

Section F.3: Annuities and Sinking Funds

Definitions: An **annuity** is a sequence of equal payments made at regular intervals of time. An **ordinary annuity** is one in which the payments are made at the end of the compounding period. The **term** of an annuity is the time from the beginning of the first period to the end of the last period.

Examples: regular deposits in savings or retirement accounts, monthly mortgage payments, **sinking funds**, which is just an account, often used by corporations, that is established to accumulate funds for some future need.

F = the future value of an ordinary annuity.

R = payment made at the end of each compounding period.

$i = r/m$ is the interest rate per period.

$n = mt$ is the number of payments.

Future Value of an Ordinary Annuity

$$F = R \times \frac{[(1 + i)^n - 1]}{i}$$

Example 1: Finding Future Value A woman pays \$130 at each quarter's end into an account earning 5.4% annual interest compounded quarterly.

- (a) How much money will be in the account after 10 years?
- (b) How much of this is from deposits? from interest?

Example 2: Finding Payment Amount You create a sinking fund that you wish to be worth \$20,000 to use as a down payment on a house at the end of 5 years. The account earns 6.4% interest compounded semiannually.

- (a) How much should you deposit at the end of every 6 months in order to have \$20,000 in 5 years?
- (b) How much interest was earned in the second half of the fourth year?

College Education As a savings program towards Jim's College Education, his parents decide to deposit \$100 at the end of every month into a bank account paying interest at the rate of 6% per year compounded monthly. If the savings program began when Jim was 6 years old, how much money would have accumulated by the time he turns 18?

Saving for Car down payment Maya joined her college near her home. She did not have to buy a car right away. Being savy about saving money, she wanted to save up for a down payment of \$ 5000 towards buying a new car when she graduates in 4 years. She found a bank, which was willing to give her a interest rate of 4% per year compounded monthly. How much should she say every month so that she can make her down payment for the car in four years?

Retirement Account John is just beginning his new job with the state of Connecticut. He gets \$2000 every year which he wants to put towards is retirement account. The retirement account offers a rate of 9 % per year compounded yearly. If John makes a deposit of \$2000 every year, for 40 years how much money would he have in the account at the end of 40 years. How of the money that he as in the account after 40 years is interest earned?

College Education Kevin and Rita are having a baby. There dream is to send their child to an IVY league school. This means that they need to have \$200,000 for their child's education at the end of 18 years. If the bank offers a rate of 9% per year compounded monthly.

- (a) How much do they need to save every month?
- (b) How much interest will have have earned over the 18 years?
- (c) What is the equity that they would build in 10 years?
- (d) How much interest did they earn in the 10th Year?