## Annuities / Present Value

Learning Goals - defining a present value of an annuity

- understand how annuities work
- use the present value formula to solve real life problems

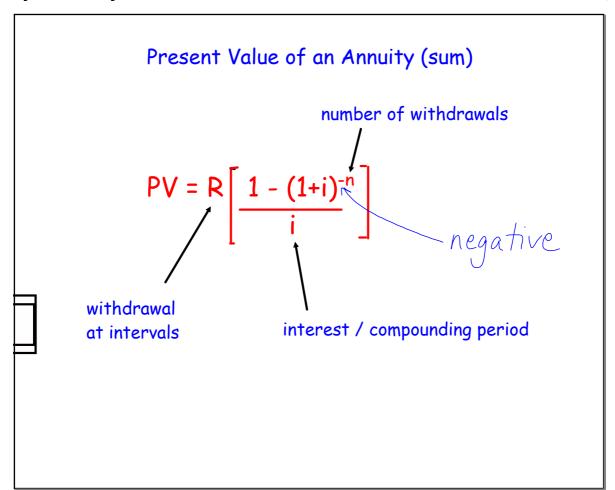
How is present value and future value different?

Future Value - you put the money in at regular intervals and you want to know how much you will have at the end.

ex. Educational savings plan

Present Value - you need to know how much money to put into the bank  $\underline{now}$  if you want to take money  $\underline{owt}$  at regular intervals.

ex. OSAP gives you a lump sum in Sept. and you need to know how much you can take out each month



Faith needs to have \$5000 for each year of college. Her bank pays 4% interest compounded yearly.

How much money does she have to put into the banktoday, so she would have enough money for college?

$$\frac{1}{2} \text{ year program}$$

$$PV = 5000 \left[ \frac{1 - \left( 1 + \frac{0.04}{1} \right)^3}{\frac{0.04}{1}} \right]$$

$$= 13875.46$$
.: She needs \$\frac{5}{3875.46}\$

Abigail borrowed \$25000 to buy a car. Her interest rate is 2% monthly.

If she is paying it back monthly for 5 years, what will be her payment?

$$25000 = R \left[ \frac{1 - \left(1 + \frac{0.02}{12}\right)^{-5(12)}}{\frac{0.02}{12}} \right]$$

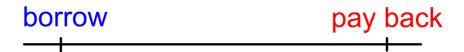
$$25000 = R \left(57.05\right)$$

$$438.19 = R$$

$$\therefore monthly payment is $\frac{4}{3}8.19$$$

Questions to ask before each problem.

- 1. Simple or compounded?
- 2. Present or Future?



3. Annuity or not?

## On the Boards...

Tam is setting up an income fund for her retirement. She wishes to receive \$1500 every month for the next 20 years, starting 1 month from now.

The income fund pays 6.25% per year compounded monthly.

How much must Tam deposit now to pay for the annuity?

$$PV = 1500 \left[ \frac{1 - \left(1 + \frac{0.0625}{12}\right)^{-240}}{\frac{0.0625}{12}} \right]$$

Nick borrowed money to buy a new car. His loan shark offered him a rate of 12% compounded semi-annually for 4 years. He has to pay back \$17190 or he will have his legs broken. What was the value of the initial loan?

Not an ANNUITY!

$$PV = 17190 \left(1 + \frac{0.12}{2}\right)^{-8}$$

$$= 10785.22$$

$$: initial boan was $10785.22$$

A contest offers a prize of \$1000 every month for 1 year. The first payment will be made 1 month from now. If money can be invested at 8% per year compounded monthly, what cash payment received immediately is equivalent to the annuity?

$$PV = 1000 \left[ \frac{1 - \left(1 + \frac{0.08}{12}\right)^{-12}}{\frac{0.08}{12}} \right]$$

$$= 11495, 78$$

$$\therefore \$ 11495, 78$$

**Assessment Focus** Isabel receives a disability settlement. She must choose one of these payment plans.

- A single cash payment of \$80 000 to be received immediately
- Monthly disability payments of \$1200 for 10 years
  Assume that money can be invested at 4.8% per year compounded monthly. Which settlement do you think Isabel should accept?

  Justify your answer.

$$PV = 1200 \left[ 1 - \left( 1 + \frac{0.048}{12} \right)^{-120} \right]$$

$$\frac{0.048}{12}$$

## Seatwork

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