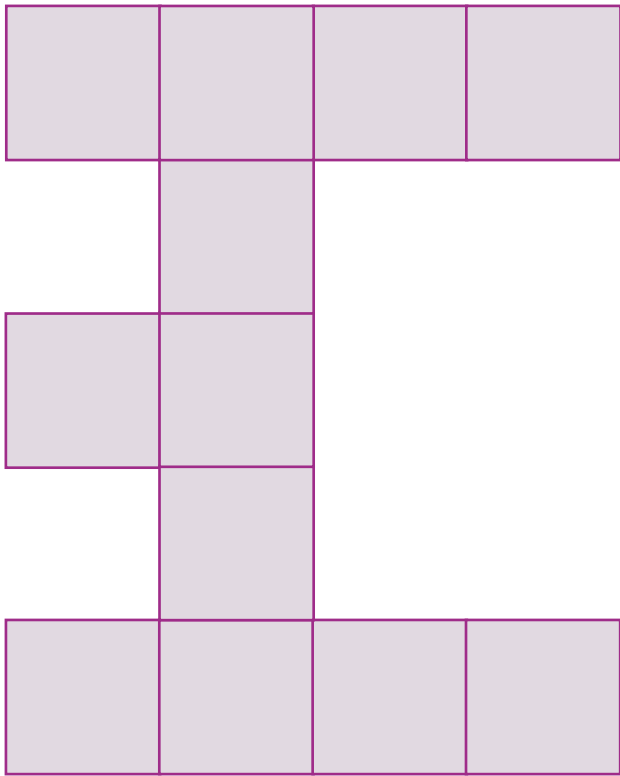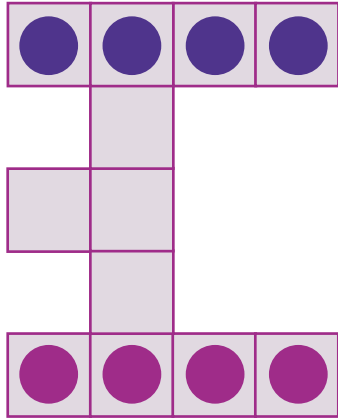At work, doing things in an **efficient order** is important. You need to be **logical** and think things through.
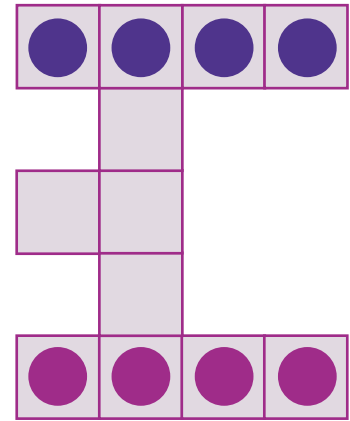
Here is a tricky puzzle to develop your logic skills.

Place counters in the **top** and **bottom rows** like this.

Moving **one counter at a time** and by **sliding only** (no jumps allowed!) swap over the two rows of counters.

create maths

Completing processes **without wasting time** is important at work.

It often means working out the best order to do things in. **This is called logistics**.

How quickly can you make a cup of tea?

You have to make a cup of tea for your 4 friends.

Use all the cards except the grey one.

What is the shortest time it will take you?

Your friends enjoyed that cup so much, they ask you to make another.

Oh dear – the cups are dirty and will need washing up!

This time, use all the cards including the grey card.

What is the **shortest time** it could take to serve up **4 fresh cups of tea?**

Ordering | Making tea

It takes **30 seconds** to add sugar to 2 of the cups.

It takes **1 minute** to pour 4 teas and stir the cups with sugar.

It takes **3 minutes** for the kettle to boil.

It takes **15 seconds** to put the tea bags in the tea pot.

It takes **30 seconds** to fill the kettle and switch it on.

It takes **30 seconds** to pour water from the kettle into the pot.

It takes **1 minute** to get the milk from the fridge and into the 4 cups.

It takes **2 minutes** for the tea to brew before it can be poured.

It takes **2 minutes** to wash up all the cups.

create maths

How quickly can you build a warehouse?

create maths

Your task is to plan how to build a warehouse in the shortest time possible.

There are various jobs that must be done.

Some jobs must be done before others – put the cards in order.

The length of each tile shows how long each job will take to complete.

If you add up all the times, it comes to **25 weeks** but some tasks can be taking place at the same time. **Find the shortest solution.**

Building a **warehouse**

Your task is to plan how to build a warehouse in the shortest time possible.
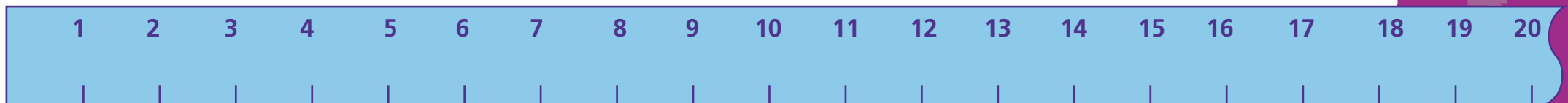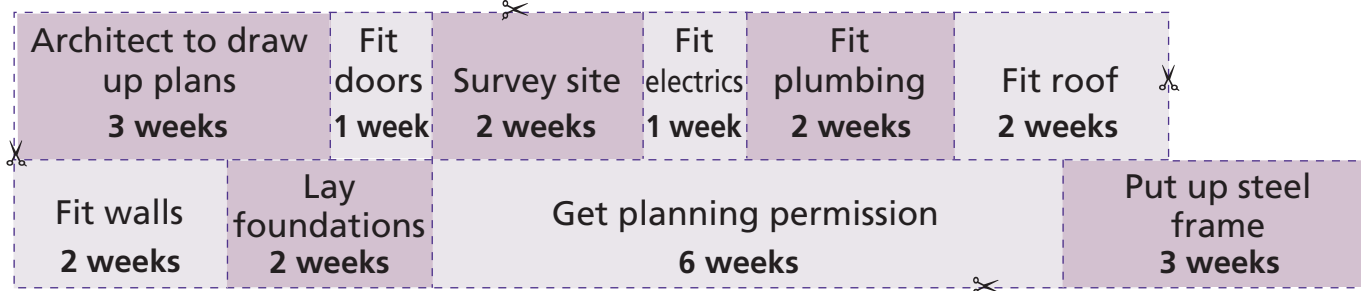
You must **survey the site** before you draw up detailed plans with the architect.

The roof and walls can be put up at the same time, as soon as the steel frame is in place. When completed, the building **will not let in the rain**.

When the building is **weather-proofed** the doors, electrics and plumbing will all be fitted by different teams of workers.

You cannot start laying the foundations or do any other building work until **planning permission** is given.

The length of each tile shows you how long each job will take to complete.

| Architect to draw up plans 3 weeks | Fit doors 1 week | Survey site 2 weeks | Fit electrics 1 week | Fit plumbing 2 weeks | Fit roof 2 weeks |

| Fit walls 2 weeks | Lay foundations 2 weeks | Get planning permission 6 weeks | Put up steel frame 3 weeks |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

Getting there: Ordering

Description

This topic develops logical and systematic thinking in different contexts – a fundamental mathematical activity.

Activity 1: Planning ahead

Activity 2: Making tea

Activity 3: Building a warehouse

The first activity requires pupils to think systematically, to notice when a particular strategy is working, and when a new strategy is required. The **Planning ahead** puzzle can be done on paper with coloured counters and it also works well as a 'people game'. The 'board' can be drawn out with chalk or mats can be used to mark the squares. Pupils take the place of the counters.

Some pupils may find the puzzle difficult to start. You could try simplifying the puzzle,

first like this...   ...and then like this
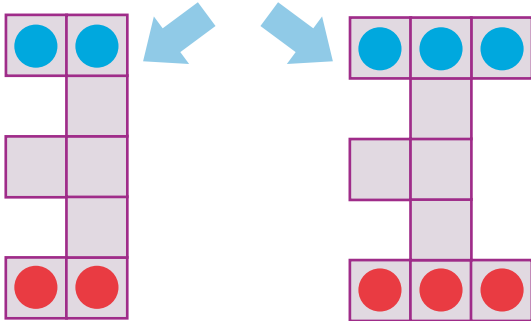
When pupils think they have 'finished' the puzzle ask them to show you how they do it. Often they will find this difficult because they have not fully thought through the strategies they have used.

Tell them to call you back when they are confident they can repeat the moves successfully. You might ask your pupils to record their key strategies.

Getting pupils to explain to the rest of the class how they solved the puzzle can help to clarify the strategies used. You can use this as an opportunity to encourage the use of appropriate mathematical language.

As a follow-up activity, ask the pupils to make up a counter puzzle themselves.

Using time efficiently is a *key* skill in logistics and **Making tea** introduces this. This is a simple example in a context which is familiar to many children which shares the logistical problems of larger scale projects such as constructing a bridge or a large building.

Adding up the times of all the individual activities involved in making four cups of tea gives an answer which is certainly sufficient for the task. However, there are some tasks that do not need attention. For example, when the kettle is boiling, the milk and sugar can be added to the cups. The shortest time for the harder problem is 7 minutes.

Encourage pupils to think of ways to record their solutions effectively and to explain their solutions to the rest of the class.

One possible extension is to ask how long it would take to make six cups of tea. You could also encourage your pupils to find out whether you can make 6 cups more quickly if you have a helper.

You could draw the pupils' attention to the importance on large scale projects of completing processes without wasting time. For example, constructing a bridge or a large building requires a complex critical path to ensure that the right materials and workers are available at the right time.

Getting there: Ordering

Building a warehouse has links with **Making tea**, but in this example a time line is used to sequence the activities. The use of a time line introduces an important tool used in real world problems, where it is often crucial to complete a building or industrial process in the shortest time possible. This context is less familiar and you may have to give some guidance about the order in which tasks must be completed and which activities can be done simultaneously.

The activity is broken down into two stages. Encourage pupils to put the four job cards in order before moving on to the time line sequencing activity. A ruler is provided.

An efficient solution to the problem shows the project can be completed in 15 weeks.

There are many ways to extend the activity by introducing more complicating factors.

Here are two examples:

■ The structure must be inspected when the steel frame of the building has been completed. The building inspector requires 2 weeks notice. When should she be invited?

■ If the foundations are laid before planning permission is granted you could save a week and complete the build in 14 weeks but what if the building inspector decides to make a surprise visit when planning permission is granted after 6 weeks, discovers that you have already begun to lay the foundations and they are wrong? It takes you an extra week to alter the foundations and the inspector insists on revisiting the site before you put up the steel frame of the building. She cannot visit again however for another 3 weeks. How long will the building take to complete now?

The mathematics

All of the activities develop multi-stage logistical thinking. The **Planning ahead** puzzle develops process skills of problem solving: working systematically and creating, describing and experimenting with systematic strategies. **Making tea** is concerned with finding the best way to organise time and draws on the Critical Path Analysis skills required to find an efficient solution to this kind of problem. **Building a warehouse** is another Critical Path Analysis activity which provides the opportunity to sequence a number of tasks considering which tasks can proceed in parallel in order to find an efficient solution.