1 are

- Operating lease: 600
- Finance lease:  $600 + (357.71 + 268.28)/2 = 913.00$

*Part K:* For an operating lease, the debt to equity ratio is  $100 / 620 = 0.16129$

For a finance lease, the firm has two additional liabilities: a lease obligation and accrued interest.

A finance lease is like a loan from the lessor, so it is considered debt. The accrued interest in this example is the textbook's method of explaining the interest expense. The lessee (the firm) might be surprised to hear that it has an accrued interest liability, since it paid the lease payment at the beginning of the year. But the textbook assumes that

- the accrued interest was paid up front
- the rest of the lease payment reduces the lease liability
- the accrued interest for the year is added to the lease liability

*Question:* What is the correct accounting for the finance lease? Was interest paid in 20X1 equal to zero and the firm has an accrued interest liability at the end of the year, or was interest paid at the beginning of the year and the firm has a higher lease liability at the end of the year?

*Answer:* IFRS and GAAP do not specify the accounting details, except in certain cases. The standards are principles-based; the details are left to the reporting entities. The practice problems here use the methods in the textbook. Accounting for finance leases is complex, and analysts differ on how to compute return on equity or return on assets with a finance lease.

Example 19 in the textbook assumes the liabilities are debt. A finance lease is equivalent to taking a loan to buy the asset, so the lease liability is the principal on the loan.

Total debt =  $100 + 278.3268$  (lease obligation) +  $20.6168$  (accrued interest) =  $398.9436$

The debt to equity ratio is  $398.9436 / 611.9626 = 65.19\%$

*Part L:* For an operating lease, the lease expense is an operating cash flow. The net revenue in this practice problem is cash, so the pre-tax operating cash flow is  $250 - 100 = 150$ . Taxes are an operating cash outflow, so the after-tax operating cash flow is  $150 \times (1 - 20\%) = 120$ .

For a finance lease, the portion of the lease payment that reduces the lease obligation is a financing cash flow, and the portion of the lease payment considered to be interest expense is an operating cash flow for GAAP and either an operating cash flow or a financing cash flow for IFRS.

The lease obligation declines from 357.71 on December 31, 20X0, to 278.33 on December 31, 20X1:

$357.71 - 278.33 = 79.38 =$  a financing cash flow for both GAAP and IFRS.

The rest of the lease payment is  $100 - 79.28 = 20.72 =$  the interest expense, which is an operating cash flow for GAAP and either a financing cash flow or an operating cash flow for IFRS.

### Exhibits for leases

The lease obligation and accrued interest for each year of the finance lease are shown below. The table here follows Example 19 in the textbook; the final exam problems on finance leases use similar data.

<i>Year</i>	<i>Lease Payment</i>	<i>Accrued Interest</i>	$\Delta(\textit{lease Liability})$	<i>Lease Liability</i>
20X0				357.71
20X1	100.00	20.62	79.38	278.33
20X2	100.00	14.27	85.73	192.59
20X3	100.00	7.41	92.59	100.00
20X4	100.00	0.00	100.00	0.00
Total		42.29	357.71	

1. The lease payment is at the beginning of the year.
2. The accrued interest is the capitalization rate (8% here)  $\times$  (the lease liability at the end of the previous year minus the lease payment at the beginning of the current year).
  - a. For 20X1,  $8\% \times (357.71 - 100) = 20.62$ .
3. The change in the lease liability is the lease payment minus the accrued interest.
  - a. For 20X1,  $100 - 20.62 = 79.38$ .
4. The lease liability at the end of the year is the lease liability at the end of the previous year minus the change in the lease liability.
  - a. For 20X1,  $357.71 - 79.38 = 278.33$ .

### Accounting for lease expenses

- The operating lease shows a lease payment each year of 100 in this practice problem.
- The finance lease shows depreciation expense of 89.4275 each year and interest expense of  $8\% \times$  the lease liability remaining after the lease payment of 100 at the beginning of the year.

Total expenses for all years combined equal the total cash paid out. The cash paid does not depend on the accounting system, so total expenses for all years combined do not depend on the type of lease. (The 0.01 difference is a rounding error.)

Year	Operating lease		Finance lease	
	Lease Payment	Interest Expense	Depreciation	Difference
20X1	100.00	20.62	89.43	10.05
20X2	100.00	14.27	89.43	3.70
20X3	100.00	7.41	89.43	-3.16
20X4	100.00	0.00	89.43	-10.57
Total		42.30	357.71	0.01

Total expenses are higher for the finance lease in 20X1 and 20X2 and lower in 20X3 and 20X4.

*Question:* Why are total expenses for the finance lease higher in the early years and lower in the later years?

*Answer:* The leased asset is most valuable when it is new (in the early years) and least valuable when it is old (in the later years). If the lease expense and the depreciation reflected the true value of the leased asset, they would be higher in the early years and lower in the later years. They would show a pattern similar to that of interest expense: high in the first year and decreasing each subsequent year.

Straight line depreciation spreads the cost of an asset evenly over its estimated useful life. Compared to the change in the fair value of the asset, depreciation expense is too low in early years and too high in later years.

A lease contract spreads the cost of leasing the asset evenly over the life of the lease. Compared to the true value of using the asset, lease expense is too low in the early years and too high in the later years.

The operating lease spreads the entire cost of the asset evenly over the years of its life. The finance lease spreads only the depreciation expense evenly over the years; the interest expense remains higher in the early years and lower in the later years. The operating lease does more spreading, so its total expenses are lower in the early years and higher in the later years compared to the total expenses of the finance lease.

Similarly, the textbook explains that accelerated depreciation, such as double declining balance depreciation, allocated more of the depreciation to the early years, when the assets contributes more value to the firm, and less to the later years, when the asset contributes less value to the firm.

### Net income with leases

To compute net income, cash flows, and financial ratios, we add a tax rate. The lease parameters give pre-tax income; the tax rate gives tax expense, after-tax income, taxes paid, and operating cash flow.

Profitability, solvency, and leverage ratios use after-tax figures. If the firm has the lease and no other revenue, its net income is negative, its operating cash flow is negative, and its financial ratios are not meaningful. We add a constant net revenue (unrelated to the lease) to all years, so net income and operating cash flow are positive. To compute financial ratios, we assume beginning assets, liabilities, and shareholders' equity. We assume the tax classification of the lease is the same as the financial classification, and the tax depreciation schedule is the same as the financial depreciation schedule.

Pre-tax income is the income unrelated to the lease minus the lease expenses. The tax rate is the same for all years: net income = pre-tax income  $\times$  (1 – tax rate). This practice problem uses a tax rate of 20%.

- A finance lease has higher expenses than an operating lease has in the early years, lower pre-tax income, lower tax expense, and lower net income.
- A finance lease has lower expenses than an operating lease has in the later years, higher pre-tax income, higher tax expense, and higher net income.

For all years combined, pre-tax income, tax expense, and net after-tax income are the same for an operating lease and a finance lease. Financial accounting rules affect financial statements but do not affect the firm's total cash flows or its true profitability. The accounting rules affect the recognition of income by year and the classification of the cash flows (operating vs financing vs investing), not the economic value of the income.

Tax accounting affects the taxes paid and the cash flows. Paying taxes earlier increases the present value of the tax liability and reduces the real value of the firm.

The tables below show income, cash flows, and financial ratios, with years along the horizontal axis.

- At December 31, 20X0, liabilities (debt) = 100 and shareholders' equity = 500.
- Net revenue is 250 *per annum*, all in cash, with no expenses (besides those of the lease).
- Depreciation of the leased asset each year is one quarter of the present value of the lease payments (on January 1, 20X1) at an 8% discount rate. The straight line depreciation expense is the same each year.
- Interest expense is the discount rate times the lease obligation remaining after the lease payment on January 1 of each year. As the lease obligation declines, the interest expense declines.
- Pre-tax income is net revenue – depreciation expense – interest expense.
- Tax expense is the tax rate (20% here) times pre-tax income.
- Net income is pre-tax income minus the tax expense.

*Income statement entries for the finance lease:*

Year	20X1	20X2	20X3	20X4	Total
Net Revenue	250	250	250	250	1000
Depreciation	89.4275	89.4275	89.4275	89.4275	357.71
Interest Expense	20.6168	14.2661	7.4074	0	42.2903
Pre-tax Income	139.9557	146.3064	153.1651	160.5725	599.9997
Tax Expense	27.99114	29.26128	30.63302	32.1145	119.9999
Net Income	111.9646	117.0451	122.5321	128.458	479.9998



*Income statement entries for the operating lease:*

<i>Year</i>	<i>20X1</i>	<i>20X2</i>	<i>20X3</i>	<i>20X4</i>	<i>Total</i>
<i>Net Revenue</i>	250	250	250	250	1000
<i>Lease Expense</i>	100	100	100	100	400
<i>Pre-tax Income</i>	150	150	150	150	600
<i>Tax Expense</i>	30	30	30	30	120
<i>Net Income</i>	120	120	120	120	480

For the finance lease (compared to an operating lease), the interest expense is highest in the first year and declines each subsequent year. The depreciation expense is spread evenly over the years, so total expenses also decline each year.

For the operating lease, the lease expense (= total expenses) is spread evenly over the years. Accounting expenses for all year combined = expenses paid, which is the same for the operating lease and the finance lease, so the finance lease has higher expenses in the early years and lower expenses in the later years than the operating lease has.

Net income has the opposite pattern as expenses, since net revenue is the same for both types of lease.

### Cash flows for leases

Finance leases differ from operating leases by the income statement allocation of expenses to year. The total cash flows are not affected by these accounting rules, except for a slight difference in tax payments. But the classification of the cash flows differs by type of lease.

- For an operating lease, the lease expense is like a rent expense, so it is an operating cash outflow.
- For a finance lease, only the interest expense is an operating cash flow. The rest of the lease payment reduces the lease obligation, so it is a financing cash flow.

For most items, operating cash flows reflect the earning power of the firm. Most cash flow financial ratios in the textbook use operating cash flow, not total cash flow.

Financing cash flows stem from (i) issue and repayment of debt, (ii) issue and repurchase of stock, (iii) payment of shareholder dividends. A financing cash outflow means the firm returns money to investors and creditors, as some mature firms do. A financing cash inflow means the firm receives money from investors and creditors, as some growing firms do.

In general, firms prefer operating cash inflows. Converting a finance lease to an operating lease raises the operating cash flow.

#### Cash flows for the finance lease:

Year	20X1	20X2	20X3	20X4	Total
Net Revenue (cash)	250	250	250	250	1000
Interest payments	0	20.6168	14.26614	7.407436	42.29038
Taxes paid	27.99114	29.26127	30.63301	32.11449	
Operating cash flow	222.0089	200.1219	205.1009	210.4781	837.7097
Paid to reduce lease liability	-100	-79.3832	-85.7339	-92.5926	-357.71
Financing cash flow	-100	-79.3832	-85.7339	-92.5926	-357.71
Total cash flow	122.0089	120.7387	119.367	117.8855	480

#### Cash flows for the operating lease:

Year	20X1	20X2	20X3	20X4	Total
Net Revenue (cash)	250	250	250	250	1000
Lease payments	100	100	100	100	400
Taxes paid	30	30	30	30	120
Operating cash flow	120	120	120	120	480
Paid to reduce lease liability	0	0	0	0	0
Financing cash flow	0	0	0	0	0
Total cash flow	120	120	120	120	480

A finance lease is like borrowing money and buying the asset, so the cash flows for the finance lease are the same as the cash flows for borrowing cash and buying the asset, with one difference. If the firm borrows cash

and buys the asset, it reports a financing cash inflow and an offsetting investing cash outflow. For a finance lease, the initial cash inflow and cash outflow are with the same party (the lessor), so no cash trades hands.

- For a finance lease, the cash paid to reduce the lease obligation is like cash paid to reduce the principal of a loan: a financing cash flow.
- For an operating lease, the lease payment is like a rental payment: an operating cash flow.

### *Financial ratios for leases*

A finance lease (compared to an operating lease) lowers the firm's reported return on equity and return on assets and raises the firm's debt-to-equity ratio. Both effects are greatest in the first year of the lease, and they gradually disappear as the lease matures. If capital markets were perfectly efficient, financial analysts would "see through" the accounting complexities and re-interpret financial ratios. But converting reported operating leases to finance leases (as explained in the textbook) takes time and is not done by most analysts.

Profitability measures, such as return on equity and return on assets, sometimes affect management bonuses. Even if the classification of leases does not influence financial analysts, it affects profitability measures and management behavior.

A finance lease (compared to an operating lease) defers pre-tax income, defers the tax payment, and reduces the present value of the tax liability, though the nominal taxes paid over all years combined does not change. Firms generally prefer to defer taxes and reduce the present value of the tax liability. But this increase is slight, especially when interest rates are low.

The textbook says that many firms prefer to classify leases as operating, not finance. In some cases, the firm effectively owns the leased asset and uses the lease as a means of financing. The firm might own the leased asset at inception, but it sells the asset to a leasing company and uses it under an operating lease.

The tables below show returns on equity and debt-to-equity ratios for a finance lease and an operating lease. The tables assume

- The firm begins with 100 of other debt and 500 of shareholders' equity on December 31, 20X0.
- The firm has other pre-tax income of 250 each year.

The lease begins on January 1, 20X1, so the entries are zero for the 20X0 column except for total liabilities and shareholders' equity. The tables use the same row labels as the textbook does, so total liabilities refers to debt liabilities, not net working capital like accounts payable and accrued expenses.

The lease obligation (also called lease liability) for a finance lease is like a loan, so it is included in total debt. The accrued interest is considered in the textbook part of the loan liability, so it is also included in total debt.

*Illustration:* In 20X1, the total debt is  $100 + 278.3268 + 20.6168 = 398.9436$ .

Net Income (during the year) is taken from the income statement entries. For the finance lease in 20X1:

- $250$  (net revenue besides the lease)  $- 89.4275$  (depreciation expense)  $- 20.6168$  interest expense =  $139.9557$  (pre-tax income)
- $139.9557 \times (1 - 20\%) = 111.9646$  (net income)

The table assumes the firm pays no shareholder dividends and retained earnings before 20X1 are zero, so retained earnings at December 31, 20X1, are 111.9646. Retained earnings are a cumulative account, so they increase each year if net income is greater than shareholder dividends.

The table assumes the firm's common stock is 500 (book value). Shareholders' equity at the end of the year is retained earnings + the book value of common stock:  $500 + 111.9646 = 611.9646$

Return on equity is the net income during the year divided by *average* shareholders' equity during the year:

$$111.9646 / ((500 + 611.9646) / 2) = 20.14\%$$

The debt-to-equity ratio is determined at the balance sheet date, using the year-end figures. The debt-to-equity ratio for December 31, 20X1, is  $398.9436 / 611.9646 = 0.6519$

*Financial ratios for the finance lease:*

December 31, (Year)	20X0	20X1	20X2	20X3	20X4
Lease obligation	0	278.3268	192.5929	100	0
Accrued interest	0	20.6168	14.2661	7.4074	0
Total liability	100	398.9436	306.859	207.4074	100
Net Income (during year)		111.9646	117.0451	122.5321	128.458
Retained earnings	0	111.9646	229.0097	351.5418	479.9998
Common stock	500	500	500	500	500
Shareholders' equity	500	611.9646	729.0097	851.5418	979.9998
Return on equity (year)		0.201382	0.174567	0.15505	0.140273
Debt-to-equity ratio		0.651906	0.420926	0.243567	0.102041

*Financial ratios for the operating lease:*

<i>December 31, (Year)</i>	<i>20X0</i>	<i>20X1</i>	<i>20X2</i>	<i>20X3</i>	<i>20X4</i>
<i>Total liability</i>	100	100	100	100	100
<i>Net Income (year)</i>		120	120	120	120
<i>Retained earnings</i>	0	120	240	360	480
<i>Common stock</i>	500	500	500	500	500
<i>Shareholders' equity</i>	500	620	740	860	980
<i>Return on equity (year)</i>		0.214286	0.176471	0.15	0.130435
<i>Debt-to-equity ratio</i>		0.16129	0.135135	0.116279	0.102041

The operating lease has no lease obligation, so total debt remains 100 each year.

- Pre-tax income each year is  $250 - 100$  (lease expense) = 150.
- Net income =  $150 \times (1 - 20\%) = 120$ .

Retained earnings and shareholders' equity increase by 120 each year.

- The return on equity for 20X1 is  $120 / ((500 + 620) / 2) = 21.43\%$ .
- The debt-to-equity ratio at year-end 20X1 is  $100 / 620 = 0.1613$ .

Basic earnings per share and diluted EPS are prescribed by IFRS and GAAP. Other financial ratios may vary by analyst. The return on equity may be a return on average equity or a return on beginning equity. Some ratios may be for a specific balance sheet date or an income statement year. The final exam problems

- use the definitions in the textbook, or
- specify a ratio for a year (meaning the average of beginning and end of the year) or for a specific date.