Definition 1

The rate of return is the interest rate earned on the unpaid balance of an amortized loan.

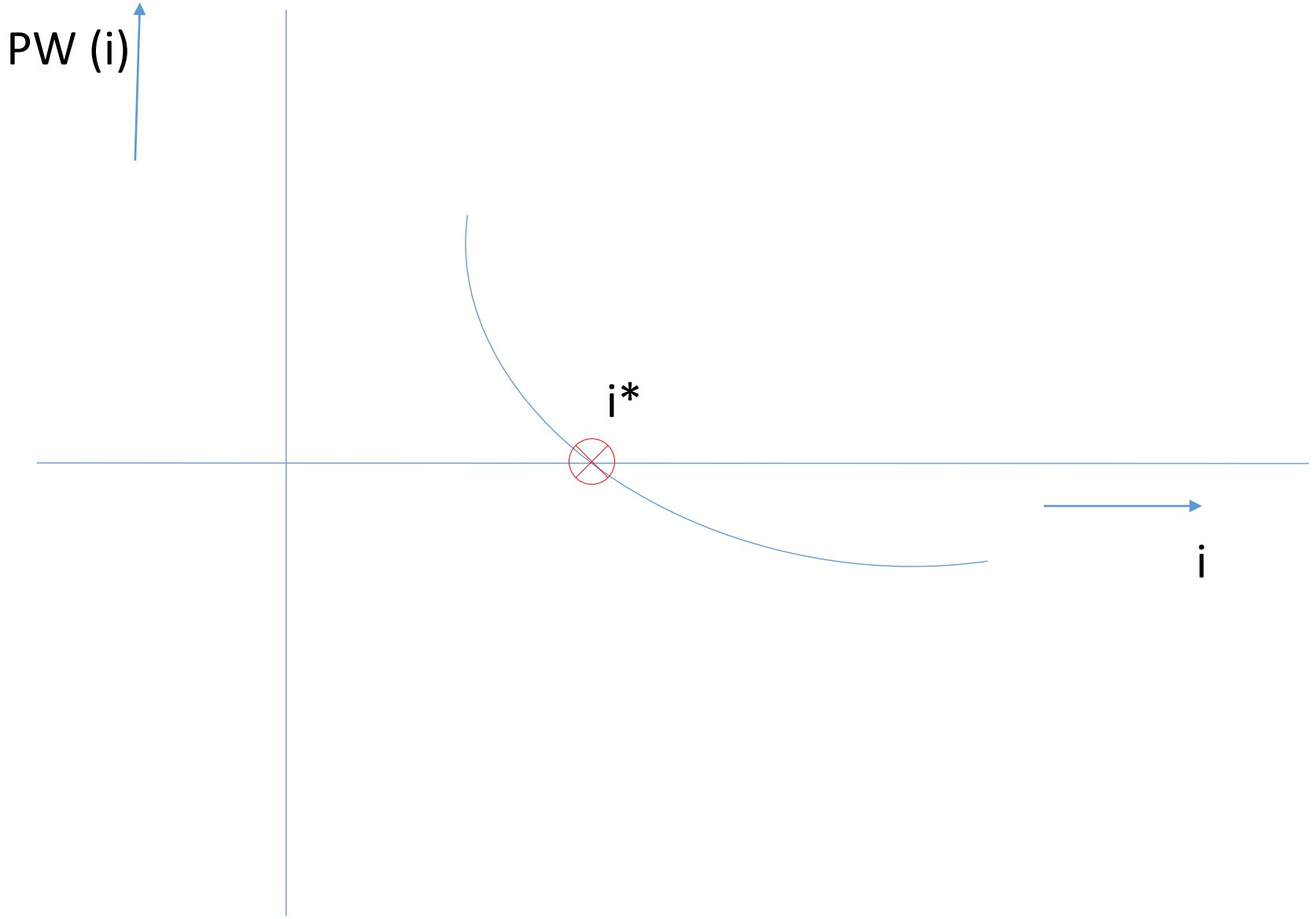
Definition 2

The rate of return is the break-even interest rate i^* that equates the present worth of a project's cash outflows to the present worth of its cash inflows, or

$$\begin{aligned} \text{PW}(i^*) &= \text{PW}_{\text{Cash inflows}} - \text{PW}_{\text{Cash outflows}} \\ &= 0. \end{aligned}$$

Definition 3

The internal rate of return is the interest rate charged on the unrecovered project balance of the investment such that, when the project terminates, the unrecovered project balance will be zero.


PW (i)
i*
i

DECISION CRITERIA

If IRR $>$ MARR, accept the project.

If IRR $=$ MARR, remain indifferent.

If IRR $<$ MARR, reject the project.

Trial-and-Error Method

The Imperial Chemical Company is considering purchasing a chemical analysis machine worth $13,000. Although the purchase of this machine will not produce any increase in sales revenues, it will result in a reduction of labor costs. In order to operate the machine properly, it must be calibrated each year. The machine has an expected life of six years, after which it will have no salvage value. The following table summarizes the annual savings in labor cost and the annual maintenance cost in calibration over six years:

Year (n)	Costs ($)	Savings ($)	Net Cash Flow ($)
0	13,000		−13,000
1	2,300	6,000	3,700
2	2,300	7,000	4,700
3	2,300	9,000	6,700
4	2,300	9,000	6,700
5	2,300	9,000	6,700
6	2,300	9,000	6,700

Find the rate of return for this project.

West Texas Oil has paid $300000 for producing oil well. Field engineers estimate that net receipts will be $120000 for the first year of operation with a constant reduction of $18000, for every year thereafter till the end of five years. It plans to sell well after 5 years for $80000.

a) What is the ROR of this project?
b) How does this seem financially if their MARR is 20%?

A mine is for sale for $240,000. It is believed the mine will produce a profit of $65,000 the first year, but the profit will decline $5000 a year after that, eventually reaching zero, whereupon the mine will be worthless. What rate of return would this $240,000 investment produce for the purchaser of the mine?

ROR=15.91%

An investor purchased a one-acre lot on the outskirts of a city for $9000 cash. Each year he paid $80 of property taxes. At the end of 4 years, he sold the lot. After deducting his selling expenses, the investor received $15,000. What rate of return did he receive on his investment?

Return= 12.8%

A new machine can be purchased today for $300,000. The annual revenue from the machine is calculated to be $67,000, and the equipment will last 10 years. Expect the maintenance and operating costs to be $3000 a year and to increase $600 per year. The salvage value of the machine will be $20,000. What is the rate of return for this machine?

Johnson Controls spent more than $2.5 million retrofitting a government complex and installing a computerized energy-management system for the State of Massachusetts. As a result, the state's energy bill dropped from an average of $6 million a year to $3.5 million. Moreover, both parties will benefit from the 10-year life of the contract. Johnson recovers half the money it saved in reduced utility costs (about $1.2 million a year over 10 years); Massachusetts has its half to spend on other things. What is the rate of return realized by Johnson Controls in this energy-control system?