

University of Macerata
Mathematical Methods for Economics and Finance

Exam Simulation A

May 02, 2023

1. Find the time required for an initial amount of \$ 5000 to be equal to a final amount of \$ 9000 deposited at 4%, compounded quarterly.
2. Find the future value of an ordinary annuity with $R = \$9200$, 10% interest compounded semiannually for 7 years, where each payment takes place at the end of each semester. Repeat the exercise in the case where the payments occur once a year.

3. Given the matrix

$$A = \begin{bmatrix} 10 & -8 & 0 \\ 0 & 6 & 0 \\ 0 & -4 & 10 \end{bmatrix},$$

compute its eigenvalues. For each eigenvalue, compute an associated eigenvector. Use also Matlab to confirm your results.

4. Find the domain of the following function: $z = \frac{\ln(x\sqrt{y-x})}{xy-1}$
5. Compute the gradient for the following function: $f(x, y) = xy \ln(x+y)$
6. Determine the critical points of the following functions in their domain, specifying whether they are maximum, minimum or saddle points:
 $f(x, y) = \tan^{-1}(x^2 - y^2) - \frac{1}{3}$. Depict a plot of the function with Matlab.