Financial Math

For the AIS, IMT and PMT Exams, candidates are expected to have a high degree of understanding of time value of money principles, security valuation and basic statistics.

Formulas are not provided on the exam, therefore you will need to memorize them and know how to use them!

Candidates report that a lot of relatively easy marks are often missed because of a lack of familiarity with basic Math skills and most surprising – simply not knowing how to use a financial calculator correctly.

If you are weak in Math and have never used a financial calculator, we suggest you use the Texas Instruments BA II PLUS….do not buy the HP 10B or 12C….you will spend weeks just learning how to turn it on!

The BA II PLUS is a much simpler machine to operate, it can do all of the required Calculations and it costs about one half the price of the HPs.

Fundamental Math Concepts

Below are some basic math concepts that you should be aware of in order to be able to perform some of the calculations for the exam.

Percent and Decimals

Rates of return, interest rates, mortgage rates and savings rates are often expressed as a percentage, such as 3%, 4.5% or 19%.

When performing financial calculations, percentages need to be translated into decimal format to make the math work.

In simple terms, ***percentage means "out of 100"***, so it follows that:

3% means 3/100 or 0.03

4.5% means 4.5/100 or 0.045

19% means 19/100 or 0.19

Exponents and Roots

You may (or may not) remember ***exponents*** from your school days as ***"….a number taken to the power of…."***

4^3 means 4 x 4 x 4 = 64

To calculate exponents we use the $\boxed{y^x}$ button on our financial calculator.

To solve 4^3, enter 4 $\boxed{y^x}$ 3 = and you get 64

Quick example:
Calculate, 1.03^5:

Solution:
To solve 1.03^5, enter 1.03 $\boxed{y^x}$ 5 = and you get 1.15927

Quick Summary – Time Value of Money Concepts

Types and measures of investment returns

Time Value of Money – Lump-Sum

Formulas on the left and the corresponding calculator key strokes on the right, followed by an example.

Present value of a lump sum payment

$$PV = \frac{FV}{(1 + I)^n}$$

Enter the following information given in the question:

FV | n | I | PMT solve for: PV

Example:
You require $10,000 in 5 years to payoff your car loan. If your savings can grow annually at 8% (ignoring taxes), how much must you deposit in your savings account today?

$$PV = \frac{\$10,000}{(1.08)^5}$$

$$= \$6,805.83$$

Enter -$10,000 FV , 5 n , 8 I , 0 PMT

Solve for PV = $6,805.83

Future value of a lump sum payment

$$FV = PV(1 + I)^n$$

Enter the following information given in the question:

PV | n | I | PMT solve for: FV

Example:
If your savings can grow annually at 11% (ignoring taxes), how much will $3,500 grow to in 15 years?

$$FV = \$3,500\ (1.11)^{15}$$

$$= \$16,746.06$$

Enter -$3,500 PV , 15 n , 11 I , 0 PMT

Solve for FV = $16,746.06

Examples:

Your client stated that she will need $10,000 in 4 years to pay for her daughter's wedding. Your client would like to know the *minimum amount* of money she would need to invest in a time deposit in order to achieve her goal? Assume the current rate on 4 year time deposits is 4%.

The solution is:
FV = 10,000, N = 4, I = 4, PMT = 0, CPT PV = $8,548.04

Your client has $5,250 in cash in an RRSP account. What will the account balance be at the end of 10 years if you were to invest the entire amount is a Government of Canada Strip Bond that is yielding 6% per annum.

The solution is:
PV = 5,250, N = 10, I = 6, PMT = 0, CPT FV = $9,401.95

Exam Tip:
Make sure you are comfortable with your financial calculator. Many exam candidates make mistakes because they do not know how to use their calculator correctly!

Effective Annual Rate (EAR)
The EAR is the rate of return actually being earned after adjusting for compounding frequency.

$$EAR = (1 + i/n)^n - 1$$

Where:
i = stated annual rate
n = compounding frequency

Quick Example:
Assume an investor buys an 8.5% semi-annual pay bond for $1,065.52. **Calculate** the effective annual rate of return assuming the bond matures in two years.

Solution:

Step 1, calculate the YTM for the bond:

On your financial calculator enter:

FV = $1,000, PV = -$1,065.52, N = 2x2 = 4, PMT = 85/2=42.5, Solve for I = 2.508%

this is the semi-annual yield!

Step 2, use the formula to calculate the effective yield:

$EAR = (1.02508)^2 - 1 = 5.078\%$

Bond Duration

There are two dimensions related to the concept of duration:

1) the time it takes to recover your investment
2) interest rate sensitivity

Macaulay duration is calculated as the "time weighted present value of the coupons divided by the bond price". The number calculated tells us essentially how long (in years) it will take to recover our initial investment. So you often hear professionals talking about a bond's duration in years, ie. 3 year duration or 10 year duration.

Duration is also a measure of interest rate sensitivity. This is often referred to as **Modified Duration** and it tells us how much a bond's price will change when interest rates change. The number calculated tells us (in percentage terms) how much the price of a bond will change when interest rates change by 1% (or 100 basis points). So you often hear professionals talking about a bond's duration in percentage terms, ie. A bond with a 3 year duration will change in value by 3% if interest rates change by 1% or a bond with a 10 year duration will change in value by 10% if interest rates change by 1%.

Three Key formulas:

$$\text{Macaulay Duration} = \frac{\sum [t \times PV(cf)]}{k \times \text{Bond Price}} \qquad \text{Modified Duration} = \frac{\text{Macaulay Duration}}{(1 + YTM/k)}$$

$$\text{Percentage change in Bond Price} = -(\text{Modified duration}) \times (\text{Change in interest rates})$$

Where:

t = time period
PV(cf) = present value of the coupon payment
YTM = yield to maturity
k = coupon payment frequency

There are over 50 pages in this workbook, full of demonstration learning examples designed to help you refresh and master the key financial concepts you need to know for the AIS, IMT and PMT exams.

And remember…..as one of Prof. Gordon's students you are never studying alone….it's like having your personal study coach standing ready to provide you with study support when you need it!

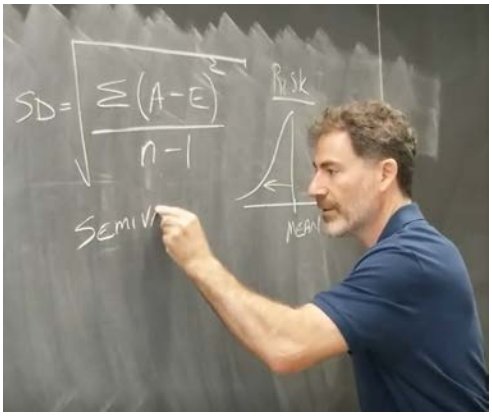
We hope you have a better idea of how this workbook can help add critical points to your exam score pushing you over the passing mark!

If you would like to access the remaining pages, just click on this link to complete the process.

Wishing you Exam Success!

Instructor/Author Profile:

Brian Y. Gordon, CFA, CFP, CIM, MBA, FCSI, is a former tenured Professor in the School of Business at Centennial College in Toronto where he taught Economics, Financial Accounting, Corporate Finance, the Canadian Securities Course, Personal Financial Planning and Investment Management.



Prof. Gordon was also a part-time faculty member at Concordia University in Montreal, where he taught Economics and Investment Management courses at the MBA level.

Prof. Gordon has also lectured at Ryerson University in Toronto teaching Corporate Finance.

Since 1999, Prof. Gordon has been a featured lecturer and workshop facilitator for CFP® and CFA® review programs offered across Canada.

Prior to entering academia, Prof. Gordon developed his expertise in the discount brokerage, full service brokerage and banking industries, specializing in investment management, business development, strategic sales and marketing, and wealth management training.

Prof. Gordon holds a BA in Economics from the University of Toronto, an MBA from Heriot-Watt University in the UK, and was awarded his CFA charter in 1999. In 1995, Prof. Gordon was granted a fellowship from the Canadian Securities Institute, earning the prestigious FCSI designation.

Prof. Gordon successfully challenged the CFP Professional Proficiency Examination and was awarded the right to use the CFP designation in 2005.