# 3.1.1 Representing algorithms (abstraction)

# Lesson plan and printable activities

## Materials needed

1. 3.1.1 (Abstraction) Lesson PowerPoint.
2. Printed cards from Starter (at least one per two students).
3. Paper for drawing on, drawing implements.

*Some of the PowerPoint slides have notes. These can be seen in preview mode.*

## Starter activity (~5 minutes)

1. **Slide 2:** Students are divided into pairs – one of each pair is given a card printed from Starter. A PowerPoint version is also available to refer to during class discussion.

   Students have three minutes to draw what they see on the card – their partner has to try and guess what is being drawn.

   **Differentiation:** Some images are going to be far easier to draw than others. These can be directed to students who need additional support.

   **Extension:** If students finish early, extra cards can be given out with images that will be harder to draw.

   **Alternative:** Group students into threes; whilst one student has the image, they have to describe it (without saying what it is) – a second student has to draw it and the third has to guess what it is.
2. **Slide 3:** Class discussion about the task.

## Main activities

1. **Slides 4 and 5:** Introduction to the key concepts of abstraction.
2. **Slide 6:** Video (4:32) on the creation of the Beck London Underground map: youtube.com/watch?v=Bg3pfUqdLp4
3. **Slide 7:** Discussion on what was kept and what was removed – Interactive White Board to be used to write key points.

   **Assessment opportunity:** Differentiation by prompting key students.

**Key questions**

- What was taken out? Why do you think that was taken out?
- What was kept in? Why do you think that was kept in?
- Would you have taken out/kept in anything different?
- Do you know of anything else which has had this process carried out on it? (Wiring diagrams, circuit diagrams.)

**Possible extension/homework activity:** Give students a print out from Google maps of local area and ask them to create an abstraction – hopefully something akin to an OS map would come out.

4. **Slide 8:** Deliberately unstructured activity to create an abstract representation of school layout. Teacher should be circulating and querying why certain features were/were not included.

   **Assessment opportunity:** Students could be asked to peer-review diagrams.

   **Key question**: Is it fit for purpose? Link back to questions asked regarding Beck's tube map.

5. **Slide 9:** Introduction to 'alternate Knight's tour' diagram problem. At this point students do not know this is the 'Knight's tour'. Short discussion on how to do it – there are multiple solutions. ***Note: this activity is the opposite way to the methodology advised by Prof Curzon, for A2 topics.***

6. **Slides 10 and 11:** Move on to introduce Knight's tour. Some will work it out – few, if any, will come up with an efficient set of instructions. This activity can fill up any extra time in the lesson – possibly as an extension activity. A print out version of the Knight's tour activity is available. Suggest to students that they write down the square numbers as they are 'landed' on.

   **Assessment opportunity:** Discussion led from key points in presentation.

7. **Slide 12:** Lead on to discussion about similarities – let the students make the discoveries themselves. Ask: 'What did you notice?' Response: The two problems are the same (if you draw out the moves the Knight can take from each square and join them together with lines you get the same shape). Ask: 'Why is this good?' Response: If there's a similar problem in the future that involves finding a path through something, we can use a similar solution.

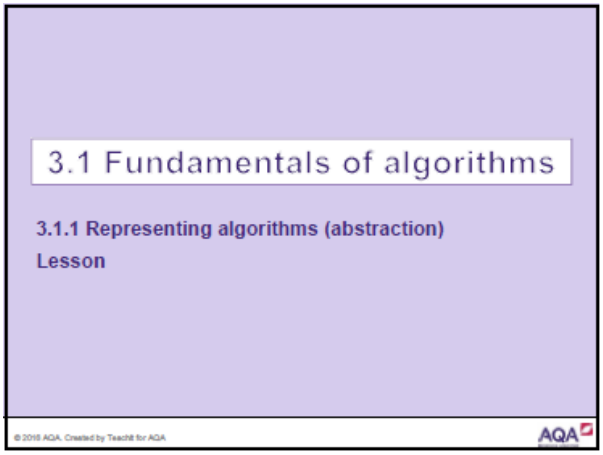
8. No need to introduce the concepts of graphs as that is above GCSE level, but the concept of removing information that is not needed and abstracting through generalisation is very useful.

   **Assessment opportunity:** See what the students identify from this discussion.

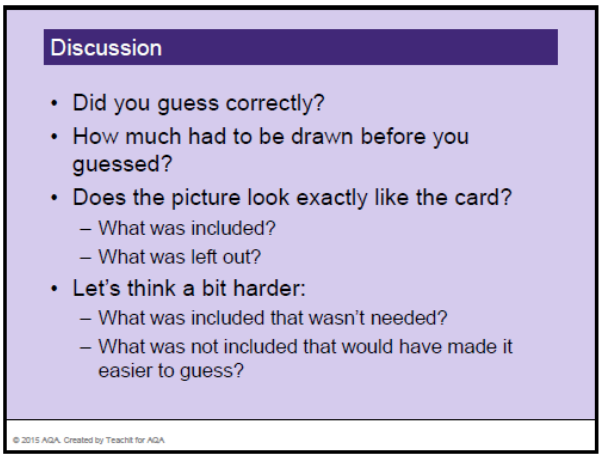
## Plenary (5-10 minutes)

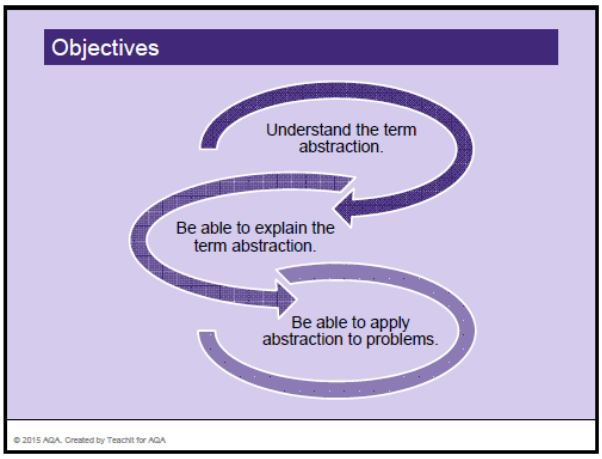
1. **Slide 13:** In groups.
    a. Students who need additional support should be able to form a definition.
    b. The majority of students should be able to write top tips for abstracting a problem.
    c. The best should be able to write a guide.

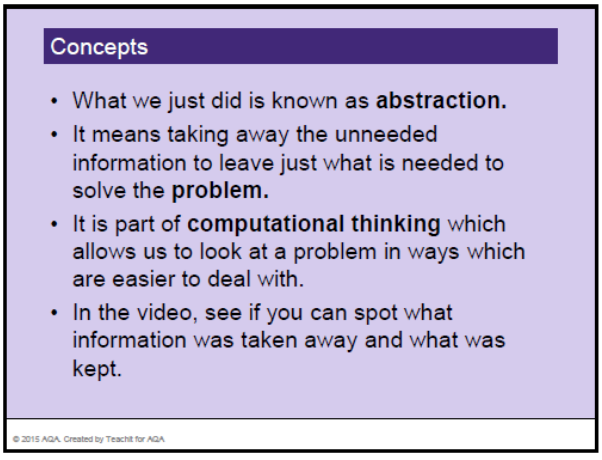
# Lesson

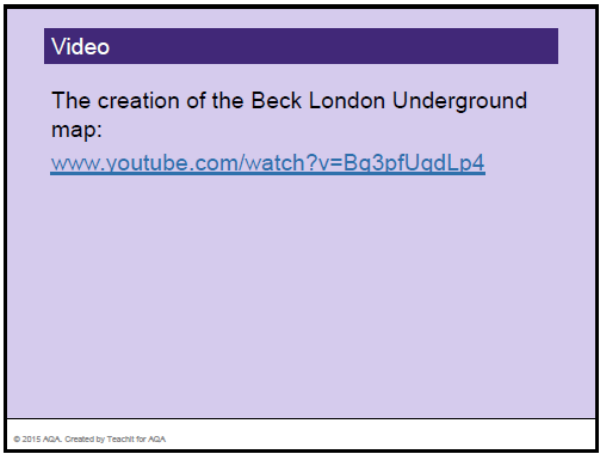






## Abstraction

**What was removed?**

**What was kept?**



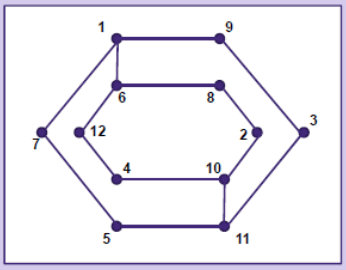
## Activity

Create an abstract representation of part of the school layout.



## Activity

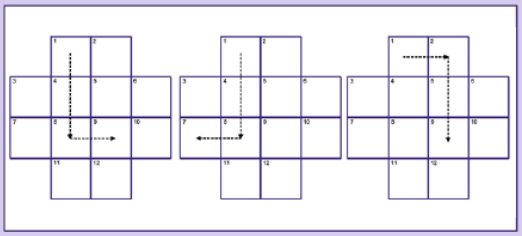
Copy this diagram. Place your finger on point 1. You can move to any adjacent point. Find a series of moves so your finger moves to every point exactly once, returning to where it started.






## Activity

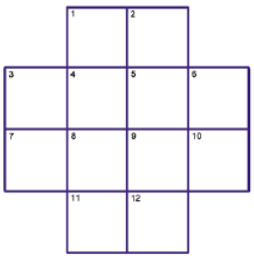
Place the Knight on square 1. By making only 'Knight' moves as in chess, find a series of moves so that the Knight visits every square exactly once before returning to square 1.



**Extra bonus:** Write a series of instructions for solving the problem.



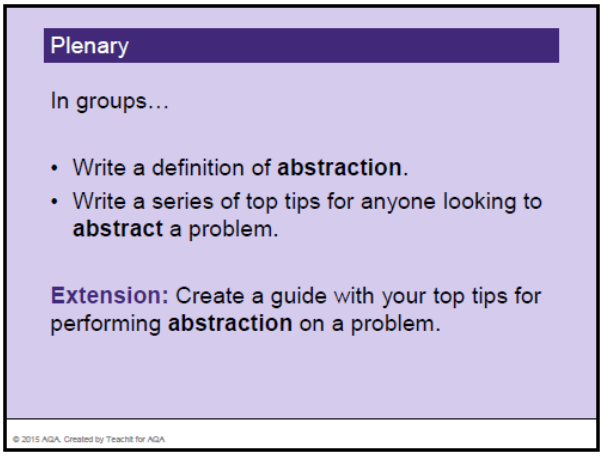
## Activity






## Discussion

- Did you solve the first problem?
- What about the second one?
- What did you notice?
- Why is this good?
- This is known as **abstraction by generalisation**.



## Starter

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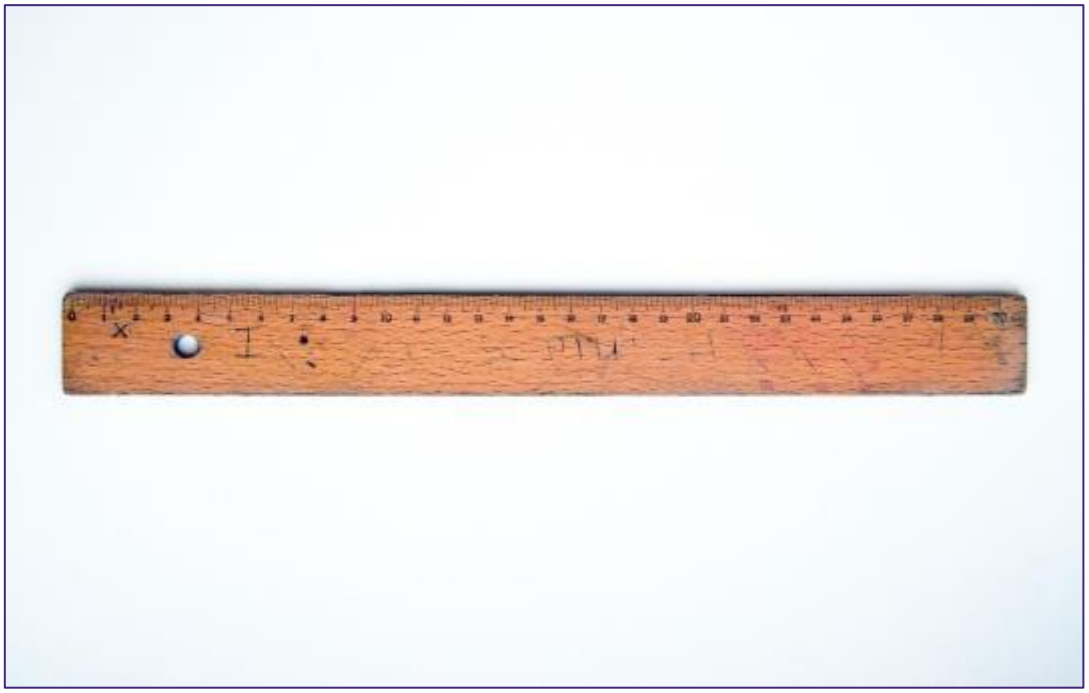

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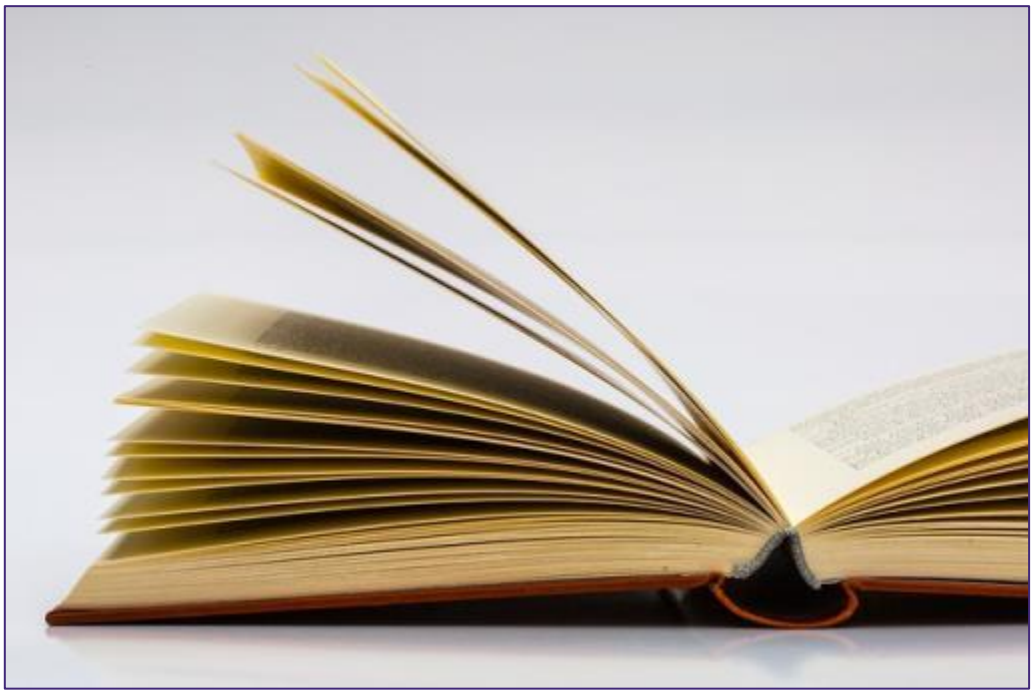

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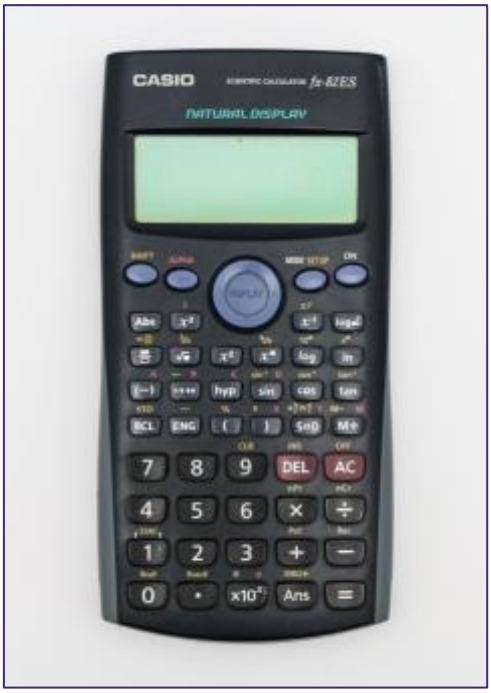


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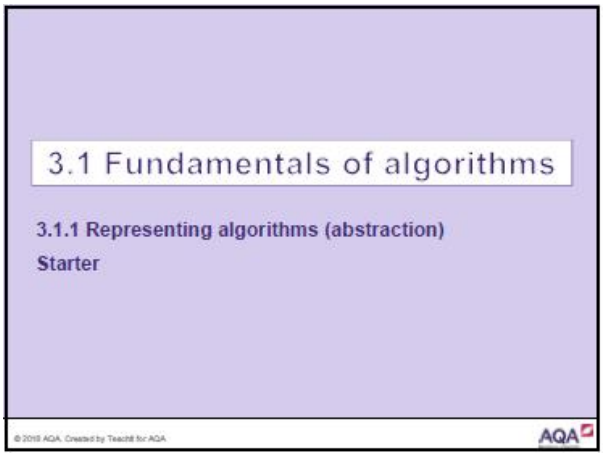
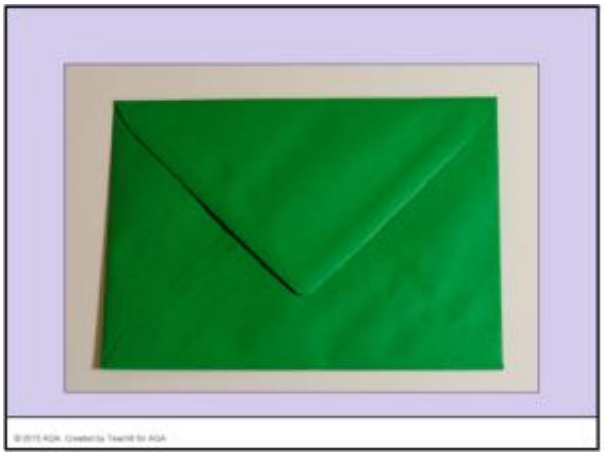
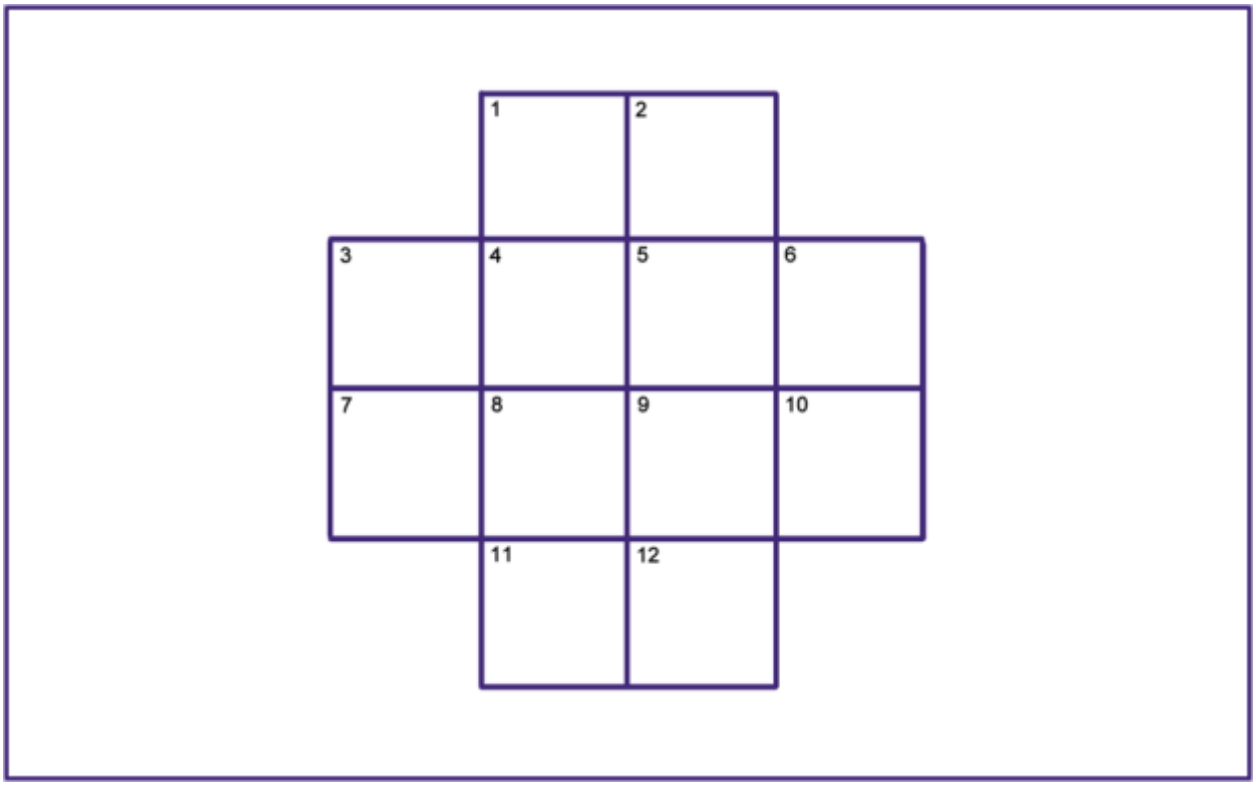
## Starter – PowerPoint version




# Knight's tour activity

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