Source: Engineering economic analysis

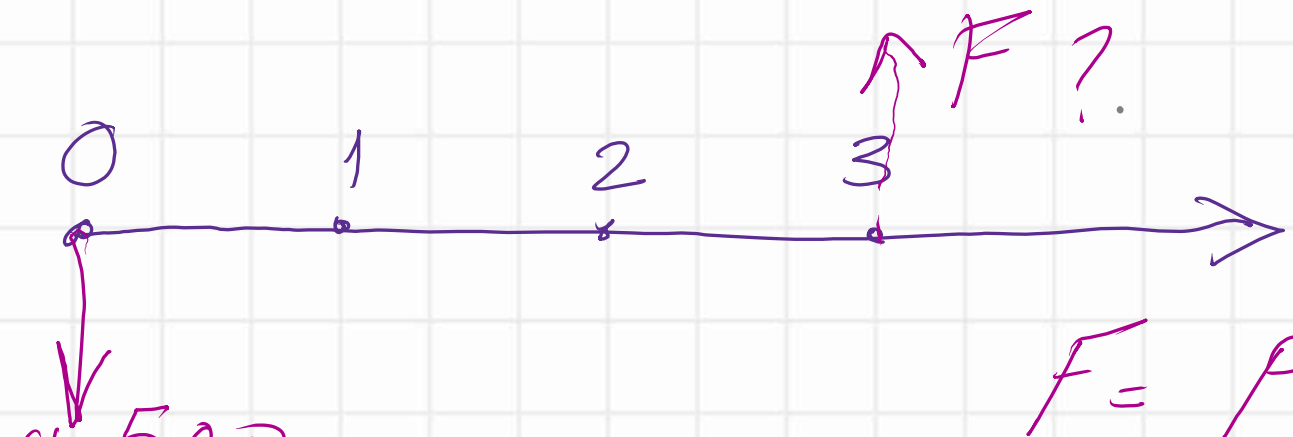
EXAMPLE 3–5

If $500 were deposited in a bank savings account, how much would be in the account 3 years from now if the bank paid 6% interest compounded annually?

Solution: given P = $500 ↓ Person Point of view

i = 6%

n = 3 years

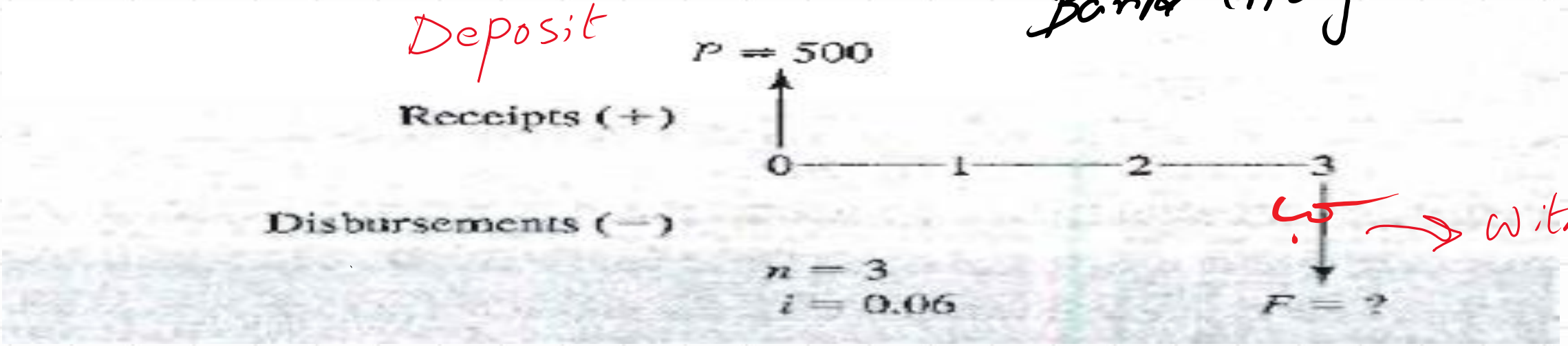


$$F = P(1+i)^n = 500(1+0.06)^3$$

$$= \$595.51$$

Bank diagram

Deposit



By Symbols $\Rightarrow F = P(F/P, 0.06, 3)$

Find F given P, i%, n

$F = 500(1.06)^3$

$= 500(1.91) = 595.508$ #

Source: Engineering economic analysis

EXAMPLE 3–6

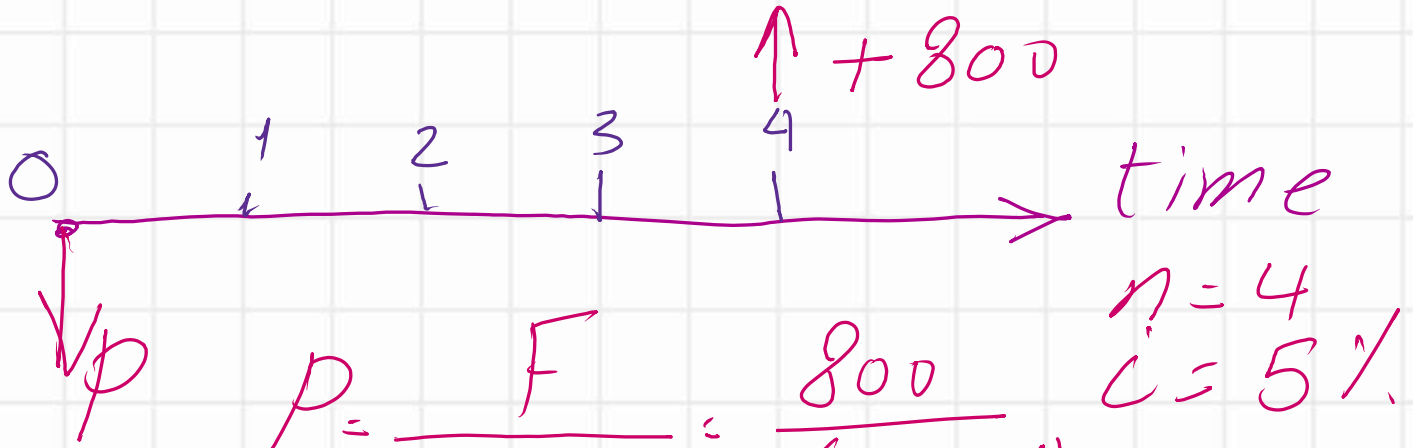
If you wish to have $800 in a savings account at the end of 4 years, and 5% interest will be paid annually, how much should you put into the savings account now?

FORMULA SOLUTION

$$F = \$800, \qquad i = 0.05, \qquad n = 4, \qquad P = \text{unknown}$$

$$P = F(1+i)^{-n} = 800(1+0.05)^{-4} = 800(0.8227) = \$658.16$$

Find P
given F
i %
n



$P = \frac{F}{(1+i)^n} = \frac{800}{(1.05)^4}$

n = 4
i = 5%

P = $658.16

$P = F(\frac{P}{F}, i\%, n)$

$P = F(0.8227)$

$P = F(\frac{P}{F}, 5\%, 4)$

$P = 800(0.8227) =$ # 658.16 ⇒ Same solution

5%

Compound Interest Factors

Single Payment		Uniform Payment Series				Arithmetic Gradient		
Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
Find *F* Given *P* *F/P*	Find *P* Given *F* *P/F* ↓	Find *A* Given *F* *A/F*	Find *A* Given *P* *A/P*	Find *F* Given *A* *F/A*	Find *P* Given *A* *P/A*	Find *A* Given *G* *A/G*	Find *P* Given *G* *P/G*	*n*
1.050	.9524	1.0000	1.0500	1.000	0.952	0	0	1
1.102	.9070	.4878	.5378	2.050	1.859	0.488	0.907	2
1.158	.8638	.3172	.3672	3.152	2.723	0.967	2.635	3
1.216	.8227	.2320	.2820	4.310	3.546	1.439	5.103	4 ←
1.276	.7835	.1810	.2310	5.526	4.329	1.902	8.237	5

EXAMPLE 2.2 The Cement Factory Case

PE

As discussed in the introduction to this chapter, the Houston American Cement factory will require an investment of $200 million to construct. Delays beyond the anticipated implementation year of 2012 will require additional money to construct the factory. Assuming that the cost of money is 10% per year, compound interest, use both **tabulated factor values** and **spreadsheet functions** to determine the following for the board of directors of the Brazilian company that plans to develop the plant.

(*a*) The equivalent investment needed if the plant is built in 2015.
(*b*) The equivalent investment needed had the plant been constructed in the year 2008.

Solution

Figure 2–2 is a cash flow diagram showing the expected investment of $200 million ($200 M) in 2012, which we will identify as time $t = 0$. The required investments 3 years in the future and 4 years in the past are indicated by $F_3 = ?$ and $P_{-4} = ?$, respectively.

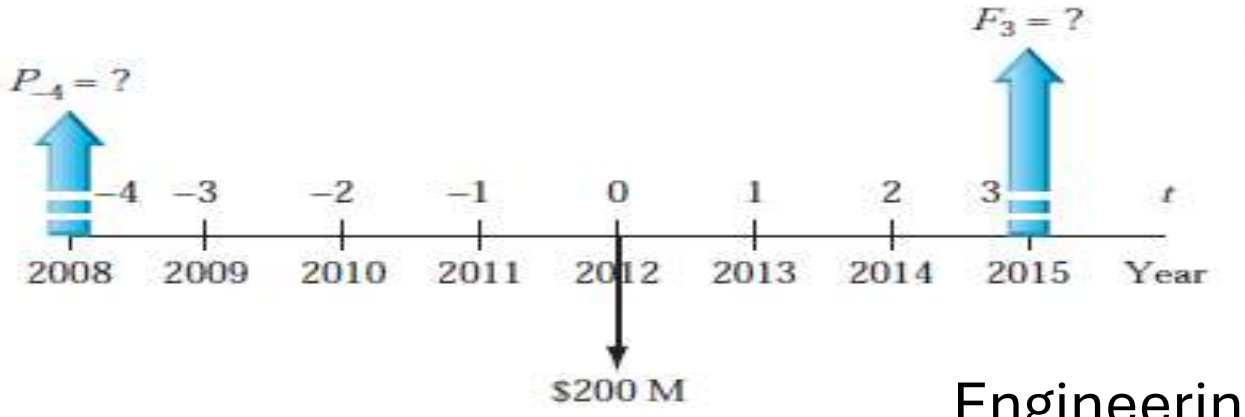


Figure 2–2
Cash flow diagram for Example 2.2*a* and *b*.

@ Use Tabulated Factor Value

(a) To find the equivalent investment required in 3 years, apply the F/P factor. Use \$1 million units and the tabulated value for 10% interest (Table 15).

$$F_3 = P(F/P,i,n) = 200(F/P,10\%,3) = 200(1.3310)$$
$$= \$266.2 \quad (\$266,200,000)$$

n = 3
P = \$200 million

Factor Table - i = 10.00%

n	P/F	P/A	P/G	F/P	F/A
1	0.9091	0.9091	0.0000	1.1000	1.0000
2	0.8264	1.7355	0.8264	1.2100	2.1000
3	0.7513	2.4869	2.3291	1.3310	3.3100
4	0.6830	3.1699	4.3781	1.4641	4.6410
5	**0.6209**	**3.7908**	**6.8618**	**1.6105**	**6.1051**
6	0.5645	4.3553	9.6842	1.7716	7.7156
7	0.5132	4.8684	12.7631	1.9487	9.4872
8	0.4665	5.3349	16.0287	2.1436	11.4359
9	0.4241	5.7590	19.4215	2.3579	13.5735
10	**0.3855**	**6.1446**	**22.8913**	**2.5937**	**15.9374**
11	0.3505	6.4951	26.3962	2.8531	18.5312
12	0.3186	6.8137	29.9012	3.1384	21.3843
13	0.2897	7.1034	33.3772	3.4523	24.5227

Using excel To calculate F/P &P/F

Part (b)

	2012-2015						2008-2012			
	p=200,000,000	i=10%		n=3	F?		p=?		i=10%		n=4	F=200,000,000
F2015	($266.20)	Million				P2008	($136.60)	Million				
Future value						Present Value						
	FV(10%,3,,200)						PV(10%,4,,200)					

(*b*) The year 2008 is 4 years prior to the planned construction date of 2012. To determine the equivalent cost 4 years earlier, consider the \$200 M in 2012 ($t = 0$) as the future value F and apply the P/F factor for $n = 4$ to find P_{-4}. (Refer to Figure 2–2.) Table 15 supplies the tabulated value.

$$P_{-4} = F(P/F,i,n) = 200(P/F,10\%,4) = 200(0.6830)$$
$$= \$136.6 \quad (\$136,600,000)$$

The PV function = PV(10%,4,,200) will display the same amount as shown in Fig-

P/F

Factor Table - i= 10.00%

n	*P/F*	*P/A*	*P/G*	*F/P*	*F/A*
1	0.9091	0.9091	0.0000	1.1000	1.0000
2	0.8264	1.7355	0.8264	1.2100	2.1000
3	0.7513	2.4869	2.3291	1.3310	3.3100
4	0.6830	3.1699	4.3781	1.4641	4.6410
5	**0.6209**	**3.7908**	**6.8618**	**1.6105**	**6.1051**
6	0.5645	4.3553	9.6842	1.7716	7.7156
7	0.5132	4.8684	12.7631	1.9487	9.4872
8	0.4665	5.3349	16.0287	2.1436	11.4359
9	0.4241	5.7590	19.4215	2.3579	13.5735
10	**0.3855**	**6.1446**	**22.8913**	**2.5937**	**15.9374**
11	0.3505	6.4951	26.3962	2.8531	18.5312
12	0.3186	6.8137	29.9012	3.1384	21.3843
13	0.2897	7.1034	33.3772	3.4523	24.5227