4C & 4D

Pg. 1

Math 160 Quiz #2 Sept 19, 2019

Name: Key

_____/20 pts

Show all work for full credit. ***(each problem is worth 4 points)***

1. Suppose you set up a new IRA (individual retirement account) that pays an APR of 5.1%, compounded monthly. If you contribute $150 per month for 15 years, how much will the IRA contain at the end of that time?

$n=12$ $APR=0.051$ $PMT=150$ $Y=15$

$$A=\frac{150\left(\left(1+\frac{0.051}{12}\right)^{12(15)}-1\right)}{\left(\frac{0.051}{12}\right)}$$

$$A=\frac{150\left[(1.00425)^{180}-1\right]}{0.00425}$$

$$A=\frac{150(2.1455\ldots-1)}{0.00425} \rightarrow A=\frac{150(1.1455\ldots)}{0.00425}$$

$A\approx 40429.89$

so there would be $40429.89 in the acct.

2. Suppose you want your son's college fund to contain $150,000 after 15 years. If you can get an APR of 4.3%, compounded monthly, how much should you deposit at the end of each month?

$APR=0.043$ A $Y=15$ $n=12$

$$PMT=150000\left(\frac{\left(\frac{0.043}{12}\right)}{\left(\left(1+\frac{0.043}{12}\right)^{12(15)}-1\right)}\right)$$

$$PMT=150000\left(\frac{0.003583\overline{3}}{\left((1.003583\overline{3})^{180}-1\right)}\right)$$

$$PMT=150000\left(\frac{0.003583\overline{3}}{1.90379\ldots-1}\right)$$

$$PMT=150000\left(\frac{0.003583\overline{3}}{0.90379\ldots}\right)$$

$$PMT=150000(0.0039647\ldots)$$

$PMT\approx 594.72$

so the monthly payment would need to be $594.72

3. Consider a student loan of $42,000 with an APR of 5% for 10 years.

a) Find the monthly payment

$n=12$ P $APR=0.05$ Y

$$PMT=\frac{42000\left(\frac{0.05}{12}\right)}{\left[1-\left(1+\frac{0.05}{12}\right)^{-(12)(10)}\right]}$$

$$PMT=\frac{42000(0.00416\overline{6})}{\left[1-(1.00416\overline{6})^{-120}\right]}$$

$$PMT=\frac{175}{1-0.6071\ldots}$$

$$PMT=\frac{175}{0.39283\ldots}$$

$PMT\approx 445.48$

b) Find the total amount paid on the loan

$$T=\frac{\$445.48}{mos}\cdot\frac{12\ mos}{1\ yr}\cdot\frac{10\ yrs}{1}$$

$T=53457.60$

so the monthly payment would be $445.48 & $53457.60 would be paid in total over 10 years

c) Find the percent of the total amount that went to principal

$I=T-P$

$I=53457.60-42000$

$I=11457.60$

$$\%\ \text{towards principal}=\frac{42000}{53457.60}\approx 0.786\approx 78.6\%$$

d) Find the percent of the total amount that went to interest

$$\%\ \text{towards Interest}=\frac{11457.60}{55457.60}\approx 0.214\approx 21.4\%$$

notice how 78.6% + 21.4% = 100%!

so 78.6% went towards the principal & 21.4% went towards the interest

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APR = 0.24

4. Suppose you have a balance of $6400 on your credit card, which charges an APR of 24%. Assume that you charge no additional expenses to the card, and you want to pay off the balance in 2 years of monthly payments.

Y=2 → n=12

a) Find your monthly payment

$$PMT = \frac{6400\left(\frac{0.24}{12}\right)}{\left[1-\left(1+\frac{0.24}{12}\right)^{-12(2)}\right]}$$

$$PMT = \frac{6400(0.02)}{\left[1-(1.02)^{-24}\right]} \rightarrow PMT = \frac{128}{1-0.6217\ldots}$$

$$PMT = \frac{128}{0.3782\ldots}$$

PMT ≈ 338.38

b) Find the total amount paid

$$T = \frac{\$338.38}{mo} \cdot \frac{12\,mos}{1\,yr.} \cdot \frac{2\,yrs}{1}$$

$$T = 8121.12$$

So the monthly payment would be ~$338.38 & the total paid would be $8121.12 over the 2 years

c) What is the total amount of interest you will end up paying?

$$I = T - P$$

$$I = 8121.12 - 6400$$

$$I = 1721.12$$

The total amt. of interest paid is $1721.12

5. Compare the monthly payment and total payment for the following pairs of loan options. Assume that both loans are fixed rate and have the same closing costs. Discuss the pros and cons of each loan.

You need a $400,000 loan.

Option 1: a 30-year loan at an APR of 8%

Option 2: a 15-year loan at an APR of 7.5%

option 1 → 30 yrs @ 8%

$$PMT = \frac{400000\left(\frac{0.08}{12}\right)}{\left[1-\left(1+\frac{0.08}{12}\right)^{-12(30)}\right]}$$

$$PMT = \frac{400000(0.00\overline{6})}{\left[1-(1.00\overline{6})^{-360}\right]}$$

$$PMT = \frac{2666.\overline{6}}{\left[1-0.091443\ldots\right]}$$

$$PMT = \frac{2666.\overline{6}}{0.90855\ldots}$$

$$PMT \approx \$2935.06$$

$$T_{30} = \frac{\$2935.06}{mo} \cdot \frac{12\,mos}{1\,yr} \cdot \frac{30\,yr}{1}$$

$$T_{30} = \$1{,}056{,}621.60$$

$$T_{15} = \frac{\$3708.05}{mo} \cdot \frac{12\,mos}{1\,yr} \cdot \frac{15\,yrs}{1}$$

$$T_{15} = \$667449$$

In Summary, in Opt 1 your montly payments are less but you pay way more over the 30 yrs than you would if you could afford the higher monthly paymt (you would save almost $400K

option 2 → 15 yrs @ 7.5%

$$PMT = \frac{400000\left(\frac{0.075}{12}\right)}{\left[1-\left(1+\frac{0.075}{12}\right)^{-12(15)}\right]}$$

$$PMT = \frac{400000(0.00625)}{\left[1-(1.00625)^{-180}\right]}$$

$$PMT = \frac{2500}{\left[1-0.32579\ldots\right]}$$

$$PMT = \frac{2500}{0.674208\ldots}$$

$$PMT \approx 3708.05$$

$$\$1{,}056{,}621.60 - \$667449 = \$389172.60$$