

SHOW ALL WORK TO RECEIVE FULL CREDIT. YOU MAY WORK IN PAIRS

1. (10 points) Colleen and Bill have just purchased a house for \$650,000, with the seller holding a second mortgage of \$100,000. They promise to pay the seller \$100,000 plus all accrued interest 5 years from now. The seller offers them three interest options on the second mortgage:

- Simple interest at 12% per annum
- 11.5% interest compounded monthly
- 11.25% interest compounded continuously

Which option is best; that is, which results in the least interest on the loan? It is not enough to do the calculations for ONE option, you must do them for ALL THREE.

Option 1  $A = P(1 + rt) = 100,000(1 + 0.12 \cdot 5)$   
 $= 100,000(1 + 0.60) = 100,000 \cdot 1.6$   
 $= 160,000 = \$160,000$

Option 2  $A = P\left(1 + \frac{r}{n}\right)^{nt} = 100,000\left(1 + \frac{0.115}{12}\right)^{12 \cdot 5}$   
 $\approx 177,227.1875\dots$   
 $= \$177,227.19$

Option 3:  $A = Pe^{rt} = 100,000\left(e^{(0.1125 \cdot 5)}\right)$   
 $= 100,000e^{0.5625}$   
 $= 175,505.465696$   
 $\approx \$175,505.47$

The first option is the best, as the interest is only \$60,000 versus more than \$70,000 for the other two.

## Quiz #11

2. (5 points) Jerome will be buying a used car for \$15,000 in 3 years. How much money should he ask his parents for now so that, if he invests it at 5% compounded continuously, he will have enough to buy the car?

$$A = Pe^{rt}$$

$A = \text{future amount} = \$15,000$   
 $P = \text{amount Jerome should ask for}$   
 $r = 0.05$   
 $t = 3 \text{ years}$

So, we can solve the equation for  $P$

$$P = \frac{A}{e^{rt}} = Ae^{-rt} = 15,000e^{-0.05 \cdot 3} = 15,000e^{-0.15}$$

$$\approx \$12,910.62$$

3. (5 points) The formula  $t = \frac{\ln A - \ln P}{r}$  can be used to find the number of years  $t$  required for an investment  $P$  to grow to a value  $A$  when compounded continuously at an annual rate  $r$ . How long will it take to increase an initial investment of \$1000 to \$8000 at an annual rate of 10%?

$$t = \frac{\ln 8000 - \ln 1000}{0.1} \approx 20.79 \text{ years}$$

approximately 21 years

## Quiz #11

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4. (2 points) EXTRA CREDIT. Derive the formula  $t = \frac{\ln A - \ln P}{r}$  from the previous question, using the compound interest formula.

$$\hookrightarrow A = Pe^{rt}$$

$$\frac{A}{P} = e^{rt}$$

$$\ln \frac{A}{P} = \ln e^{rt} = rt$$

$$t = \frac{\ln\left(\frac{A}{P}\right)}{r} = \frac{\ln A - \ln P}{r}$$

Please list at least 2 topics/problem types/sections in the book you would like to see some review questions about for the upcoming final exam. These will be used to write Quiz 12, which will be a graded review activity for the final exam that you will have all of next week to complete.