1. A bank advertises an interest rate of 2% per year. If you deposit $10,000, how much is in the account 4 years later if the interest is compounded

(a) Continuously?

Let $P(t)$ be the amount in the account after $t$ years, then since the interest is compounded continuously,

\[ P(t) = 10,000e^{0.02t} \]

so that after 4 years ($t = 4$) the balance is

\[ P(4) = 10,000e^{0.02 \cdot 4} = 10,000e^{0.08} = 10,832.87 \]

Therefore the balance is $10,832.87

(b) Quarterly?

If the compounding is quarterly,

\[ P(t) = 10,000\left(1 + \frac{0.02}{4}\right)^{4t} \]

so that after 4 years, the balance is

\[ P(4) = 10,000(1.005)^{4 \cdot 4} = 10,000(1.005)^{16} = 10,830.71 \]

Therefore the balance is $10,830.71.

2. A business associate owes you $3000 and offers you two options for repayment

- **Option 1**: $2800 now.
- **Option 2**: 3 yearly installments of $1000 each, with the first installment paid now.

Assuming a 3% interest rate per year compounded continuously, which option should you choose?

**Option 1**: Accept $2800 now and place it in account earning interest continuously at 3% for 2 years for a comparison with the installments

\[ P_1(t) = 2800e^{0.03t} \Rightarrow P_1(2) = 2800e^{0.06} = 2973.14 \]

**Option 2**: The first installment is in the bank for 2 years, the second 1 year and the last does not spend any time in the bank so we compute the value of **Option 2** as

\[ P_2(2) = 1000e^{0.03 \cdot 2} + 1000e^{0.03 \cdot 1} + 1000 = 3092.29 \]

From the above calculations we conclude that **Option 2** is better.