DEPT. MANAGEMENT & LAW
BACHELOR DEGREE IN BUSINESS ADMINISTRATION & ECONOMICS

COURSE
Cost Analysis for Business Decisions

Planning for Capital Investments

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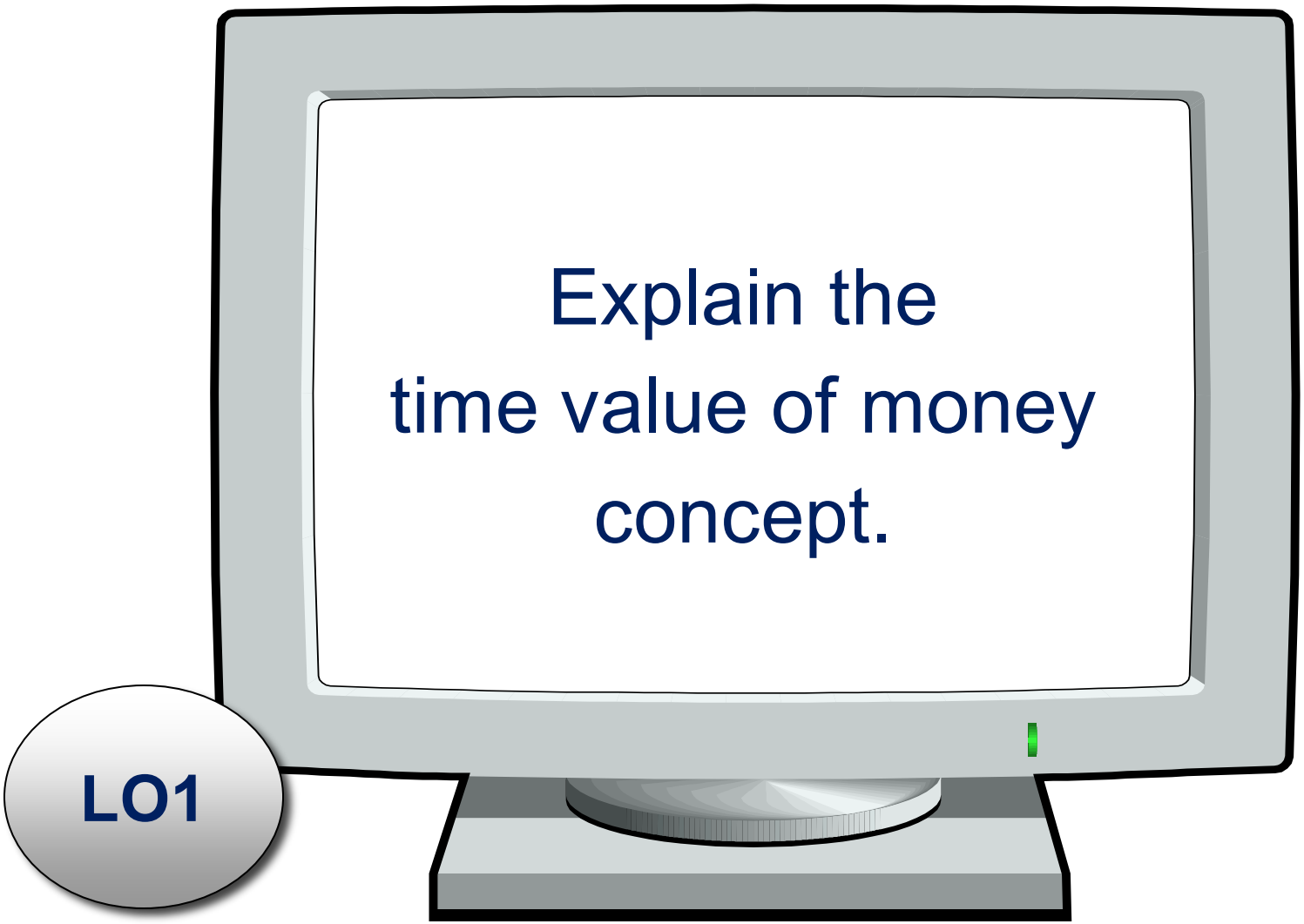
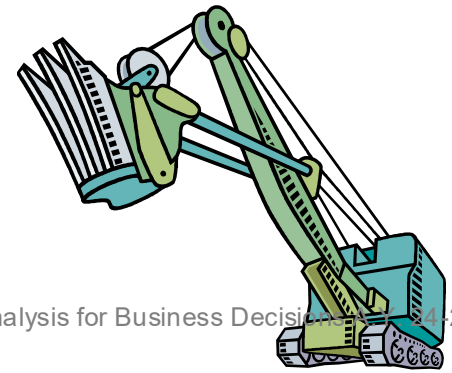
Learning Objective



Capital Investment Decisions

Purchases of long-term operational assets are **capital investments**. Once a company purchases operational assets, it is committed to these investments for an extended period of time. Understanding the time value of money concept will help you make rational capital investment decisions.



Time Value of Money

This concept recognizes that the value of a dollar **received in the future** is less than today's dollar. The further into the future the receipt is expected to occur, the smaller its present value.

When a company invests in capital assets, it sacrifices present dollars in exchange for the opportunity to receive future dollars.

Minimum Rate of Return

Most companies consider the cost of capital to be the minimum expected **return on investment** opportunities. Creditors expect interest payments; in most companies, owners expect dividends and increased stock value. The blend of creditor and owner costs is considered the cost of capital for an organization.

Present and Future Value

Present Value

Value today of a future cash flow.

Future Value

Amount to which an investment will grow after earning interest

NOTE that COMPOUNDING is the process where the value of an investment increases because the earnings on an investment, both capital gains and interest, earn interest as time passes.

In other terms, Compounding is the process in which an asset's earnings, from either capital gains or interest, are reinvested to generate additional earnings over time. This growth is calculated using exponential functions and it occurs because the investment will generate earnings from both its initial principal and the accumulated earnings from preceding periods.

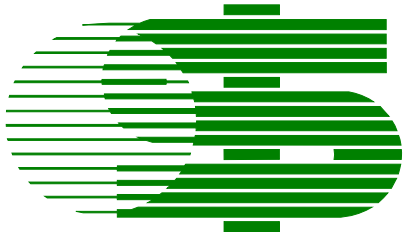
Future Values

Future Value of $100 = FV

$$FV = \$100 \times (1 + r)^t$$

Future Values

$$FV = \$100 \times (1 + r)^t$$



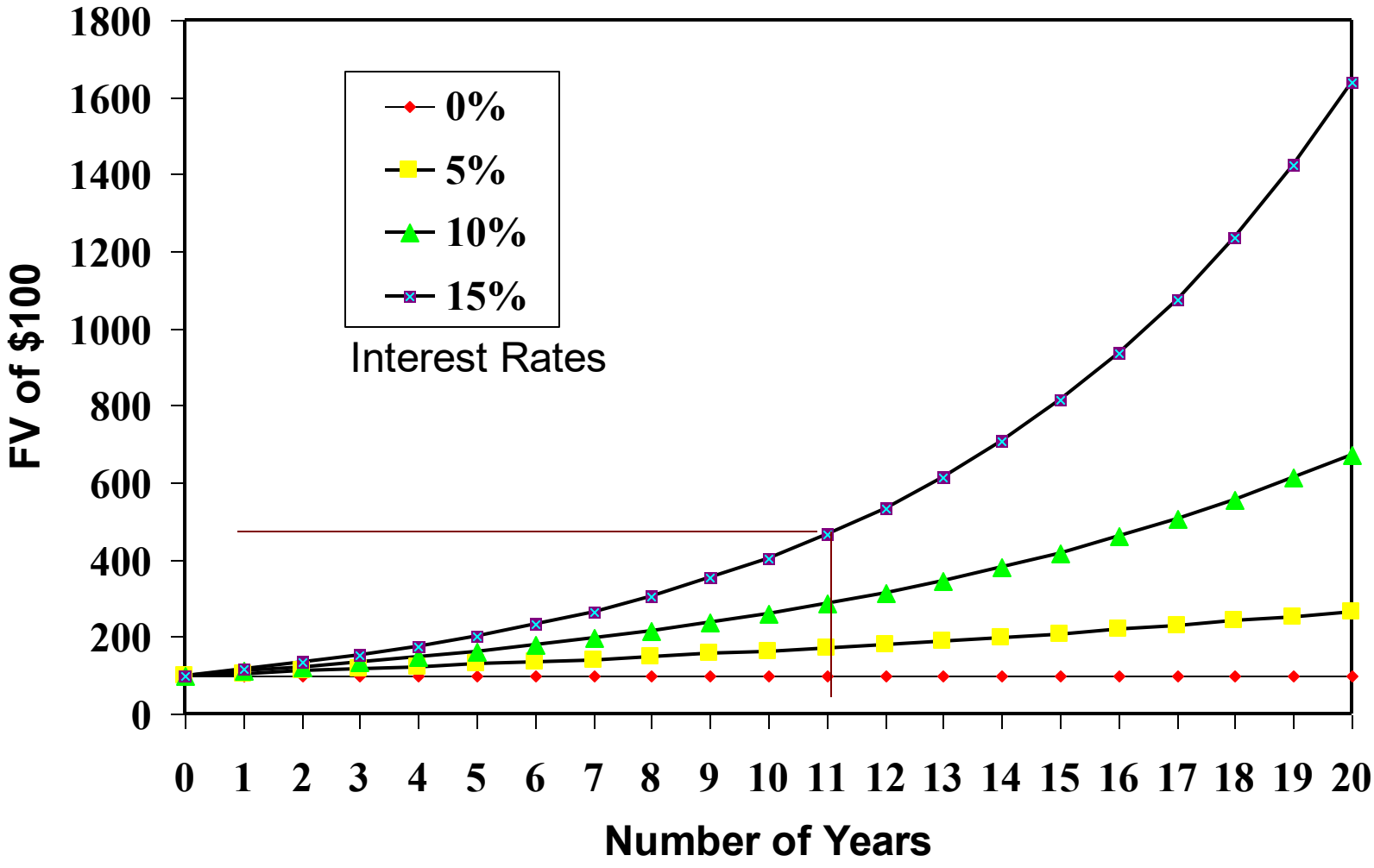
Example - FV

What is the future value of $100 if interest is compounded annually at a rate of 7% for two years?

$$FV = \$100 \times (1.07) \times (1.07) = 114.49$$

$$FV = \$100 \times (1 + .07)^2 = \$114.49$$

Future Values with Compounding



Present Value

$$\text{Present Value} = \text{PV}$$

$$\text{PV} = \text{discount factor} \times C_1$$

Present Value

Discount Factor = DF = PV of $1

$$DF = \frac{1}{(1+r)^t}$$

Discount Factors can be used to compute the present value of any cash flow.

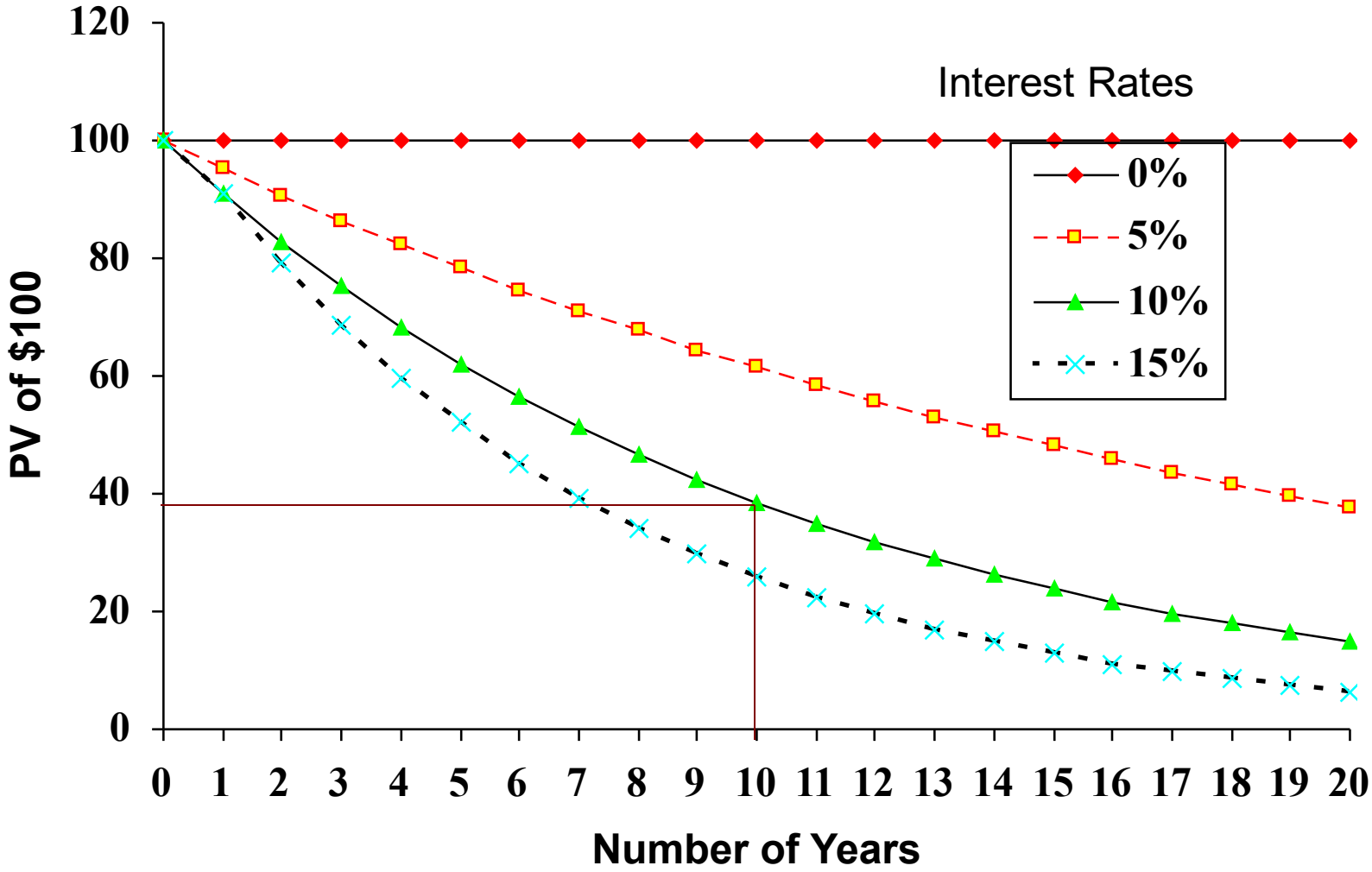
Present Value

The PV formula has many applications. Given any variables in the equation, you can solve for the remaining variable. Also, you can reverse the prior example.

$$PV = DF_2 \times C_2$$

$$PV = \frac{1}{(1+.07)^2} \times 114.49 = 100$$

Present Values with Compounding



Example:
Valuing an Office Building

Step 1: Forecast cash flows

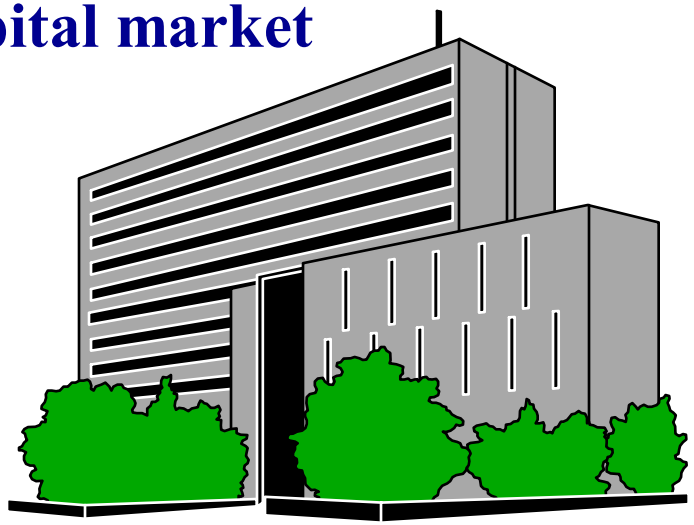
Cost of building = C_0 = 370,000

Sale price in Year 1 = C_1 = 420,000

Step 2: Estimate opportunity cost of capital

If equally risky investments in the capital market offer a return of 5%, then

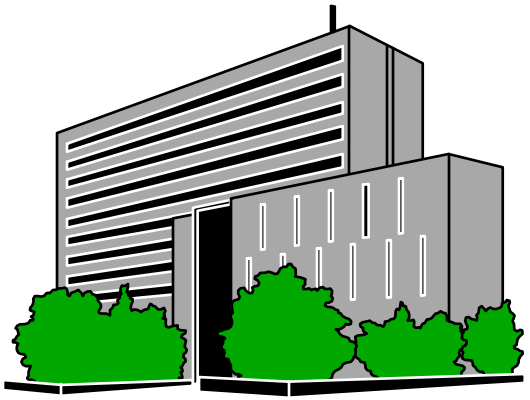
Cost of capital = r = 5%



Valuing an Office Building

Step 3: Discount future cash flows

$$PV = \frac{C_1}{(1+r)} = \frac{420{,}000}{(1+.05)} = 400{,}000$$



Converting Future Cash Inflows to Their Equivalent Present Values

EZ Rentals wants to add LCD projectors to its product line. If EZ invests $178,571 on January 1 and requires a rate of return of 12%, the company will expect a $200,000 cash inflow at the end of the first year.

$$\text{Investment} + (0.12 \times \text{Investment}) = \text{Future cash inflow}$$

$$1.12\,(\text{Investment}) = \$200{,}000$$

$$\text{Investment} = \$178{,}571$$

Present Value Table for Single-Amount Cash Inflows

Table 1 in the Appendix (p. 225)

Period	Present Value Factor for $1		
	10%	12%	14%
1	0.909091	0.892857	0.877193
2	0.826446	0.797194	0.769468
3	0.751315	0.711780	0.674972
4	0.683013	0.635518	0.592080
5	0.620921	0.567427	0.519369

$200,000 × 0.892857 = **$178,571** (rounded)

TABLE 1 Present Value of $1

n	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	20%
1	0.961538	0.952381	0.943396	0.934579	0.925926	0.917431	0.909091	0.892857	0.877193	0.862069	0.833333
2	0.924556	0.907029	0.889996	0.873439	0.857339	0.841680	0.826446	0.797194	0.769468	0.743163	0.694444
3	0.888996	0.863838	0.839619	0.816298	0.793832	0.772183	0.751315	0.711780	0.674972	0.640658	0.578704
4	0.854804	0.822702	0.792094	0.762895	0.735030	0.708425	0.683013	0.635518	0.592080	0.552291	0.482253
5	0.821927	0.783526	0.747258	0.712986	0.680583	0.649931	0.620921	0.567427	0.519369	0.476113	0.401878
6	0.790315	0.746215	0.704961	0.666342	0.630170	0.596267	0.564474	0.506631	0.455587	0.410442	0.334898
7	0.759918	0.710681	0.665057	0.622750	0.583490	0.547034	0.513158	0.452349	0.399637	0.353830	0.279082
8	0.730690	0.676839	0.627412	0.582009	0.540269	0.501866	0.466507	0.403883	0.350559	0.305025	0.232568
9	0.702587	0.644609	0.591898	0.543934	0.500249	0.460428	0.424098	0.360610	0.307508	0.262953	0.193807
10	0.675564	0.613913	0.558395	0.508349	0.463193	0.422411	0.385543	0.321973	0.269744	0.226684	0.161506
11	0.649581	0.584679	0.526788	0.475093	0.428883	0.387533	0.350494	0.287476	0.236617	0.195417	0.134588
12	0.624597	0.556837	0.496969	0.444012	0.397114	0.355535	0.318631	0.256675	0.207559	0.168463	0.112157
13	0.600574	0.530321	0.468839	0.414964	0.367698	0.326179	0.289664	0.229174	0.182069	0.145227	0.093464
14	0.577475	0.505068	0.442301	0.387817	0.340461	0.299246	0.263331	0.204620	0.159710	0.125195	0.077887
15	0.555265	0.481017	0.417265	0.362446	0.315242	0.274538	0.239392	0.182696	0.140096	0.107927	0.064905
16	0.533908	0.458112	0.393646	0.338735	0.291890	0.251870	0.217629	0.163122	0.122892	0.093041	0.054088
17	0.513373	0.436297	0.371364	0.316574	0.270269	0.231073	0.197845	0.145644	0.107800	0.080207	0.045073
18	0.493628	0.415521	0.350344	0.295864	0.250249	0.211994	0.179859	0.130040	0.094561	0.069144	0.037561
19	0.474642	0.395734	0.330513	0.276508	0.231712	0.194490	0.163508	0.116107	0.082948	0.059607	0.031301
20	0.456387	0.376889	0.311805	0.258419	0.214548	0.178431	0.148644	0.103667	0.072762	0.051385	0.026084

Present Value Table for Annuities

An annuity is a series of equal periodic payments. Rent on your apartment or home, or leasing of your automobile is probably paid in the form an equal periodic payment.

Let's assume that EZ Rentals is going to receive $200,000 at the end of each of the next 4 years. The company uses an interest rate for present value calculations of 12%.

How do we determine the present value when faced with a series of payments?

Present Value Table for Annuities

Table 1 in the Appendix (p.225)

Period	Present Value Factor for $1		
	10%	12%	14%
1	0.909091	0.892857	0.877193
2	0.826446	0.797194	0.769468
3	0.751315	0.711780	0.674972
4	0.683013	0.635518	0.592080
5	0.620921	0.567427	0.519369

Investing $607,470 today at a 12% return is equivalent to receiving $200,000 each year for the next four years.

PV of $200,000 Cash Inflows Received for 4 Years

Period	FV		Factor		Amount
1	$ 200,000	×	0.892857	=	$ 178,571
2	200,000	×	0.797194	=	159,439
3	200,000	×	0.711780	=	142,356
4	200,000	×	0.635518	=	127,104
					$ 607,470

Present Value Table for Annuities

An annuity must meet three criteria: (1) equal payment amounts, (2) equal time intervals between payments, and (3) a constant rate of return.

$200,000 × 3.037349 = $607,470 (rounded)

	Present Value Factor for an Annuity of $1			
Period	8%	10%	12%	14%
1	0.925926	0.909091	0.892857	0.877193
2	1.783265	1.735537	1.690051	1.646661
3	2.577097	2.486852	2.401831	2.321632
4	3.312127	3.169865	3.037349	2.913712
5	3.992710	3.790787	3.604776	3.433081

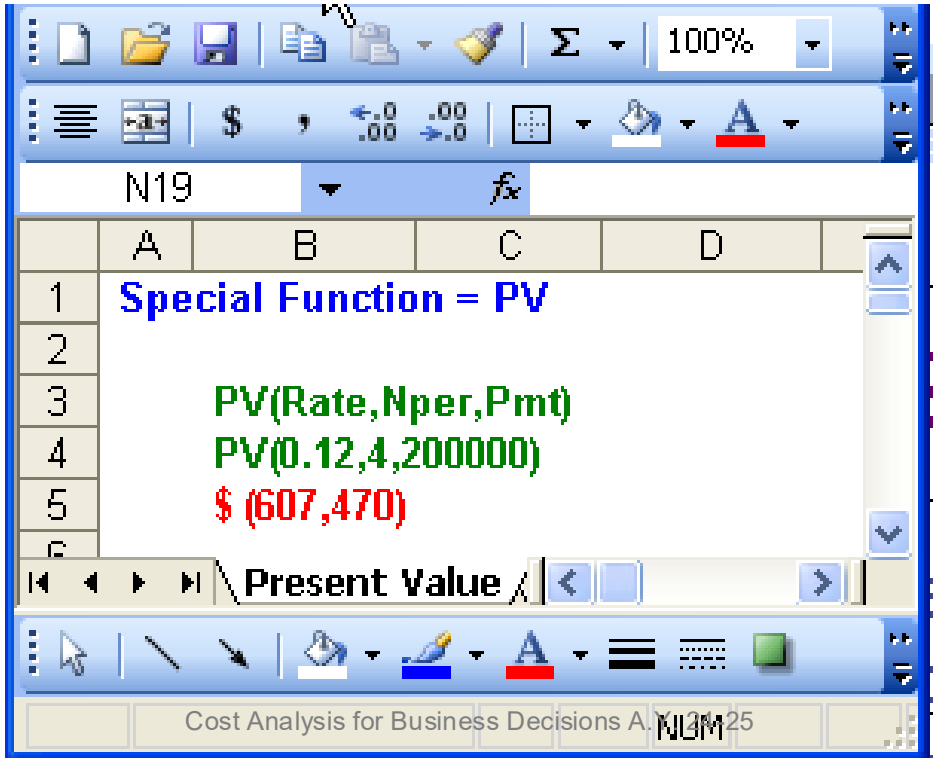
Table 2 in the Appendix (p.226)

TABLE 2 Present Value of an Annuity of $1

n	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	20%
1	0.961538	0.952381	0.943396	0.934579	0.925926	0.917431	0.909091	0.892857	0.877193	0.862069	0.833333
2	1.886095	1.859410	1.833393	1.808018	1.783265	1.759111	1.735537	1.690051	1.646661	1.605232	1.527778
3	2.775091	2.723248	2.673012	2.624316	2.577097	2.531295	2.486852	2.401831	2.321632	2.245890	2.106481
4	3.629895	3.545951	3.465106	3.387211	3.312127	3.239720	3.169865	3.037349	2.913712	2.798181	2.588735
5	4.451822	4.329477	4.212364	4.100197	3.992710	3.889651	3.790787	3.604776	3.433081	3.274294	2.990612
6	5.242137	5.075692	4.917324	4.766540	4.622880	4.485919	4.355261	4.111407	3.888668	3.684736	3.325510
7	6.002055	5.786373	5.582381	5.389289	5.206370	5.032953	4.868419	4.563757	4.288305	4.038565	3.604592
8	6.732745	6.463213	6.209794	5.971299	5.746639	5.534819	5.334926	4.967640	4.638864	4.343591	3.837160
9	7.435332	7.107822	6.801692	6.515232	6.246888	5.995247	5.759024	5.328250	4.946372	4.606544	4.030967
10	8.110896	7.721735	7.360087	7.023582	6.710081	6.417658	6.144567	5.650223	5.216116	4.833227	4.192472
11	8.760477	8.306414	7.886875	7.498674	7.138964	6.805191	6.495061	5.937699	5.452733	5.028644	4.327060
12	9.385074	8.863252	8.383844	7.942686	7.536078	7.160725	6.813692	6.194374	5.660292	5.197107	4.439217
13	9.985648	9.393573	8.852683	8.357651	7.903776	7.486904	7.103356	6.423548	5.842362	5.342334	4.532681
14	10.563123	9.898641	9.294984	8.745468	8.244237	7.786150	7.366687	6.628168	6.002072	5.467529	4.610567
15	11.118387	10.379658	9.712249	9.107914	8.559479	8.060688	7.606080	6.810864	6.142168	5.575456	4.675473
16	11.652296	10.837770	10.105895	9.446649	8.851369	8.312558	7.823709	6.973986	6.265060	5.668497	4.729561
17	12.165669	11.274066	10.477260	9.763223	9.121638	8.543631	8.021553	7.119630	6.372859	5.748704	4.774634
18	12.659297	11.689587	10.827603	10.059087	9.371887	8.755625	8.201412	7.249670	6.467420	5.817848	4.812195
19	13.133939	12.085321	11.158116	10.335595	9.603599	8.905115	8.364920	7.365777	6.550369	5.877455	4.843496
20	13.590326	12.462210	11.469921	10.594014	9.818147	9.128546	8.513564	7.469444	6.623131	5.928841	4.869580

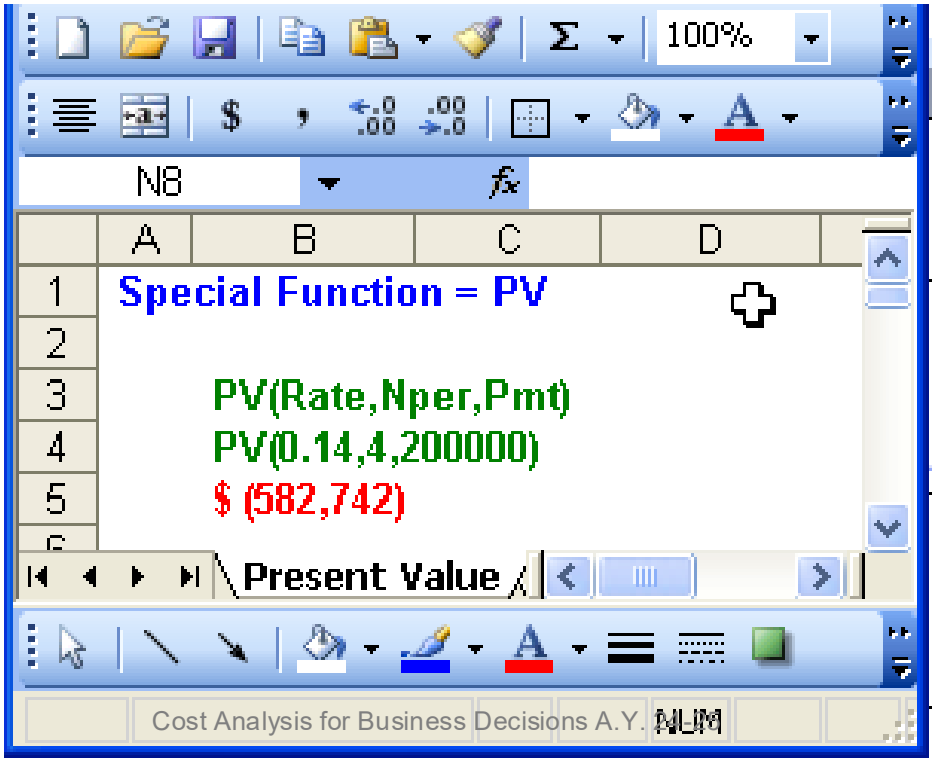
Software Programs for PV

We will use Excel to demonstrate the use of software to complete our present value computations. Let's assume that EZ Rentals receives an annuity of $200,000 at the end of each of the next 4 years. At 12% required return, how much could EZ invest in this project?



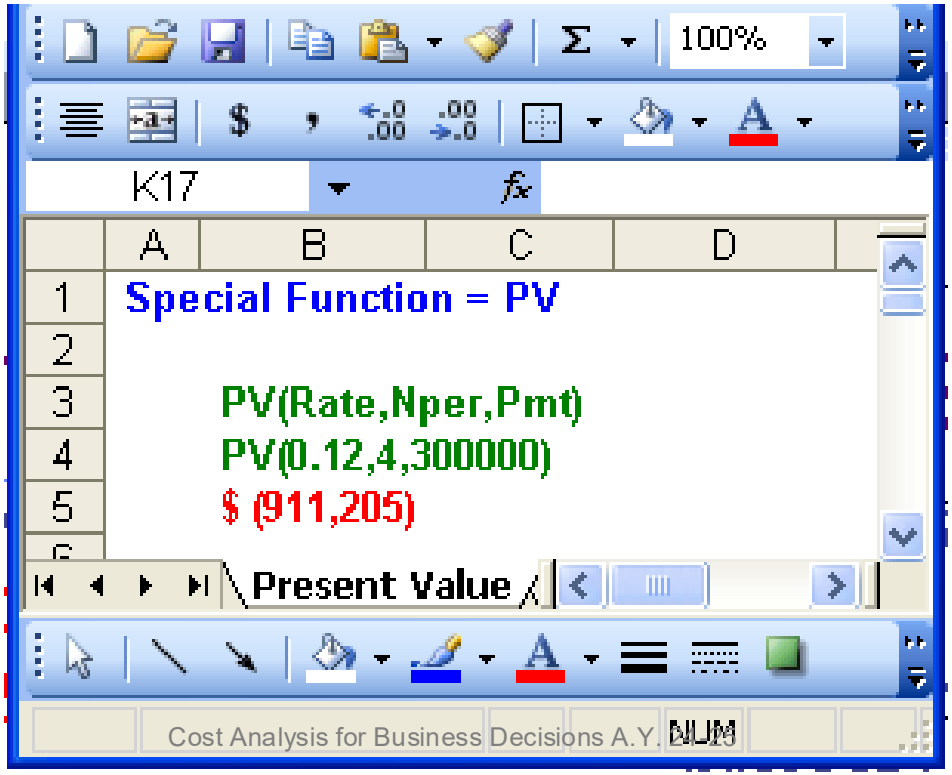
Software Programs for PV

Now let's assume that EZ Rentals receives an annuity of $200,000 at the end of each of the next four years. At **14%** required return, how much could EZ invest in this project?



Software Programs for PV

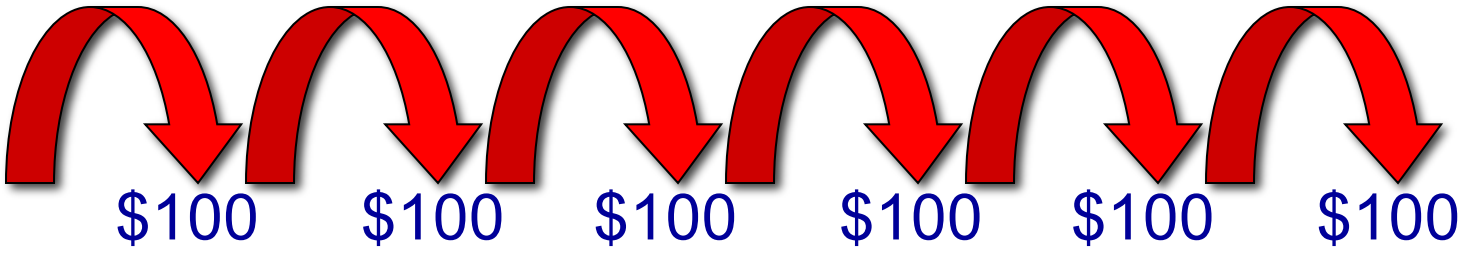
Now let's assume that EZ Rentals receives an annuity of **$300,000** at the end of each of the next four years. At **12%** required return, how much could EZ invest in this project?



Ordinary Annuity Assumption

An ordinary annuity is a series of equal payments made at the end of each period.

Capital investment decisions often involve uncertainties about future cash inflows and outflows. The assumptions inherent in ordinary annuities simplify the calculation process.

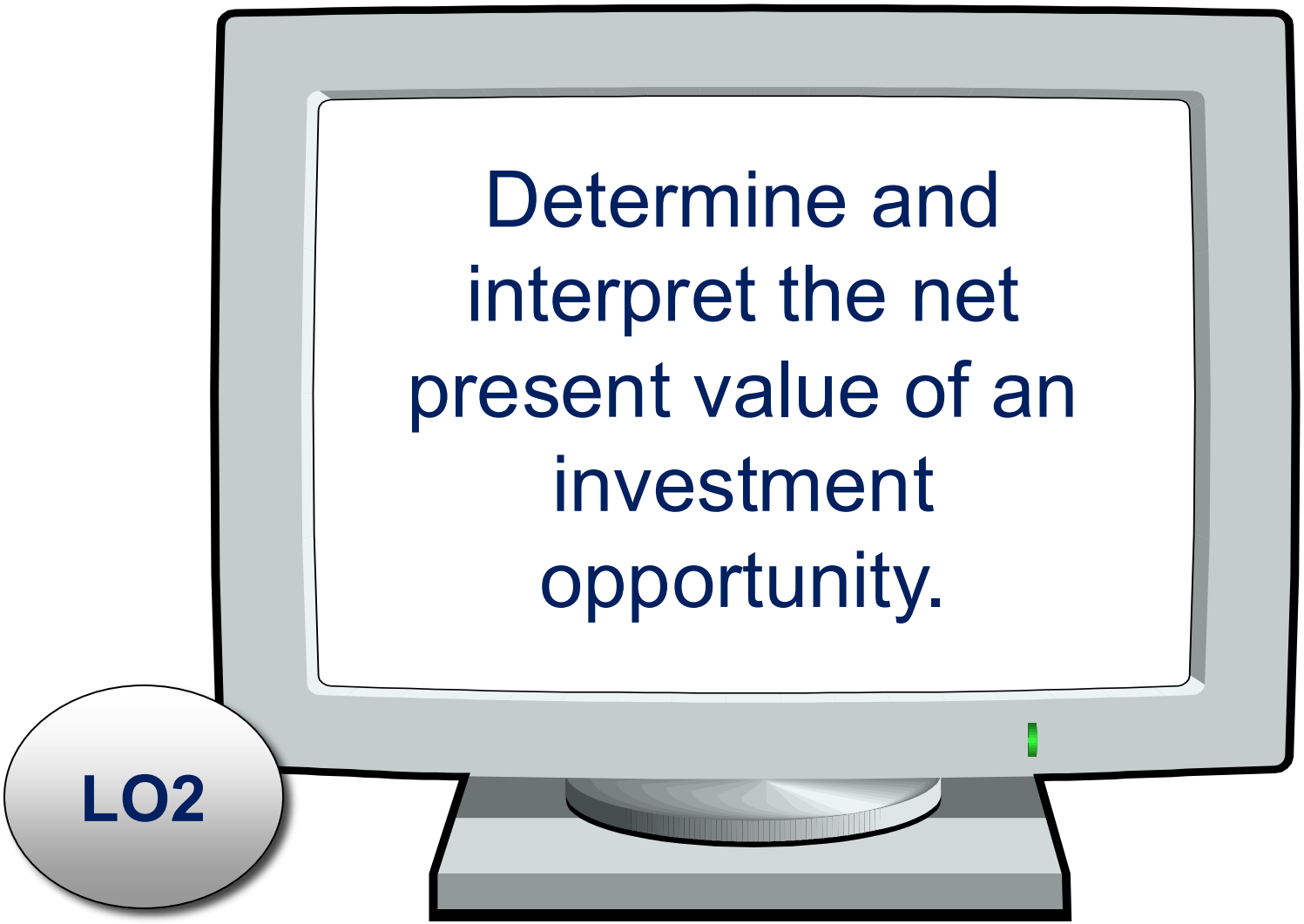


Reinvestment Assumption

In the first example of using Excel to calculate present value, we determine that the present value of the investment was $607,470 at a 12% rate of return. This calculation assumes that the periodic cash inflows, in our case $200,000, will be reinvested at the desired rate of return, or 12%. Here is the proof.

	A	B	C = A*12%	D = B-C	E = A-D
Period	Beginning Investment	Annual Cash Inflow	Return at 12%	Investment Recovery	Year-End Investment
1	$ 607,470	$ 200,000	$ 72,896	$ 127,104	$ 480,366
2	480,366	200,000	57,644	142,356	338,010
3	338,010	200,000	40,561	159,439	178,571
4	178,571	200,000	21,429	178,571	(0)
		$ 800,000	$ 192,530	$ 607,470	

Learning Objective



Net Present Value

Subtracting the cost of the investment from the present value of future cash inflows determines the net present value of the investment opportunity. A positive net present value indicates the investment will yield a rate of return higher than the required return. A negative net present value means the return is less than the required return.

Let's look at an example.

Net Present Value

$$\text{NPV} = \text{PV} - \text{required investment}$$

$$\text{NPV} = C_0 + \frac{C_1}{1 + r}$$

Example: Valuing an Office Building

Step 1: Forecast cash flows

Cost of building = C_0 = 370,000

Sale price in Year 1 = C_1 = 420,000

Step 2: Estimate opportunity cost of capital

If equally risky investments in the capital market offer a return of 5%, then

Cost of capital = r = 5%

Valuing an Office Building

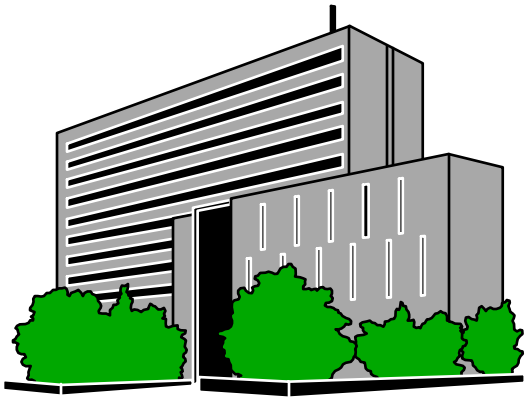
Step 3: Discount future cash flows

$$PV = \frac{C_1}{(1+r)} = \frac{420{,}000}{(1+.05)} = 400{,}000$$

Step 4: Go ahead if PV of payoff exceeds investment

$$NPV = 400{,}000 - 370{,}000$$

$$= 30{,}000$$



Risk and Present Value

Higher risk projects require a higher rate of return

Higher required rates of return cause lower PVs

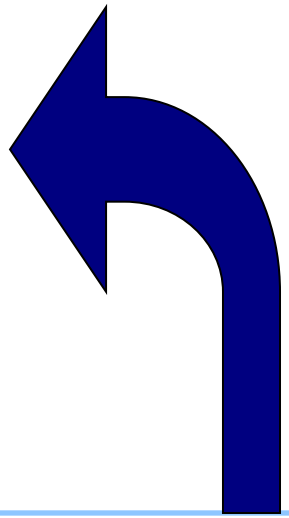
$$\text{PV of } C_1 = \$420{,}000 \text{ at } 5\%$$

$$\text{PV} = \frac{420{,}000}{1+.05} = 400{,}000$$

Risk and Present Value

$$\text{PV of } C_1 = \$420{,}000 \text{ at } 12\%$$

$$PV = \frac{420{,}000}{1+.12} = 375{,}000$$



$$\text{PV of } C_1 = \$420{,}000 \text{ at } 5\%$$

$$PV = \frac{420{,}000}{1+.05} = 400{,}000$$

Risk and Net Present Value

$$NPV = PV - \text{required investment}$$

$$NPV = 375{,}000 - 370{,}000$$

$$= \$5{,}000$$

Net Present Value Rule

Accept investments that have positive net present value

Example

Use the original example. Should we accept the project given a 10% expected return?

$$NPV = -370{,}000 + \frac{420{,}000}{1.05} = \$30{,}000$$

Rate of Return Rule

Accept investments that offer rates of return in excess of their opportunity cost of capital

Example

In the project listed below, the foregone investment opportunity is 12%. Should we do the project?

$$\text{Return} = \frac{\text{profit}}{\text{investment}} = \frac{420{,}000 - 370{,}000}{370{,}000} = .135 \text{ or } 13.5\%$$

Multiple Cash Flows

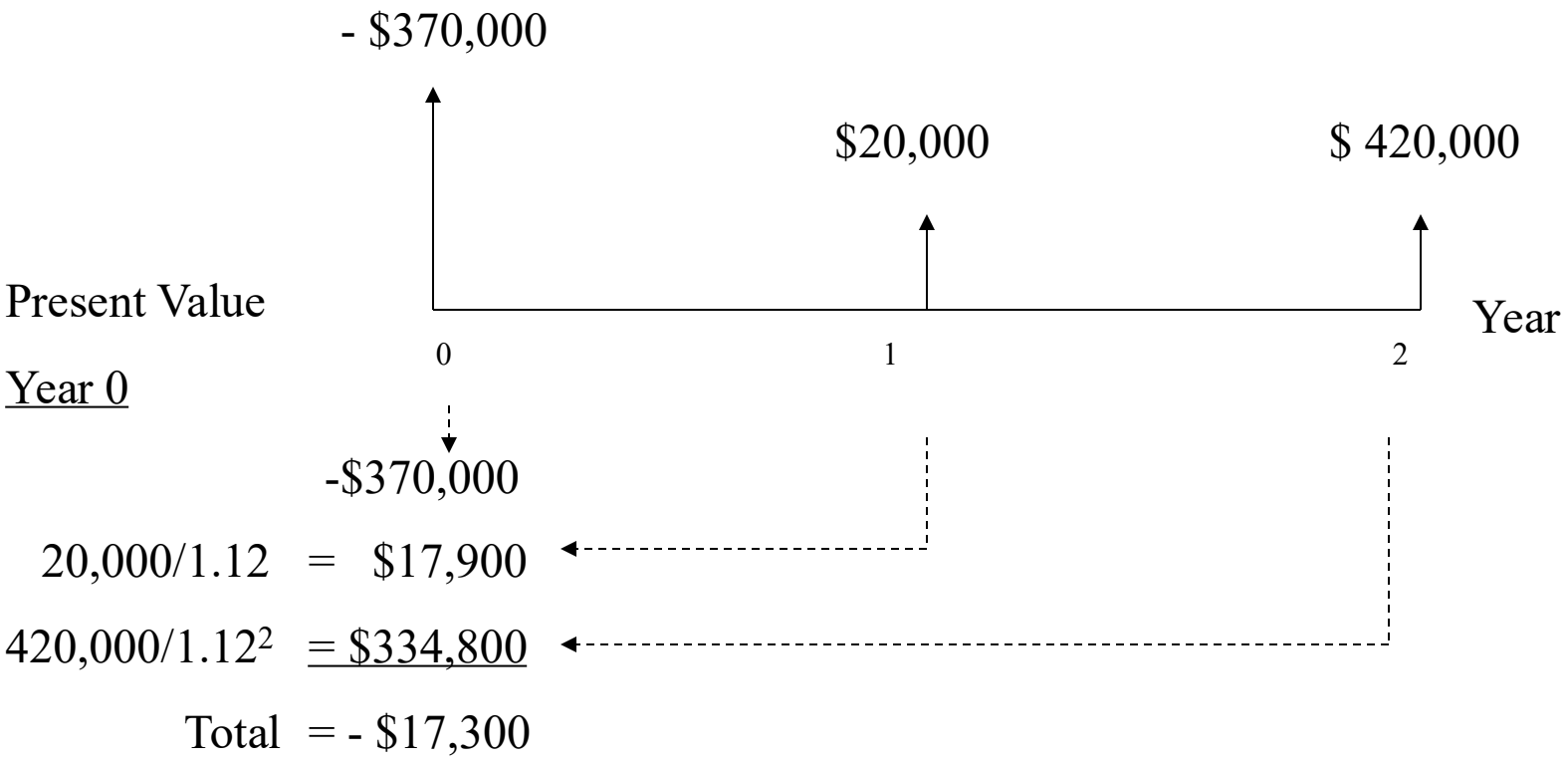
For multiple periods we have the

Discounted Cash Flow (DCF) formula

$$PV_0 = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + ... + \frac{C_t}{(1+r)^t}$$

$$NPV_0 = C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

Net Present Values



Net Present Value

Let's assume that EZ Rentals can purchase the LCD projectors for $582,742. The company has a desired rate of return of 12%. The investment will provide a $200,000 cash inflow for the next four years. Should EZ buy the projectors?

Present value of future cash inflows	**$ 607,470**
Cost of the investment	**(582,742)**
Net present value	**$ 24,728**

The positive net present value tells us that the investment will earn more than the desired rate of 12%. EZ should invest in the LCD projectors.

✓Check Yourself

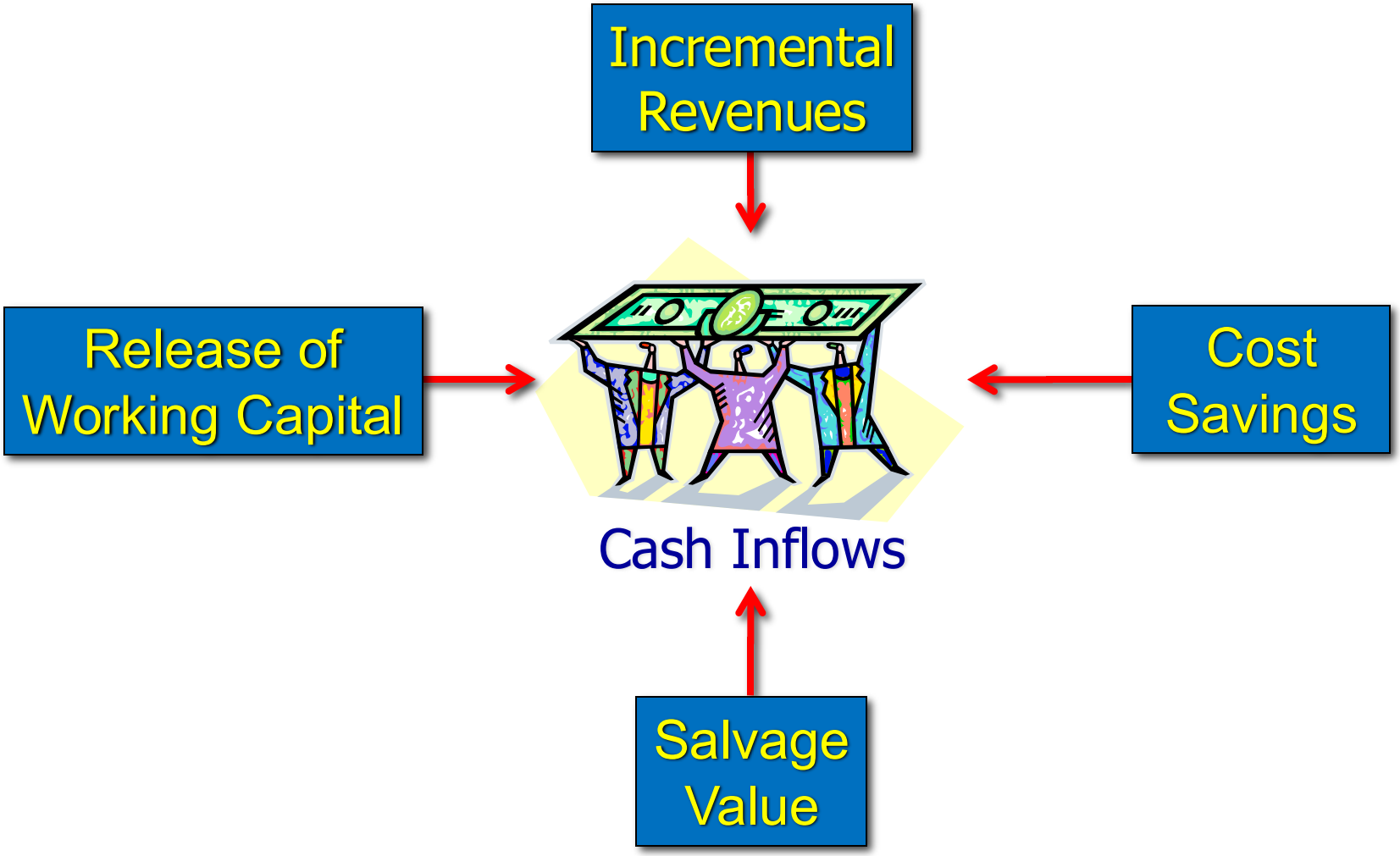
To increase productivity, Wald Corporation is considering the purchase of a new machine that costs $50,000. The machine is expected to provide annual net cash inflows of $12,500 for each of the next five years. Wald desires a minimum annual rate of return of 10%. Would you recommend that Wald invest in the new machine?

PV of cash inflows = $12,500 × 3.790787 = $47,385

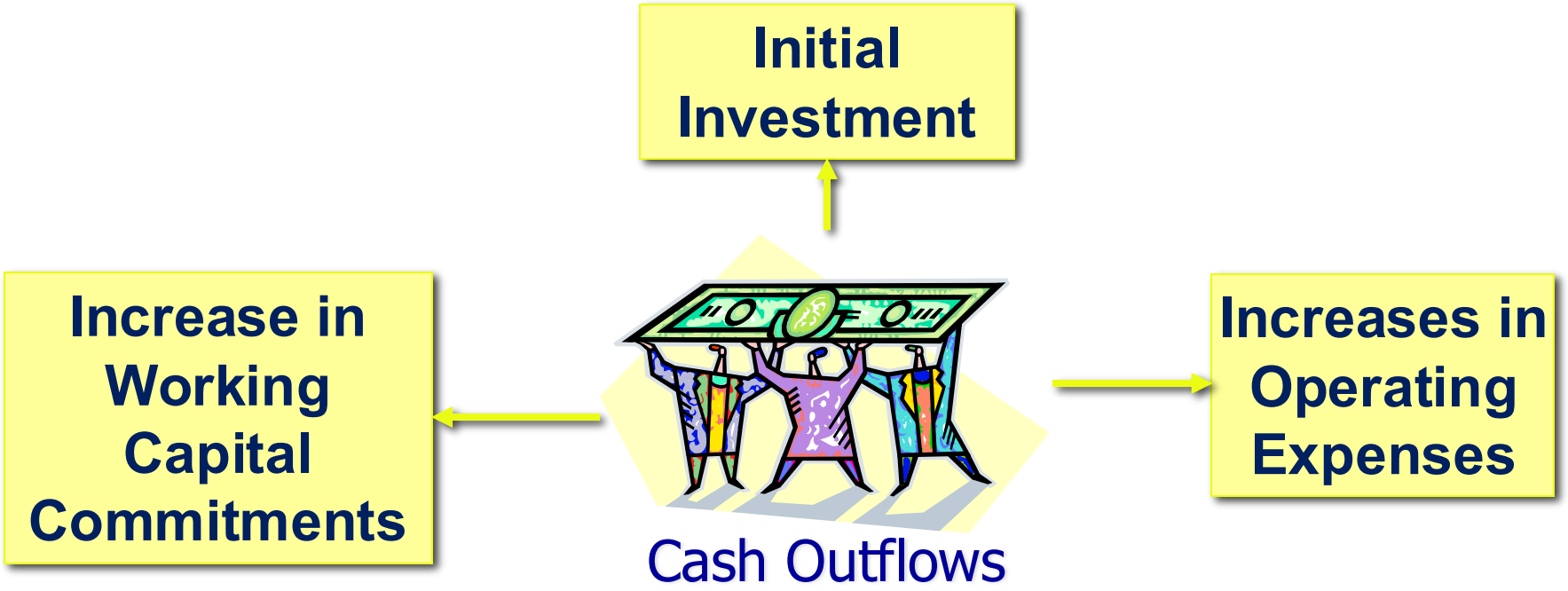
Present value of future cash inflows	$ 47,385
Cost of the investment	(50,000)
Net present value	$ (2,615)

Wald should <u>not</u> purchase the new machine.

Measuring Investment Cash Inflows



Measuring Investment Cash Outflows



Comparing Alternative Capital Investment Opportunities

Desired rate of return is 14%

Alternative 1

- Purchase new equipment, $80,000. O
- Useful life is 5 years with $4,000 salvage value. I
- Incur $3,000 in training costs. O
- Will reduce parts inventory by $12,000 in first year. I
- Will reduce annual operating expenses by $21,500. I
- Replaces equipment that cost $45,000, book value $15,000, and trade-in value of $5,000. I

Alternative 2

- Purchase new truck for $115,000. O
- Useful life is 5 years with $30,000 salvage value. I
- Additional working capital required $5,000, released at the end of the truck's useful life. I O
- Incremental revenue $69,000 per year. I
- Increase annual operating expenses by $32,000. O
- A $20,000 major overhaul at the end of third year. O

Net Present Value: Alternative 1 (Modernize Maintenance Facility)

Cash inflows						
Cost savings	$	21,500	×	3.433081	=	$ 73,811
Salvage value	$	4,000	×	0.519369	=	2,077
Working capital recovery	$	12,000	×	0.877193	=	10,526
Total						86,414
Cash outflows						
Cost of equipment, less trade-in	$	75,000	×	1.000000	=	75,000
Training costs	$	3,000	×	1.000000	=	3,000
Total						78,000
Net present value						$ 8,414

PV of annuity for 5 periods at 14%

PV of $1 for 5 periods a t 14%

PV of $1 for 1 period at 14%

Net Present Value: Alternative 2

Alternative 2: Purchase Delivery Truck						
Cash inflows						
Incremental revenues	$	69,000	×	3.433081	=	$ 236,883
Salvage value	$	30,000	×	0.519369	=	15,581
Working capital recovery	$	5,000	×	0.519369	=	2,597
Total						255,061
Cash outflows						
Cost of truck	$	115,000	×	1.000000	=	115,000
Working capital increase	$	5,000	×	1.000000	=	5,000
Increase in operating expenses	$	32,000	×	3.433081	=	109,859
Major overhaul	$	20,000	×	0.674972	=	13,499
Total						243,358
Net present value						$ 11,703

PV of annuity for 5 periods at 14%

PV of $1 for 3 periods at 14%

PV of $1 for 5 periods a t 14%

PV Index

$$\text{PV index} = \frac{\text{PV of cash inflows}}{\text{PV of cash outflows}}$$

$$\text{Alternative 1} = \frac{\$86,414}{\$78,000} = 1.108$$

$$\text{Alternative 2} = \frac{\$255,061}{\$243,358} = 1.048$$

Alternative 1 yields a higher return than Alternative 2.

Exercise D.P. 5-1:

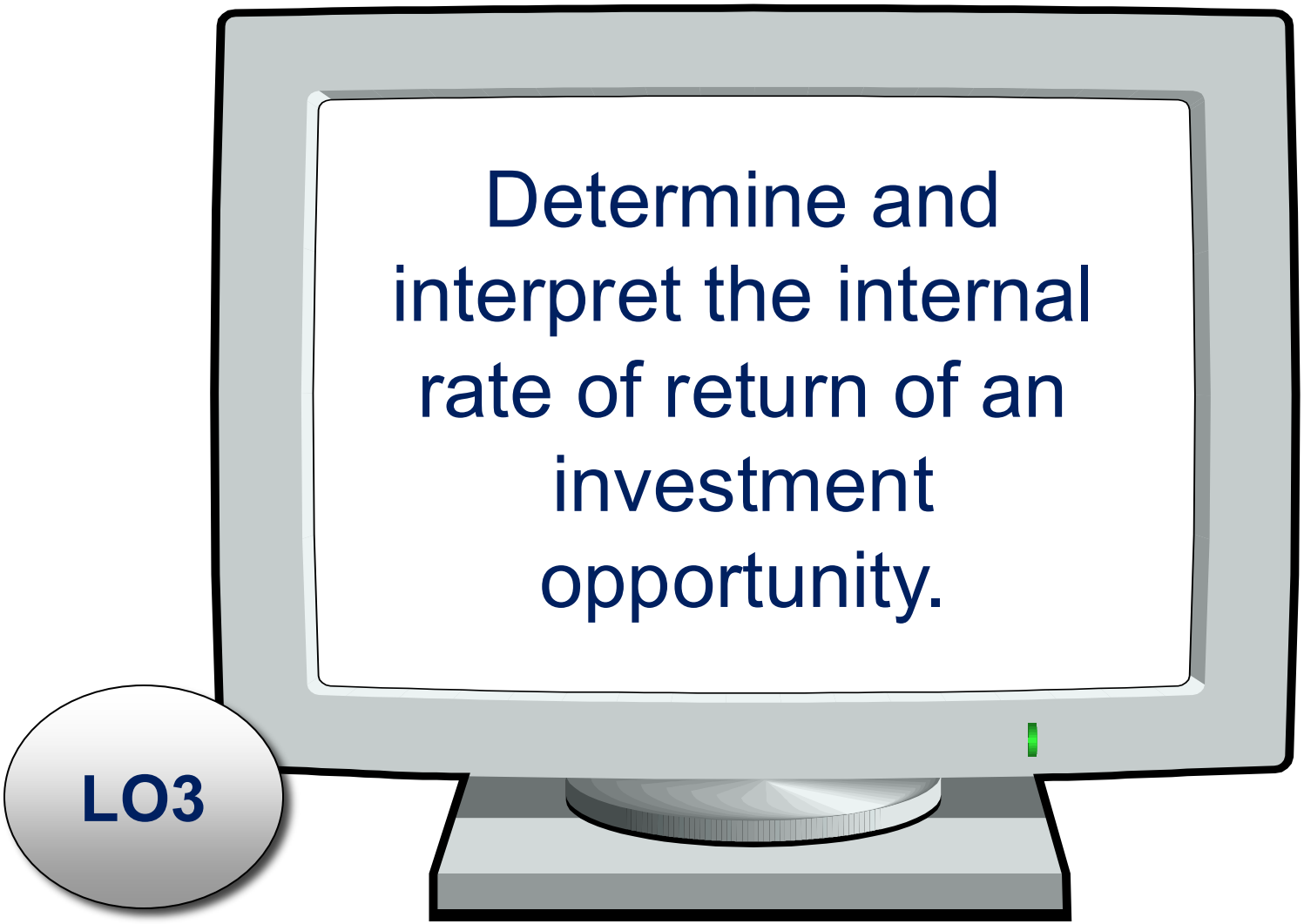
Net Present Value/Present Value Index

The management team at Savage Corporation is evaluating two alternative capital investment opportunities. The first alternative, modernizing the company's current machinery, costs $45,000. Management estimates the modernization project will reduce annual net cash outflows by $12,500 per year for the next five years. The second alternative, purchasing a new machine, costs $56,500. The new machine is expected to have a five-year useful life and a $4,000 salvage value. Management estimates the new machine will generate cash inflows of $15,000 per year. Savage's cost of capital is 10%.

Required

a. Determine the present value of the cash flow savings expected from the modernization program.
b. Determine the net present value of the modernization project.
c. Determine the net present value of investing in the new machine.
d. Use a present value index to determine which investment alternative will yield the higher rate of return.

Learning Objective



Internal Rate of Return

The internal rate of return is the rate at which the present value of cash inflows equals cash outflows.

An investment cost $582,742, and will return $200,000 at the end of each of the next 4 years. What is the IRR?

Cost / Cash inflow **$582,742 ÷ $200,000 = 2.91371**

	Present Value Factor for an Annuity of $1			
Period	8%	10%	12%	14%
1	0.92593	0.90909	0.89286	0.87719
2	1.78326	1.73554	1.69005	1.64666
3	2.57710	2.48685	2.40183	2.32163
4	3.31213	3.16987	3.03735	2.91371
5	3.99271	3.79079	3.60478	3.43308

Internal Rate of Return

In other terms, the internal rate of return is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero.

$$0 = \mathrm{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+IRR)^t} - C_0$$

where:
Ct=Net cash inflow during the period t
*C*0=Total initial investment costs
IRR=The internal rate of return
t=The number of time periods

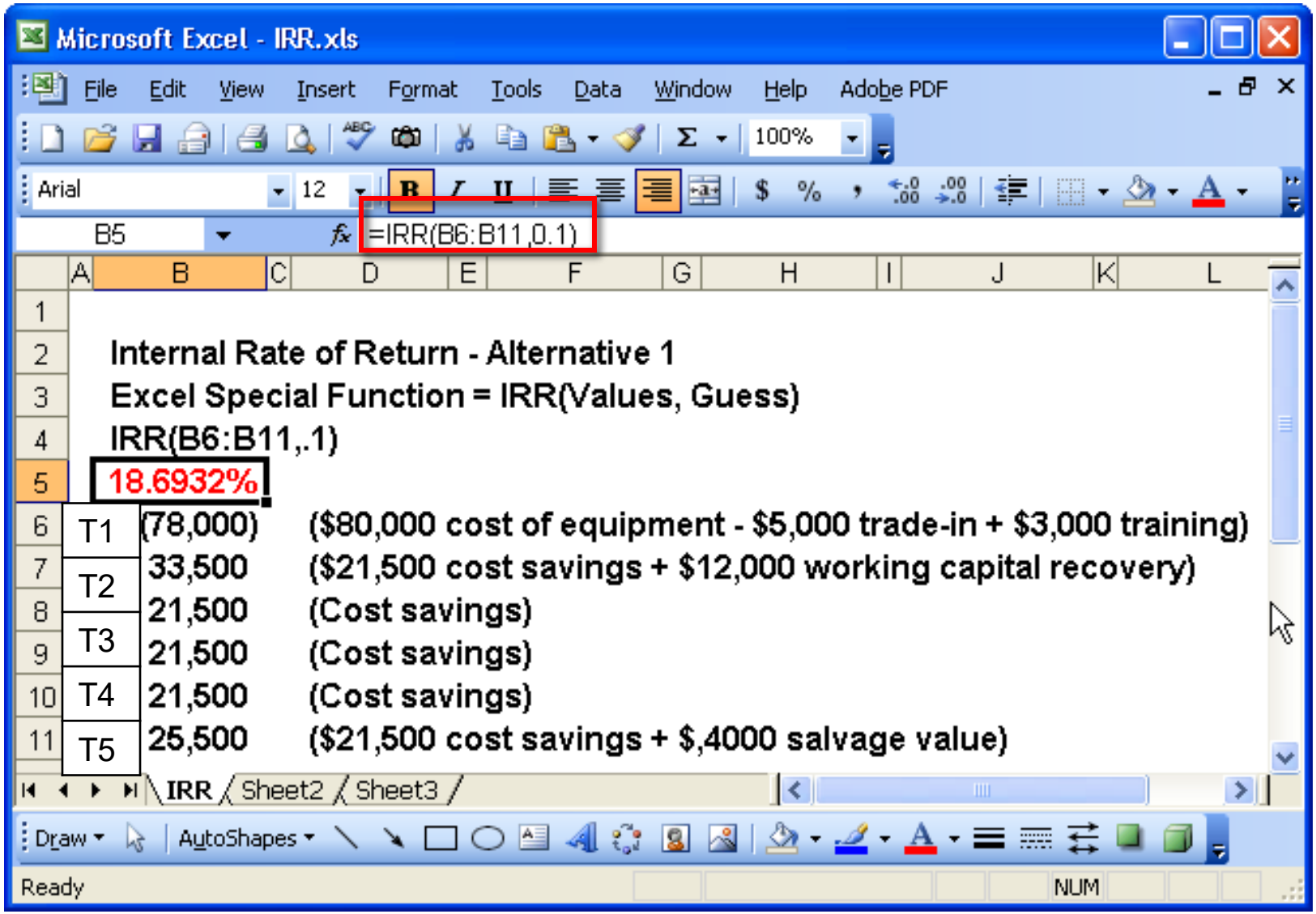
Thus, the IRR is a metric used to estimate the profitability of potential investments, because it highlights what represents the omni-comprehensive earning rate of the investment that the company is evaluating

Internal Rate of Return

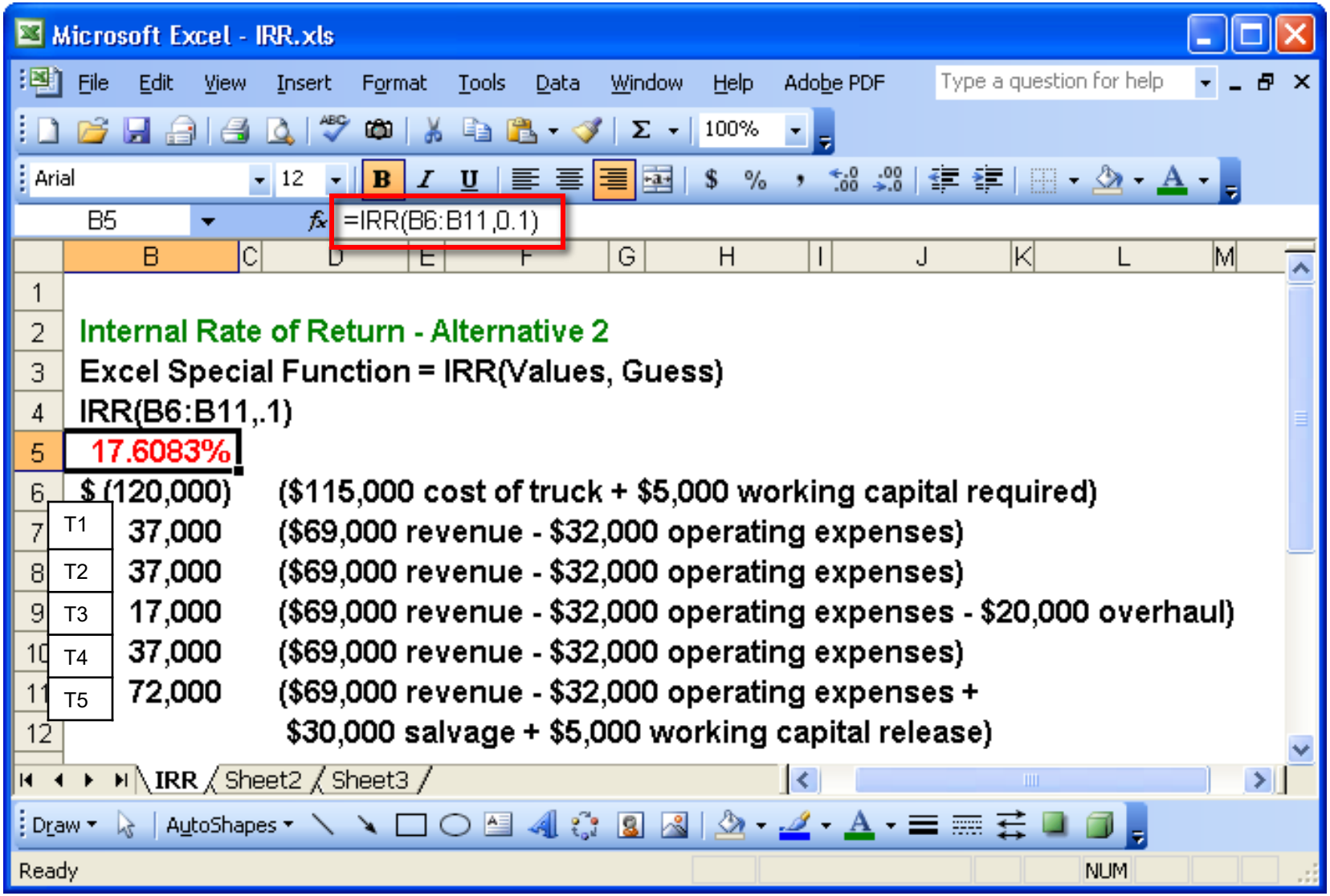
When management uses the internal rate of return (IRR), the higher the return, the more profitable the investment. Calculating IRR can be tedious. Let's use Excel to make the process efficient. To use Excel's special functions, we must know the values involved and make a reasonable guess as to the IRR. The guess is necessary to help Excel determine the correct IRR.

Let's calculate the IRR for Alternatives 1 and 2 using Excel.

Internal Rate of Return



Internal Rate of Return



Relevance and the Time Value of Money

You have an opportunity to invest in one of the two projects shown below. Both require an investment of $6,000, and return total cash inflows of $8,000.

	Project 1	Project 2
Period 1	$ 3,500	$ 2,000
Period 2	3,000	2,000
Period 3	1,000	2,000
Period 4	500	2,000
Total	$ 8,000	$ 8,000

If you have a desired rate of return of 10%, in which project would you invest?

Relevance and the Time Value of Money

Project 1						
Period	Cash Inflow			PV Factor		PV
1	$	3,500	×	0.909091	=	$ 3,182
2	$	3,000	×	0.826446	=	2,479
3	$	1,000	×	0.751315	=	751
4	$	500	×	0.683013	=	342
PV of cash inflows						$ 6,754
PV of cash outflows						(6,000)
NPV of Project 1						$ 754
Project 2						
PV of cash inflows	$	2,000	×	3.169865	=	$ 6,340
PV of cash outflows						(6,000)
						$ 340

$$PVidx\mathbf{1} = \frac{\$6,754}{\$6,000} = 1.125$$

$$PVidx\mathbf{2} = \frac{\$6,340}{\$6,000} = 1.056$$

Project 1 is clearly preferable to Project 2.

Tax Considerations

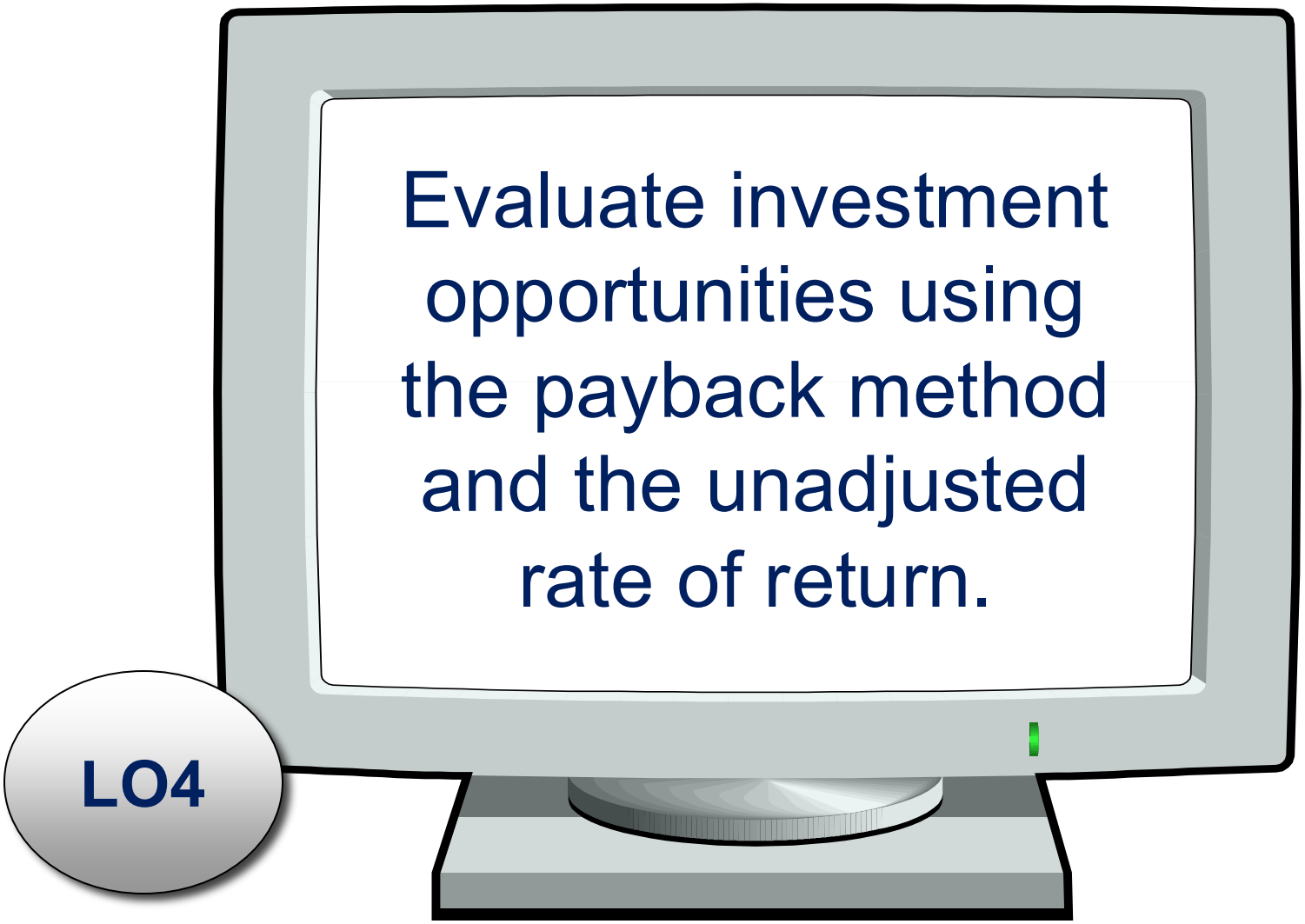
Taxes affect the amount of cash flows generated by investments. In the following example, Wu Company purchases an asset for $240,000. The asset has a four-year useful life, no salvage value, and straight-line depreciation is used. The asset is expected to generate incremental revenues of $90,000 per year. Wu's income tax rate is 40%, and the company has a desired *after tax return* of 10%.

Tax Considerations

	Period 1	Period 2	Period 3	Period 4
Cash revenue	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Depreciation expense (noncash)	(60,000)	(60,000)	(60,000)	(60,000)
Income before taxes	30,000	30,000	30,000	30,000
Income tax at 40%	(12,000)	(12,000)	(12,000)	(12,000)
Income after tax	18,000	18,000	18,000	18,000
Depreciation add back	60,000	60,000	60,000	60,000
Annual cash inflows	$ 78,000	$ 78,000	$ 78,000	$ 78,000

	Net PV
Annual cash annuity	$ 78,000
PV of annuity of $1, 4 periods, 10%	3.169865
PV of annual cash annuity	247,249
PV of cash outflow	(240,000)
Net present value	$ 7,249

Learning Objective

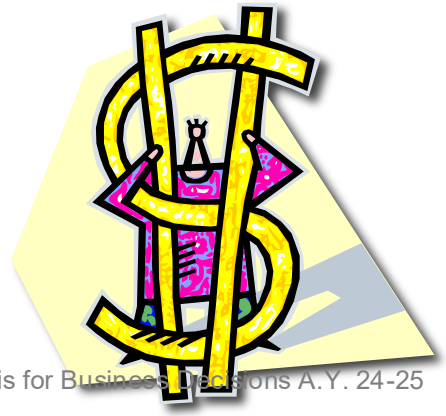


Techniques That Ignore the Time Value of Money

Payback Method

This is a simple and easy approach to looking at the recovery of an investment.

$$\text{Payback period} = \frac{\text{Net cost of investment}}{\text{Annual net cash inflows}}$$



Payback Method

Winston Cleaners can purchase a piece of equipment for $100,000 that will reduce labor costs by $40,000 per year over a four-year useful life. Let's calculate the payback period.

$$\text{Payback period} = \frac{\text{Net cost of investment}}{\text{Annual net cash inflows}}$$

$$\text{Payback period} = \frac{\$100{,}000}{\$40{,}000} = \textbf{2.5 years}$$

Generally, the shorter the payback period, the better.

Unequal Cash Flows

The payback method requires adjustment when cash flows are unequal. Let's assume a company purchases a machine for $6,000, with the cash inflows shown below:

2010	2011	2012	2013	2014
$ 3,000	$ 1,000	$ 2,000	$ 1,000	$ 500

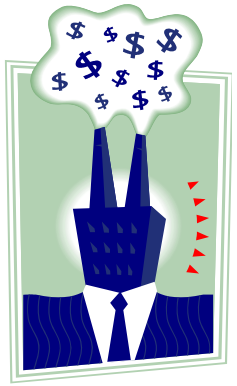
Year	Annual Amount	Cumulative Amount
2010	$ 3,000	$ 3,000
2011	$ 1,000	$ 4,000
2012	$ 2,000	$ 6,000

Unequal Cash Flows

Another approach is to calculate the **average** annual cash inflows to compute the payback period.

Year	Annual Amount
2010	$ 3,000
2011	1,000
2012	2,000
2013	1,000
2014	500
Total	7,500
÷	5
Average	$ 1,500

$$\text{Payback period} = \frac{\$6,000}{\$1,500} = 4 \text{ years}$$



Unadjusted Rate of Return

Investment cash flows are not adjusted to reflect the time value of money. The return is computed as follows:

$$\text{Unadjusted rate of return} = \frac{\text{Average incremental increase in annual net income}}{\text{Net cost of original investment}}$$

To avoid distortions caused by the failure to recognize the recovery of invested capital, the unadjusted rate of return should be based on the average investment when working with investments in depreciable assets.

Unadjusted Rate of Return

Dining Table, Inc. is considering opening a new restaurant that will require an investment of $2,000,000. Over a 10-year period the restaurant is expected to provide average after-tax return of $280,000 per year.

$$\text{Unadjusted rate of return} = \frac{\$280,000}{\$2,000,000} = 14\%$$

Unadjusted Rate of Return

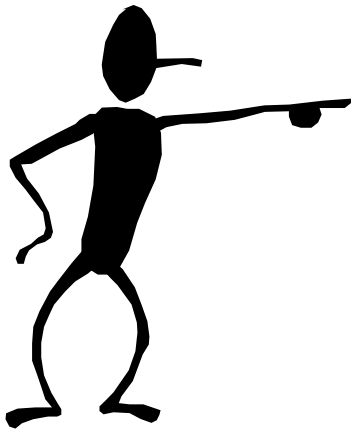
The accuracy of this method suffers from the failure to recognize the recovery of invested capital. Let's look at an example.

A company can purchase a depreciable asset with a two-year life and no salvage value for $1,000. The asset produces incremental revenue of $600 per year. The income statement for the first year would look like this:

Income Statement	
Revenue	$ 600
Depreciation Expense	(500)
Net Income	$ 100

Unadjusted Rate of Return

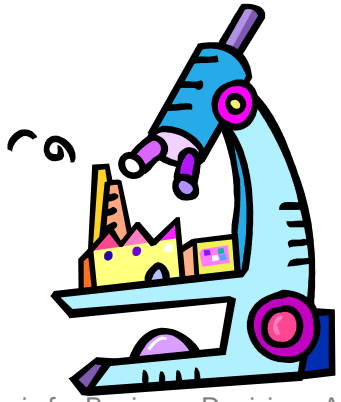
Given the pattern of cash flows over the life of the investment, the amount of invested capital will range from a beginning balance of $1,000 to an ending balance of zero. The unadjusted rate of return should be calculated as follows:



$$\text{Unadjusted rate of return} = \frac{\$100}{\$1000} = 10\%$$

Postaudits

A postaudit is conducted at the completion of a capital investment project, using the same analytical technique that was used to justify the original investment. The focus should be on continuous improvement in the capital expenditure process.



Exercise D.P. 5-2: Payback/Unadjusted Rate of Return

EZ Rentals can purchase a van that costs $24,000. The van has an expected useful life of 5 years and no salvage value. EZ expects cash revenue from leasing the van to be $12,000 per year. Alternatively, EZ can purchase a car that costs $16,000. EZ expects cash revenue from leasing the car to be $10,000 per year over a 3-year useful life. Ignore income taxes.

Required

a. Determine the payback period for the van.
b. Determine the payback period for the car.
c. Indicate which vehicle is the better alternative if payback is used as the sole investment criteria.
d. Describe the possible shortcomings of using payback as the investment criteria.
e. Determine the unadjusted rate of return for both alternatives.