

# Resource Types

## Introductory investigation

An exploratory task, designed to be presented with little preamble. Students rapidly get engaged with the task, which then gives them an opportunity to discover the relevant ideas or concepts for themselves, perhaps by working collaboratively with others. This might well be followed by some sort of summary, or exposition, or worked examples, to formalise what has been found.

## Introductory problem

A task that gets students started on the sort of thinking or mathematics in a section of work, but that is perhaps less open and exploratory than an introductory investigation.

## Exposition

A presentation of some mathematics, perhaps in the form of an article or a video. It might, but need not, include questions for the student to consider while reading/watching the presentation.

## Worked examples

An illustration of a standard technique, or a standard way of presenting an argument, for example, through carefully chosen examples. Crucially the worked examples are followed by problems for students to try themselves, and while these problems are related to the worked examples, they require more than just 'templating' (changing a few numbers in the worked examples). Another sort of resource in this category could be an invitation to the student to come up with their own examples, as a way of getting a feel for the scope of an idea or technique.

## Scaffolded task

A task that gives students an opportunity to engage with material that would otherwise be out of their grasp. For example, it might be a 'proof sorter' activity that enables students to understand the components of a proof and their ordering, although creating the proof from scratch would be

beyond the students. Or it might be a 'hide and reveal' task, which has a number of sections that can be revealed one at a time, to offer some structure (e.g. subtasks leading to a big task) that helps students to make progress on something that would otherwise be too big or demanding.

## Problem inviting multiple approaches or representations

Students sometimes seize the first idea that comes to mind, when it might not necessarily be the most effective. These problems draw students' attention to the thought that there might be several ways to tackle a problem, or to represent an idea. They might do this not only by setting a problem that can be tackled in several ways, but also by illustrating some of these ways, or suggesting several starting points.

## Carefully designed set of problems

This is a set of problems that have been designed and that should be thought of as a single entity. It might be that the problems build on each other, so that by the end they are requiring more sophistication but in a way that is accessible to students who have worked through the whole set. Or it might be that by working on all of the problems, the student is naturally prompted to explore some underlying structure or to make a generalisation.

## Problem requiring decisions

Students are often used to problems being posed in such a way that they have all the information that they require for a solution, and no more. Problems (especially from the real world) are very often not like this, and so resources of this type will give students the opportunity to develop the skills needed to deal with this. Some problems might not contain enough information to answer a question, and so students will have to find some additional information (perhaps by making assumptions, perhaps by asking an expert (teacher), perhaps by carrying out an experiment, perhaps by researching online). And some problems might contain too much data, so that part of the challenge is to identify the useful information.

## Open-ended investigation

Something for students to get stuck into. It might start with just an interesting context, or with some initial questions to explore, but the emphasis is on students posing their own questions, and pursuing the avenues that interest them. This is good for developing various mathematical skills, and gives students the opportunity to work on things that really inspire them. These investigations might be good for after-school clubs, or individual projects.

## Fluency exercises

A bank of routine exercises (perhaps randomly generated) that students can use to develop fluency. Students can be encouraged to do as many as they need to do to feel confident and fluent with a particular idea or technique.

### **Lucky dip**

A mixed collection of problems for further practice. Students (or teachers) might pick a problem at random, or might rummage through the bag to find a problem that appeals to them. Working on these problems is not necessary for understanding the topic, but it is useful to have these problems available for additional practice and for variety. Many of them might be fairly short.

### **Review questions**

Students will regularly want to test their understanding, both of a particular topic and of their ability to draw together ideas from a number of topics. Review questions might include some past examination questions, alongside other fairly closed problems and other problems designed to get students to look back over what they have learned. They might be pitched at different levels, and might be flagged to show whether they incorporate ideas from other topics.

### **Go and think about it...**

A problem for which students (probably) have the required mathematical knowledge, but where the challenge is identifying how to get started, what tools might help, and how to apply the relevant mathematical knowledge. Students might tackle such a problem at home, for a challenge, as these problems are often more suited for individual consideration than classroom collaboration.

### **The bigger picture**

A resource that puts the mathematics into context, perhaps by offering a historical perspective, or describing the mathematicians who worked on it, or linking it to areas of current research, or illustrating how it leads on to further topics (e.g. at university level). They would not all need to be accessible to all students: sometimes it might be appropriate to have something that is designed for a student with a particular interest (e.g. for a student with an interest in Physics, who is studying A-level Physics alongside Maths). This sort of resource might be an article or video, for example. It might, but need not, contain questions for the student to consider while reading or watching.