

MEI
Conference
2018

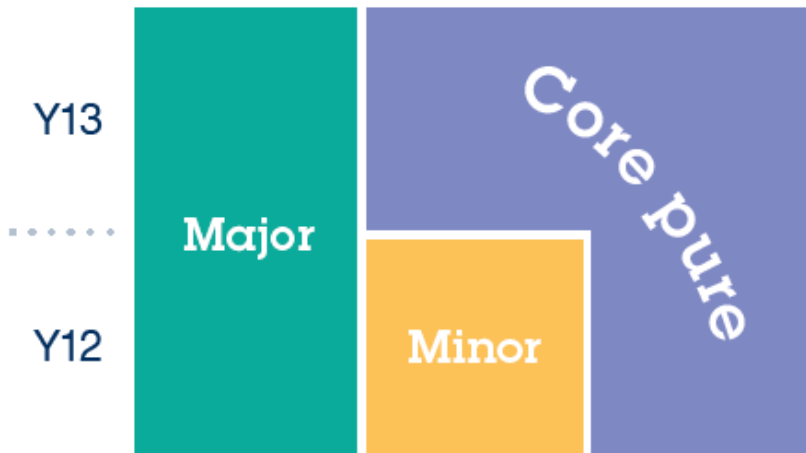
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MEI Further Maths options

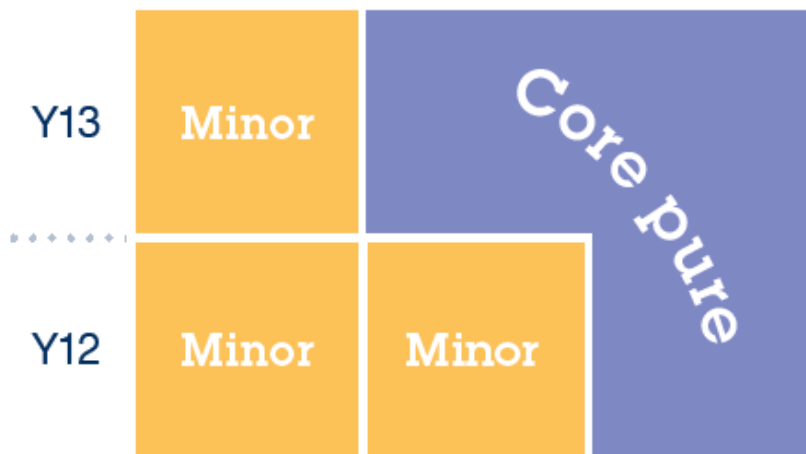


Major Options




Major

- Mechanics major
- Statistics major



Minor Options



Minor

- Mechanics minor
- Statistics minor
- Modelling with algorithms
- Numerical methods
- Extra Pure
- Further pure with technology

Extra Pure topics

- Recurrence relations
- Groups
- Matrices
- Multivariable calculus

No choice of questions

Schedule

Week	Maths: Teacher A	
1	26	Differentiation
2		
3	33	Vectors
4	39	Kinematics
5		
6	42	Projectiles
7		
8	24	Sequences and series
9		
10		
11		
12	30	Further differentiation
13		
14		
15		
16	31	Integration
17		
18		
19		
20		
21		
22		
23		
24		
25	34	Differential equations
26		
27	40	Force and motion
28		
29		
30	43	Friction
31		
32	41	Moments
33		

Maths: Teacher B	
25	Functions
23	Trigonometry
27	Trigonometric functions
29	Trigonometric identities
28	Algebra
32	Parametric equations
22	Proof
36	Probability
37	Probability distributions
38	Hypothesis testing
35	Numerical methods

Core Pure

8	Vectors 1
9	Matrices
10	Series and induction
18	Vectors 2

Prior

28 partial fracs

17	Complex numbers	29,24
13	Maclaurin series	30
14	Hyperbolic functions	25

11	Further calculus	30,31, 27, 28
12	Polar coordinates	(23), 27,29, 31
15	Integration	all
16	Differential Equations 1	all
19	Differential Equations 2	all, 29

Extra Pure

2 Groups

3 Matrices

1 Rec rel'ns

4 Multiv calc

Matrices

- Eigenvalues and eigenvectors

https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors

for applications

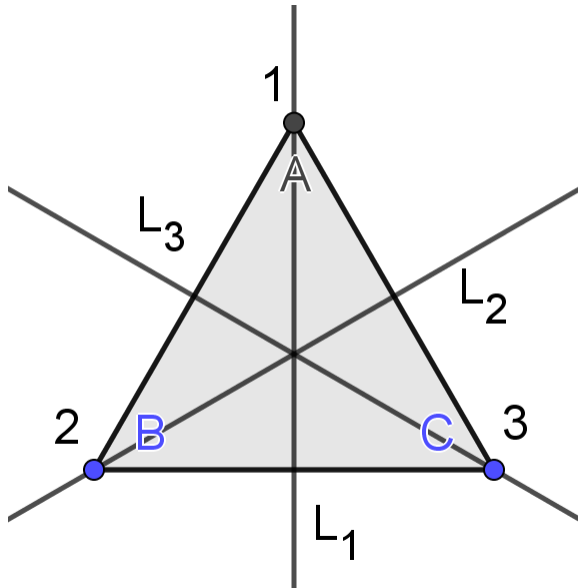
What eigenvectors/values does a rotation in 3D have?

What eigenvectors/values does a reflection in 3D have?

Groups

- All the big ideas in one go

Symmetries of a triangle



r_1 is a rotation of 120° anticlockwise about the centre of the triangle.

r_2 is a rotation of 120° clockwise about the centre of the triangle.

s_1 is a reflection in the line L_1

s_2 is a reflection in the line L_2

s_3 is a reflection in the line L_3

$$s_1 \circ s_2 = ?$$

On the triangle, perform s_2 , then perform s_1 on the image.
Which symmetry takes you from the original triangle to the final image?

Permutations on $\{1, 2, 3\}$

$$i = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \end{pmatrix} \quad p = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix} \quad q = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{pmatrix}$$

$$u = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{pmatrix} \quad v = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix} \quad w = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \end{pmatrix}$$

Six functions

$$e(x) = x \quad f(x) = 1 - x \quad g(x) = \frac{1}{x}$$

$$h(x) = \frac{x-1}{x} \quad i(x) = \frac{x}{x-1} \quad j(x) = \frac{1}{1-x}$$

Stand up...

- ... if you are the *identity* element
- ... if your element is *self-inverse*
- ... if your element has *order 3*
- ... in a pair with your *inverse*
- ... if your element *generates the group*
- ... if your element generates a subgroup of order 2
- ... if your element generates a subgroup of order 3
- ... if your element generates a subgroup of order 4
- ... in a pair so that that the pair of elements generates the whole group

Stand up

- Stand in a triple with one person from each group (*sic*) that you are most like

Six functions

$$e(x) = x \quad f(x) = 1 - x \quad g(x) = \frac{1}{x}$$

$$h(x) = \frac{x-1}{x} \quad i(x) = \frac{x}{x-1} \quad j(x) = \frac{1}{1-x}$$

$$f(2) = -1, \quad f\left(\frac{1}{2}\right) = \frac{1}{2}, \quad f(-1) = 2$$

$$i(2) = 2, \quad i\left(\frac{1}{2}\right) = -1, \quad i(-1) = \frac{1}{2}$$

Recurrence relations

- Everything is a geometric sequence in the end

Multivariable Calculus

- The pictures are beautiful!

About MEI

- Registered charity committed to improving mathematics education
- Independent UK curriculum development body
- We offer continuing professional development courses, provide specialist tuition for students and work with employers to enhance mathematical skills in the workplace
- We also pioneer the development of innovative teaching and learning resources