Financial Math

For the CFP Exam, candidates are expected to have a high degree of understanding of time value of money principles, security valuation and basic statistics.

Formulas are provided on at the beginning of the exam booklet. Therefore, do not memorize them, 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.

3. Net present value (NPV)

In investment theory NPV analysis indicates whether or not a potential investment will increase an investor's wealth or decrease an investor's wealth.

Investments that have a positive NPV are said to be "wealth enhancing", while investments that have a negative NPV are said to be "wealth reducing".

Thus a rational investor would only select investments that have positive NPVs!

Using a financial calculator, use the "cash flow" keys to calculate NPV.

To calculate NPV without a financial calculator, use the following formula:

$$NPV = CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + ... + \frac{CF_n}{(1+k)^n}$$

Where: CF = Cash flow
k = discounting rate

4. Internal rate of return (IRR)

The IRR is another investment evaluation tool that allows investors to identify "wealth enhancing" investments.

The IRR is the rate which sets the NPV equal to zero, it is often considered to be similar to a break even rate of return.

Candidates should know how to use a financial calculator to find it otherwise they must use trial and error.

The decision rule is as follows:
If the IRR is greater than the cost of your capital (ie. the discount rate), then the investment will be "wealth enhancing", so a rational investor would select it.

If the IRR is less than the cost of your capital (ie. the discount rate), then the investment will be "wealth reducing", so a rational investor would not select it.

Example:

An investment is estimated to cost $150 million. It is assumed that the investment will yield the following end of year cash flows:

year	1	2	3	4	5
net cash flow ($ million)	25	50	55	40	60

Calculate the project's NPV and IRR assuming the cost of capital is 10%:

> **Using the formula:**
>
> $$NPV = (150) + \frac{25}{1.1} + \frac{50}{1.1^2} + \frac{55}{1.1^3} + \frac{40}{1.1^4} + \frac{60}{1.1^5} = 19.947$$
>
> **Using the cash flow keys on your financial calculator:**
>
> $CF0 = (150)$, $CF_1 = 25$, $CF_2 = 50$, $CF_3 = 55$, $CF_4 = 40$, $CF_5 = 60$, $I = 10$,
>
> Solve for NPV = 19.947
>
> Use the calculator to solve for IRR = 14.59%

Example:

Your client has $10,000 and is looking to invest in a private equity deal. You present your client with the following investment opportunity, invest $10,000 today and receive the following year end cash flows.

Year	0	1	2	3	4
Cash Flow	($10,000)	$3,500	$4,500	$5,000	$5,000

What is the NPV of this investment, assuming a discount rate of 12% is applied?

The answer is $3,448.86

What is the IRR?

The answer is 26.51%

> *Exam Tip:*
> NPV and IRR calculation questions and theory questions are low probability for the exam.
> Just know the basic decision rules.

10. Real rate of return

The real rate of return represents the rate at which an individual's "real wealth" increases.

The real rate of return is equal to the nominal rate less the expected inflation rate.

Calculate the exact rate not the approximation for the exam!

Real vs. Nominal Rate of Return

Approximation:	Nominal Rate = Real Rate + Inflation
Exact:	Nominal Rate = (1+Real Rate)(1+Inflation) - 1

Example:

Calculate the real risk free rate of return given a nominal return on US T-Bills of 9% during the year, when the rate of inflation was 5%.

The answer is 3.8%

11. After-tax return

Since individual investors face taxes on their investment income, the focus should be on after tax rates of return.

After Tax Rate of Return = (Pre-Tax Rate of Return)(1 – Marginal Tax Rate)

Example:

Bill has a non-registered investment account that has generated a 15% return over the last year. **Calculate** Bill's after tax return assuming his marginal tax rate is 42%.

The answer is 8.7%

Example:

As a quick indication of the relative attractiveness of two potential investments you decide to calculate the current yield on ABC Inc. common stock and ABC Inc. 8% annual pay debentures. ABC common stock is currently trading at a price per share of $22.05 and pays an annual dividend of $1.80, while the debentures are currently valued at $980.

Calculate the current yield for both securities.

The answer is 8.163% for both!

As a follow up to the previous example, assume you have a middle aged, married client with a high tolerance for risk who is in the top marginal tax bracket, without doing any calculations, which investment would you select for your client? Why?

(Write your answer down and then email Prof. Gordon to see if your logic was correct)

Solution:

After tax return is the focus for taxable individual investors! Thus, you would select ABC common stock because the dividend income is taxed at a lower effective rate than the interest income from the debentures due to the dividend tax credit. Therefore, your client will have more money in his/her pocket after tax.

Exam Tip:

For individual investors, remember the focus should be on after tax real returns!

To calculate the after tax real return, use the following short cut formula:

$$ATRR = \frac{[\text{ Nominal Return x (1 – Marginal Tax Rate) }] – \text{Expected Inflation}}{(1 + \text{Expected Inflation})}$$

Instructor/Author Profile:

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

Prof. Gordon is also a part-time faculty member at Concordia University in Montreal, where he teaches 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.