

What Is Net Present Value (NPV)?

Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV is used in capital budgeting and investment planning to analyze the profitability of a projected investment or project. NPV is the result of calculations used to find today's value of a future stream of payments.

the Internal Rate of Return is the **interest rate that makes the Net Present Value zero.**

<https://www.mathsisfun.com/money/net-present-value.html#NetPresentValue>

NPV Example

Example: A friend needs \$500 now, and will pay you back \$570 in a year. Is that a good investment when you can get 10% elsewhere?

Money Out: \$500 now

➡ You invested \$500 now, so $PV = -\$500.00$

Money In: \$570 next year

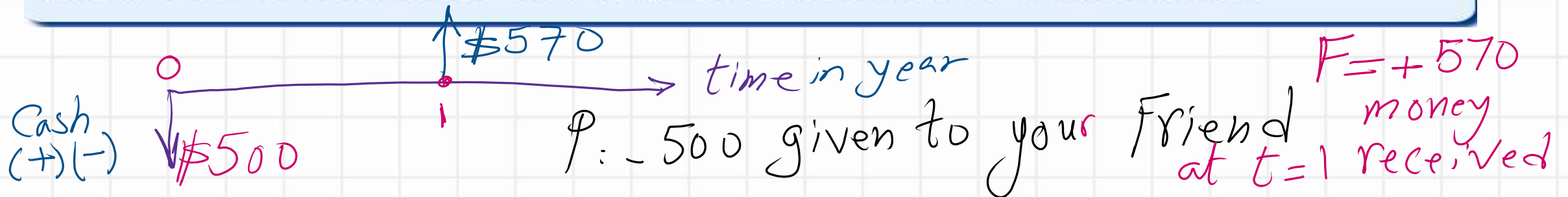
➡ $PV = \$570 / (1+0.10)^1 = \$570 / 1.10 = \$518.18$ (to nearest cent)

The Net Amount is:

➡ Net Present Value = $\$518.18 - \$500.00 = \$18.18$

So, at 10% interest, that investment is worth **\$18.18**

(In other words it is **\$18.18** better than a 10% investment, in today's money.)



$$NPV = -PV + \text{Sum} \left(F \left(\frac{P}{F}, i\%, t \right) \right)$$

$$= -500 + \left(570 \left(\frac{500}{570}, 10\%, 1 \right) \right)$$

Since: $\frac{P}{F} = \frac{1}{(1+i)^n} = \frac{1}{(1+0.10)^1} = 0.909$

$$NPV = -500 + (570)(0.909) = -500 + 518.18$$

NPV = \$18.18 → this a positive value

You earn money ⇒ \$18.18 in one year

Net present value + N.P.V

Case of -ve N.P.V

Example: Same investment, but try it at 15%.

Money Out: \$500

→ You invested \$500 now, so $PV = -\$500.00$

Money In: \$570 next year:

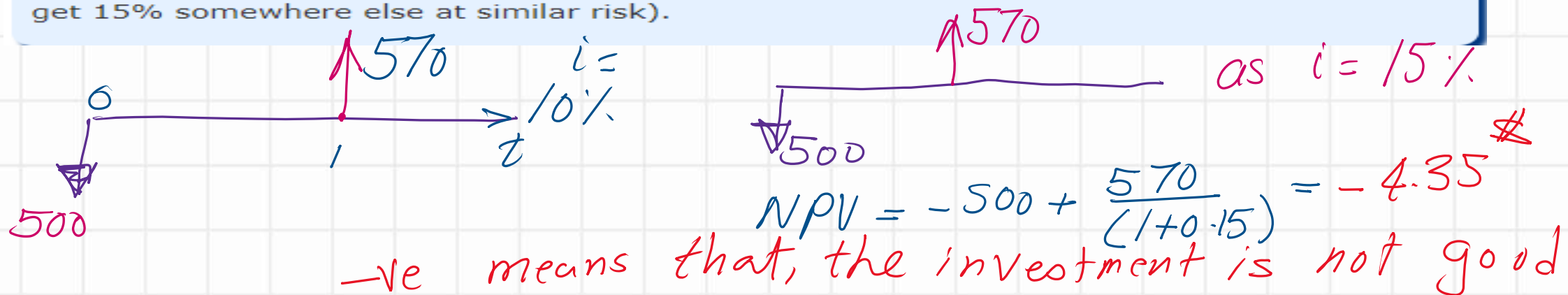
→ $PV = \$570 / (1+0.15)^1 = \$570 / 1.15 = \$495.65$ (to nearest cent)

Work out the Net Amount:

→ Net Present Value = $\$495.65 - \$500.00 = -\$4.35$

So, at 15% interest, that investment is worth **-\$4.35**

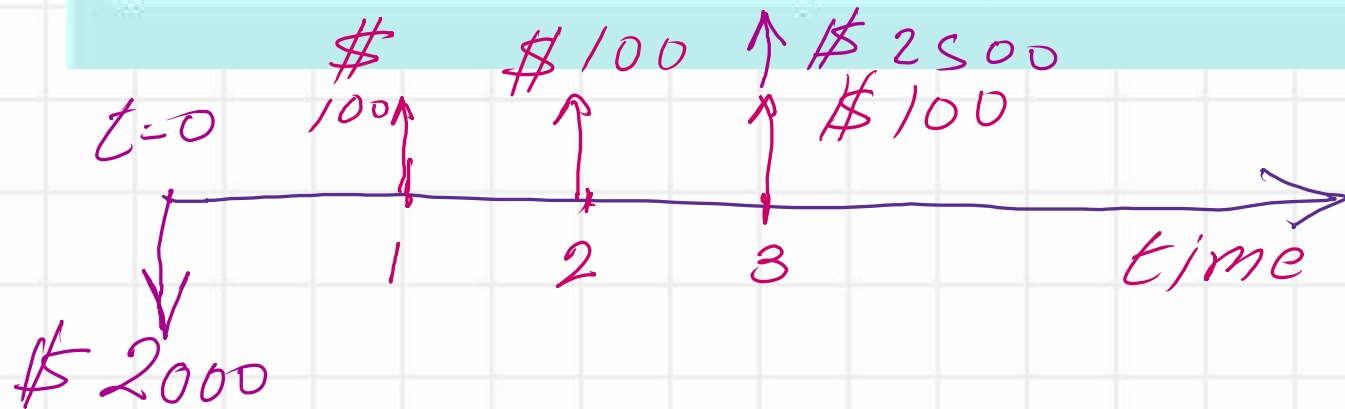
It is a bad investment. But only because you are demanding it earn 15% (maybe you can get 15% somewhere else at similar risk).



Internal rate of return (IRR)

the Internal Rate of Return is the interest rate that makes the Net Present Value zero.

Example: Invest \$2,000 now, receive 3 yearly payments of \$100 each, plus \$2,500 in the 3rd year. What is the IRR or internal rate of return?



i ?

Present Worth $P = \$2000$

$$2000 = \frac{100}{(1+i)^1} + \frac{100}{(1+i)^2} + \frac{100}{(1+i)^3} + \frac{2500}{(1+i)^3}$$

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First Guess
For $i\%$
value

By Guessing try $i = 10\%$

$$2000 = \frac{100}{1.1} + \frac{100}{(1.1)^2} + \frac{100}{(1.1)^3} + \frac{2500}{(1.1)^3}$$

$$= 90.909 + 82.644 + 75.131 + 1878.29 =$$

$$L.H.S = \overset{\text{Rs}}{2000}$$

$$R.H.S = 2126.97$$

$$L.H.S \neq R.H.S$$

$$NPV = -2000 + 2126.97 = \overset{\text{Rs}}{126.97}$$

$$> 0$$

$$2000 = 100\left(\frac{1}{1+i}\right)^1 + 100\left(\frac{1}{1+i}\right)^2 + 100\left(\frac{1}{1+i}\right)^3 + 2500(1+i)^{-3}$$

$$\text{Guess} \rightarrow i = 12\%$$

2nd Guess For
i %

$$\begin{aligned} 2000 &= \frac{100}{1.12} + \frac{100}{(1.12)^2} + \frac{100}{(1.12)^3} + \frac{2500}{(1.12)^3} \\ &= 89.286 + 79.719 + 71.178 + 1779.54 \end{aligned}$$

$$R.H.S = 2019.633$$

$$N.P.V = -2000 + 2019.633$$

$$N.P.V = +19.633 > 0$$

$$2000 = 100\left(\frac{1}{1+i}\right)^1 + 100\left(\frac{1}{1+i}\right)^2 + 100\left(\frac{1}{1+i}\right)^3 + 2500(1+i)^{-3}$$

By Guessing $i = 12.40\%$

$$\begin{aligned} 2000 &= \frac{100}{(1.124)} + \frac{100}{(1.124)^2} + \frac{100}{(1.124)^3} + \frac{2500}{(1.124)^3} \\ &= 88.968 + 79.153 + 70.421 + 1760.52 \\ &= \end{aligned}$$

N.P.V

↓ \$1999.06

$$\begin{aligned} &= -2000 + (88.968 + 79.153 + 70.421 + 1760.52) \\ &= -0.94 < 0 \end{aligned}$$

By excel = 12.3816%
IRR $\approx$ 12.40%

	A	B	C	D	E	F	G
1							
2	Calculate IRR						
3			10%				
4	Time	Cash Flow	Present value	Present value			
5	0	-2000	-2000.0000	(\$2,000.00)			
6	1	100	90.9091	\$90.91			
7	2	100	82.6446	\$82.64			
8	3	2600	1953.4185	\$1,953.42			
9							
10							
11	NPV		126.9722014	126.9722014			
12	NPV		126.972				
13							
14	Calculate IRR						
15			12%				
16	Time	Cash Flow	Present value	Present value			
17	0	-2000	-2000.0000	(\$2,000.00)			
18	1	100	89.2857	\$89.29			
19	2	100	79.7194	\$79.72			
20	3	2600	1850.6286	\$1,850.63			
21							
22			19.63374636	19.63374636			
23	NPV		19.634				
24							

24						
25						
26						
27	Calculate IRR					Built in
28			12.40%			
29	Time	Cash Flow	Present value	Present value		IRR
30	0	-2000	-2000.0000	(\$2,000.00)		
31	1	100	89.2857	\$88.97		12.382%
32	2	100	79.7194	\$79.15		
33	3	2600	1850.6286	\$1,830.94		
34						
35		\$	19.63374636	-0.937757416		
36	NPV		-0.938			
37						

$C_{36} = B29 + NPV(C27, B30:B32)$

