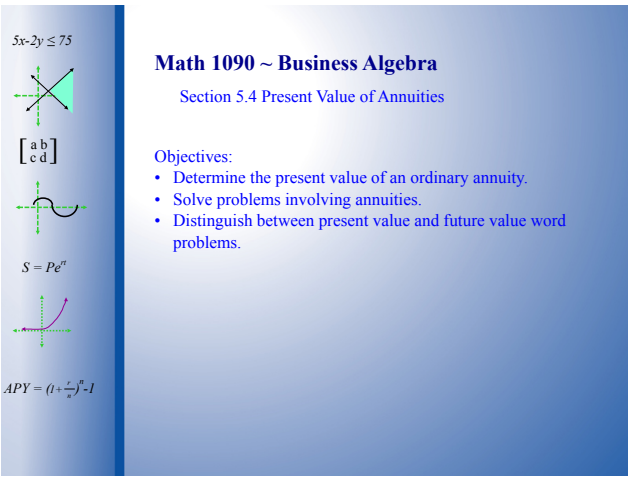

Math 1090 ~ Business Algebra

Section 5.4 Present Value of Annuities

Objectives:
- Determine the present value of an ordinary annuity.
- Solve problems involving annuities.
- Distinguish between present value and future value word problems.

Present Value of an annuity: We calculate this when we leave a lump sum of dollars in an account and make regular withdrawals (like what happens after a person retires.)

ordinary annuity	annuity due
withdrawals occur at the end of each period.	withdrawals occur at the beginning of each period.

Ex 1: You want to withdraw $1000 at the end of each year from an account that earns 10% interest compounded annually for 4 years. How much needs to be in the account from the start?

$$S = P\left(1+\frac{r}{n}\right)^{nt} \qquad r_c = \frac{r}{n} \qquad N = nt$$

After 1st year:

After 2nd year:

After 3rd year:

After 4th year:

Present Value of an Ordinary Annuity

$$P = R\left[\frac{1-(1+r_c)^{-N}}{r_c}\right]$$

Present Value of an Annuity Due

$$P_{due} = \left[\frac{R(1+r_c)(1-(1+r_c)^{-N})}{r_c}\right]$$

Ex 2: Find PV of an annuity that pays $4000 at the end of each month from an account that earns 8% interest compounded monthly for 25 years.

Ex 3: An inheritance of $500,000 will provide how much at the end of each year for 20 years if money is worth 7.2% compounded annually?

Deferred Annuity: The first payment is deferred until a later date at which point regular payments are made.

$P = PV$ of deferred annuity — m = number of periods of deferment

N = number of regular withdrawals — R = payment each period

$$P = \frac{R(1-(1+r_c)^{-N})}{r_c(1+r_c)^m}$$

Ex 4: Carol received a trust fund inheritance of $10,000 on her 30th birthday. She plans to use it to supplement her income with 20 quarterly payments beginning on her 60th birthday. If money is worth 8.1% compounded quarterly, how much will each payment be?

Ex 5: A lottery prize worth $1,800,000 is awarded in payments of $10,000 at the beginning of each month for 15 years. Suppose money is worth 6.6% monthly. What is the real value of the prize?