CORPORATE FINANCE PRACTICE EXAM PROBLEMS: ECONOMIC INCOME AND DEPRECIATION

(The attached PDF file has better formatting.)

*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 cash flows at –$200,000 at time 0, and +$90,000 each at times 1, 2, and 3.) The opportunity cost of capital is 12% per annum.

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 is –$200,000 + $90,000 × (1/1.12 + 1/1.12$^2$ + 1/1.12$^3$) = $16,164.81

*Question 1.2: Economic Depreciation

A firm invests $200,000 after-tax in machinery that yields net cash flows of $90,000 after-tax at the end of each of the next three years. (The cash flows at –$200,000 at time 0, and +$90,000 each at times 1, 2, and 3.) The opportunity cost of capital is 12% per annum.

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 1.2: D

*Economic depreciation* is the change in the present value of the project's *future* cash flows from the end of year 2, after the cash flow at time 2, to the end of year 3, after the cash flow at time 3.

● At the end of year 2, after the cash flow at time 2, the present value of future cash flows is $90,000 / 1.12 = $80,357.14 ≈ $80,000.
● At the end of year 3, after the cash flow at time 3, the present value of future cash flows is zero.

The difference is $80,357, which is approximately $80,000.

*Question 1.3: Economic Income

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 income *to the nearest thousand dollars* in year 3?

A.  $4,000
B.  $6,000

C. $8,000
D. $10,000
E. $12,000

Answer 1.3: D

Accountants define net after-tax income as net after-tax cash flows minus depreciation. We use the same definition for economic income, using economic depreciation.

The net after-tax cash flow in year 3 is $90,000. The economic depreciation is $80,357. The economic income is $90,000 – $80,357 = $9,643.

We verify by the relation that economic income equals the opportunity cost of capital times the present value of the project at the end of the second year:

$$(\$90,000 / 1.12) \times 12\% = \$9,642.86$$

*Question:* We have two definitions for economic income; are they the same?

*Answer:* Suppose we evaluate net income for year N. For simplicity, we assume all cash flows occur at the end of the year.

- Cash flows that occurred prior to year N are past history; they don't affect either definition of economic income.
- The cash flows that occur after year N can be replaced by a single cash flow in year N+1.

This has the same effect on both definitions.

We label the cash flows at years N and N+1 as $CF_N$ and $CF_{N+1}$. We label the opportunity cost of capital as R.

The economic depreciation in year N is $CF_N / (1+R) + CF_{N+1} / (1+R)^2 – CF_{N+1} / (1+R)$

The economic income in year N is

$$CF_N – [CF_N / (1+R) + CF_{N+1} / (1+R)^2 – CF_{N+1} / (1+R)] =$$
$$CF_N (1 – 1/(1+R)) + CF_{N+1} (1/(1+R) – 1/ (1+R)^2) =$$
$$(CF_N + CF_{N+1} /(1+R) ) \times (1 – 1/(1+R)) =$$
$$(CF_N + CF_{N+1} /(1+R) ) \times (R/(1+R)) =$$
$$(CF_N / (1+R) + CF_{N+1} /(1+R)^2 ) \times R$$

This is the present value of the project at the beginning of year N times the opportunity cost of capital.


*Question 1.4: Economic Income

A project with an initial after-tax investment of $250,000 returns $100,000 after-tax at the end of each of three years. The net present value of the project is zero. The project has no salvage value at the end of the three years.

A. Economic depreciation is highest in year 1; economic income is highest in year 3.
B. Economic depreciation is highest in year 1; economic income is highest in year 1.
C. Economic depreciation is highest in year 3; economic income is highest in year 3.
D. Economic depreciation is highest in year 3; economic income is highest in year 1.
E. Economic depreciation and economic income are the same in all three years.

Answer 1.4: D

For this solution, we examine the economic income first and then economic depreciation.

- The economic income each year is the present value of the *future* cash flows times the opportunity cost of capital for one year.
- The economic depreciation each year is the cash flow in the year minus the economic income.

The present value of the future cash flows decreases each year. The cost of capital doesn't change over the years, so the economic income decreases each year. The nominal cash flow is the same each year, so the economic depreciation increases each year.


*Question 1.5: Net Present Value

A firm invests $Y after-tax in machinery that yields net cash flows of $Z after-tax at the end of each of the next N years. The opportunity cost of capital is 12% per annum.

If the cost of capital increases to 15%, which of the following is true?

A. The NPV of the project increases, and the economic income in year N increases.
B. The NPV of the project increases, and the economic income in year N decreases.
C. The NPV of the project decreases, and the economic income in year N increases.
D. The NPV of the project decreases, and the economic income in year N decreases.
E. The NPV of the project increases, and the economic income in year N stays the same.

Answer 1.5: C

The NPV of the project *decreases*, since the present value of the future cash flows is lower.

The economic income in the last year is the present value of the last cash flow times the cost of equity capital, or $Z \times R / (1+R)$. Z is constant in this exercise. The function $(1+R)/R = 1 + 1/R$ is strictly decreasing as R increases, so the function $R/(1+R)$ is strictly increasing as R increases. Economic income increases as R increases, if Z doesn't change.