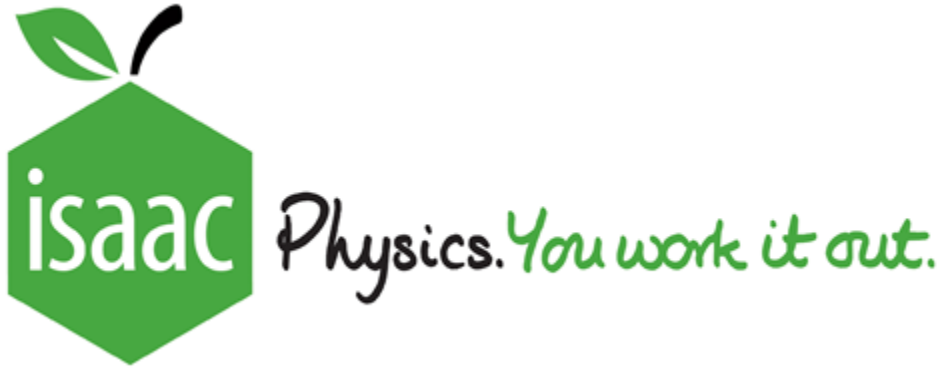



# Isaac Maths

Jonathan Waugh, Julia Riley & Matthew Rihan

jnw34@cam.ac.uk jmr2@cam.ac.uk mcr48@cam.ac.uk

# Overview of Isaac maths resources

GCSE Maths Book

Pre-U Maths Book

Practise Maths & Master Maths

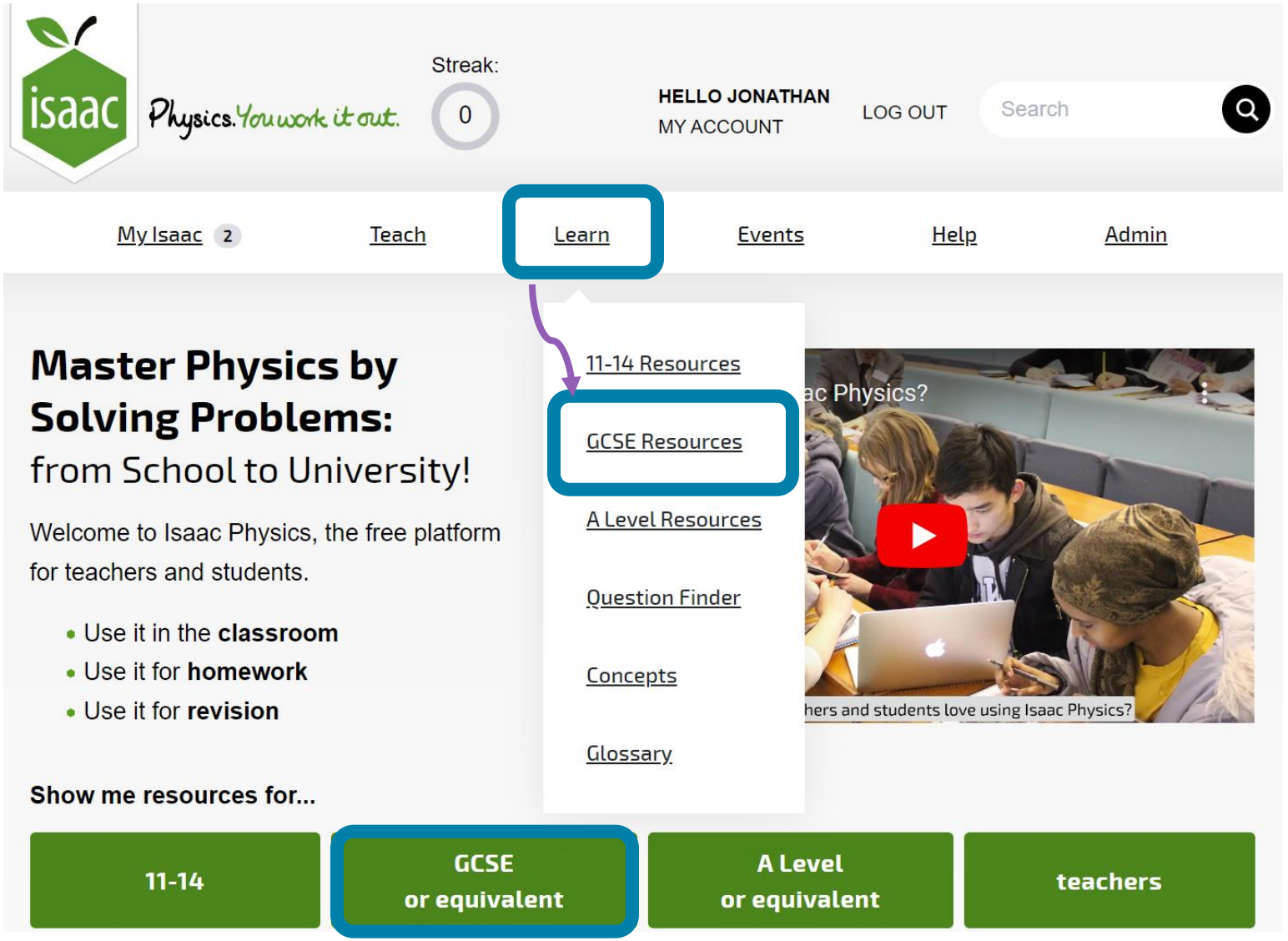
Question Finder

Concept Pages

# New maths resources and features this year

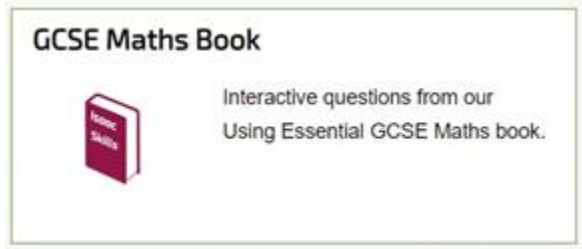
- Graph sketcher interactive graph sketching tool
  - new features
- New Inline question type
- New Coordinate question type

# GCSE Book



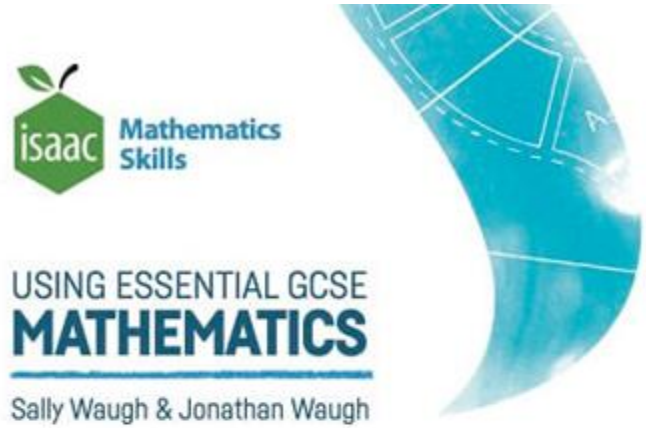

Head to the GCSE page…

… then use this icon:



# GCSE Book

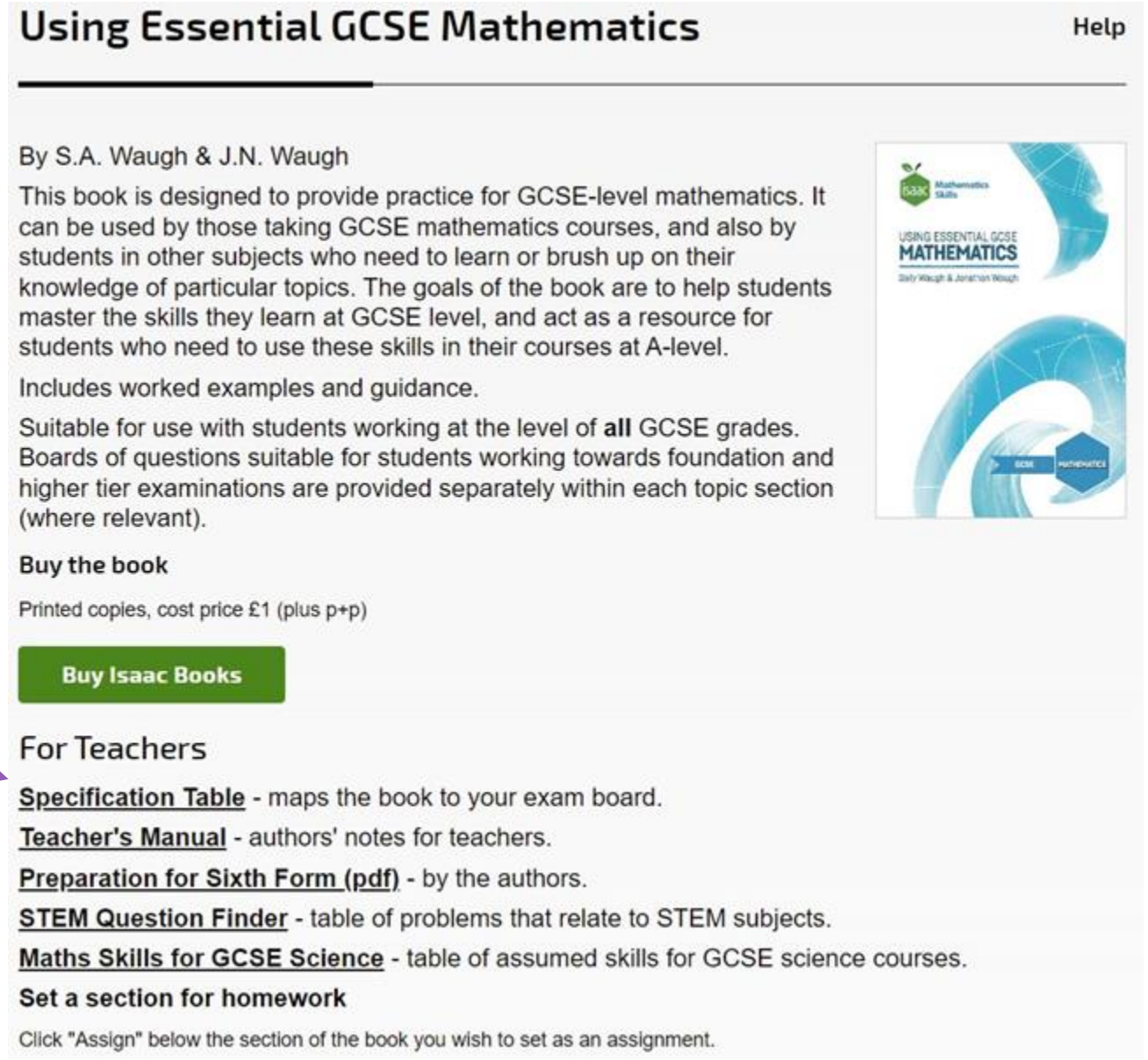
- Print book
- All material is also online
- Written for both Foundation & Higher (shown with § symbol)
- Useful for supporting maths skills in STEM subjects at A-level:
  - Sixth form induction programs
  - Ongoing support where GCSE-level maths is needed, e.g. proportionality.




# GCSE Book

Additional online resources include:

- STEM Question Finder
- Preparation for 6th Form guide
- A Teacher's Manual



## Using Essential GCSE Mathematics

Help

By S.A. Waugh & J.N. Waugh

This book is designed to provide practice for GCSE-level mathematics. It can be used by those taking GCSE mathematics courses, and also by students in other subjects who need to learn or brush up on their knowledge of particular topics. The goals of the book are to help students master the skills they learn at GCSE level, and act as a resource for students who need to use these skills in their courses at A-level.

Includes worked examples and guidance.

Suitable for use with students working at the level of **all** GCSE grades. Boards of questions suitable for students working towards foundation and higher tier examinations are provided separately within each topic section (where relevant).



**Buy the book**

Printed copies, cost price £1 (plus p+p)

Buy Isaac Books

For Teachers

**Specification Table** - maps the book to your exam board.

**Teacher's Manual** - authors' notes for teachers.

**Preparation for Sixth Form (pdf)** - by the authors.

**STEM Question Finder** - table of problems that relate to STEM subjects.

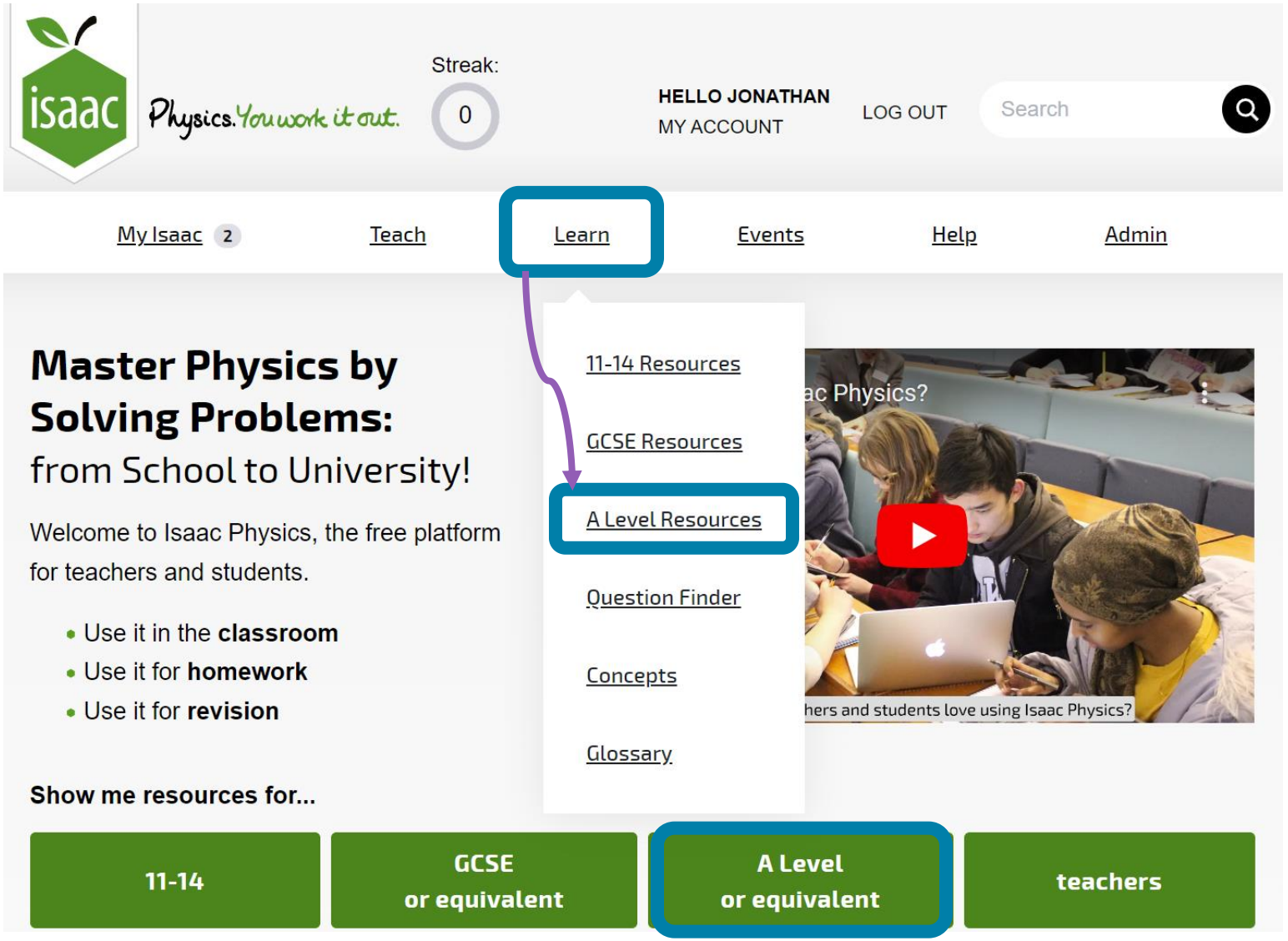
**Maths Skills for GCSE Science** - table of assumed skills for GCSE science courses.

**Set a section for homework**

Click "Assign" below the section of the book you wish to set as an assignment.

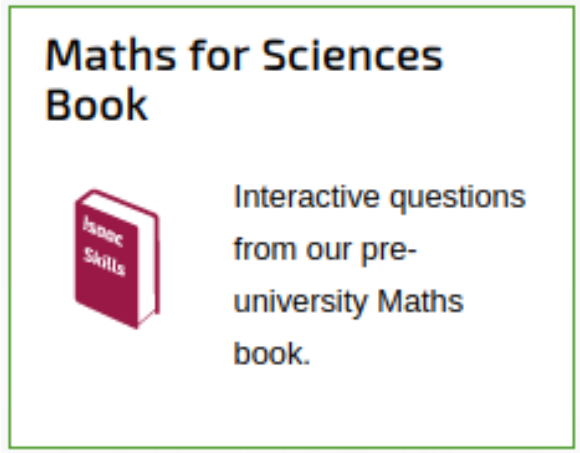
https://isaacphysics.org/books/maths_book_gcse

# Pre-U Maths Book



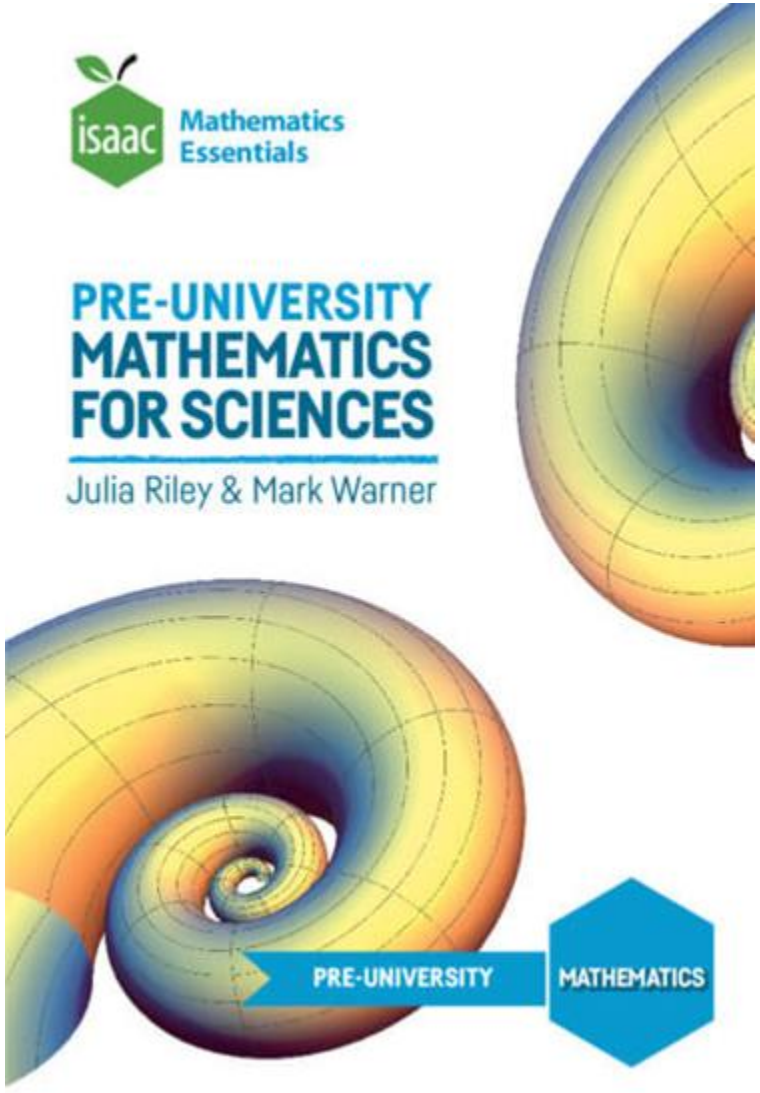

Head to the A-level page…

… then use this icon:



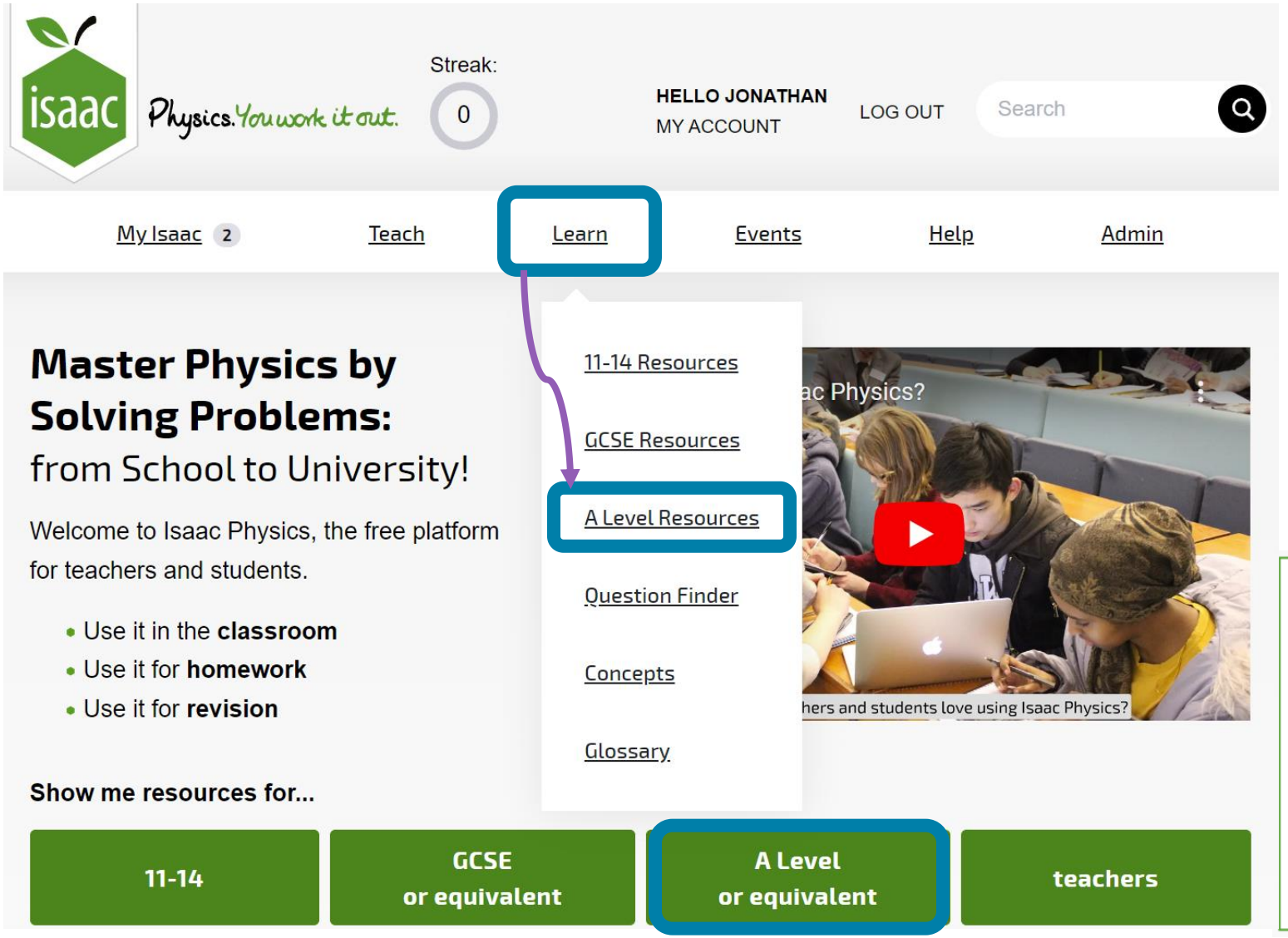
# Pre-U Maths Book

- Print book
- All material is also online
- Written with maths for science in mind
- Maths content ranges from end-of-GCSE to first year University.
- Useful for supporting maths in science where topics are first met at A-level, such as logarithms or calculus.



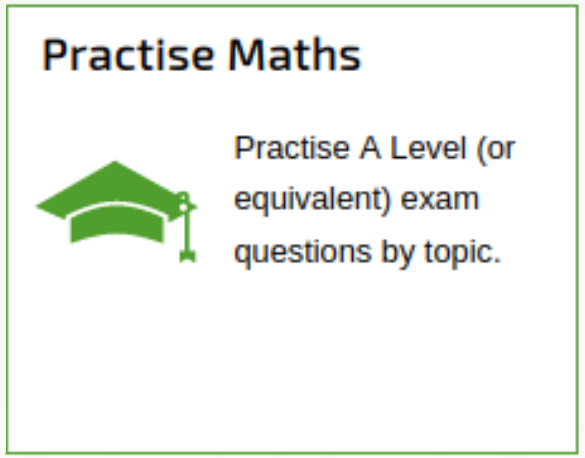

https://isaacphysics.org/books/pre_uni_maths

# Practise Maths

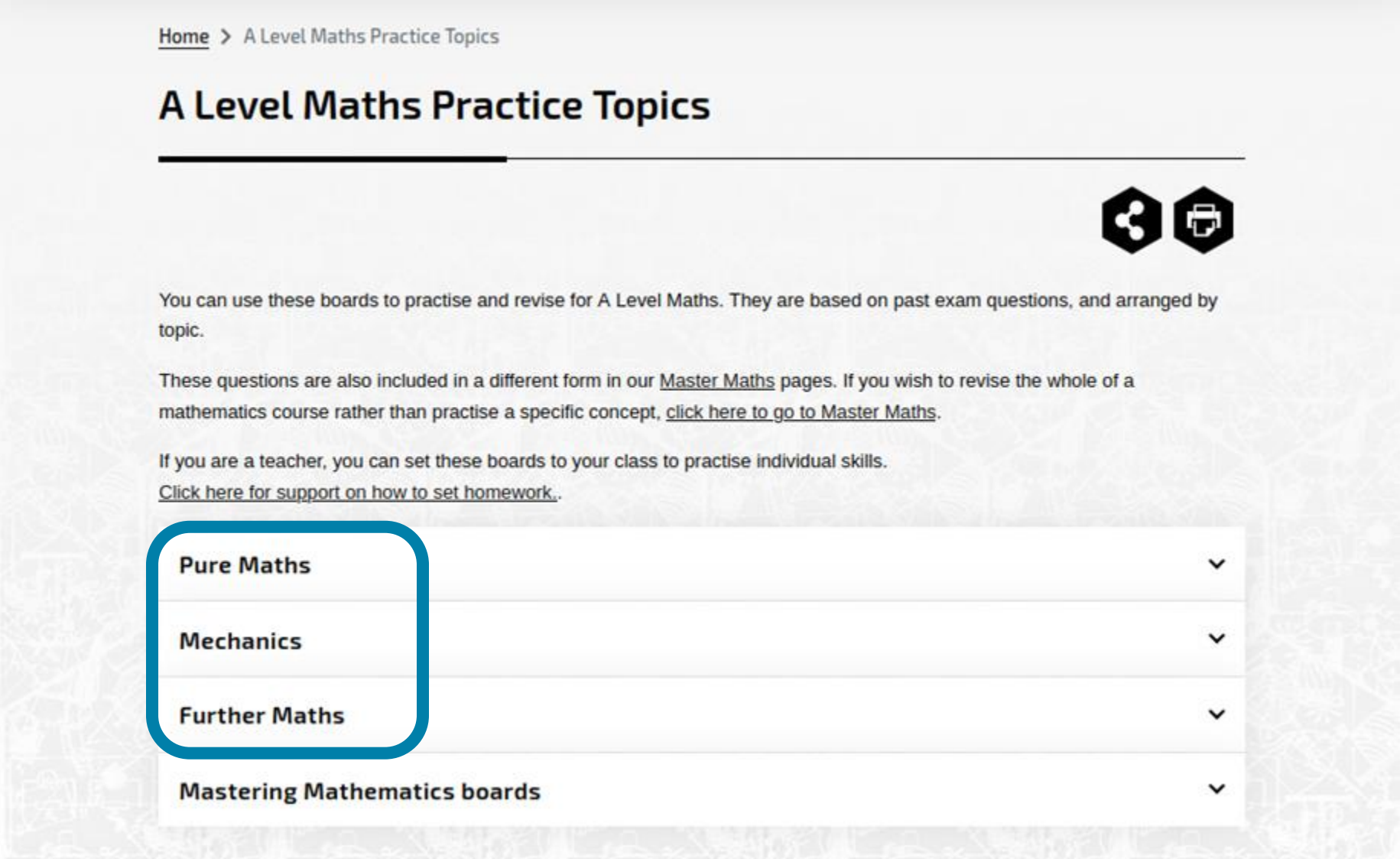



Head to the A-level page...

... then use this icon:



# Practise Maths



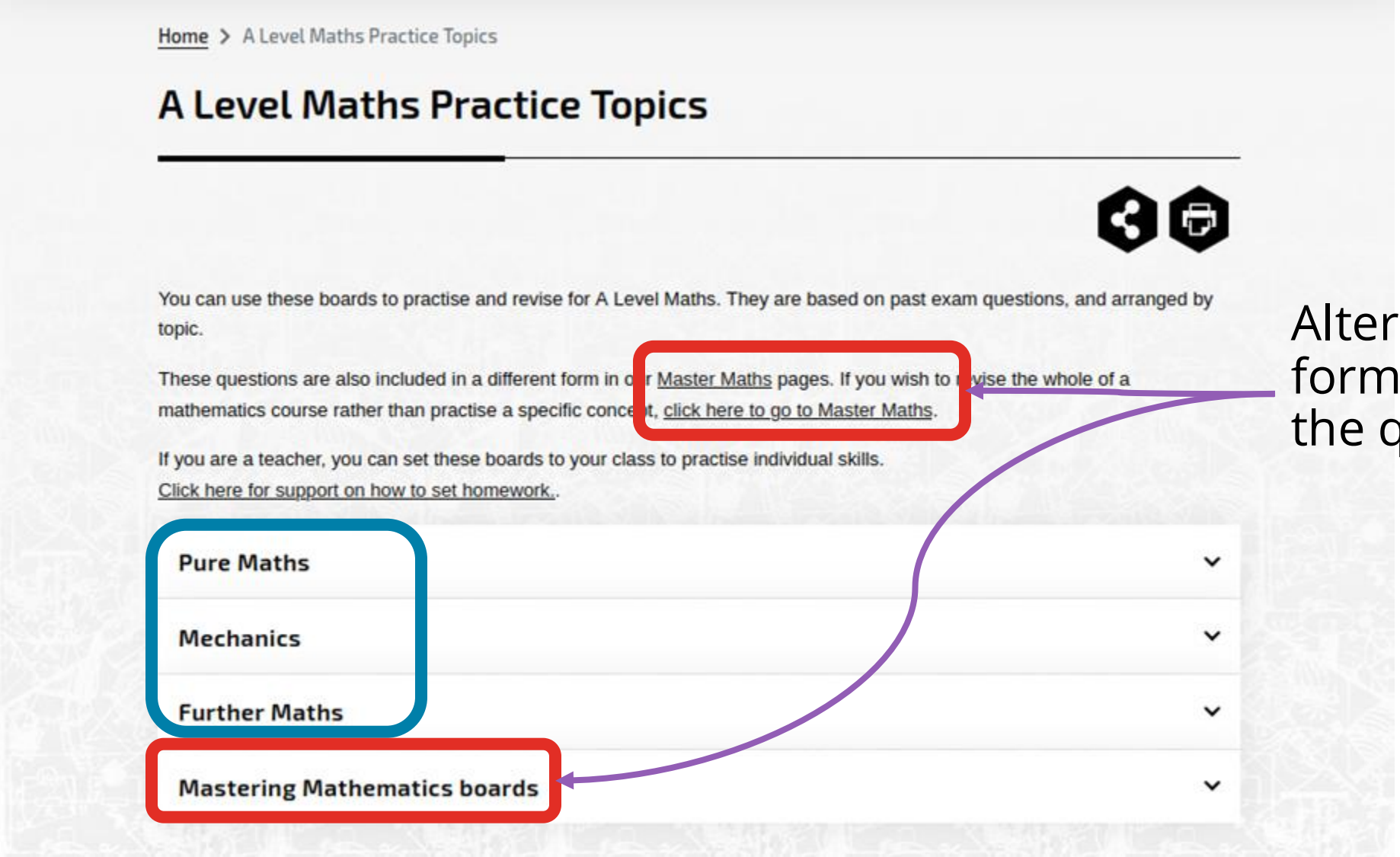
# Practise Maths

## Stage 2 (Year 13)

| Field | Topic | Board |
|---|---|---|
| Series | Series: Induction | Link |
| | Series: Summation - Standard Results | Link |
| | Series: Method of Differences | Link |
| Further vectors | Vectors: Lines and Planes | Link |
| | Vectors: Angles and Distances | Link |
| | Vectors: Geometry | Link |
| | Vectors: Intersecting Planes | Link |
| Matrices | Matrices: Intersection of Planes | Link |

Either link takes you to the gameboard

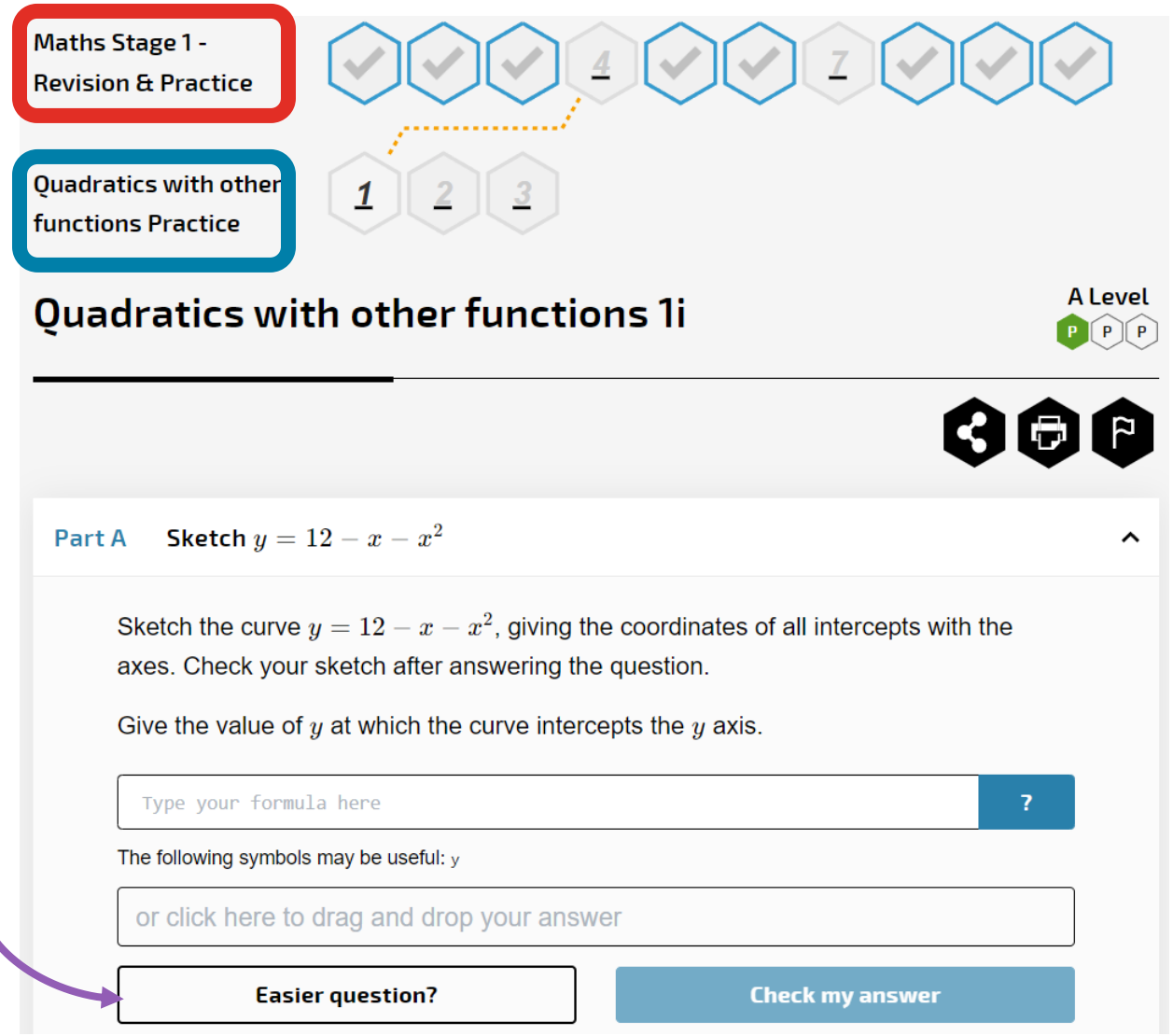
# Master Maths




Alternative format for the questions

# Master Maths

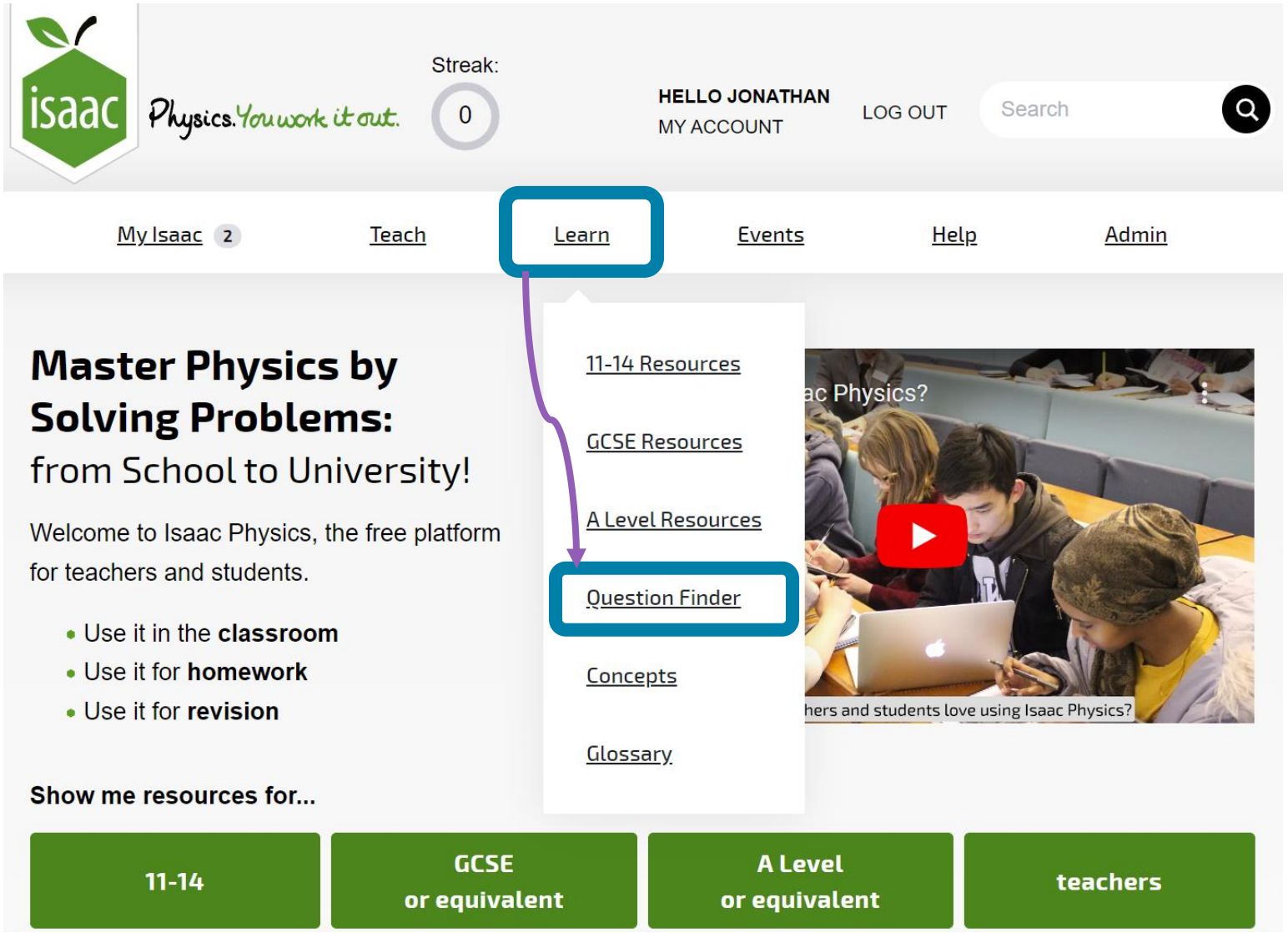
Descending level of difficulty



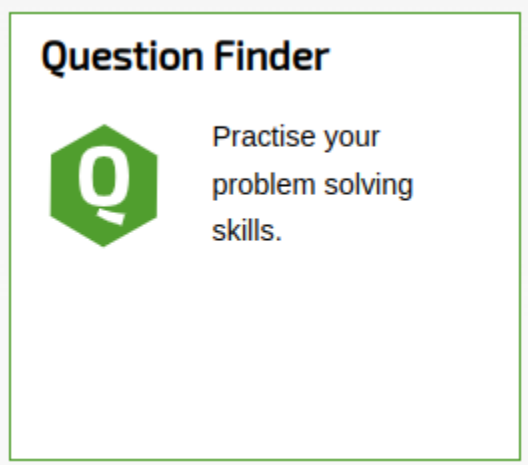

Students can find easier questions on a topic to practice skills where they are less confident.

https://isaacphysics.org/pages/master_maths

# Question Finder




This box on the A-level & GCSE pages:



# Question Finder

Select subject & topic

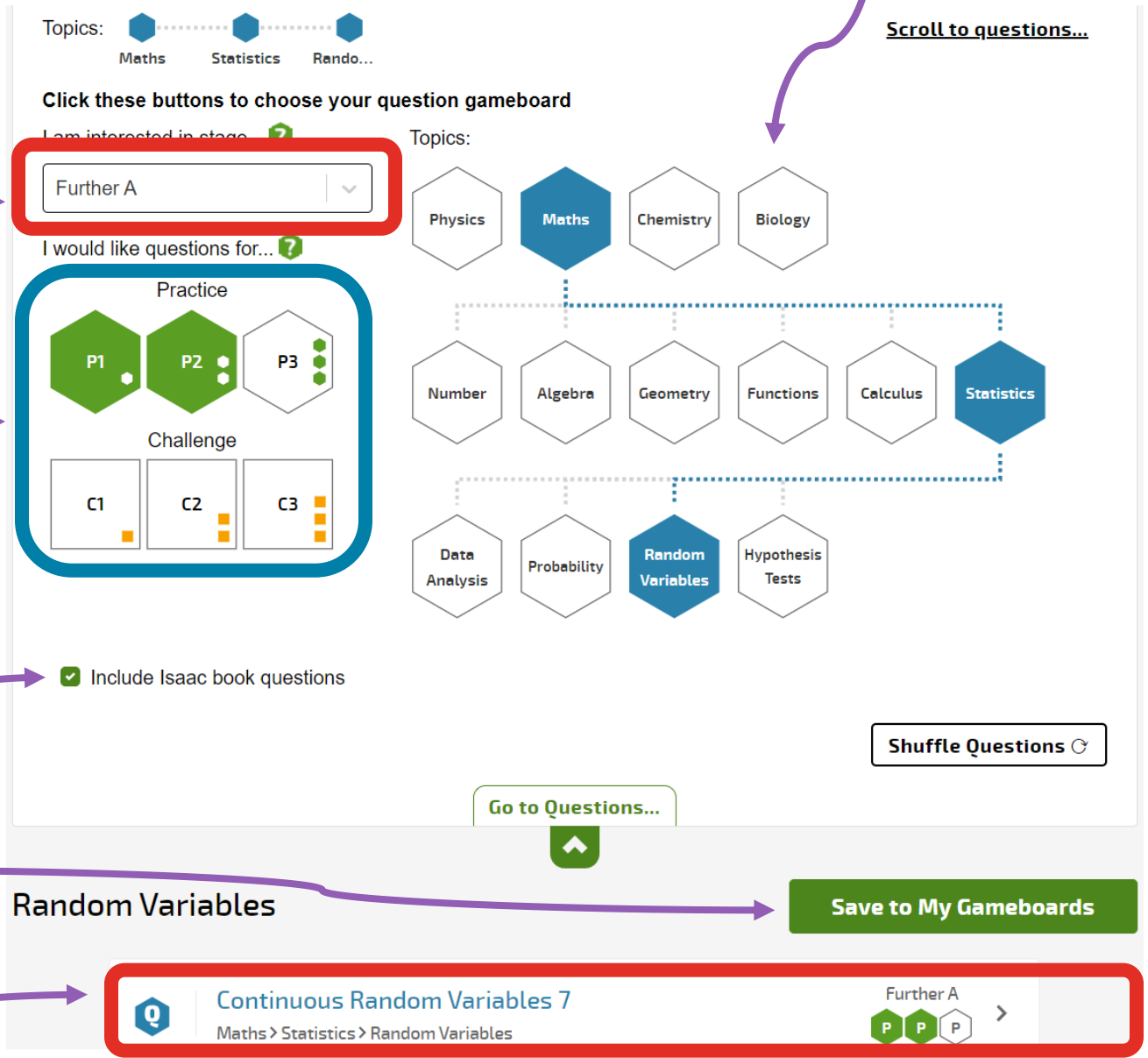
Select educational stage

Select practice and/or challenge level

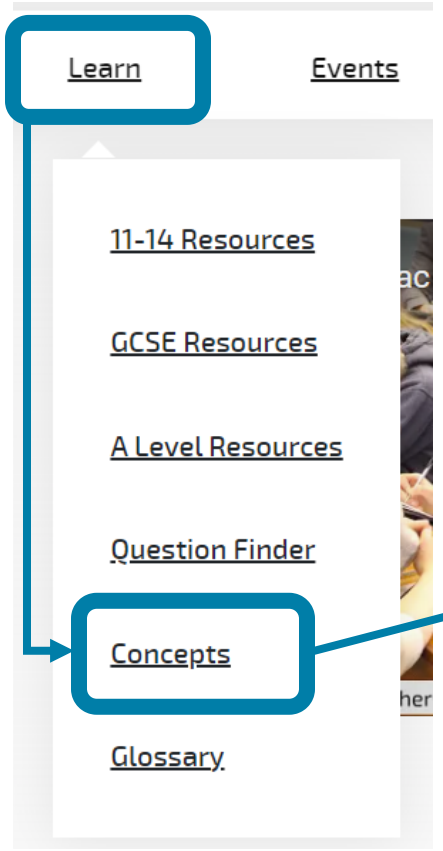
Include book questions (new)

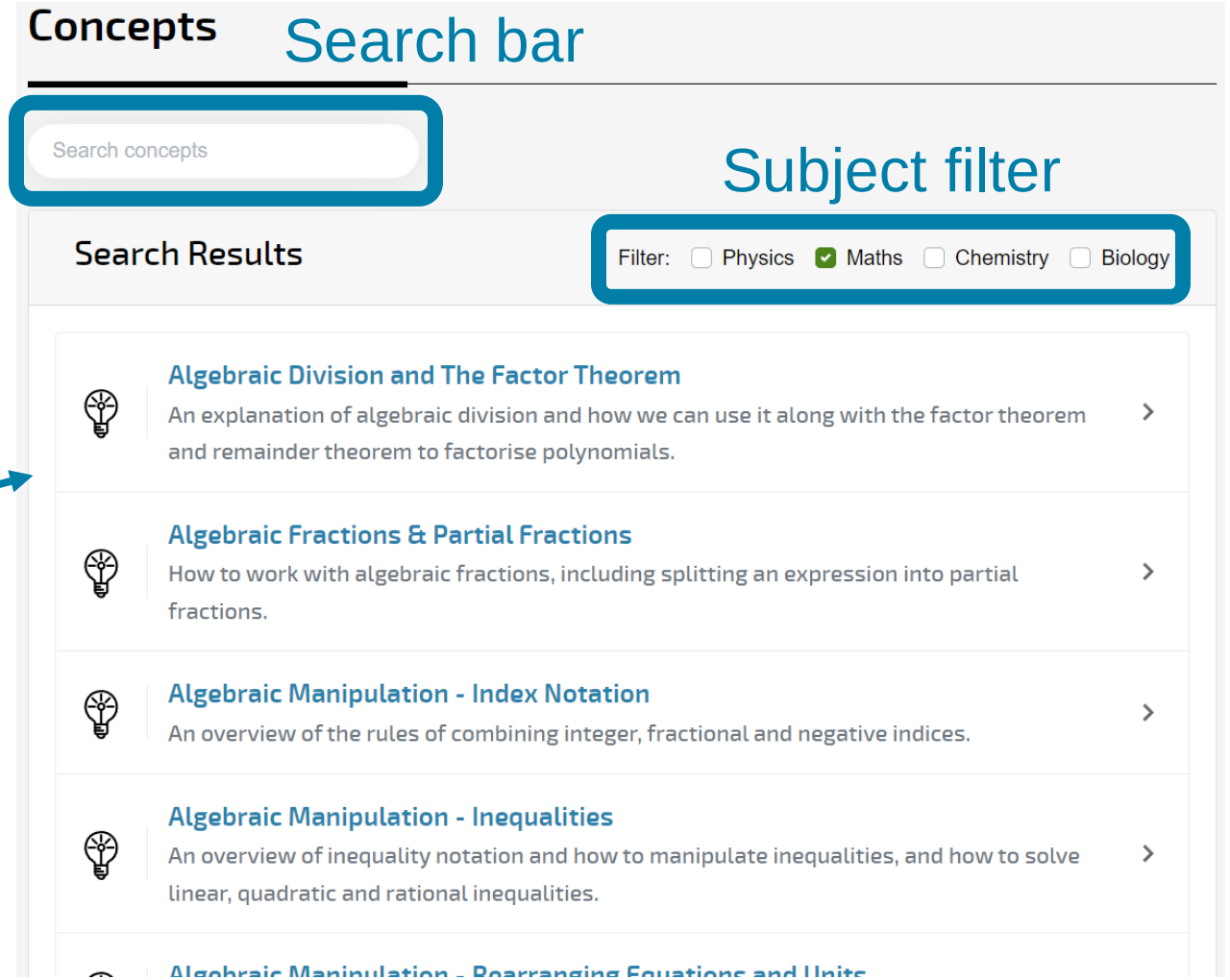
Save selection

10 questions



# Concept Pages




https://isaacphysics.org/concepts

# Concept Pages

## Matrices - Definition

All stages

Matrices have many applications in Mathematics, Physics, Chemistry and Computer Science. They can be used to
systems of simultaneous equations, stess and strain in materials, geometrical transformations of objects as well as
uses in statistics, quantum mechanics, graph theory and artificial intelligence.

A matrix is an array of elements set out in a pair of brackets and arranged in rows and columns. We can describe th
matrix using the number of rows and columns, $m \times n$.

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ $2 \times 2$ matrix

$\begin{pmatrix} 4 \\ 1 \\ -2 \end{pmatrix}$ $3 \times 1$ matrix

$\begin{pmatrix} 0 & 0 & -3 \\ -2 & 2 & k^2 \end{pmatrix}$ $2 \times 3$ matrix

$\begin{pmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \dots & a_{mn} \end{pmatrix}$ $m \times n$ matrix

Further A **Special types of matrix**

Further A **Matrix addition and subtraction**

Further A **Scalar multiplication**

These explain a concept in detail

Further A **Matrix addition and subtraction**

We can add or subtract two matrices (of the same size) by adding or subtracting the corresponding elements, just as we would for vectors. For example,

$$\begin{pmatrix} 2 & -1 & 0 \\ -3 & 1 & k \end{pmatrix} + \begin{pmatrix} 3 & k & -3 \\ 5 & 2 & 2k \end{pmatrix} = \begin{pmatrix} 5 & k-1 & -3 \\ 2 & 3 & 3k \end{pmatrix}$$

**Quick Q1** | Quick Q2

Given that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 0 & -3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 4 & 3 \\ -2 & -5 \end{pmatrix}$, find $\mathbf{A} + \mathbf{B}$.

**Hide answer**

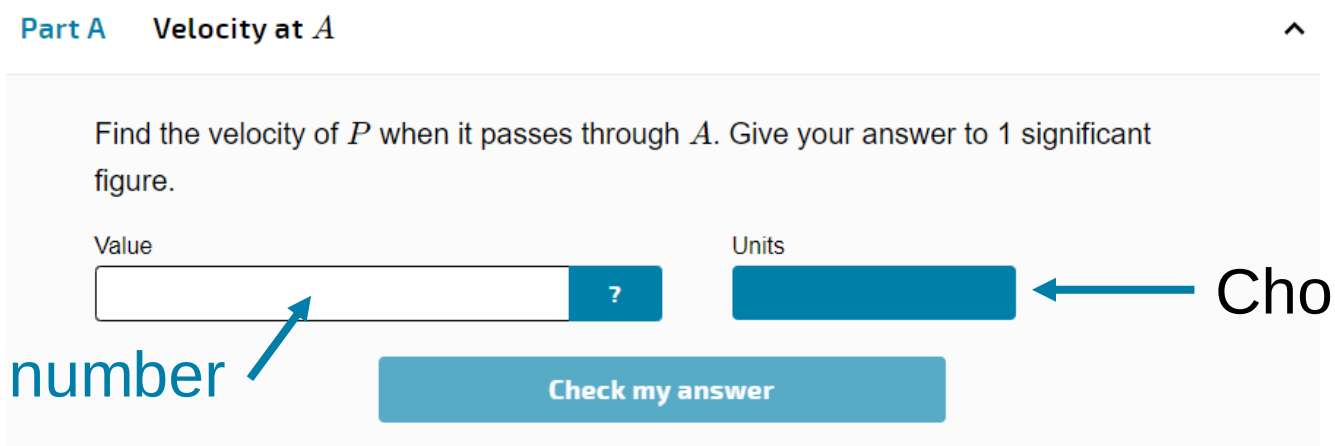
$$\begin{aligned} \mathbf{A} + \mathbf{B} &= \begin{pmatrix} 2 & -1 \\ 0 & -3 \end{pmatrix} + \begin{pmatrix} 4 & 3 \\ -2 & -5 \end{pmatrix} \\ &= \begin{pmatrix} 2+4 & -1+3 \\ 0+(-2) & -3+(-5) \end{pmatrix} \\ &= \begin{pmatrix} 6 & 2 \\ -2 & -8 \end{pmatrix} \end{aligned}$$

Feature worked examples

# Question Types

We have a variety of questions of different types available.

## Numeric Questions



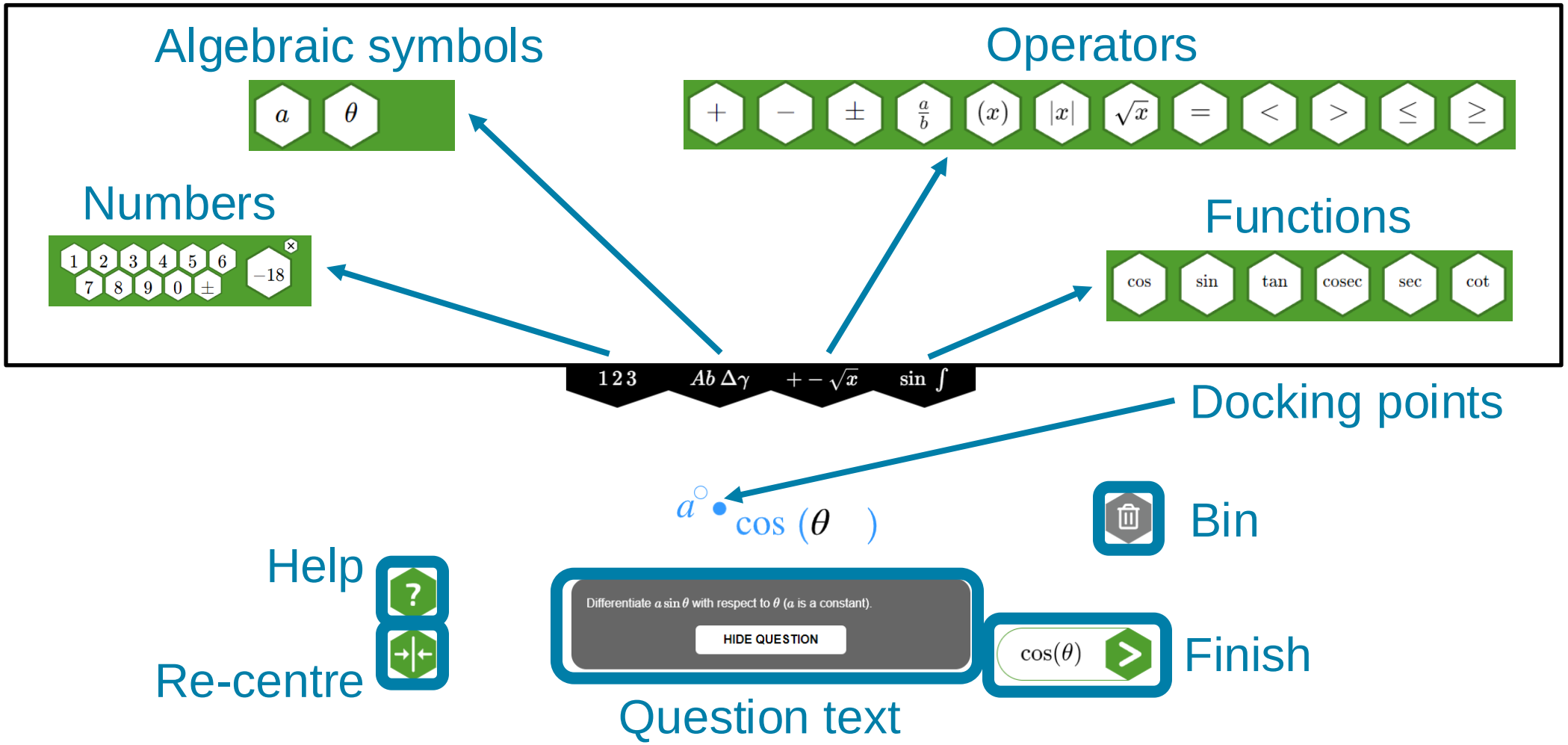

Enter a number

Choose a unit

These will check answers for appropriate use of significant figures.

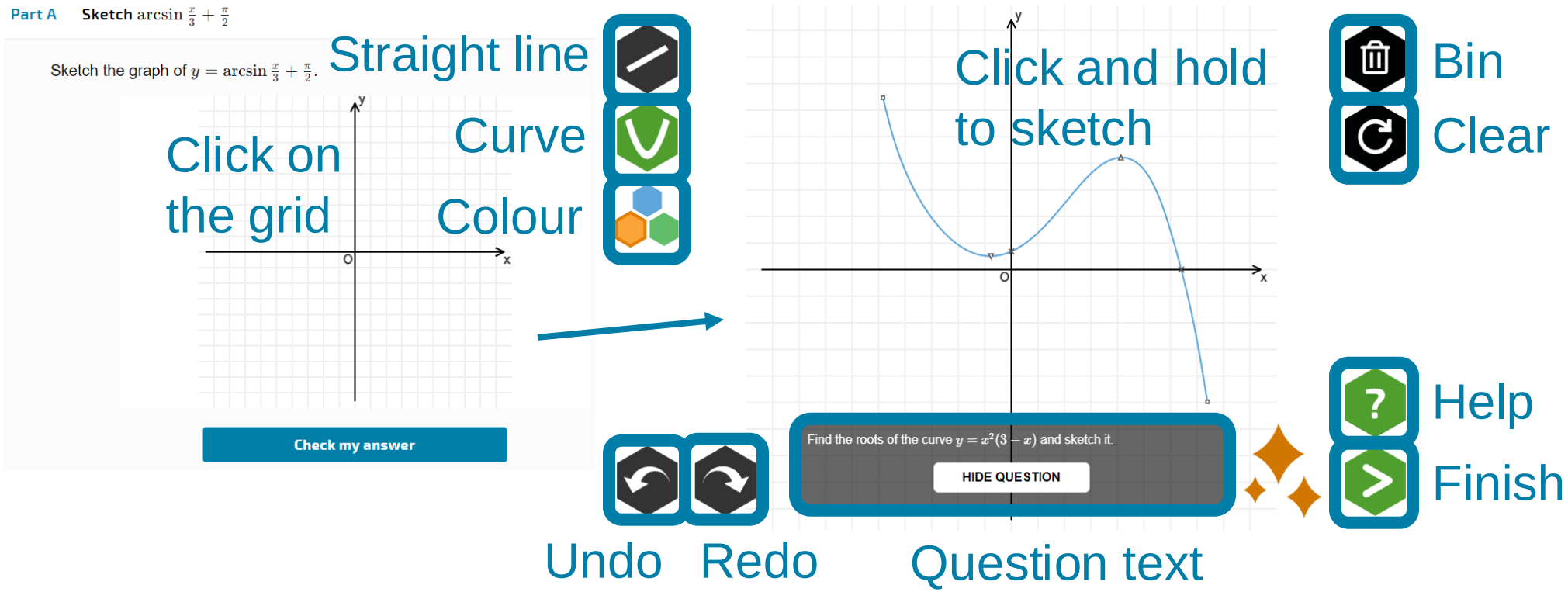
# Question Types

## Symbolic Questions



# Question Types

## Graph Sketcher



# Question Types

## Graph Sketcher

You can

- Draw up to 3 strokes
- Move, stretch or rotate strokes 
- Move turning points or ends 
- Delete by dragging it off the grid or using the buttons

Demo Link

# Question Types

## Graph Sketcher

**How strict is it?**

It uses rough positions:

- Which quadrant?
- Where does it cross the axes? (+/- or origin)
- Where are the turning points?
- What are the start and end slopes?
- Where do curves intersect?

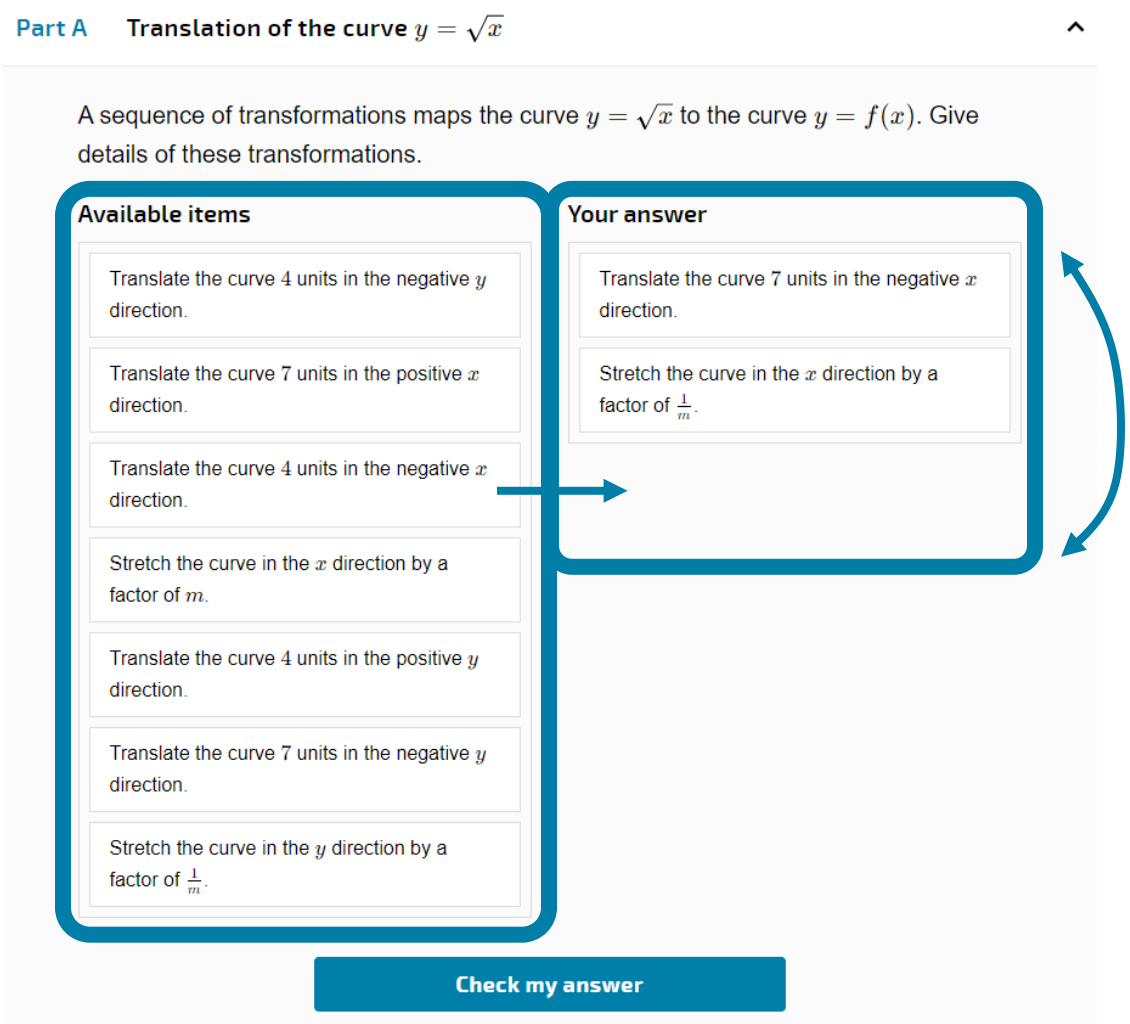
# Question Types

## Reorder

Choose from available items

Drag items into the answer

Put items in the correct order



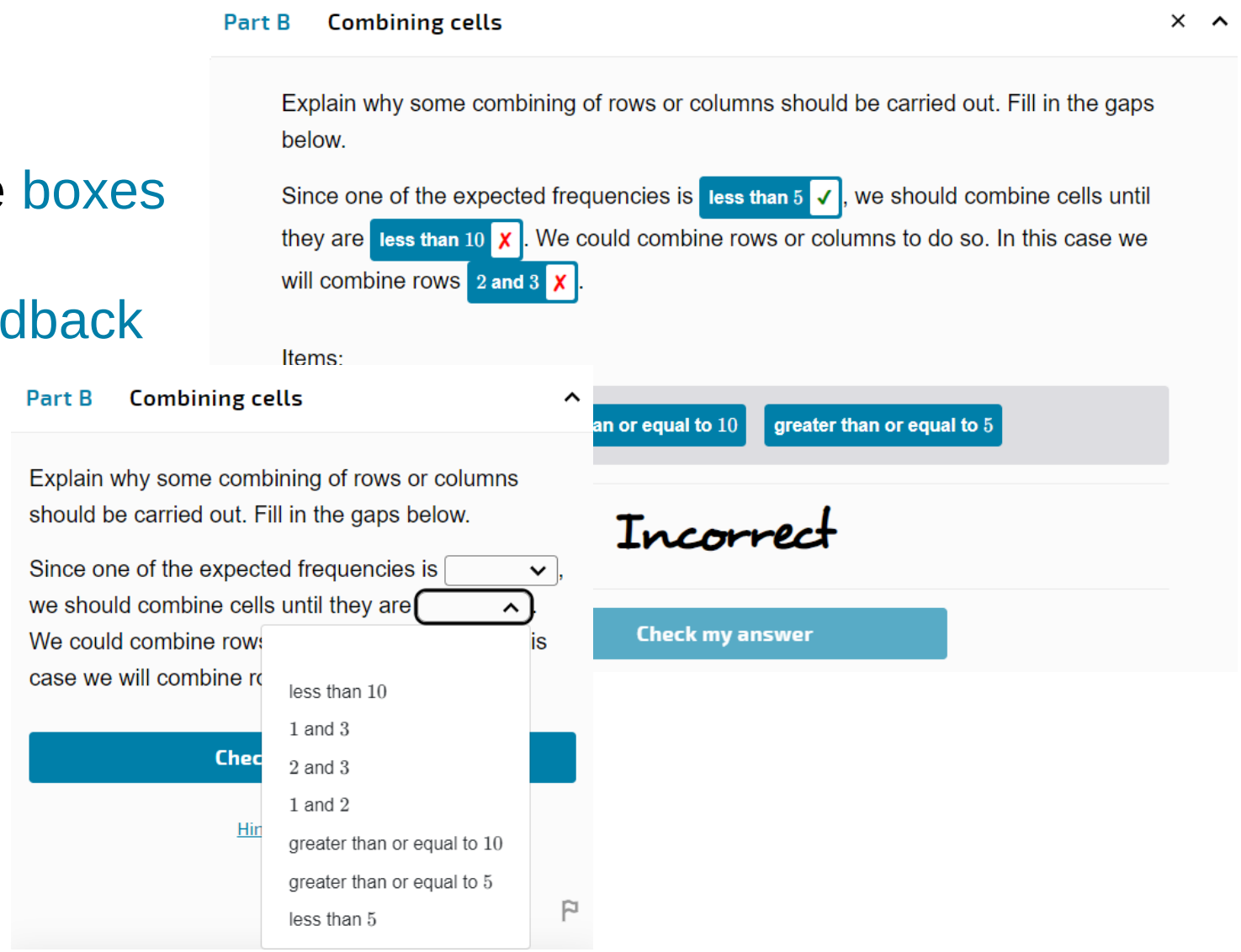
# Question Types

## Cloze Text

Drag items to fill in the boxes

Receive individual feedback on each item

Small screens use a dropdown menu



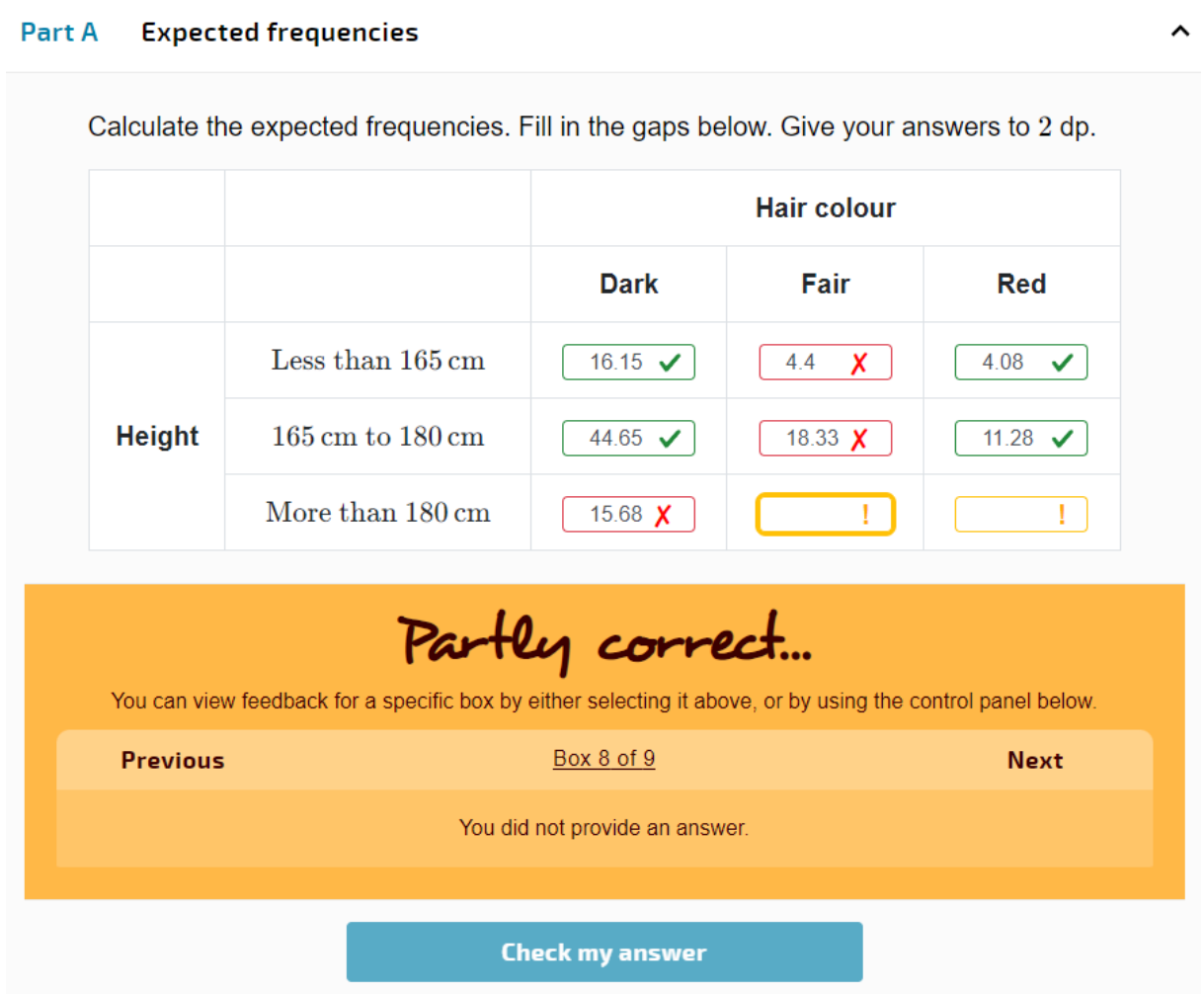
# Question Types

## Inline

Type numbers or text in the boxes

Receive individual feedback on each box

Some boxes may require units

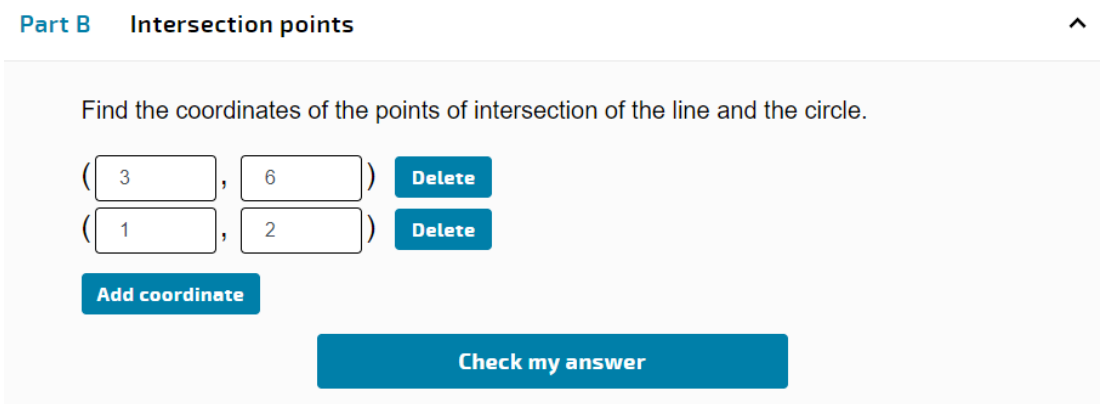
# Question Types

## Coordinate

Type numbers in the boxes

You can add/delete coordinates

Coordinate points can be submitted in any order (but not the abscissa and ordinate)



# Maths Skills for Science Teachers

**Over to Ally Davies …**

We plan to help develop a Maths skills course for science teachers.

Will include sets of questions for different skills

Example questions to practice rearranging equations:
https://isaacphysics.org/gameboards#ipts24_fri_3_jnw_jmr_mcr_re_eq

# Have a go!

| | |
|---|---|
| GCSE Book | https://isaacphysics.org/books/maths_book_gcse |
| Pre-U Book | https://isaacphysics.org/books/pre_uni_maths |
| Practise Maths | https://isaacphysics.org/pages/maths_practice |
| Master Maths | https://isaacphysics.org/pages/master_maths |
| Question Finder | https://isaacphysics.org/gameboards |
| Concept Pages | https://isaacphysics.org/concepts |
| Questions to try | https://isaacphysics.org/gameboards#ipts24_fri_3_jnw_jmr_mcr |
| Maths Skills | https://isaacphysics.org/gameboards#ipts24_fri_3_jnw_jmr_mcr_re_eq |