*Question 1.1: Net Present Value

A firm invests $200,000 in machinery that yields net after-tax cash flows of $90,000 at the end of each of the next three years. The opportunity cost of capital is 12%.

What is the net present value of the project (to the nearest thousand dollars)?

A. −$16,000
B. −$8,000
C. $0
D. $8,000
E. $16,000

Answer 1.1: E

The net present value problems take various forms. This problem gives after-tax cash flows. Other problems give pre-tax cash flows, tax rates, depreciation schedules, and so forth. The opportunity cost of capital is the after-tax rate.

~   If the exam problem does not specify whether the cash flows are pre-tax or after-tax, assume they are after-tax, unless the problem also gives a depreciation schedule.
~   If the cash flows are pre-tax and the exam problem does not specify a tax rate, assume the tax rate is 35%.

The net present value is −$200,000 + $90,000 / 1.12 + $90,000 / 1.12^2 + $90,000 / 1.12^3 = $16,165

*Question 1.2: Net Present Value

A firm invests $200,000 in machinery at time 0 that yields net after-tax cash flows of $20,000 at the end of each year (1, 2, 3, …) *in perpetuity*. The opportunity cost of capital is 12.5% per annum. What is the net present value of the project?

A. −$40,000
B. −$20,000
C. $20,000
D. $40,000
E. The net present value is infinite

Answer 1.2: A

The present value of a perpetuity is the annual cash flow divided by the annual discount rate:

$$\$20,000 / 12.5\% = \$160,000.$$

The net present value of the project is $160,000 − $200,000 = −$40,000.

*Question 1.3: Economic Depreciation

A firm invests $200,000 in machinery that yields net after-tax cash flows of $90,000 at the end of each of the next three years. The opportunity cost of capital is 12%.

What is the economic depreciation in year 3 (to the nearest thousand dollars)?

A. $50,000
B. $60,000
C. $70,000
D. $80,000
E. $90,000

Answer 1.3: D

We conceive of economic depreciation in the same fashion as accounting depreciation.

Accountants determine an asset's value as cost minus accumulated depreciation. The decrease in the asset's value during the accounting period is the depreciation.

Economists determine an asset's value as the present value of its future cash flows. The change in the future cash flows during the accounting period is the economic depreciation.

~ The future cash flows at the end of year 3 (after the third cash inflow) are zero.
~ The present value of the future cash flows at the end of year 2 are $90,000 / 1.12 = $80,357.14.
~ The economic depreciation is $80.357 – 0 = $80,357 ≈ $80,000.

*Question 1.4: Perpetual Cash Flows

An investment of $15,000 at time 0 produces *perpetual* cash flows of equal size each year at times 1, 2, 3, …. At a 12% market capitalization rate, the project has a net present value of zero. If the project's market capitalization rate declines to 11.5% and all the cash flows stay the same, what is the new net present value of this project?

A. −$650
B. −$350
C. $150
D. $350
E. $650

Answer 1.4: E

The project has a net present value of zero at a 12% market capitalization rate, so the annual cash flows are 12% × $15,000 = $1,800. At an 11.5% market capitalization rate, the net present value is $1,800 / 11% − $15,000 = $652.17 ≈ $650.

*Question 1.5: Real Dollar Cash Flows

The cash flows in real dollars are the nominal cash flows divided by the inflation rate. A cash flow two years hence divides by inflation for two years. A project's cash flows in *real terms* (current dollars) are as follows.

Year	Real Cash Flow
0	-4,500
1	4,000
2	2,000
3	1,000

If the firm's nominal discount rate is 12.3% per annum, and inflation is 8% per annum, what is the net present value of the project (to the nearest thousand dollars)? (Use a deflated discount rate to discount cash flows in real terms. The deflated discount rate is the nominal discount rate divided by the inflation rate.)

A. −$1,000
B. $1,000
C. $2,000
D. $3,000
E. $4,000

Answer 1.5: C

The real discount rate is the nominal discount rate divided by the inflation rate = 1.123 / 1.08 = 1.040. The present value of the cash flows is

Year	Real Cash Flow	PV (cash flows)
0	($4,500)	($4,500)
1	$4,000	$3,846
2	$2,000	$1,849
3	$1,000	$889
Total		$2,084

To the nearest thousand dollars, this is $2,000.

*Question 1.6: Cash Flows

An actuarial candidate is deciding whether to continue pursuing the exams. All but which of the following items should be considered?

A. The present value of the FSA designation
B. The opportunity value of time spent studying for future exams
C. The value of time spent studying for past exams in previous years
D. The probability of passing the remaining exams
E. The value of pursuing an alternative career

Answer 1.6: C

Only future cash flows are relevant to financial decisions, not sunk costs. Item C is a sunk cost.

One often hears candidates say: "I have spent two years studying and passed the first two exams. If I give up now, I lose the value of those two years of study."

This statement is not well worded. The candidate exchanged the years of study for two things: (i) a higher current salary and (ii) less time needed to achieve Fellowship. To decide whether to continue in this career, the candidate should consider the time needed to finish the exams, the value of the Fellowship, the time needed for an alternative career, and the value of an alternative career.