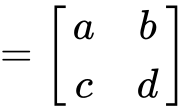
# 1.15 Eigenvalues and eigenvectors

**1a.** *[4 marks]*

The matrix ***A*** is given by ***A*** .

Show that the eigenvalues of ***A*** are real if .

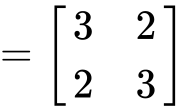


**1b.** *[2 marks]*

Deduce that the eigenvalues are real if ***A*** is symmetric.



**1c.** *[2 marks]*

The matrix ***B*** is given by ***B*** .

Determine the eigenvalues of ***B***.



**1d.** *[4 marks]*

Determine the corresponding eigenvectors.



**2a.** *[4 marks]*

A matrix ***M*** is called idempotent if ***M*** ***M***.

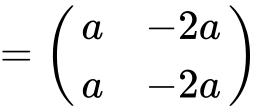
(i)     Explain why ***M*** is a square matrix.

(ii)     Find the set of possible values of det(***M***).



**2b.** *[12 marks]*

The idempotent matrix ***N*** has the form

***N*** 

where .

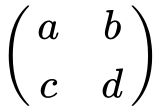
(i)     Find the value of .

(ii)     Find the eigenvalues of ***N***.

(iii)     Find corresponding eigenvectors.



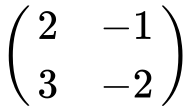
**3.** *[12 marks]*

The matrix ***M*** is defined by ***M*** = .

The eigenvalues of ***M*** are denoted by .

(a)     Show that  and (***M***).

(b)     Given that , show that 1 is an eigenvalue of ***M***.

(c)     Find eigenvectors for the matrix .

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