

# Tricky Problems

## Fall 2017 Midterm 1

For the next two questions, assume you receive \$1200 annually forever. Assume the effective annual discount rate is %20. Determine the present value given the following assumptions:

9) You receive the first payment in six months, with subsequent payments made every 12 months:

The trick to this problem is to notice that we are compounding instead of discounting (as the payment is coming sooner than the one period implicit in the perpetuity formula). In other words, our  $t$  will be negative:

$$PV = \frac{1200}{.2} \cdot \frac{1}{(1.2)^{-\frac{1}{2}}} = \frac{1200}{.2} \cdot \sqrt{1.2} = 6,572.67$$

Now the question came up in the review section: Why don't we have to adjust our discounting period to account for the perpetuity formula? The reason is that there is no change to the time in which we are analyzing the perpetuity formula. The entire time we are calculating the perpetuity from the perspective of period 0. Thus there is no need to "adjust" the discounting to align with the "one period forward" implicit in the perpetuity formula.

10) You receive the first payment one year from today, but you receive \$600 every six months:

First note that we need to calculate our 6 month rate out of our annual rate:

$$\text{6 month rate} = \sqrt{1.2} - 1 = 0.0954451$$

Now note that when we are calculating our discount factor that our new perpetuity formula considers 1 period to be 6 months. And note that the first payment occurs in 12 months. Thus when we are discounting we must discount 6 months. Using the Consequently we get:

$$PV = \frac{600}{.0954451} \cdot \frac{1}{1 + .0954451} = 5,738.61$$