

Review question:

(From Barron's GRE 2009 Test Prep Guide – most GRE practice tests have a question like this on them, which is a pretty good indication that this is also a common GRE question.)

Of the 200 seniors at Monroe High School, exactly 40 are in the band, 60 are in the orchestra and 10 are in both. How many students are in neither the band nor the orchestra?

- a) 80    b) 90    c) 100    d) 110    e) 120

(Also from the Barron's GRE 2009, and, again, a common theme for a problem.)

Jordan has taken 5 math tests so far this semester. If he gets a 70 on his next test, it will lower the average (arithmetic mean) of his test scores by 4 points. What is his average now?

- a) 74    b) 85    c) 86    d) 90    e) 94

1. If you need to have \$150,000 for when your newborn goes to college in 18 years, how much do you need to save every month if you can get a 6% annual return compounded monthly?

How much interest do you earn over the entire 18 years?

How much interest do you earn during the 10th year?

2. If you purchase an ordinary annuity for \$100,000 at 7% per year compounded quarterly for 20 years, what is the **quarterly** payment you will receive over the 20 year period?

What is the interest earned during the first quarter of the fifth year?

3. You have a choice between taking a lump-sum payment of \$500,000 or being paid \$50,000 per year for 15 years. Assuming you can make 8.3% annual interest compounded annually, which of these is the better deal?

4. Jim has racked up \$10,000 in credit card debt which he will pay off in 5 months by living with his parents and working two jobs which will also have the salutary effect of preventing him from charging anything new – incurring new debt – on his credit card). His interest rate is 18.2% annually, and is compounded monthly. Make an amortization table for his repayment of this debt.

Note: You take care of roundoff errors in the last line of the amortization table.

End of Period	Repayment made	Interest charged	Payment toward principal	Outstanding principal
0	—	—	—	\$10,000.00
1				
2				
3				
4				
5				\$0,000.00

5. (True story) Jean Marie bought a house, making her first monthly mortgage payment at the end of January 2004. The purchase price was \$128,000. She made a 5% downpayment, financed 80% of the 128,000 with a 5.75% annual percentage rate loan for 30 years (compounded monthly) and the remaining 15% at 6.875% annual percentage rate loan for 15 years (compounded monthly). Splitting the loans like this allowed her to put less than 20% down and to also avoid private mortgage insurance which is required if a loan is made for more than 80% of a home's value. (PMI insurance is annoying, expensive and hard to get rid of once you have reached 20% equity in the house...) What are her two payments?

How much equity does she have in the house now (November, 2008) if we assume the house's value has not changed since purchase and that Jean Marie has made the minimum payments?

**Equity** is the amount of the house that one owns. Since we are assuming the house has not appreciated (increased in value) or depreciated (decreased in value) this would be the amount of principal she has paid off plus the amount of the downpayment. If the house has appreciated, we have to add in the amount of appreciation. If the house has depreciated, we have to subtract off the amount of the depreciation.

If the house has appreciated to \$150,000, how much equity does she have assuming she made the minimum payments?

Being a frugal mathematician, Jean Marie has been attempting to pay the higher interest rate loan off early by making an extra \$150/month payment toward principal since the loan's inception. How much does she currently owe on this loan?

Given the higher payments Jean Marie has been making on the higher interest rate loan, and given that the house is currently worth about \$150,000, what is her equity in the house?

How much interest has Jean Marie paid on each of the two loans (and in total) on the house so far?

5. Jane has racked up \$13,000 in credit card debt which she will pay off in 6 months by living with her parents and working two jobs, which will also have the salutary effect of preventing her from charging anything new – incurring new debt – on her credit card. Her interest rate is 16.4% annually, and is compounded monthly. Make an amortization table for her repayment of this debt.

Note: You take care of roundoff errors in the last line of the amortization table.

End of Period	Repayment made	Interest charged	Payment toward principal	Outstanding principal
0	—	—	—	\$13,000.00
1				
2				
3				
4				
5				
6				\$0,000.00

## The TVM Solver

TVM stands for the Time Value of Money.

**N** – number of compoundings (payments)

**I%** – percent, not decimal, interest rate (per compounding period as we are using it). You enter 10 for 10% not 0.1 here.

**PV** – previous value or original principal

**PMT** – payment (on an annuity, mortgage payment, amount saved every month)

**FV** – Future value

**P/Y** – Payments per year (we are not using this)

**C/Y** – Compoundings (also called conversions) per year (we are not using this)

**PMT:END BEGIN** tells whether the payment is at the end of the compounding period or at the beginning – we consistently have had it at the END of the period.

The calculator uses a cash flow convention, and consequently so must we. Money is negative when it leaves your hands for the bank, and it is positive when it comes back to you. The PV on a mortgage loan is money that the bank gives me, so that is positive, but my monthly payment is made to the bank, so that is negative. Likewise, if I am saving for college, the monthly payment I make is negative, but the amount I have accumulated at the end is positive.

One of my favorite personal finance websites is <http://www.fool.com>. You may want to read their investing basics and personal finance sections.