

## Chapter 4: More General Annuities

### Section 4.7: Payments Varying in Geometric Progression

In annuities with payments varying in geometric progression, the underlying concept is that the payments follow a compound rate of increase or decrease.

Example: Find the present value of an annuity-immediate with 12 payments in which the first payment is 500 and each subsequent payment is 6% greater than the preceding payment. The effective rate per period is 10%.

Future value of an annuity immediate with payment varying in geometric progressions with common ratio  $(1 + k)$  is

Present value of a perpetuity-immediate with payments  $1, 1(1+k), 1(1 + k)^2, \dots$  is

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Formulas for annuity-due and perpetuity-due can be obtained by multiplying the previous formulas by  $1 + i$ .

Example: Find the accumulated value at the end of 10 years for an annuity in which payments are made at the beginning of each half year for 5 years. The first payment is 2000 and each payment thereafter is 98% of the prior payment. the interest rate is 10% convertible quarterly.

Example: Find the present value of a perpetuity-immediate if payments are made quarterly, the first payment made is \$1000 and each payment increases by 3%. The effective interest rate per quarter is 4%.

#### **Section 4.8** More General Varying Annuities

In 4.6/4.7 the payment period and the interest conversion period are equal and coincide. If this is not the case, find the rate of interest convertible at the same frequency as payments are made.

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Example: Find the present value of an annuity at the time of the first payment, where the first payment was \$15,000 and each subsequent payment decreases by \$2,000 until the last payment is \$1,000. The payments are made every other year and the annual effective interest rate is 6%.