1. Find the PV and FV of a **continuous annuity** of $1,000 per year for 20 years with
   (a) 10% continuously compounded interest rate?
   (b) 10% annually compounded interest rate?
   (c) 10% quarterly compounded interest rate?

2. You invested $6,000 and in 6 years get back $15,000. What is the nominal interest rate (APR) if
   (a) interest is compounded annually?
   (b) interest is compounded monthly?
   (c) interest is compounded continuously?

3. You deposit a lump sum amount of $7,000 in an account. You wish to close the account and withdraw the money when the balance reaches $15,000. How long will this take if
   (a) APR=12% and interest is compounded annually?
   (b) APR=12% and interest is compounded continuously?
   (c) APR=12% and interest is compounded monthly?

4. Do the following problems:
   (a) You deposit a lump sum amount of $1,000 at 9% APR, how long will it take to double, triple the investment if interest is compounded annually?
   (b) Same as part (a) if interest is compounded quarterly?
   (c) You deposited $1,200 per year, APR=10%. How long will it take for the balance to reach $5,000 if interest is compounded annually? What if you deposit $100 per month and interest is compounded monthly?
   (d) You deposited $1,200 at the end of each year, APR=10%. How long will it take for the balance to reach $5,000 if interest is compounded monthly? If interest is compounded continuously?

5. You have $500,000 in an account earns 8% APR with quarterly interest compounding. How long will it take to exhaust the account if
   (a) you withdraw $50,000 at the end of each year? What if you withdraw $40,000 a year?
   (b) you withdraw $5,000 at the end of each month? What if you withdraw $3,000 a month instead?
(c) you withdraw $15,000 at the end of each quarter? What if you withdraw $10,000 instead?

6. You own an oil pipeline which will generate $2 million cash return over the coming year. The pipelines operating costs are negligible and it expected to last for a very long time. Unfortunately, the volume of oil shipped is declining and cash flows are expected to decline by 4% per year. (APR=10%)  
(a) What's the PV if the pipelines last forever?  
(b) What if it lasts 20 years?

7. Your firm expects to earn $200,000 this year (end-of-year) and projects a 5% growth rate in earnings thereafter. APR=10% (interest is compounded annually). What is the PV of the earnings if  
(a) the earnings will grow forever;  
(b) the earnings will grow for another 10 years and then shut down;  
(c) the earnings will grow for another 10 years and then level earnings (no growth) thereafter.

8. ABC corp. will pay off a $50 million loan 20 years from now. It is required to set up a sinking fund to pay off the loan. What will be the annual contribution of the fund with the following stipulations if the annually compounded rate of interest is 12% and if we expect:  
(a) level payment each year;  
(b) payments to grow at 6% per year (find the payments for years 1,2).

9. Find the PV of the following cash flows. Assume the annually compounded interest rate is 8% and all cash flows are end-of-year.  
(a) $2,000 for the first 9 years and then level cash flows (no growth) thereafter (forever).  
(b) Nothing for the first 4 years, $5,000 in the 5th year and then the cash flows will grow at 3.5% per year for another 8 years.  
(c) $9,000 per year for the first 6 years, $8,000 in the 7th years and then positive growth of 3% per year for another 10 years.  
(d) Nothing for the first 2 years, then $6,000 per year level cash flows forever.

10. Find the PV of the following end-of-year cash flow stream. Assume APR=8% for the first 5 years, 10% for the next 5 years (6-10) and 12% thereafter,  
(a) $8,000 per year for 10 years and then perpetual growth of 3% per year thereafter;  
(b) $3,000 per year for 5 years and then growth of 4% per year for the next 12 years.
11. You must choose between 2 projects A and B. Project A expects to earn nothing for 2 years, $5 million in the 3rd year and then grows at 4% per year for another 8 years and then have level earnings thereafter (forever). Project B expects to earn $6 million in the 4th year (nothing for the first 3 years) and to earn the same for another 5 years and then have perpetual growth of 2% per year thereafter, APR=10% and interest is compounded annually. (Hint: choose the one with the higher PV).

12. Find the present value of the following cash flow stream if interest rate is 10% with annual interest compounding:
   (a) $1,000 at the end of the first year, then grow at 12% annual rate for the next 9 years, then perpetual growth at 5% annual rate thereafter.
   (b) $200 at the end of the first year, then grow at 15% annual rate for the next 9 years, then grow at 8% annual rate for the next 10 years, then perpetual growth at 5% annual rate thereafter.