Spring '08/MAT 117/Exam 1 **Name:** Solution *Show all your work.*

$F = P(1+rt)$ $F = P\left(1+\frac{r}{n}\right)^{nt}$ $F = D\frac{\left(1+\frac{r}{n}\right)^{nt}-1}{\frac{r}{n}}$ $P = R\frac{1-\left(1+\frac{r}{n}\right)^{-nt}}{\frac{r}{n}}$ $APY = \left(1+\frac{r}{n}\right)^{n}-1$

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1. (8pts) Giorgio was pleasantly surprised to find \$1098.24 in an account he forgot about. If this account bears 4.8% simple interest, and his money was in the account for 3 years, how much had he initially deposited?

$F = P(1+rt)$

$1098.24 = P(1+0.048\cdot 3)$

$1098.24 = P\cdot 1.144 \quad |\div 1.144$

$P = \frac{1098.24}{1.144}$

$P = \$960.00$

2. (12pts) A certain payday lender (with offices in Murray), advertises on their website that you can get a \$100 loan that you repay in 14 days with \$115. What simple annual interest rate are they charging?

$F = P(1+rt)$

$115 = 100\left(1+r\cdot\frac{14}{365}\right) \quad |\div 100$

$1.15 = 1+r\cdot\frac{14}{365} \quad |-1$

$0.15 = r\cdot\frac{14}{365} \quad |\cdot\frac{365}{14}$

$0.15\cdot\frac{365}{14} = r$

$r = 3.910714$

or 391.0714%

3. (9pts) Isabella deposits \$300 into an account bearing 5.19% interest, compounded quarterly. How much does she have in 2 years?

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

$F = 300\left(1+\frac{0.0519}{4}\right)^{4\cdot 2}$

$= 300\cdot 1.012975^{8}$

$= \$332.59$

4. (11pts) A coffee-drinker realizes that he spends \$3 every day on a cup of coffee. He ponders how much he would save in 2 years if instead he deposited this money daily into an account bearing 5.49%, compounded daily. While he ponders, you calculate and give the value of the account after two years.

$$F = P\,\frac{(1+\frac{r}{n})^{nt}-1}{\frac{r}{n}}$$

$$F = 3.\,\frac{(1+\frac{0.0549}{365})^{365\cdot 2}-1}{\frac{0.0549}{365}}$$

$$= 3.\,\frac{1.00015\ldots^{730}-1}{0.00015\ldots}$$

$$= 3.\ 771.52\ldots$$

$F = \$\ 2314.57$

5. (12pts) In 1992, your instructor could buy a gallon of milk for \$1.99. In 2008 he pays \$3.49 for a gallon of milk. What compounded annual "dairy" inflation rate does this growth correspond to?

16 years from 1992 to 2008

$$F = P(1+\tfrac{r}{n})^{nt}$$

$$3.49 = 1.99\,(1+\tfrac{r}{1})^{1\cdot 16} \quad \big| \div 1.99$$

$$1.7537\ldots = (1+r)^{16} \quad \big| \,\hat{}\,\tfrac{1}{16}$$

$$1.7537^{\frac{1}{16}} = 1+r$$

$$1.0357\ldots = 1+r$$

$$0.0357341 = r$$

Approx. 3.57341 % annual inflation

$$P = R\,\frac{1-\left(1+\frac{r}{n}\right)^{-nt}}{\frac{r}{n}}$$

6. (32pts) The Energizer Bunny's drum has worn out so he decides to get a new one for \$725. He will finance this purchase at 16.23% interest, compounded monthly, for 4 years.

a) What is his montly payment on the loan?

b) What are his total payments over the course of the loan? How much of this amount is for interest?

c) How much does he owe after 1 year?

d) How much of his 13th payment goes toward interest, and how much towards the principal?

a) $725 = R\,\dfrac{1-\left(1+\frac{0.1623}{12}\right)^{-12\cdot 4}}{\frac{0.1623}{12}}$

$725 = R \cdot \dfrac{1-1.013525^{-48}}{0.013525}$

$725 = R \cdot 35.139\ldots \quad \div 35.135$

$R = \dfrac{725}{35.135} = \boxed{20.63}$

b) total payments

$20.63 \cdot 48 = \$990.24$

For interest is

$990.24 - 725 = \$265.24$

c) amount owed = Present value of remaining 3 years of 1 payments

$P = 20.63 \cdot \dfrac{1-\left(1+\frac{0.1623}{12}\right)^{-12\cdot 3}}{\frac{0.1623}{12}}$

$= 20.63 \cdot \dfrac{1-1.013525^{-36}}{0.013525}$

$= 20.63 \cdot 28.35\ldots$

$= \$584.90$

d)

Toward interest:

$584.90 \cdot \frac{0.1623}{12} = \$7.91$

Toward principal:

$20.63 - 7.91 = \$12.72$

7. (16pts) Once you are out of college and have a job, you would like to save up for a new \$23,000 car. If you can deposit \$800 quarterly into an account bearing 7.3%, compounded quarterly, how long will it take until you have the desired amount?

$$F = D\,\frac{\left(1+\frac{r}{n}\right)^{nt}-1}{\frac{r}{n}}$$

$$23{,}000 = 800\,\frac{\left(1+\frac{0.073}{4}\right)^{4\cdot t}-1}{\frac{0.073}{4}}$$

$$23{,}000 = 800\cdot\frac{1.01825^{4t}-1}{0.01825} \quad | \div 800$$

$$28.75 = \frac{1.01825^{4t}-1}{0.01825} \quad | \cdot 0.01825$$

$$0.524\ldots = 1.01825^{4t}-1 \quad | +1$$

$$1.524\ldots = 1.01825^{4t} \quad | \log$$

$$\log 1.524\ldots = 4t \log 1.01825$$

$$t = \frac{\log 1.524\ldots}{4 \log 1.01825}$$

$$= 5.830503 \text{ years}$$

Bonus. (10pts) Sally deposits \$1,000 into an account bearing 4.4%, compounded weekly. For two years, she doesn't make any additional deposits. Then, she deposits \$25 every week for three years. How much is in this account five years from the initial deposit of \$1,000?

Need to compute and add:

Future value of the \$1000: $F = 1000\left(1+\frac{0.044}{52}\right)^{52\cdot 5} = 1245.96$

Future value of \$25 deposits over 3 years: $F = 25\cdot\frac{\left(1+\frac{0.044}{52}\right)^{52\cdot 3}-1}{\frac{0.044}{52}} =$

$= 25 \cdot 166.68\ldots = 4167.23$

Total value $= 5413.19$