Activity 18. Read the article to enumerate the applications of mathematics described in the text. Extend the list with your ideas. For that, use Appendix I. Cohesive Devices.

"When will you ever need to use maths in real life?" It's the question asked perennially in maths classrooms up and down the country and indeed around the world. The answer is easy — perhaps we should be responding to the question with the counter, "When will you not?"

The pandemic has provided some very upfront answers. For the last few years, we have been hearing regularly about the potential for cases to rise exponentially. News programmes carried regular features on the reproduction number, R. Others reported, in vain, that we might nearly have reached elusive mathematically defined herd immunity thresholds.

We relied on mathematical models, not only to understand the current situation but to predict what might happen in the future, from the impact of mitigations to the effectiveness of vaccines. We used maths to determine the most efficient order to deliver jabs during the vaccine rollout and to plan the roadmap out of lockdown in early 2021. Maths was front and centre much of the time.

Even outside times of crisis we see maths in the newspaper headlines every day. We use it to establish whether our politicians are telling the truth about unemployment. Maths allows us to monitor exchange rates during currency crashes. It is invaluable to opinion pollsters determining the popularity of our political parties and to fact-checkers holding politicians to account.

Away from the front-page headlines, maths is the language of science. It appears everywhere from physics to engineering and chemistry — aiding us in understanding the origins of the universe and building bridges that won't collapse in the wind. Perhaps a little more surprisingly, maths is also increasingly integral to biology. Scientists in my own specialist area of mathematical biology are helping to develop treatments for diseases and to answer the question of how the leopard got its spots.

Beyond the academy, we are increasingly employing maths in sport to enhance the performance of our top athletes. We use it in the movies to create computer-generated images of scenes that couldn't exist in reality. More mundanely, we are frequently using maths in our everyday lives when we go shopping or when we follow a recipe, when we tell the time or when we budget for the future. Much of the time we do it without even realising it.

Certainly, much of the maths we learn early on in school we use directly in our everyday lives. Other topics that we might have learnt later, or perhaps we never got around to, are essential for the functioning of modern society even if we don't often see their use directly.

There are of course bits of maths (particularly pure maths) for which it is harder to imagine a direct use. But isn't this true of every subject? Should we hold geography, for example, to the same exacting standards of utility we expect of maths? I don't remember the last time I put my hard-won knowledge of oxbow lakes to use. Similarly, in chemistry, when was the last time you needed to write down the chemical reaction diagram depicting esterification? Probably not very recently.

This is not to denigrate these subjects, but to point out that this is not a maths-specific issue. Perhaps maths suffers more because it is harder to visualise the direct application of an algebraic equation than it is to picture the flow of water in a river, for example. We can all remember sitting by a river watching the water flow past, but fewer of us, I would suggest, can imagine laying down our picnic blanket on the complex plane of an Argand diagram.

By necessity, maths tends to deal in generalities and therefore abstractions from reality. But, at least in part, it is the generality — the abstractness — which makes mathematics so pervasive.

At university, I teach students that a single abstract equation can describe the spread of heat through your radiator, the diffusion of a drop of food colouring in a glass of water and the random dispersion of cells on a petri dish. With such a diverse range of applications, you can start to see how powerful it is to study a seemingly abstract and lifeless equation for the deep insights it can provide about ostensibly unrelated systems.

It was not for nothing that philosopher Eugene Wigner wrote of "the unreasonable effectiveness of mathematics" for describing the natural world. Many simple mathematical ideas come up over and over again in different areas. The "normal distribution" — or bell curve — for example, can be used to describe people's IQs as well as their heights and has hundreds of other applications too. The problem mathematics faces may be that it has too many applications.

(by Kit Yates, from The Independent, 2022)