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MATH 101
Spring 2022
HW 14: Due 05/05

"Money is a terrible master but an excellent servant."

–P.T. Barnum

Problem 1. (10pt) Suppose you take out a loan for $250 at a 5% annual interest rate, compounded monthly. How much is owed after a year and a half?

Solution.

$$\begin{aligned} F &= P\left(1+\frac{r}{k}\right)^{kt} \\ &= 250\left(1+\frac{0.05}{12}\right)^{12\cdot 1.5} \\ &= 250(1.00416667)^{18} \\ &= 250(1.0777162) \\ &= \$269.43 \end{aligned}$$

Problem 2. (10pt) If you invest \$6000 in an account which earns 2.5% annual interest, compounded continuously, how much is in the account after 7 years?

Solution.

$$\begin{aligned} F &= Pe^{rt} \\ &= 6000e^{0.025 \cdot 7} \\ &= 6000(1.1912462) \\ &= \$7147.48 \end{aligned}$$

Problem 3. (10pt) If one were to place \$5000 into a savings account that earns 4% annual interest, compounded semiannually, how long until the account has \$7000?

Solution.

$$F = P\left(1 + \frac{r}{k}\right)^{kt}$$

$$7000 = 5000\left(1 + \frac{0.04}{2}\right)^{2t}$$

$$7000 = 5000(1.02)^{2t}$$

$$(1.02)^{2t} = 1.4$$

$$\ln(1.02)^{2t} = \ln(1.4)$$

$$2t\ln(1.02) = \ln(1.4)$$

$$t = \frac{\ln(1.4)}{2\ln(1.02)}$$

$$t \approx 8.5 \text{ years}$$

Problem 4. (10pt) If you take out a loan for $1200 at a 6.5% annual interest, compounded continuously, how long until the loan amount has doubled?

Solution.

$$F = Pe^{rt}$$

$$2400 = 1200e^{0.065t}$$

$$e^{0.065t} = 2$$

$$\ln e^{0.065t} = \ln(2)$$

$$0.065t = \ln(2)$$

$$t = \frac{\ln(2)}{0.065}$$

$$t \approx 10.66 \text{ years}$$