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### Problem Set 1

#### Problem 1:

First, note that the money market account's interest rate is 0.2% per month. Then:

$$\begin{aligned} V_{\text{year 6}} &= \$60000 \cdot 1.002^{72} - \$45,000 \cdot 1.002^{72-30} + \sum_{k=1}^6 4000 \cdot 1.002^{72-12k} \\ &\approx \$69283.08 - \$48939.19 + \$25503.92 \\ &\approx \$45747.81 \end{aligned}$$

#### Problem 2:

1)

$$\begin{aligned} \$300,000 &= \frac{M}{0.005} \left( 1 - \frac{1}{1.005^{360}} \right) \\ &\approx 166.79M \\ M &\approx \frac{\$300000}{166.79} \approx \$1798.65 \end{aligned}$$

2)

$$\begin{aligned} \$300,000 &= \frac{\$1600}{0.005} \left( 1 - \frac{1}{1.005^{360}} \right) + \frac{X}{1.005^{360}} \\ &\approx \$266866.58 + \frac{X}{6.023} \\ X &\approx 6.023 \cdot (\$300000 - \$266866.58) \\ &\approx \$199548.50 \end{aligned}$$

#### Problem 3:

1) Consider the present value of the revenue and operating cost streams as two separate perpetuities:

$$\begin{aligned} PV_R &= \frac{\$2000000}{0.10} &&= \$20,000,000 \\ PV_E &= \frac{\$1000000}{0.10 - 0.05} &&= \$20,000,000 \\ PV &= PV_R - PV_E &&= 0 \end{aligned}$$

2) Now consider the same streams as annuities:

$$PV_R = \frac{\$2000000}{0.10} \left(1 - \frac{1}{(1.1)^{15}}\right) \approx \$15,212,159$$

$$PV_E = \frac{\$1000000}{0.10 - 0.05} \left(1 - \left(\frac{1.05}{1.1}\right)^{15}\right) \approx \$10,046,422$$

$$PV = PV_R - PV_E \approx \$5,165,736$$

**Problem 4:**

1)

$$\$8239.05 = \frac{M}{0.142/12} \left(1 - \frac{1}{(1 + 0.142/12)^{48}}\right)$$

$$M = \$225.97$$

2)

$$X = \sum_{i=1}^{48} \frac{M}{(1 + 0.08/12)^i} = \$9256.23$$

...and \$9,256.23 is higher than the price of the car.

3) This article is nonsense. Paying cash will always be a better choice as long as the loan interest rate is higher than the savings interest rate. While it's true that the "average amount on which he'd be paying interest [is] only about half the total amount borrowed", it's incorrect to say that the investment "would earn interest on his full deposited principal, plus continually compounded interest". This doesn't take into account that the monthly loan payments need to be subtracted from the investment balance — and the loan payments will be higher than the interest as long as the loan interest rate is higher than the CD interest rate.