

$P = \text{Present Value}$
 $= \text{Principal}$

8.3 Present Value

$A = \text{Future Value}$

A Present Value

The amount or future value formula

$$A = P(1+i)^n$$

may be also written as:

$$P = \frac{A}{(1+i)^n}$$

or

$$P = A(1+i)^{-n}$$

Present Value

P

Future Value

$A = P + I$

0

t

Time Line

interest rate per period

Some other useful relations are here:

$$i = \frac{r}{m}$$

interest rate per year

total interest
 time (in years)
 number of periods per year

$$A = P + I$$

$$n = m \cdot t$$

Future Value

Principal (Present Value)

where:

P is the principal or the present value

A is the amount or the future value

I is the total accumulated interest

r is the interest rate per year

i is the interest rate per compounding period

n is the total number of compounding periods

m is the number of compounding periods per year

t is the time (in years)

Example 1. Samuel wants to invest enough money today to have \$10,000 for tuition when he goes to college in ten years. If he invests his money at 4% per year, compounded monthly, how much does he need to invest now?

$$A = \$10,000$$

$$t = 10 \text{ years}$$

$$r = 4\%$$

$$m = 12$$

$$P = ?$$

$$\textcircled{3} P = \frac{A}{(1+i)^n}$$

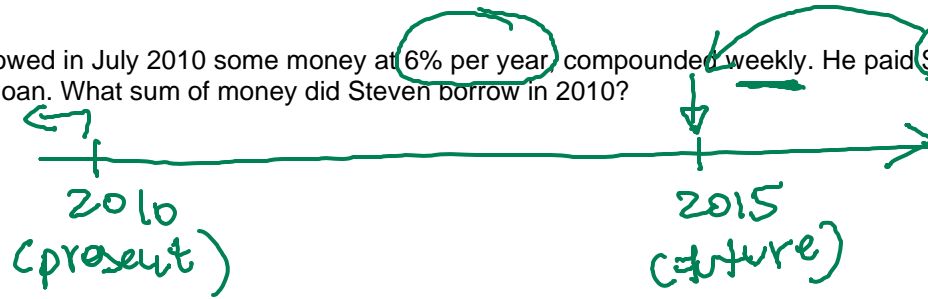
$$\textcircled{1} i = \frac{r}{m} = \frac{4\%}{12} = \frac{4}{100 \cdot 12} = 4/100/12$$

$$\textcircled{2} n = m \cdot t = (12) \cdot (10) = 120$$

$$\textcircled{3} P = \frac{A}{(1+i)^n} = \frac{\$10,000}{(1 + 4/100/12)^{120}} \approx \$6,707.66$$

∴ Samuel needs to invest now \$6,707.66

Example 2. Steven borrowed in July 2010 some money at 6% per year compounded weekly. He paid \$5,423.57 in July 2015 to pay off the loan. What sum of money did Steven borrow in 2010?



$$A = \$5,423.57$$

$$r = 6\%$$

$$m = 52$$

$$P = ?$$

$$t = 5 \text{ years}$$

$$\textcircled{3} P = \frac{A}{(1+i)^n} = \frac{\$5,423.57}{(1 + 6/100/52)^{260}} \approx \$4,018.57$$

$$\textcircled{1} i = \frac{r}{m} = \frac{6\%}{52} = 6/100/52$$

$$\textcircled{2} n = m \cdot t = (52) \cdot 5 = 260$$

Example 3. Alex purchased online a laptop in Dec 1st, 2019 by using his credit card and forgot completely about paying any money back. Consequently, in Dec 1st 2020, he had to pay back \$2,145.85 to pay off his debt. The credit company charges 21% interest rate per year, compounded daily. What was the price of the laptop?



$$A = \$2,145.85$$

$$r = 21\% = 21/100$$

$$m = 365$$

$$t = 1 \text{ year}$$

$$\textcircled{1} i = \frac{r}{m} = \frac{21/100}{365} = 21/100/365$$

$$\textcircled{2} n =$$