Midterm exam 2026–2027

Use the course formulas for ratios, discounting, annuities and NPV. Unless stated otherwise, cash flows occur at year-end and rates are effective annual rates. Final monetary results are rounded to two decimals; calculations retain unrounded intermediate values.

A. Multiple choice questions (8 points)

Each question is worth 1 point and may have one or more correct answers. Select all correct answers. You receive 1 point only if your selection contains all and only the correct answers; otherwise you receive 0. There are no negative points.

1. Which transactions provide new financing directly to a company?

A. A bank grants the company a new loan.
B. An investor buys existing shares from another investor on a stock exchange.
C. The company issues new shares to investors.
D. During an IPO, an investor purchases existing shares sold by the company's founder.

Answer. A and C. A new bank loan and newly issued shares bring funds into the company. Purchases of existing shares pay the selling shareholder, including when a founder sells existing shares during an IPO.

2. A bank finances seven-year fixed-rate loans with deposits that customers can withdraw at any time. Which statements are correct?

A. A rise in market interest rates necessarily increases the market value of its existing loans.
B. It may need to sell long-term assets at a loss if many depositors withdraw at once.
C. Its assets must be worthless whenever it cannot immediately meet withdrawal requests.
D. It can face a liquidity crisis even if the value of its assets exceeds its liabilities.

Answer. B and D. Deposits can be withdrawn before the long-term loans mature. Large withdrawals may force sales at a loss. A bank can lack immediate cash even when its assets exceed its liabilities. Higher market rates lower the present value of the fixed loan receipts.

3. A machine cost EUR 84,000. Accumulated depreciation is EUR 31,500 and its current resale price is EUR 61,000. No other accounting adjustment has occurred. Which statements are correct?

A. Its historical cost is EUR 84,000.
B. Its book value is EUR 61,000.
C. Its current market value is EUR 31,500.
D. Its book value is EUR 52,500.

Answer. A and D. Historical cost is EUR 84,000; market value is EUR 61,000.

$$\text{Book value} = \text{Historical cost} - \text{Accumulated depreciation} = 84{,}000 - 31{,}500 = \boxed{\text{EUR } 52{,}500.00}.$$

4. A firm with no debt reports annual net income of EUR 96,000, depreciation of EUR 18,000, capital expenditure of EUR 47,000 and an increase in non-cash working capital of EUR 13,000. What is its cash flow after investment?

A. EUR 96,000.
B. EUR 114,000.
C. EUR 67,000.
D. EUR 54,000.

Answer. D. For this debt-free firm,

$$\begin{aligned} CF &= \text{Net income} + \text{Depreciation} - \text{Capital expenditure} - \Delta\text{Non-cash working capital} \\ &= 96{,}000 + 18{,}000 - 47{,}000 - 13{,}000 = \boxed{\text{EUR } 54{,}000.00}. \end{aligned}$$

Add back non-cash depreciation; subtract investment and the cash absorbed by working capital.

A. Multiple choice questions (continued)

5. Three deposits have the same positive quoted annual rate of 4.8%, with annual, semi-annual or continuous compounding. There are no fees. For money invested today for one year, which statements are correct?

A. All three deposits produce the same future value.
B. Semi-annual compounding produces a larger future value than annual compounding.
C. Continuous compounding produces a smaller future value than semi-annual compounding.
D. Semi-annual compounding produces a future value equal to $PV \times (1.024)^2$.

Answer. B and D. With quoted annual rate r, compounding m times per year gives $FV = PV(1 + r/m)^{mt}$; continuous compounding gives $FV = PVe^{rt}$. Over one year,

$$\frac{FV_{\text{annual}}}{PV} = 1.048, \qquad \frac{FV_{\text{semi}}}{PV} = (1.024)^2 = 1.048576, \qquad \frac{FV_{\text{cont}}}{PV} = e^{0.048} \approx 1.049171.$$

Thus $FV_{\text{annual}} < FV_{\text{semi}} < FV_{\text{cont}}$.

6. A contract pays EUR 840 at t = 1, then an annual payment growing by 1.5% forever. The discount rate is 6.5%. What is its present value at t = 0?

A. EUR 12,923.08.
B. EUR 16,800.
C. EUR 17,052.
D. The present value is infinite.

Answer. B. Use the growing-perpetuity formula, with $C_1 = 840$ and $r > g$:

$$PV_0 = \frac{C_1}{r - g} = \frac{840}{0.065 - 0.015} = \boxed{\text{EUR } 16{,}800.00}.$$

The EUR 840 is already the first payment; do not multiply it by $1 + g$.

7. A default-free zero-coupon bond pays EUR 1,250 in seven years. Its market yield rises from 3% to 5.5%. Which statements are correct?

A. Its price falls.
B. Its promised payment at maturity rises to EUR 1,318.75.
C. Its price is unchanged because the promised payment is fixed.

Answer. A only. A zero-coupon bond is worth $P_0 = F/(1+r)^T$. With seven years remaining in both valuations,

$$P_{\text{before}} = \frac{1{,}250}{1.03^7} = \text{EUR } 1{,}016.36, \qquad P_{\text{after}} = \frac{1{,}250}{1.055^7} = \text{EUR } 859.30.$$

The promised maturity payment remains EUR 1,250. B is false because a change in market yield does not change the promised payment. C is false because fixed promised cash flows can change in present value.

8. A project requires one initial outflow followed only by positive cash flows. Its unique IRR is 16%. Expected cash flows remain unchanged, but the required return rises from 11% to 19%. Which statements are correct?

A. The project's IRR rises to 19%.
B. Its NPV at the new required return is positive.
C. Its IRR remains 16%.
D. It must be accepted because its IRR is positive.

Answer. C only. The IRR solves

$$0 = CF_0 + \sum_{t=1}^{T} \frac{CF_t}{(1 + \text{IRR})^t}.$$

It depends on the cash flows, so it remains 16%. For one initial outflow followed only by positive receipts, NPV decreases with the required return. Since $19\% > 16\%$, the new NPV is negative: reject the project.

B. Exercise 1 - Profitability and liquidity (2 points)

ReUse Bikes is a fictional bicycle-repair company. Its simplified data are below (EUR thousands). Use year-end values for all ratios. The current-asset categories shown are exhaustive.

Item	2025	2026
Cash	72	63
Accounts receivable	168	189
Inventories	240	378
Total current assets	480	630
Total current liabilities	240	315
Total assets	960	1,260
Total equity	480	630
Annual net sales	1,440	1,764
Annual net income	72	105.84

a. *Calculate the current ratio and the quick ratio in each year.* (*1 point*)

Answer. The course defines

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}, \qquad \text{Quick ratio} = \frac{\text{Cash} + \text{Receivables}}{\text{Current liabilities}}.$$

There are no marketable securities in the exhaustive asset categories given.

	2025	2026
Current ratio	$480/240 = \boxed{2.00}$	$630/315 = \boxed{2.00}$
Quick ratio	$(72+168)/240 = \boxed{1.00}$	$(63+189)/315 = \boxed{0.80}$

b. *The manager argues: "The current ratio is unchanged, so our short-term liquidity is unchanged." Evaluate this statement.* (*0.5 points*)

Answer. The statement is too strong. The unchanged current ratio masks growing inventories and a quick ratio falling from 1.00 to 0.80. Readily liquid assets cover a smaller share of current liabilities. This signals weaker liquidity, although sector context and the timing of receipts and payments are needed to conclude whether default is likely.

c. *For 2026, calculate the net profit margin and total asset turnover. Use them to obtain the return on assets.* (*0.5 points*)

Answer. Using year-end assets, as requested,

$$\text{Net profit margin} = \frac{\text{Net income}}{\text{Net sales}} = \frac{105.84}{1{,}764} = \boxed{6.00\%},$$

$$\text{Total asset turnover} = \frac{\text{Net sales}}{\text{Total assets}} = \frac{1{,}764}{1{,}260} = \boxed{1.40},$$

$$\text{ROA} = \text{Net profit margin} \times \text{Total asset turnover} = 0.06 \times 1.40 = \boxed{8.40\%}.$$

Check: $105.84/1{,}260 = 8.40\%$.

B. Exercise 2 - A service contract and a savings account (2 points)

A company can purchase the right to receive six annual net cash payments from a maintenance contract. The first payment is EUR 24,500 at t = 3. Subsequent payments grow by 2.5% per year, with the sixth and final payment at t = 8. The discount rate is 7.5%. The seller asks EUR 108,000 today.

a. *Calculate the present value of the contract at t = 0.* (*0.75 points*)

Answer. The six payments occur at $t = 3, 4, \ldots, 8$, with $C_t = 24{,}500(1.025)^{t-3}$. The course's growing-annuity formula gives the value *one period before the first payment*, hence at $t = 2$:

$$\begin{aligned} V_2 &= \frac{C_3}{r-g}\left[1-\left(\frac{1+g}{1+r}\right)^6\right] \\ &= \frac{24{,}500}{0.075-0.025}\left[1-\left(\frac{1.025}{1.075}\right)^6\right] = \text{EUR } 121{,}796.01, \\ V_0 &= \frac{V_2}{(1+r)^2} = \frac{V_2}{1.075^2} = \boxed{\text{EUR } 105{,}394.06}. \end{aligned}$$

Equivalently, $V_0 = \sum_{t=3}^{8} 24{,}500(1.025)^{t-3}/1.075^t$.

b. *Should the contract be purchased?* (*0.5 points*)

Answer.

$$\text{NPV} = V_0 - \text{Price} = 105{,}394.06 - 108{,}000 = \boxed{-\text{EUR } 2{,}605.94}.$$

Reject the purchase: the receipts are worth less today than the asking price.

c. *Independently of the contract, the company deposits EUR 12,500 today in an account paying a quoted annual rate of 5.2%, compounded semi-annually. There are no additional deposits or withdrawals. How much will be in the account at t = 4?* (*0.75 points*)

Answer. For a quoted annual rate r compounded m times per year,

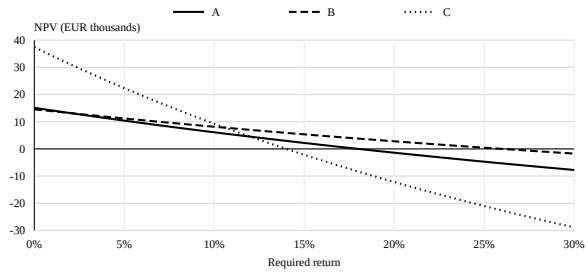
$$FV_t = PV\left(1+\frac{r}{m}\right)^{mt}.$$

The six-month rate is $0.052/2 = 2.6\%$ and there are $2 \times 4 = 8$ periods:

$$FV_4 = 12{,}500\left(1+\frac{0.052}{2}\right)^8 = \boxed{\text{EUR } 15{,}349.31}.$$

B. Exercise 3 - Reading NPV profiles (2 points)

The graph shows the NPV profiles of three independent projects. NPVs and cash flows are in EUR thousands. Project A costs 84 at t = 0 and generates 99.12 at t = 1; B costs 56 at t = 0 and generates 70.56 at t = 1; C costs 125 at t = 0 and generates 162.45 at t = 2. All other cash flows are zero. Reading approximate values from the graph is sufficient.



a. *Give the IRR of each project. What feature of the graph identifies an IRR?* (*0.75 points*)

Answer. IRR$(A) = 18\%$, IRR$(B) = 26\%$, IRR$(C) = 14\%$. Each is the discount rate where its NPV curve crosses the horizontal zero line.

b. *With no funding constraint, which projects should be accepted at a required return of 7.5%? Which should be accepted at 22.5%? Explain the decision rule.* (*0.75 points*)

Answer. Accept A, B and C at 7.5%; accept only B at 22.5%. Accept a project when its NPV at the required return is positive.

c. *At a required return of 7.5%, the company has an initial investment budget of EUR 181,000. Projects are indivisible and may each be undertaken at most once. Which project combination maximizes total NPV within this budget? Explain using the feasible combinations.* (*0.5 points*)

Answer. Choose B and C. Their combined initial cost is $56 + 125 = 181$ (EUR thousands), with total NPV about 25.21. The only other feasible pair is A+B, costing 140, with total NPV about 17.84. A+C costs 209 and is infeasible. Each single project has a lower NPV than B+C, and all three cost 265.

C. Problem - Should Renault expand vehicle reconditioning? (6 points)

Renault announced the conversion of its Flins site into the Refactory in November 2020 and inaugurated a workshop for industrial used-vehicle reconditioning in November 2021. Reconditioning aims to extend the useful life of vehicles and parts.

Renault is considering an additional reconditioning line. All amounts in this problem are in EUR millions.

The line requires an investment of 14.80 today (t = 0). Net operating cash flow is 1.35 at the end of each of years 1 and 2. At t = 2, an additional equipment investment of 2.75 is paid alongside that year's operating receipt. Net operating cash flow then rises to 4.20 at the end of each year from t = 3 through t = 9 inclusive. There is no residual value or further cash flow after t = 9.

a. *Calculate the project's NPV at 8%. Should Renault undertake the project on financial grounds?* (*2 points*)

Answer. All calculations below are in EUR millions. Combine the two flows at $t = 2$:

Date t	0	1	2	3 through 9
Net project cash flow	-14.80	1.35	$1.35 - 2.75 = -1.40$	4.20 each year

The seven receipts from years 3–9 form an annuity valued at $t = 2$:

$$V_2 = \frac{4.20}{0.08}\left(1 - \frac{1}{1.08^7}\right) = 21.866754249.$$

Discount each flow to $t = 0$, using the course NPV formula:

$$\text{NPV}_0 = -14.80 + \frac{1.35}{1.08} - \frac{1.40}{1.08^2} + \frac{V_2}{1.08^2} = 3.996942943 \approx \boxed{+4.00}.$$

Accept: the project creates EUR 4.00 million in present value.

b. *Find the undiscounted payback period. Renault uses a five-year payback cutoff. Would this rule give the same decision as NPV? Explain one limitation of the payback period rule illustrated here.* (*0.75 points*)

Answer. Cumulative *undiscounted* cash flow, including both equipment investments, is:

End of year	0	1	2	3	4	5	6
Cumulative CF	-14.80	-13.45	-14.85	-10.65	-6.45	-2.25	1.95

The first non-negative total occurs at the **end of year 6**. The five-year cutoff **rejects** the project, unlike NPV. The cutoff disregards the valuable later receipts; payback also ignores the time value of money.

c. *A downside scenario lowers every operating receipt in years 3-9 by 30%; all earlier receipts, equipment costs and dates remain unchanged. Calculate the new NPV.* (*1 point*)

Answer. Only years 3–9 change: $4.20(1 - 0.30) = 2.94$ each year.

$$\begin{aligned}\text{NPV}_{\text{down}} &= -14.80 + \frac{1.35}{1.08} - \frac{1.40}{1.08^2} + \frac{1}{1.08^2}\frac{2.94}{0.08}\left(1 - \frac{1}{1.08^7}\right) \\ &= -1.627222244 \approx \boxed{-1.63}.\end{aligned}$$

The downside project is financially unattractive before financing.

C. Renault problem (continued)

Consider financing separately from the project. Two banks each offer 14.80 at t = 0. Bank A requires nine total payments of 2.30, at t = 1,...,9; these include all interest and principal, with no extra final payment. Bank B requires one total payment of 31.80 at t = 9 and no earlier payments. There are no fees. Use 8% as the discount rate for both repayment streams. Renault can meet either payment schedule from its other activities, so liquidity constraints do not prevent either choice.

d. *Calculate the NPV of each loan contract from Renault's perspective as borrower. Which offer is financially preferable?* (*1.5 points*)

Answer. From Renault's perspective, the initial loan proceeds are positive and repayments are negative. Using the course annuity and single-payment formulas,

$$\mathrm{NPV}_A = 14.80 - \frac{2.30}{0.08}\left(1 - \frac{1}{1.08^9}\right) = \boxed{+0.43},$$
$$\mathrm{NPV}_B = 14.80 - \frac{31.80}{1.08^9} = \boxed{-1.11}.$$

The repayment present values are 14.37 for A and 15.91 for B. Choose **Bank A**: with identical initial proceeds, it has the higher borrower NPV and lowers the present cost of repayments by **EUR 1.54 million**. These loan valuations are separate from the project NPV.

e. *Return to the downside project in part* (*c*)*, before financing. Suppose the project generates external environmental benefits valued at 0.45 per year, at the end of each year from t = 1 through t = 9. Use a discount rate of 8%. Assume there are no other external costs or benefits. Calculate the social NPV. Explain briefly how the private and social recommendations can differ, and why the environmental benefits should not simply be entered as Renault's cash receipts.* (*0.75 points*)

Answer. The external benefits form a nine-payment annuity beginning at $t = 1$:

$$PV_{\text{env}} = \frac{0.45}{0.08}\left(1 - \frac{1}{1.08^9}\right) = 2.811099560 \approx \boxed{2.81}.$$

Add these benefits to the NPV:

$$\mathrm{NPV}_{\text{social}} = \mathrm{NPV}_{\text{down}} + PV_{\text{env}} = -1.627222244 + 2.811099560 \approx \boxed{+1.18}.$$

The downside project is socially worthwhile, although Renault would privately reject it. The environmental benefits accrue outside Renault. They are not company cash receipts unless a policy or contract turns them into payments to Renault.