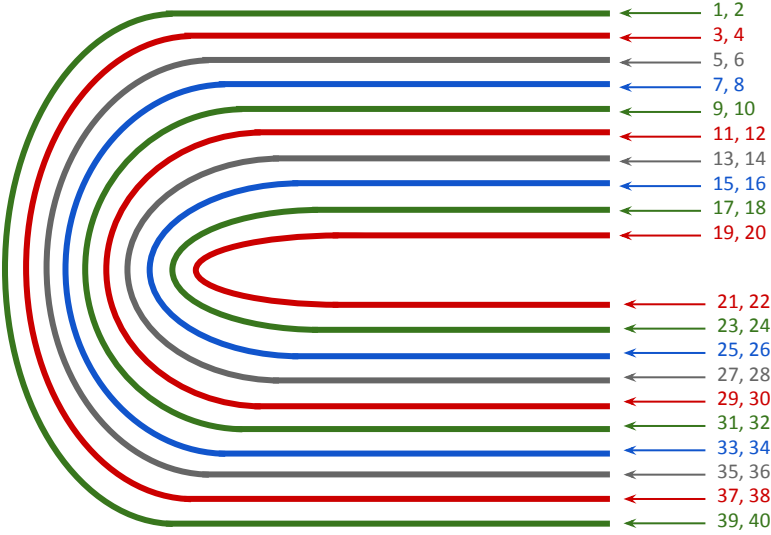


Answer: 11

Working out the solution to this puzzle can be done in a few ways. My favourite way is to solve it entirely by using the diagram as below.



On the left, all the large sheets have been labelled with their page numbers. We can see that Natalie must have picked this red sheet (which has page 29 on it). The four pages on this sheet are 11, 12, 29 and 30.

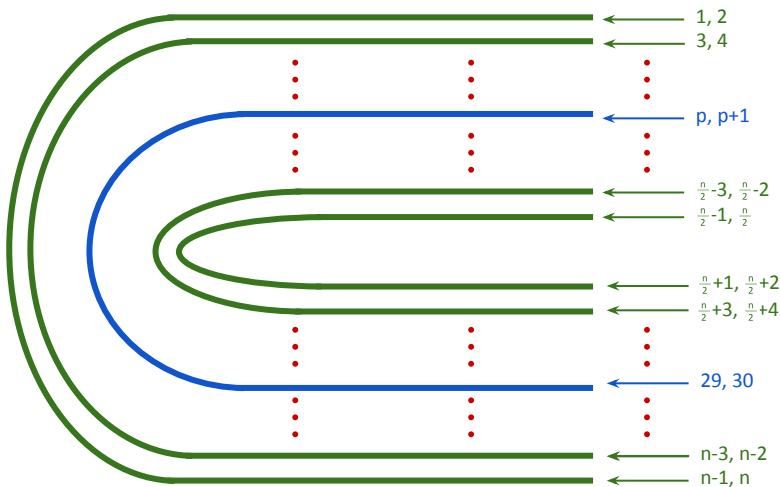
That means that the lowest page number on the sheet is page 11.

### Taking it further

In the extension we are asked what the answer would be if the paper contained  $n$  pages. As we don't know how many pages the paper contains then there are two possibilities:

- Page 29 is in the first half of the paper. In which case the lowest page number on the sheet of paper will be 29 as the sheet will also contain page 30 and two other higher sheets.
- Page 29 is in the second half of the paper (as in the puzzle above).

To find the answer to the second of these two possibilities we can use the fact that the sum of all the page numbers on any sheet is the same. In the example above the sum is always 82. The diagram below helps us find the sum for an  $n$  page newspaper.



In the four green sheets to the left we can find the sum of all the page numbers in terms of  $n$ :

$$1 + 2 + n - 1 + n = 2n + 2$$

$$3 + 4 + n - 3 + n - 2 = 2n + 2$$

$$\frac{n}{2} - 3 + \frac{n}{2} - 2 + \frac{n}{2} + 3 + \frac{n}{2} + 4 = 2n + 2$$

$$\frac{n}{2} - 1 + \frac{n}{2} + \frac{n}{2} + 1 + \frac{n}{2} + 2 = 2n + 2$$

Now that we know the sum of all 4 pages on any sheet is  $2n + 2$  we can label the lowest page on our blue sheet as  $p$ , then sum the four pages to equal  $2n + 2$ .

$$\begin{aligned} 2n + 2 &= p + p + 1 + 29 + 30 \\ 2n + 2 &= 2p + 60 \\ 2n &= 2p + 58 \\ n &= p + 29 \\ n - 29 &= p \end{aligned}$$

This is the value of the lowest page on the sheet containing page 29 in a newspaper with  $n$  pages