MATH 1550: PRECALCULUS Fall 2010, Section 10

Worksheet for §5.6 & §5.7

Compound Interest Formula

Interest that is applied to the balance of an account at the end of a compounding period.

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

- A = **amount:** the amount in the account after interest is added
- P = **principal:** the amount in the account before interest is added
- r = **interest rate:** the interest rate also known as APR *in decimal form*
- t = **time:** the number of years
- n = **number of compoundings per year: number of times the interest is compounded**
  - annually : n=1
  - semiannually : n=2
  - quarterly : n=4
  - monthly : n=12
  - weekly : n=52
  - daily : n=365
  - ⋮

---

1. In the standard notation given above, what should n be if the interest is compounded every minute.

2. If I deposit $ 800 in a savings account at 6% interest compounded annually, and if I make no withdrawals or deposits for 4 years, how much will I have in my account at the end of 4 years?

3. Laura deposit $ 2000 in a CD account at 3% interest compounded monthly, after 2 years, she withdraws all the money from that bank and deposits in another CD account at another bank which pays 3.5% compounded annually. How much will she have in her account 3 years after she had invested in the new bank? If she did not change the banks, how much would she have had in 5 after depositing $ 2000 in the first bank?

4. How much should I save today in a CD account, which pays 3% compounded monthly, if I am to have $ 3000 in 5 years?

5. Michael's parents has deposited $ 2500 in an account which pays 2.25% interest compounded daily. If no money is deposited to or withdrawn from that account, how old will Michael be when that account has a balance of $ 5000 ?

6. If you deposit $ 1000 in a CD at The First United Trust Bank of Far Far Away Land, which is run by Princess Fiona and Shrek, you are guaranteed to get $ 1500 after 5 years. All you know is they compound the interest semiannually. How much is their interest rate?

Continuously Compound Interest Formula

Interest that is applied to the balance of an account continuously

$$A = Pe^{rt}$$

- A = **amount:** the amount in the account after interest is added
- P = **principal:** the amount in the account before interest is added
- r = **interest rate:** the interest rate *in decimal form*
- e = **natural base:** 2.71828...
- t = **time:** the number of years

Exponential Growth and Decay Formula

A model of growth or decay that has the form

$$\mathcal{N}(t) = \mathcal{N}_0 e^{kt}$$

- $\mathcal{N}(t)$= function notation for the size of a population at a given time
- $\mathcal{N}_0$= the initial population
- **e=natural base:** 2.71828...
- **t=time:** use the given units
- **k=growth or decay constant:**
  - If $k > 0$ growth
  - If $k < 0$ decay

1. Suppose you invest \$ 1000 at 4% for 5 years. Calculate (and tabulate) how much you will have as balance under different conpounding plans.

Plan	A	r	t	n	P
Annually	\$ 1000	0.04	5	1	
Semiannually	\$ 1000	0.04	5	2	
Quarterly	\$ 1000	0.04	5	4	
Monthly	\$ 1000	0.04	5	12	
Weekly	\$ 1000	0.04	5	52	
Daily	\$ 1000	0.04	5	365	
Hourly	\$ 1000	0.04	5	365×24	
Every minute	\$ 1000	0.04	5	$365 \times 24 \times 60$	
Every second	\$ 1000	0.04	5	$365 \times 24 \times 60 \times 60$	
Continuously	\$ 1000	0.04	5	—	

2. *Growth of bacteria can be modeled as an exponential growth.* At the start of an experiment there are 3500 bacteria present. Two hours later, the population is 5200.

   (a) Determine the growth constant.
   (b) Determine the population five hours after the experiment began.
   (c) When will the population reach 10000?

3. *Radioactive decay can be modeled as an exponential decay.* The half-life (i.e. if you start with some amount, the time it takes to decay down to one half of the starting amount) of Iodine-131 is 8 days.

   (a) Determine the decay constant.
   (b) If you start with a sample of 5 grams of Iodine-131, how much of it will remain after 6 days?
   (c) How long will it take until only 1 gram of Iodine-131 is left?