**Spring '05/MAT 117/Worksheet 3** **Name:** *Show all your work.*

**1.** (7pts) Suppose you want to save \$20,000 to buy a car. If you can afford to put \$400 at the end of every month into a savings account bearing 5% compounded monthly, how long will it take you to save up for the car?

(series of payments - systematic savings)

$$20000 = 400 \cdot \frac{\left(1+\frac{0.05}{12}\right)^{12t}-1}{\frac{0.05}{12}} \quad | \div 400$$

$$50 = \frac{(1.004166\ldots)^{12t}-1}{0.004166} \quad | \cdot 0.004166$$

$$0.20833\ldots = (1.004166\ldots)^{12t} - 1 \quad | +1$$

$$1.20833\ldots = (1.004166)^{12t} \quad | \log$$

$$\log 1.20833\ldots = 12t \log(1.004166\ldots)$$

$$\frac{\log 1.20833\ldots}{12\log(1.004166\ldots)} = t$$

$t = 3.79$ years

**2.** (6pts) In order to buy a car, you borrowed \$20,000 at 5% interest compounded monthly, which will be repaid over 4 years. What is your monthly payment?

$$20{,}000 = R\ \frac{1-\left(1+\frac{0.05}{12}\right)^{-12\cdot 4}}{\frac{0.05}{12}} \quad \text{(loan formula)}$$

$$20{,}000 = R \cdot \frac{1-(1.004166\ldots)^{-48}}{0.004166\ldots}$$

$$20{,}000 = R \cdot 43.429\ldots \quad | \div 43.429\ldots$$

$$\frac{20{,}000}{43.429\ldots} = R$$

$R = \$460.59$

**3.** (7pts) What annual interest rate makes a \$1,000 deposit grow to \$1,800 in 5 years, assuming interest is compounded quarterly?

(one-time deposit - compound interest formula)

$$1800 = 1000\left(1+\frac{r}{4}\right)^{4\cdot 5} \quad | \div 1000$$

$$1.8 = \left(1+\frac{r}{4}\right)^{20} \quad | (\ )^{\frac{1}{20}}$$

$$1.8^{\frac{1}{20}} = 1+\frac{r}{4} \quad | -1$$

$$0.02982\ldots = \frac{r}{4} \quad | \cdot 4$$

$$0.1193018\ldots = r$$

$$r = 11.93\%$$