Title: Finding the midpoint	E
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I am learning more about the idea of halfway	AC
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I am learning more about the idea of halfway

Linkages
Statistics (an early introduction to finding the mean)
Algebra (the creation of a formula in words and symbols)

Prerequisite Knowledge
Students are able to:
Find the difference between 2 and 3-digit numbers
Halve numbers to 100
Undertake multi-stage calculations
For the 'generalization from number' stage students should have already been introduced to the idea of using a letter for some number that we do not know. Additionally, they should understand the idea of grouping phrases with brackets, and how the relationship between division and fractions can be recorded in writing.

Equipment
0 to 100 number line and pegs

Using Materials
Put up the number line and put a peg on 2 and 6, then ask 'what number is halfway between these numbers?' and 'how do you know?' This second question aims to establish that the *distance* from both 2 and 6 (to the halfway point) is the same, though this may be expressed as 'if you add 2 to 4 you get 6, and if you subtract 2 from 4 you get 2 so it must be in the middle'. Encourage students to give as many explanations as they can come up with, and develop the language of halfway so terms like *halfway, midpoint, midway*, and *middle* are seen as equivalent terms.
Repeat the activity several times, slowly increasing the number size and the gap between the numbers. For example, 5 & 9, 12 & 20, 5 & 17, 14 & 26, 16 & 32, and 41 & 67. Discuss strategies for finding the midpoint that can be used on the number line, and establish the idea that the midpoint is at the middle of the gap between the numbers. Set the challenge for students to work out a method they can use when using the numbers alone (in twos and threes)

Using Imaging

Swap from using the number line and pegs to using an empty number line, and show only the numbers being used. For example:

26

Half of 26 is 13
41 + 13 is 54

41   67
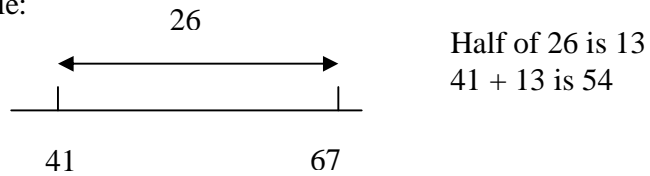
Continue the size of the numbers, and the gap between them. For example, 36 + 84 and 57 and 93. Introduce some examples where the gap would result in an odd number.

Using Number Properties

Give students a number of problems like 'what is midway between 116 and 154?' and 'where is the midpoint between 131 and 150?' Get them to explain how to get the answer without referring to or drawing a number line

Generalising From Number

Pose the following question. 'Suppose you had two numbers, but don't know what they are. Let's use the letters a and b to name them. Can you describe how to find the number that is exactly halfway between them?' Get students to discuss this and work in groups of two or three before reporting back. (This could be set as a challenge that could be discussed at a later session).

In gathering student responses, be aware that different algebraic approaches are likely to come to light, and that scaffolding may be needed to support the learning at this stage. For example the following questions may be of value:

- Which number are you going to have as the bigger number?
- How would you write the difference between the two numbers e.g., $b - a$
- How would you record half of this difference? Here knowledge of algebraic syntax should have been met before starting this stage of the lesson. For example the use of brackets ½($b - a$) or the showing of fractions as divisions $\dfrac{b - a}{2}$
- How do we show this number added on to the smallest number? (or subtracted from the larger number)

An extension would be to challenge students to see if they could change the developed formula(e) – like $a + \frac{1}{2}(b - a)$ into the standard formula for finding the midpoint ($\dfrac{a + b}{2}$)