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For discrete compounding, to find the EAR, we use the equation:

$$\text{EAR} = [1 + (\text{APR}/\text{m})]^{m} - 1$$

$$\text{EAR} = [1 + (0.09/4)]^{4} - 1 = 0.0931, \text{or } 9.31\%$$

$$\text{EAR} = [1 + (0.16/12)]^{12} - 1 = 0.1723, \text{or } 17.23\%$$

$$\text{EAR} = [1 + (0.12/365)]^{365} - 1 = 0.1275, \text{or } 12.75\%$$

To find the EAR with continuous compounding, we use the equation:

$$\text{EAR} = \text{e}^{\text{APR}} - 1 = \text{e}^{0.11} - 1 = 0.1163, \text{or } 11.63\%$$

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The time line is:

0	1	2	3	4
PV	\$2,480	\$0	\$3,920	\$2,170

Here the cash flows are annual and the given interest rate is annual, so we can use the interest rate given. We can find the PV of each cash flow and add them together.

$$\text{PV} = \frac{\$2{,}480}{1.0717} + \frac{\$3{,}920}{1.0717^{3}} + \frac{\$2{,}170}{1.0717^{4}} = \$7{,}143.77$$

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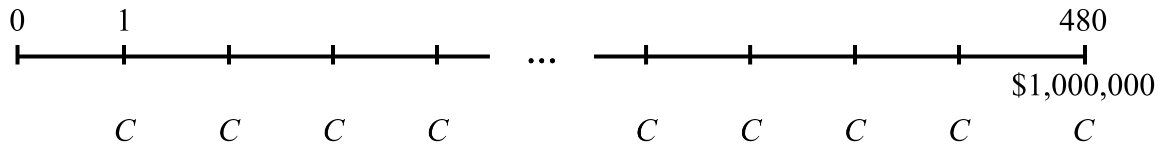
Here we are finding the annuity payment necessary to achieve the same FV. The interest rate given is an APR of 9.7 percent, with monthly deposits. We must make sure to use the number of months in the equation. So, using the FVA equation: $\text{FV} = \text{C} \times \text{FV}_{\text{A}} = \text{C}\left\{\frac{[(1+r)^{t}-1]}{\text{r}}\right\}$.

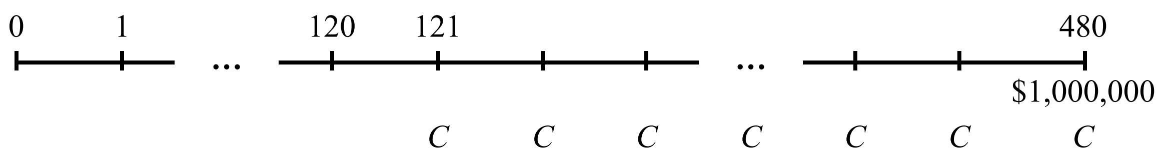
Starting today:



$$\text{FV} = \text{C}\left\{\frac{\left[\left(1+\left(\frac{0.097}{12}\right)\right)^{40\times 12}-1\right]}{\left(\frac{0.097}{12}\right)}\right\}$$

$$\text{C} = \frac{\$1{,}000{,}000}{5{,}774.1984} = \$173.18$$

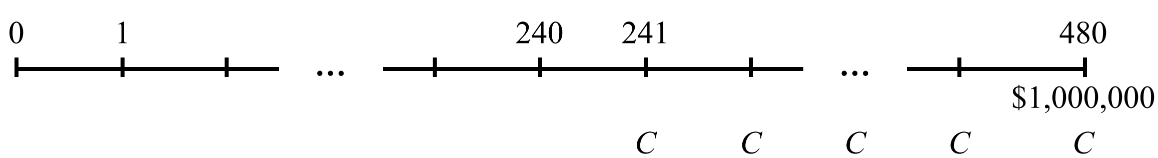
Starting in 10 years:



$$\text{FV} = \text{C}\left\{\frac{\left[\left(1+\left(\frac{0.097}{12}\right)\right)^{30\times 12}-1\right]}{\left(\frac{0.097}{12}\right)}\right\}$$

$$\text{C} = \frac{\$1{,}000{,}000}{2{,}120.8215} = \$471.52$$

Starting in 20 years:



$$\mathrm{FV} = \mathrm{C}\left\{\frac{\left[\left(1+\left(\frac{0.097}{12}\right)\right)^{20\times 12}-1\right]}{\left(\frac{0.097}{12}\right)}\right\}$$

$$\mathrm{C} = \frac{\$1{,}000{,}000}{730.4773} = \$1{,}368.97$$

Notice that a deposit for half the length of time, i.e., 20 years versus 40 years, does not mean that the annuity payment is doubled. In this example, by reducing the savings period by one-half, the deposit necessary to achieve the same ending value is about 8 times as large.