

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

1. (4pts) Solve the equation, rounding the answer to 6 significant digits.

$$(1+r)^3 = 2.25 \quad | \left(\right)^{\frac{1}{3}}$$

$$\left((1+r)^3 \right)^{\frac{1}{3}} = 2.25^{\frac{1}{3}}$$

$$1+r = 2.25^{\frac{1}{3}}$$

$$r = 2.25^{\frac{1}{3}} - 1 = 0.310371$$

2. (4pts) What is the future value of \$700 deposited for 9 months in an account bearing simple interest of 10%?

$$F = 700 \left(1 + 0.10 \cdot \frac{9}{12} \right) = 700 \cdot 1.075 = 752.50$$

time in years

3. (5pts) A woman deposits \$4,000 into an account bearing a simple interest rate of 8%. How long will it take until she has \$5,000 in the account?

$$5000 = 4000(1 + 0.08t) \quad | \div 4000$$

$$1.25 = 1 + 0.08t \quad | -1$$

$$0.25 = 0.08t \quad | \div 0.08$$

$$\frac{0.25}{0.08} = t$$

$$0.08$$

$$t = 3.125 \text{ years}$$

4. (5pts) What is the annual percentage yield of an account bearing 4.71% interest if it is compounded daily?

$$APY = \left(1 + \frac{0.0471}{365}\right)^{365} - 1 = 0.04822\dots$$

4.82%

5. (6pts) Peter would like to save \$24,000 to buy a new car. He can get a savings account bearing 5% compounded quarterly. How much should he deposit at the end of every quarter in order to have \$24,000 after 3 years?

(systematic savings formula)

$$24000 = D \frac{\left(1 + \frac{0.05}{4}\right)^{4 \cdot 3} - 1}{\frac{0.05}{4}}$$

$$24000 = D \frac{(1.0125)^{12} - 1}{0.0125}$$

$$24000 = D \cdot 12.86\dots \quad | \div 12.86\dots$$

$$\frac{24000}{12.86\dots} = D$$

$$D = 1866.20 \text{ every quarter}$$

6. (6pts) If inflation averages 4% over the next 10 years, how much will an item costing \$10 today cost in 2015?

$$F = 10(1 + 0.04)^{10} = 10 \cdot 1.04^{10} = 14.80$$

7. (12pts) The bored teenagers from the last exam decided to go and fight a bull one night. Sneaking around a cattle farm in the darkness, they accidentally rammmed the van of an animals' rights group (with protesters sleeping inside), and caused \$15,000 worth of damage and medical expenses. In order to cover the damage, they took out a 4-year loan at 9% interest, compounded monthly.

a) What is their monthly payment?

b) What is the balance on the loan after 3 years?

c) Use your result from a) to figure out what their monthly payment would be, had the damage been only \$7,500.

a) Loan formula:

$$15,000 = R \frac{1 - \left(1 + \frac{0.09}{12}\right)^{-12 \cdot 4}}{\frac{0.09}{12}}$$

$$15,000 = R \frac{1 - (1.0075)^{-48}}{0.0075}$$

$$15,000 = R \cdot 40.1847 \dots \quad | + 40.1847 \dots$$

$$\frac{15000}{40.1847} = R$$

$$R = 373.28$$

b) Balance = present value of remaining payments

$$= 373.28 \cdot \frac{1 - (1.0075)^{-12 \cdot 1}}{0.0075}$$

$$= 373.28 \cdot 11.43 \dots$$

$$= 4268.42$$

c) Half the loan amount will give half the payment,

$$\text{thus here } R = \frac{1}{2} \cdot 373.28$$

$$= 186.64$$

8. (8pts) How long will it take a deposit to triple if it is getting 15% interest, compounded semiannually?

(compound-interest formula)

$$3 = 1 \cdot \left(1 + \frac{0.15}{2}\right)^{2t}$$

$$3 = (1.075)^{2t} \quad | \log$$

$$\log 3 = 2t \log(1.075)$$

$$\frac{\log 3}{2 \log(1.075)} = t$$

$$t = 7.60 \text{ years}$$

Bonus. (5pts) A couple of newlyweds took out a 20-year, \$154,000 loan to finance their new home. The interest rate on this loan is 5.75% compounded monthly, making their monthly payment \$1081.21. Write the amortization schedule for the first three payments.

no.	payment	toward interest	toward principal	balance
1	1081.21	737.92	343.29	153,656.71
2	1081.21	736.27	344.94	153,311.77
3	1081.21	734.62	346.59	152,965.18