

Financial Mathematics (Tutor Worksheet)

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Total Marks: 20
Number of Pages: 3

Instructions

- This sheet is compiled from past material with minor adjustments and mainly for your own practice.
- Your workings are very important and earn part marks in excel assessments.
- Label columns and make sure your work is understandable.
- Aim to learn more than you already know.
- **Note:** The mark allocations in this sheet are not a true reflection of the actual marking standard.

Good luck and do your best! Remember, the goal is to test your own understanding and identify areas that need revision.

Q1 On 1 Jan 2025, the government of some country issued an index linked bond of term ten years. Coupons are paid half-yearly in arrears on 1 Jan and 1 Jul each year. The annual nominal coupon is 2%.

Note: Interest and capital payments are indexed by reference to the value of an inflation index with a time lag of eight months.

Suppose you have the following values of the inflation index:

Date	Inflation index
1 May 2024	100.00
1 Nov 2024	110.00
1 May 2025	112.3
1 Nov 2025	113.2
1 May 2026	113.8

In this case, assume that the future development of the inflation index is to increase continuously at the rate of 2.5% per annum effective from its last known value (namely, in May 2026).

An investor, paying tax at the rate of 20% on coupons only, purchased the stock on 1 Jul 2026, just after a coupon payment had been made.

Calculate the price to this investor such that a real net yield of 3% per annum convertible half yearly is obtained and assuming that the investor holds the particular bond to maturity.

[5]

Q2 An individual, Craig, is considering investing a sum of R2 514 650 in a group called SpinTop. SpinTop requires the investment in properties that are to be let out to tenants.

The details are:

- Craig expects to receive continuous income from rents at an annual rate of R99 000 per year for a four-year period, after an initial two-year period where no income will be received.
- Rents are expected to increase thereafter at the start of each year at a rate of 1% per annum, with the first increase immediately following the four-year period.
- From the start of this project, the running costs are payable annually in advance. The first payment is R13 000 per annum, and payments will increase by a constant amount of R1 000 per annum, thereafter.
- At the end of 20 years, Craig expects to sell the properties for R3 000 000, after which the revenue and costs will cease.

“Remember, preparation is the key to success! Take your time, read each question carefully, and trust in your knowledge. Good luck!”

An alternative investment plan to SpinTop is Malta GOALs that involves the investment of R2 514 650 in an investment fund.

The details are:

- The fund is expected to pay an income of R195 000 per annum annually in advance and return the full invested sum at the end of 20 years.
 - Here, Craig plans to borrow the investment of R2 514 650 from a bank at a rate of 3.4% per annum compounded continuously.
 - Any Income from Malta GOALs will immediately be used as instalments to repay the loan.
 - Once the loan has been repaid money can be invested at 4.5% per annum effective.
- (a) Calculate the net present value of the project with SpinTop at an interest rate of 3.4% per annum compounded continuously. (10)
- (b) Calculate the discounted payback period (namely, DPP) of the project with Malta GOALs at the stated borrowing rate. (5)

[15]

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