Calculation Example: Non-conventional Cash Flows and Multiple Feasible IRR's

Question: The mining firm has found ***another*** potential new gold mine on its property. The required return of the gold mine is 10% pa given as an effective annual rate. The after-tax cash flows are:

- $9m outflow to buy extra machinery needed to excavate the mine which will be delivered and paid for immediately (t=0).
- $13.9m inflow in one year (t=1) from gold sales.
- $10m inflow in two years (t=2) from gold sales.
- $15m outflow in two years (t=3) to clean up the mine and restore the natural environment.

Evaluate the project using the NPV and IRR methods.

Notice that there is a negative cash flow at the end of the project (t=3). This is a common type of non-conventional cash flow.

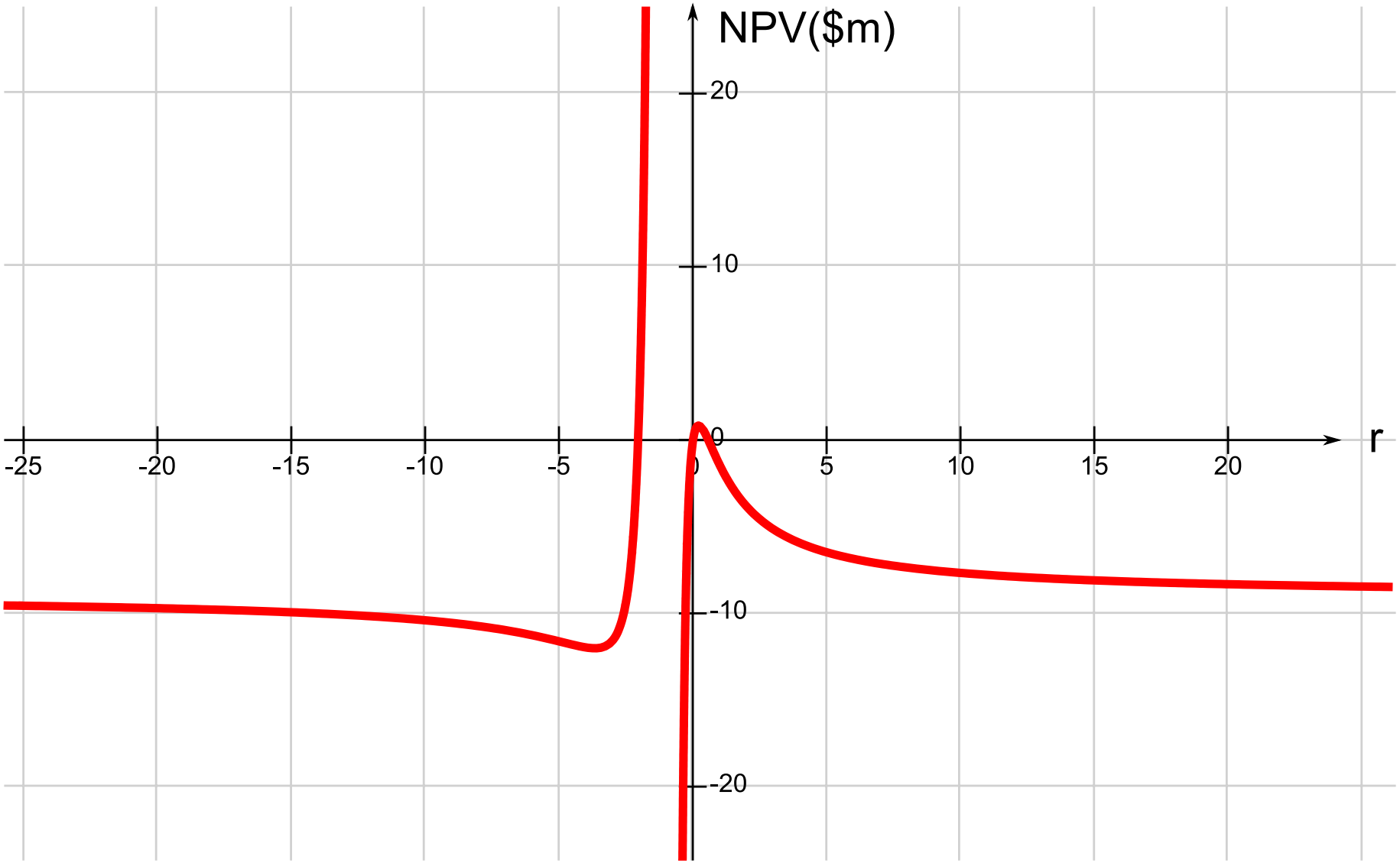
Answer: In this particular case there are actually 3 internal rates of returns! You can see them in the graph. The left-most IRR is unfeasible since it's less than -1. But the other two, 0.937% and 58.009% are perfectly feasible. So which one is the right one to compare to the 10% cost of capital?

Since the NPV is positive between 0.937% and 58.009%, the project should be accepted for any cost of capital between those rates. Therefore we should accept the project.

You can see that if we naively evaluated the IRR using a spreadsheet program's IRR function we may have been given a value of 0.937% and then rejected the project since it is less than the 10% required return. Of course, this would be the wrong thing to do.

In case you're interested, this is how the NPV vs discount rate graph looks like from a zoomed-out perspective and a close-up perspective.

Net Present Value (NPV) vs Discount Rate (r)



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