Topic: Compounding interest

Question: Four years ago, you owed $10 on your credit card. Since then, you haven't made any payments. If the card carries an annual interest rate of 22%, compounded continuously, how much do you owe on the credit card today?

Answer choices:

A $21.14

B $24.11

C $21.41

D $14.11

Solution: B

Both the interest rate and time have units in years, so with matching units we can plug directly into the exponential growth formula to find the amount you currently owe on the credit card.

$$A = Pe^{rt}$$

$$A = 10e^{(0.22)(4)}$$

$$A = 24.11$$

Topic: Compounding interest

Question: You made an initial investment of $1,000 at an annual interest rate of 4.5%, compounded continuously. If the investment is currently worth $5,632, how many years have you had the investment?

Answer choices:

A   384 years

B   3,840 years

C   38.4 years

D   3.84 years

Solution: C

Both the interest rate and time have units in years, so with matching units we can plug directly into the exponential growth formula to find the number of years we've held the investment.

$$A = Pe^{rt}$$

$$5{,}632 = 1{,}000e^{(0.045)t}$$

$$5.632 = e^{0.045t}$$

Apply the natural logarithm to both sides.

$$\ln 5.632 = \ln(e^{0.045t})$$

$$\ln 5.632 = 0.045t$$

$$t = \frac{\ln 5.632}{0.045}$$

$$t \approx 38.4$$

Topic: Compounding interest

Question: Twenty years ago, you purchased $5,000 worth of stock. This stock paid an interest compounded monthly, and today your shares are worth $45,000. What was the interest rate?

Answer choices:

A   111 %

B   0.11 %

C   1.10 %

D   11.04 %

Solution: D

Because interest is compounded monthly, $n = 12$. Using the compound interest formula, plug in what we know.

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

$$45{,}000 = 5{,}000 \left(1 + \frac{r}{12} \right)^{12(20)}$$

$$9 = \left(1 + \frac{r}{12} \right)^{240}$$

$$\sqrt[240]{9} = \left(1 + \frac{r}{12} \right)$$

$$1.0092 = 1 + \frac{r}{12}$$

$$r = 12(1.0092 - 1)$$

$$r = 0.1104$$

The interest rate was $11.04\,\%$.