A company with a cost of capital of 10% is considering investing in a project. Initial payment required is Rs. 10,000 while it will yield Rs. 6,000 per year for the initial two years. Should the project be undertaken?

One way to understand the problem is to analyze cash flows with their discount factors as below:

Year	Cash flow	Discount factor (10%)	Present value
0	(10,000)	1	(10,000)
1	6,000	$\frac{1}{(1.1)}$	5,456
2	6,000	$\frac{1}{(1.1)^2}$	4.959
NPV			415

The project is viable since the NPV is positive.

The same problem can be solved using PV formula:

$$\text{Present value} = X \times \left[\frac{1-\frac{1}{(1+r)^n}}{r}\right]$$

$$\text{Present value} = 6{,}000 \times \left[\frac{1-\frac{1}{(1+0.1)^2}}{0.1}\right]$$

$$\text{Present value} = 6{,}000 \times \left[\frac{0.17355}{0.1}\right]$$

$$\text{Present value} = 6{,}000 \times 1.7355$$

$$\text{Present value} = 10{,}413.22$$

PV is more than the initial outlay. This means that project's worth for investment is more than the cost. And hence must be accepted.

A company is considering whether to invest in a new item of equipment costing Rs.53,000 to make a new product. The product would have a four-year life. Calculate the NPV assuming the discount rate of 11% and the estimated cash profits over the four-year period as follows.

Year	Rs.
1	17,000
2	25,000
3	16,000
4	12,000

In solving for the above problem, each year's cash flow would be discounted at the given rate to calculate the PV.

Year	Cash flow	Discount factor (11%)	Present value
0	(53,000)	1	(53,000)
1	17,000	$\frac{1}{(1.11)}$	15,315
2	25,000	$\frac{1}{(1.11)^2}$	20,291
3	16,000	$\frac{1}{(1.11)^3}$	11,699
4	12,000	$\frac{1}{(1.11)^4}$	7,905
NPV			2,210

The NPV is positive so the project should be accepted

A company is considering whether to invest in a new item of equipment costing Rs. 65,000 to make a new product. The product would have a three-year life. Calculate the NPV of the project using a discount rate of 8% if the cash flows are as follows:

Year	Rs.
1	27,000
2	31,000
3	15,000

In solving for the above problem, each year's cash flow would be discounted at the given rate to calculate the PV.

Year	Cash flow	Discount factor (8%)	Present value
0	(65,000)	1	(65,000)
1	27,000	$\frac{1}{(1.08)}$	25,000
2	31,000	$\frac{1}{(1.08)^2}$	26,578
3	15,000	$\frac{1}{(1.08)^3}$	11,907
NPV			(1,515)

The NPV is negative so the project should be rejected.

A company is considering whether to invest in a project which would involve the purchase of machinery with a life of five years. The machine would cost Rs. 556,000 and would have a net disposal value of Rs. 56,000 at the end of Year 5. The project would earn annual cash flows (receipts minus payments) of Rs. 200,000. Calculate the NPV of the project using a discount rate of 15%

One way to solve for the above problem is to discount cash flow each year for the calculation of the PV.

Year	Cash flow	Discount factor (15%)	Present value
0	(556,000)	1	(556,000)
1	200,000	$\frac{1}{(1.15)^1}$	173,913
2	200,000	$\frac{1}{(1.15)^2}$	151,229
3	200,000	$\frac{1}{(1.15)^3}$	131,503
4	200,000	$\frac{1}{(1.15)^4}$	114,351
5	200,000	$\frac{1}{(1.15)^5}$	99,435
5	56,000	$\frac{1}{(1.15)^5}$	27,842
NPV			142,273

The same problem can be solving using PV of an annuity as well as PV of a lump sum amount formula

$$\text{Present value} = X \times \left[\frac{1-\frac{1}{(1+r)^n}}{r}\right] + X\left[\frac{1}{(1+r)^n}\right]$$

$$\text{Present value} = 200{,}000 \times \left[\frac{1-\frac{1}{(1+0.15)^5}}{0.15}\right] + 56{,}000\left[\frac{1}{(1+0.15)^5}\right]$$

$$\text{Present value} = 200{,}000 \times \left[\frac{0.50282}{0.15}\right] + 56{,}000(0.4972)$$

$$\text{Present value} = 670{,}431 + 27{,}842$$

$$\text{Present value} = 698{,}273$$

PV is more than the initial outlay. This means that project's worth for investment is more than the cost. And hence must be accepted.

A company is considering whether to invest in a project which would involve the purchase of machinery with a life of four years. The machine would cost Rs.1,616,000 and would have a net disposal value of Rs.301,000 at the end of Year 4. The project would earn annual cash flows (receipts minus payments) of Rs.500,000. Calculate the NPV of the project using a discount rate of 10%

One way to solve for the above problem is to discount cash flow each year for the calculation of the PV.

Year	Cash flow	Discount factor (15%)	Present value
0	(1,616,000)	1	(1,616,000)
1	500,000	$\frac{1}{(1.10)^1}$	454,546
2	500,000	$\frac{1}{(1.10)^2}$	413,223
3	500,000	$\frac{1}{(1.10)^3}$	375,657
4	500,000	$\frac{1}{(1.10)^4}$	341,507
4	301,000	$\frac{1}{(1.10)^4}$	205,587
NPV			174,520

The same problem can be solving using PV of an annuity as well as PV of a lump sum amount formula

$$\text{Present value} = \text{X} \times \left[\frac{1-\frac{1}{(1+r)^n}}{\text{r}}\right] + X\left[\frac{1}{(1+r)^n}\right]$$

$$\text{Present value} = 500{,}000 \times \left[\frac{1-\frac{1}{(1+0.10)^4}}{0.10}\right] + 301{,}000\left[\frac{1}{(1+0.10)^4}\right]$$

$$\text{Present value} = 500{,}000 \times \left[\frac{0.316987}{0.10}\right] + 301{,}000(0.6830135)$$

$$\text{Present value} = 1{,}584{,}933 + 205{,}587$$

$$\text{Present value} = 1{,}790{,}520$$

A business requires a minimum expected rate of return of 12% on its investments. A proposed capital investment has the following expected cash flows. Estimate IRR:

Year	Cash flow
0	(80,000)
1	20,000
2	36,000
3	30,000
4	17,000

In calculating IRR, PV at 10% and 15% are calculated below:

Year	Cash flow	Discount factor at 12%	Present value at 12%	Discount factor at 10%	Present value at 10%	Discount factor at 15%	Present value at 15%
0	(80,000)	1.0000	(80,000)	1.000	(80,000)	1,000	(80,000)
1	20,000	0.8929	17,857	0.909	18,180	0.870	17,400
2	36,000	0.7972	28,699	0.826	29,736	0.756	27,216
3	30,000	0.7118	21,353	0.751	22,530	0.658	19,740
4	17,000	0.6355	10,804	0.683	11,611	0.572	9,724
NPV			(1,287)		+ 2,057		(5,920)

Now Using the formula:

$$\text{IRR} = \text{A}\% + \left(\frac{\text{NPV}_\text{A}}{\text{NPV}_\text{A} - \text{NPV}_\text{B}}\right) \times (\text{B} - \text{A})\%$$

$$\text{IRR} = 10\% + \left(\frac{2{,}057}{2{,}057 - (-5{,}920)}\right) \times (15 - 10)\%$$

$$\text{IRR} = 10\% + \left(\frac{2{,}057}{2{,}057 + 5{,}920}\right) \times 5\%$$

$$\text{IRR} = 10\% + \left(\frac{2{,}057}{2{,}057 + 5{,}920}\right) \times 5\%$$

$$\text{IRR} = 10\% + \left(\frac{2{,}057}{7{,}977}\right) \times 5\%$$

$$\text{IRR} = 10\% + 0.258 \times 5\% = 10\% + 1.3\%$$

$$\text{IRR} = 11.3$$

The IRR of the project (11.3%) is less than the target return (12%).

The project should be rejected.

The following information is about a project.

Year	Rs.
0	(53,000)
1	17,000
2	25,000
3	16,000
4	12,000

This project has an NPV of Rs. 2,210 at a discount rate of 11%. Estimate the IRR of the project.

In calculating IRR, PV at two different points, NPV at 11% is given at 2,210. We should estimate a discount rate which yields a negative NPV. Let's calculate at 15%.

Year	Cash flow	Discount factor at 15%	Present value at 15%
0	(53,000)	1,000	(53,000)
1	17,000	0.870	14,790
2	25,000	0.756	18,900
3	16,000	0.658	10,528
4	12,000	0.572	6,864
NPV			(1,918)

Now Using the formula:

$$\text{IRR} = \text{A}\% + \left(\frac{\text{NPV}_\text{A}}{\text{NPV}_\text{A} - \text{NPV}_\text{B}}\right) \times (\text{B} - \text{A})\%$$

$$\text{IRR} = 11\% + \left(\frac{2{,}210}{2{,}210 - (-1{,}918)}\right) \times (15 - 10)\%$$

$$\text{IRR} = 11\% + \left(\frac{2{,}210}{2{,}210 + 1{,}918}\right) \times 5\%$$

$$\text{IRR} = 11\% + \left(\frac{2{,}210}{4{,}128}\right) \times 5\%$$

$$\text{IRR} = 11\% + 0.535 \times 5\% = 11\% + 2.7\%$$

$$\text{IRR} = 13.7\%$$

The IRR of the project (13.7%) is greater than the target return (11%).

The following information is about a project.

Year	Rs.
0	(65,000)
1	27,000
2	31,000
3	15,000

This project has an NPV of Rs.(1,515) at a discount rate of 8%. Estimate the IRR of the project.

NPV at 8% is Rs.(1,515). A lower rate is needed to produce a positive NPV. (say 5%)

Year	Cash flow	Discount factor at 5%	Present value at 5%
0	(65,000)	1,000	(65,000)
1	27,000	0.952	25,704
2	31,000	0.907	28,117
3	15,000	0.864	12,960
NPV			1,781

Now Using the formula:

$$\text{IRR} = \text{A}\% + \left(\frac{\text{NPV}_\text{A}}{\text{NPV}_\text{A} - \text{NPV}_\text{B}}\right) \times (\text{B} - \text{A})\%$$

$$\text{IRR} = 5\% + \left(\frac{1{,}781}{1{,}781 - (-1{,}515)}\right) \times (8 - 5)\%$$

$$\text{IRR} = 5\% + \left(\frac{1{,}781}{1{,}781 + 1{,}515}\right) \times 3\%$$

$$\text{IRR} = 5\% + \left(\frac{1{,}781}{3{,}296}\right) \times 3\%$$

$$\text{IRR} = 5\% + 0.540 \times 3\% = 5\% + 1.6\%$$

$$\text{IRR} = 6.6\%$$

Annually a project provides for Rs. 12,000 for 12 years. The initial investment required is Rs. 90,000. Should the project be acceptable at 9% rate of return or 6%. What would be the rate where investor would be indifferent about the offer?

Since the investment returns is in the form of an annuity, NPV would be calculated at both the given rates.

$$\text{Present value} = X \times \left[\frac{1 - \frac{1}{(1+r)^n}}{r}\right]$$

$$\text{PV} = 12{,}000 \times \left[\frac{1 - \frac{1}{(1+0.09)^{12}}}{0.09}\right]$$

$$\text{PV} = 12{,}000 \times \left[\frac{0.6445}{0.09}\right]$$

$$\text{PV} = 85{,}929$$

$$\text{NPV} = -90{,}000 + 85{,}929 = (4{,}071)$$

At 9% the proposal must be rejected

$$\text{Present value} = X \times \left[\frac{1 - \frac{1}{(1+r)^n}}{r}\right]$$

$$\text{PV} = 12{,}000 \times \left[\frac{1 - \frac{1}{(1+0.06)^{12}}}{0.06}\right]$$

$$\text{Present value} = 12{,}000 \times \left[\frac{0.5030}{0.06}\right]$$

$$\text{Present value} = 100{,}606$$

$$\text{NPV} = -90{,}000 + 100{,}606 = 10{,}606$$

While at 6% the proposal can be accepted.

The rate at which the investor would be indifferent, can be estimated using the formula:

$$\text{IRR} = \text{A}\% + \left(\frac{\text{NPV}_\text{A}}{\text{NPV}_\text{A} - \text{NPV}_\text{B}}\right) \times (\text{B} - \text{A})\%$$

$$\text{IRR} = 6\% + \left(\frac{10{,}606}{10{,}606 - (-4{,}071)}\right) \times (9 - 6)\%$$

$$\text{IRR} = 6\% + \left(\frac{10{,}606}{10{,}606 + 4{,}071}\right) \times 3\%$$

$$\text{IRR} = 6\% + \left(\frac{10{,}606}{14{,}677}\right) \times 3\%$$

$$\text{IRR} = 6\% + 0.723 \times 3\% = 6\% + 2.17\%$$

$$\text{IRR} = 8.17\%$$

IRR must be around 8%

The following information is about a project.

Year	Rs.
0	(65,000)
1	27,000
2	31,000
3	15,000

This project has an NPV of Rs. (1,515) at a discount rate of 8%

The calculation of estimated IRR is:

NPV at 8% is Rs. (1,515). A lower rate is needed to produce a positive NPV. (say 5%)

Year	Cash flow	Discount factor at 5%	Present value at 5%
0	(65,000)	1.000	(65,000)
1	27,000	0.952	25,704
2	31,000	0.907	28,117
3	15,000	0.864	12,960
NPV			1,781

Using $\text{IRR} = \text{A}\% + \left(\frac{\text{NPV}_\text{A}}{\text{NPV}_\text{A} - \text{NPV}_\text{B}}\right) \times (\text{B} - \text{A})\%$

$\text{IRR} = 5\% + \left(\frac{1{,}781}{1{,}781 - -1{,}515}\right) \times (8 - 5)\%$

$\text{IRR} = 5\% + \left(\frac{1{,}781}{1{,}781 + 1{,}515}\right) \times 3\%$

$\text{IRR} = 5\% + \left(\frac{1{,}781}{3{,}296}\right) \times 3\%$

$\text{IRR} = 5\% + 0.540 \times 3\% = 5\% + 1.6\%$

$\text{IRR} = 6.6\%$

A company is considering whether to invest in a new item of equipment costing Rs. 45,000 to make a new product. The product would have a four-year life, and the estimated cash profits over the four-year period are as follows.

Year	Rs.
1	17,000
2	25,000
3	16,000
4	04,000

The project would also need an investment in working capital of Rs. 8,000, from the beginning of Year 1.

The company uses a discount rate of 11% to evaluate its investments.

The expected calculation of IRR is:

The cash outflow in Year 0 = cost of equipment + working capital investment = Rs. 45,000 + Rs. 8,000 = Rs. 53,000.

The cash inflow for year 4 = project's net cash profits + working capital recovered = Rs. 4,000 + Rs. 8,000 = Rs. 12,000.

		Cost of capital 11%		Cost of capital 15%	
Year	Cash flow	Discount factor	PV	Discount factor	PV
	Rs.		Rs.		Rs.
0	(53,000)	1.000	(53,000)	1.000	(53,000)
1	17,000	0.901	15,317	0.870	14,790
2	25,000	0.812	20,300	0.756	18,900
3	16,000	0.731	11,696	0.658	10,528
4	12,000	0.659	7,908	0.572	6,864
NPV			+ 2,221		(1,918)

NPV at 11% cost of capital = + Rs. 2,221

$$\text{IRR} = 11\% + \left[\frac{2{,}221}{(2{,}221 + 1{,}918)} \times (15 - 11)\%\right]$$

= 11% + 2.1% = 13.1%