

What's Going On?

Checking In

Minds on

What's an Annuity?

Action!

Future Value Formula

Consolidation

Present Value Formula

Learning Goal - I will be able to solve financial problems that deal with annuities .

 Minds on

What's an Annuity?

Minds on

By the Book

Annuity

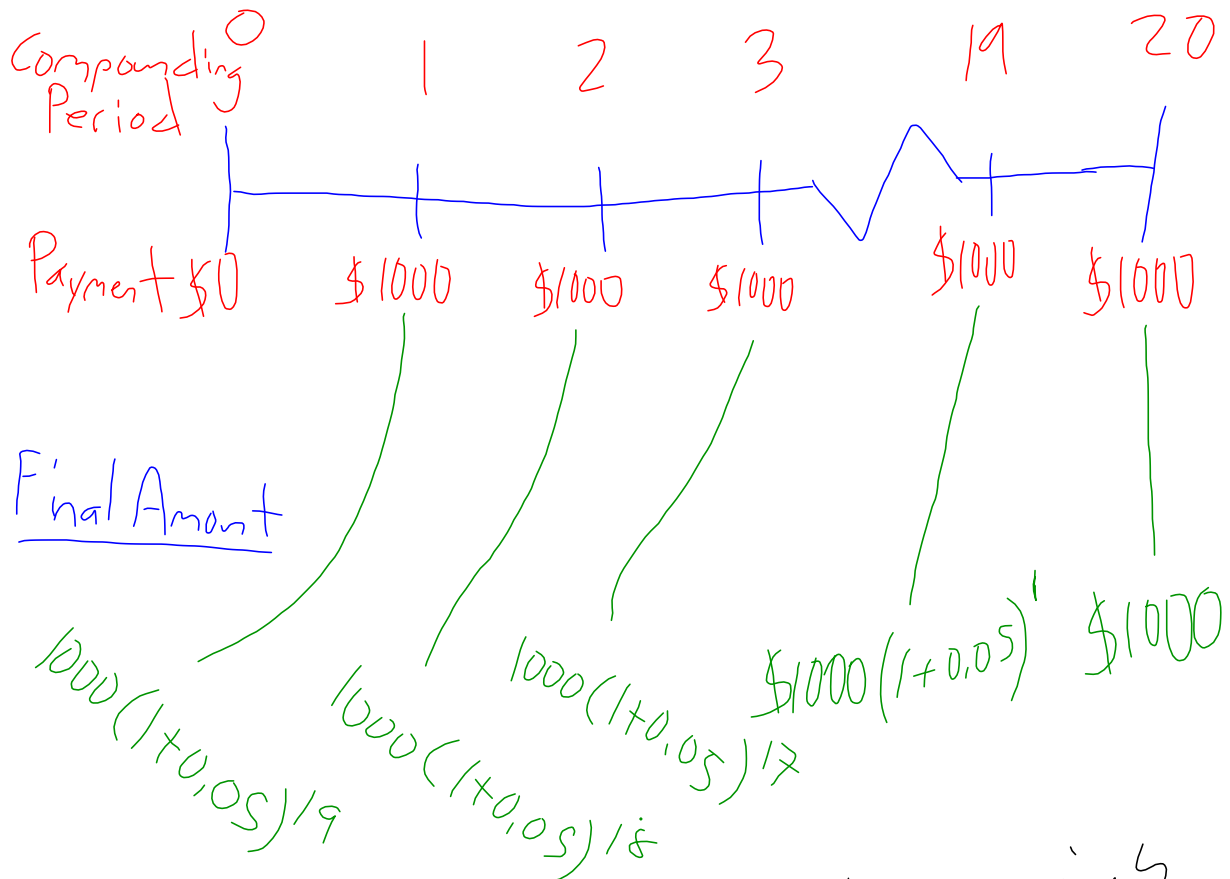
A series of payments or investments made at regular intervals. A **simple** annuity is an annuity in which payments coincide with the compounding period, or *conversion* period. An **ordinary** annuity is an annuity in which the payments are made at the end of each interval. We will only deal with simple, ordinary annuities.

Action!

Future Value Formula

You plan to put away \$1000 per year in an annuity that earns 5% interest compounded annually for the next 20 years.

What will this annuity be worth in 20 years?



The sum is a geometric series

$$\begin{aligned} \text{Total Value} &= 1000 + 1000(1+0.05) + 1000(1+0.05)^2 \\ \text{(FV)} &+ 1000(1+0.05)^3 + \dots + 1000(1+0.05)^{19} \end{aligned}$$

Geometric Series

$$a = 1000$$

$$r = (1+0.05)$$

$$n = 20 \text{ (same)}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$S_n = \frac{1000 \left((1+0.05)^{20} - 1 \right)}{(1+0.05) - 1}$$

$$S_n = 33065.95$$

$R \rightarrow$ amount of each payment

$i \rightarrow$ interest rate per compounding period

$n \rightarrow$ total number of compounding periods

$FV \rightarrow$ total future value

$$FV = \frac{R \left((1+i)^n - 1 \right)}{i}$$

$$FV = R \times \left(\frac{(1+i)^n - 1}{i} \right)$$

Action!

Future Value Formula

You plan to put away \$ R per year in an annuity that earns $i\%$ interest compounded annually for the next n years.

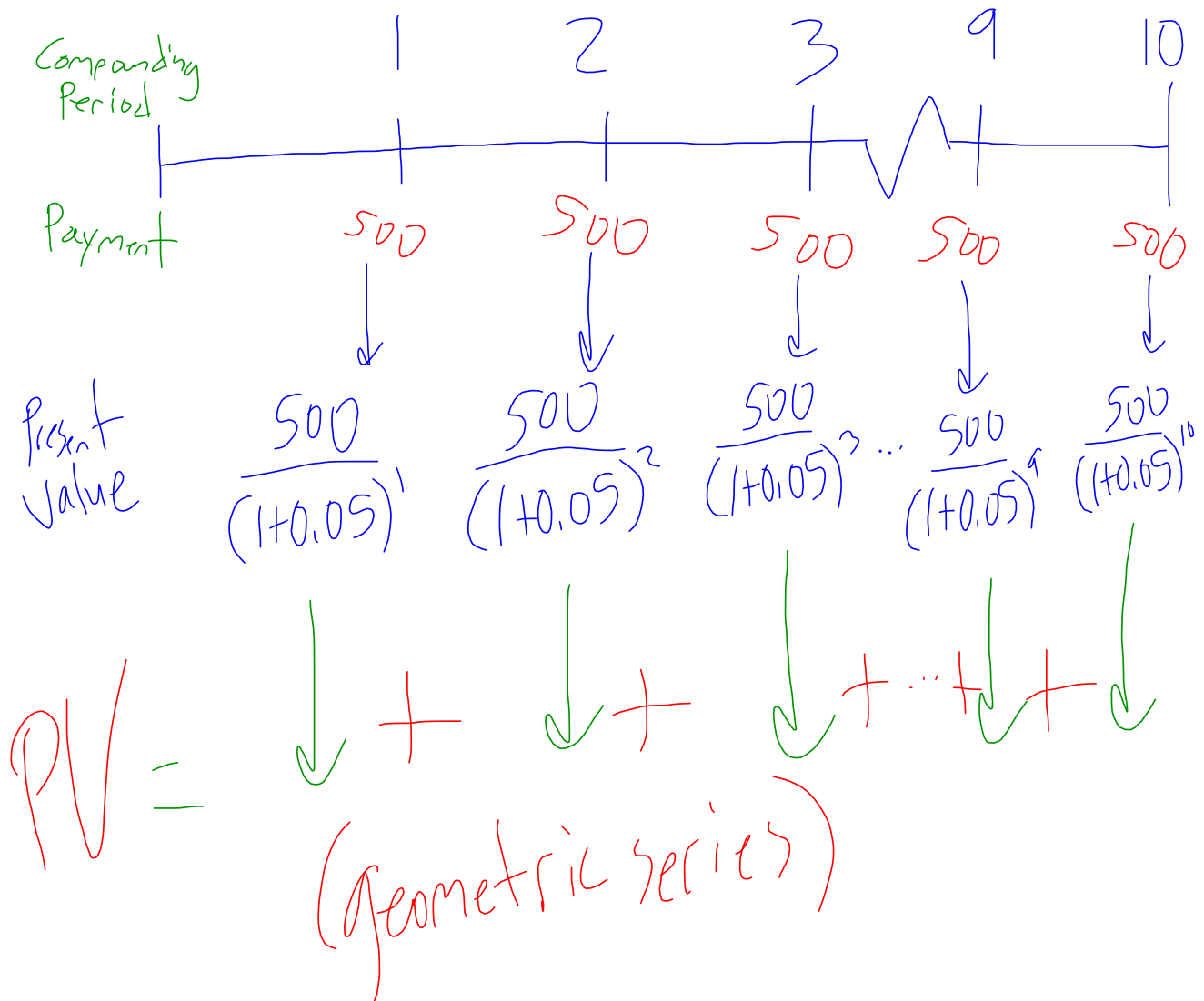
What will this annuity be worth in n years?

$$FV = R \times \frac{\left((1+i)^n - 1 \right)}{i}$$

Consolidation

Present Value Formula

How much would you need to invest now at 5% interest compounded annually to provide \$500 per year for the next 10 years?



$$PV = \frac{500}{(1+0.05)^1} + \frac{500}{(1+0.05)^2} + \dots + \frac{500}{(1+0.05)^{10}}$$

$$a = \frac{500}{(1+0.05)} = 500 \times (1+0.05)^{-1}$$

$$r = \frac{1}{(1+0.05)} = (1+0.05)^{-1}$$

$$n = 10$$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$S_n = \frac{500 \times (1+0.05)^{-1} \left((1+0.05)^{-10} - 1 \right)}{(1+0.05)^{-1} - 1}$$

$$PV = R \times \left(\frac{(1+i)^{-1} ((1+i)^{-n} - 1)}{(1+i)^{-1} - 1} \right) \times \frac{1+i}{1+i}$$

$$PV = R \times \frac{\cancel{(1+i)^{-1}} ((1+i)^{-n} - 1) \times \cancel{(1+i)}}{((1+i)^{-1} - 1) \times (1+i)}$$

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

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

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

Consolidation

Present Value Formula

How much would you need to invest now at $i\%$ interest compounded annually to provide $\$R$ per year for the next n years?

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

Consolidation

Future vs. Present

Future Value problems deal with investments that increase in value over time (you keep adding a certain amount of money to the investment over time).

Present Value problems deal with investments that decrease in value over time (you invest a bunch of money now and slowly take funds from it)

Consolidation

Homework

Future Value: Pg. 511

3, 5, 6

Present Value: Pg. 520

3, 8, 10

Chapter 7/8 Review
Pg 538 1-14