Factor Name	Symbol	Formula
Single Payment Compound Amount	$(F/P\,,i,n)$	$F_n = P\left(1+\frac{i}{m}\right)^{nm}$
Single Payment Present Worth	$(P/F\,,i,n)$	$P = F_n\left(1+\frac{i}{m}\right)^{-nm}$
Uniform Series Compound Amount	$(F/A\,,i,n)$	$F_n = A\left[\frac{\left(1+\frac{i}{m}\right)^{nm}-1}{\frac{i}{m}}\right]$
PUniform Series Sinking Fund	$(A/F\,,i,n)$	$A = F_n\left[\frac{\frac{i}{m}}{\left(1+\frac{i}{m}\right)^{nm}-1}\right]$
Uniform Series Present Worth	$(P/A\,,i,n)$	$P = A\left[\frac{\left(1+\frac{i}{m}\right)^{nm}-1}{\frac{i}{m}\left(1+\frac{i}{m}\right)^{nm}}\right]$
Capital Recovery	$(A/P\,,i,n)$	$A = P\left[\frac{\frac{i}{m}\left(1+\frac{i}{m}\right)^{nm}}{\left(1+\frac{i}{m}\right)^{nm}-1}\right]$
Uniform Gradient Present Worth	$(P/G\,,i,n)$	$P = G\left[\frac{\left(1+\frac{i}{m}\right)^{nm}-1}{\left(\frac{i}{m}\right)^{2}\left(1+\frac{i}{m}\right)^{nm}}-\frac{n}{\frac{i}{m}\left(1+\frac{i}{m}\right)^{nm}}\right]$
Uniform Gradient Future Worth	$(F/G\,,i,n)$	$F = G\left[\frac{\left(1+\frac{i}{m}\right)^{nm}-1}{\left(\frac{i}{m}\right)^{2}}-\frac{n}{\frac{i}{m}}\right]$
Uniform Gradient Uniform Series	$(A/G\,,i,n)$	$A = G\left[\frac{1}{\frac{i}{m}}-\frac{n}{\left(1+\frac{i}{m}\right)^{nm}-1}\right]$

Simple Interest: $F_n = P(1+i_s n)$

Continuous Interest: $F_n = Pe^{i_c t}$

$$i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^{m} - 1$$

Converting for different compound duration: $i_2 = m_2\left(\left(1 + \frac{i_1}{m_1}\right)^{m_1/m_2} - 1\right)$

Depreciation Formulas:

Depreciation is a tax savings – it spreads the cost of a fixed capital investment over a period of years, n, determined by the federal government. Equipment life, n, is determined for each industry (IRS Publication 946). Typical value for chemical plants is 9.5 years.

FCI_L: Fixed capital investment, minus land

S: Salvage value (the value of FCI_L at year n, often assumed to be 0)

n: Equipment class life

k: Year of interest

d_k: Depreciation in year k

R: Revenue from sales

COM_d: Manufacturing costs (excluding depreciation)

t: Tax Rate (Typical value = 40% including federal, state and local)

Straight Line Depreciation: Simplest method, depreciation is equal in all years

$$d_k^{SL} = \left(\frac{FCI_L - S}{n}\right)$$

Sum of Years Digits Depreciation: Historical method, no longer in use

$$d_k^{SOYD} = \left(\frac{(n+1-k)(FCI_L - S)}{\frac{1}{2}n(n+1)}\right)$$

Double Declining Balance Depreciation:

$$d_k^{DDB} = \frac{2}{n}\left(FCI_L - \sum_{j=0}^{k-1} d_j\right)$$

The quantity 'FCI_L minus sum of depreciation from all prior years' is called the "Book Value"

In the final year, depreciation is calculated as 'Book Value minus Salvage'

Sum of depreciation over all years must equal Fixed Capital Investment minus Salvage

MACRS Depreciation (Modified Accelerated Cost Recovery System): Uses a shorter equipment class life, n, based on tables in IRS Publication 946. Typical Value is 5 years for Chemical Plants.

This method uses DDB then switches to SL when SL becomes the higher value. Note that the denominator for SL is remaining years, not original n. The ½ year convention is commonly used, assumes equipment placed in service at mid-year. Multiply 1st and last year depreciation by 0.5.

It is much easier to use the MACRS Schedule then to calculate by hand.

Note that MACRS always sets Salvage value to 0.

Table A1 from IRS Publication 946: MACRS Schedules for various recovery periods, using the half-year convention.

Year	MACRS Depreciation Rate for Recovery Period of:				
	3-year	5-year	7-year	10-year	15-year
1	33.33%	20%	14.29%	10%	5%
2	44.45	32	24.49	18	9.5
3	14.81	19.2	17.49	14.4	8.55
4	7.41	11.52	12.49	11.52	7.7
5		11.52	8.93	9.22	6.93
6		5.76	8.92	7.37	6.23
7			8.93	6.55	5.9
8			4.46	6.55	5.9
9				6.56	5.91
10				6.55	5.9
11				3.28	5.91
12					5.9
13					5.91
14					5.9
15					5.91
16					2.95

$$\text{Expenses} = (COM_d + \mathrm{d}_k)$$

$$\text{Income Tax} = (\mathrm{R} - COM_d - \mathrm{d}_k) \cdot t$$

$$\text{After Tax Net Profit} = (\mathrm{R} - COM_d - \mathrm{d}_k) \cdot (1 - t)$$

$$\text{After Tax Cash Flow} = (\mathrm{R} - COM_d - \mathrm{d}_k) \cdot (1 - t) + d_k$$

From the FE Exam Reference Manual – a representative Interest Rate Table for given value of i

Interest Rate Tables
Factor Table - $i = 4.00\%$

n	*P/F*	*P/A*	*P/G*	*F/P*	*F/A*	*A/P*	*A/F*	*A/G*
1	0.9615	0.9615	0.0000	1.0400	1.0000	1.0400	1.0000	0.0000
2	0.9246	1.8861	0.9246	1.0816	2.0400	0.5302	0.4902	0.4902
3	0.8890	2.7751	2.7025	1.1249	3.1216	0.3603	0.3203	0.9739
4	0.8548	3.6299	5.2670	1.1699	4.2465	0.2755	0.2355	1.4510
5	**0.8219**	**4.4518**	**8.5547**	**1.2167**	**5.4163**	**0.2246**	**0.1846**	**1.9216**
6	0.7903	5.2421	12.5062	1.2653	6.6330	0.1908	0.1508	2.3857
7	0.7599	6.0021	17.0657	1.3159	7.8983	0.1666	0.1266	2.8433
8	0.7307	6.7327	22.1806	1.3686	9.2142	0.1485	0.1085	3.2944
9	0.7026	7.4353	27.8013	1.4233	10.5828	0.1345	0.0945	3.7391
10	**0.6756**	**8.1109**	**33.8814**	**1.4802**	**12.0061**	**0.1233**	**0.0833**	**4.1773**
11	0.6496	8.7605	40.3772	1.5395	13.4864	0.1141	0.0741	4.6090
12	0.6246	9.3851	47.2477	1.6010	15.0258	0.1066	0.0666	5.0343
13	0.6006	9.9856	54.4546	1.6651	16.6268	0.1001	0.0601	5.4533
14	0.5775	10.5631	61.9618	1.7317	18.2919	0.0947	0.0547	5.8659
15	**0.5553**	**11.1184**	**69.7355**	**1.8009**	**20.0236**	**0.0899**	**0.0499**	**6.2721**
16	0.5339	11.6523	77.7441	1.8730	21.8245	0.0858	0.0458	6.6720
17	0.5134	12.1657	85.9581	1.9479	23.6975	0.0822	0.0422	7.0656
18	0.4936	12.6593	94.3498	2.0258	25.6454	0.0790	0.0390	7.4530
19	0.4746	13.1339	102.8933	2.1068	27.6712	0.0761	0.0361	7.8342
20	**0.4564**	**13.5903**	**111.5647**	**2.1911**	**29.7781**	**0.0736**	**0.0336**	**8.2091**
21	0.4388	14.0292	120.3414	2.2788	31.9692	0.0713	0.0313	8.5779
22	0.4220	14.4511	129.2024	2.3699	34.2480	0.0692	0.0292	8.9407
23	0.4057	14.8568	138.1284	2.4647	36.6179	0.0673	0.0273	9.2973
24	0.3901	15.2470	147.1012	2.5633	39.0826	0.0656	0.0256	9.6479
25	**0.3751**	**15.6221**	**156.1040**	**2.6658**	**41.6459**	**0.0640**	**0.0240**	**9.9925**
30	0.3083	17.2920	201.0618	3.2434	56.0849	0.0578	0.0178	11.6274
40	0.2083	19.7928	286.5303	4.8010	95.0255	0.0505	0.0105	14.4765
50	0.1407	21.4822	361.1638	7.1067	152.6671	0.0466	0.0066	16.8122
60	0.0951	22.6235	422.9966	10.5196	237.9907	0.0442	0.0042	18.6972
100	**0.0198**	**24.5050**	**563.1249**	**50.5049**	**1,237.6237**	**0.0408**	**0.0008**	**22.9800**