

[Main Page - Back](#)

# X-Wing Strategy

From [sudokuwiki.com](http://sudokuwiki.com), the puzzle solver's site

|   |   |   |
|---|---|---|
| 2 |   |   |
|   | 3 | 6 |
| 5 |   | 7 |

This strategy is looking at single numbers in rows and columns. It should be easier to spot in a game as we can concentrate on just one number at a time. The rule is

*When there are*

- *only two possible cells for a value in each of two different rows,*
- *and these candidates lie also in the same columns,*

*then all other candidates for this value in the columns can be eliminated.*

The reverse is also true for 2 columns with 2 common rows.

|   | 1      | 2        | 3          | 4      | 5        | 6               | 7          | 8        | 9                 |
|---|--------|----------|------------|--------|----------|-----------------|------------|----------|-------------------|
| 1 | 1<br>7 | 4        | 3          | 9      | 8        | <b>A</b> 6<br>7 | 2          | 5        | 1 6<br>7 <b>B</b> |
| 2 | 6      | 7 8 9    | 1<br>7 8 9 | 4      | 2        | 5               | 1 3<br>8   | 3<br>8   | 1<br>7 8          |
| 3 | 2      | 5<br>7 8 | 5<br>7 8   | 3<br>7 | 3 6      | 1               | 6<br>8     | 9        | 4                 |
| 4 | 9      | 5 6<br>8 | 2 5 6<br>8 | 1 3    | 1 3<br>5 | 4               | 1 5 6<br>8 | 7        | 1 2 6<br>8        |
| 5 | 3      | 5<br>7   | 2 5<br>7   | 6      | 1 5<br>7 | 8               | 4<br>9     | 2 4      | 1 2<br>9          |
| 6 | 4      | 1        | 5 6<br>7 8 | 2      | 5<br>7   | 9               | 5 6<br>8   | 6<br>8   | 3                 |
| 7 | 8      | 2        | 1<br>7     | 5      | 1 6      | 3 6<br>7        | 4<br>9     | 4 3<br>5 | 6<br>9            |
| 8 | 1<br>7 | 6<br>9   | 6<br>9     | 1<br>7 | 4        | 2 3             | 3<br>8     | 2 3<br>8 | 5                 |
| 9 | 5      | 3        | 4          | 8      | 9        | <b>C</b> 2 6    | 7          | 1        | <b>D</b> 2 6      |

The above picture shows a classic x-wing, this example being based on the number **six**. The X is formed from the diagonal correspondence of squares marked **A**, **B**, **C** and **D**. What's special about them?

Well, **A** and **B** are a locked pair of 6's. So is **C** and **D**. They are locked because they are the only 6's in the first and last rows. We know therefore that if **A** turns out to be a 6 then **B** cannot be a 6, and vice versa. Likewise if **C** turns out to be a 6 then **D** cannot be, and vice versa.

What is interesting is the 6's present in the two columns 6 and 9 directly between **A** and **C** and **B** and **D**. These have been highlighted with yellow boxes. Think about the example this way. **A**, **B**, **C** and **D** form a rectangle. If **A** turns out to be a 6 then it rules out a 6 at **C** as well as **B**. Because **A** and **CD** are 'locked' then **D** must be a 6 if **A** is. Or vice versa. So a 6 MUST be present at **AD** or **BC**. If this is the case then any other 6's along the edge of our rectangle are redundant.

We can remove the 6's marked in the cyan squares. This is good news because this leaves only a 9 at G9 and we can complete.

This strategy works in the other direction as well. If we had two pairs in two columns and those four numbers shared two rows, then we can eliminate any other occurrences of those numbers on the same rows.

## Generalising X-Wing

X-Wing is not restricted to rows and columns. We can also extend the idea to boxes as well.

If we generalise the rule above we get:

*When there are*

- *only 2 candidates for a value, in each of 2 different units of the same kind,*
- *and these candidates lie also on 2 other units of the same kind,*

*then all other candidates for that value can be eliminated from the latter two units.*

Now we have 6 combinations:

- Starting from 2 rows and eliminating in 2 columns
- Starting from 2 columns and eliminating in 2 rows
- Starting from 2 boxes and eliminating in 2 rows
- Starting from 2 boxes and eliminating in 2 columns
- Starting from 2 rows and eliminating in 2 boxes
- Starting from 2 columns and eliminating in 2 boxes
- Classic X-Wing
- Classic X-Wing
- Same effect as line/box reduction
- Same effect as line/box reduction
- Same effect as pointing pairs
- Same effect as pointing pairs

Here is an example of combination 5. Starting from 2 rows and eliminating in 2 boxes, in this case the last two boxes in the Sudoku. The rows are 7 and 8 and they each have two 7s. Our x-Wing is now a trapezoid but the logic is the same. We can be certain that 7 can be eliminated at X, Y and Z

|             |               |        |        |        |        |   |             |          |          |   |
|-------------|---------------|--------|--------|--------|--------|---|-------------|----------|----------|---|
| 1           | 9             | 6      | 5      | 4<br>8 | 4<br>7 | A | 2           | 4<br>7 8 | B        | 3 |
| 5<br>8      | 3             | 4      | C      | 1 2    | 1 2    |   | 6           | 9        |          | D |
| 2<br>5<br>8 | 2<br>5<br>7 8 | 5<br>7 | 3<br>6 | 9      | 3<br>6 |   | 1<br>4<br>7 | X        | 4<br>7 8 | Y |
|             |               |        |        |        |        |   |             |          |          | Z |

But HOLD UP one moment. There is a simpler strategy that does the same job!

|             |               |   |   |        |        |        |             |          |          |          |
|-------------|---------------|---|---|--------|--------|--------|-------------|----------|----------|----------|
| 1           | 9             | 6 | 5 | 4<br>8 | 4<br>7 |        | 2           | 4<br>7 8 |          | 3        |
| 5<br>8      | 3             | 4 |   | 1 2    | 1 2    |        | 6           | 9        |          | 5<br>7 8 |
| 2<br>5<br>8 | 2<br>5<br>7 8 | A | B | 3<br>6 | 9      | 3<br>6 | 1<br>4<br>7 | X        | 4<br>7 8 | Y        |
|             |               |   |   |        |        |        |             |          |          | Z        |

A and B above are a pointing pair. This removes the same 7s in the same place. Combination 6 is also the complement of a pointing pair. Combinations 3 and 4 are also complements of the Line/Box Reduction. Our generalization of X-Wing to boxes hasn't profited us at all. We learn that

**X-Wings containing boxes are the inverse of the Intersection Removal strategies**

|   |  |   |
|---|--|---|
| 2 |  |   |
| 8 |  | 6 |
|   |  | 3 |

|   |   |   |
|---|---|---|
|   | 3 | 6 |
| 5 |   | 7 |
|   |   |   |

## Comments...

**Wednesday 3-Feb-2010**

... by: Kantilal M Mane

Excellent technique !!!

**Friday 18-Dec-2009**

... by: John Mathews

If I am understanding this right, then the pattern can only be a square, rectangle, or trapezoid shape for any of these X-wing solutions. Is that correct?

**Sunday 4-Oct-2009**

... by: Nick Pannell

I'm a mathematician and I'm really intrigued at the setting of patterned sudokus and the decision as to what makes one easy, medium or hard. Your solution strategies are very interesting, although the explanations are a bit difficult to follow: but your graphics are excellent. Thank you

## Add your comments

A confirmation email will be sent to you after submitting.

Your Name

Email Address - required for confirmation (it will not be displayed here)

Your comment or question

☐ Remember me

Add Comment!

Please keep your comments relevant to this article. **Email addresses are never displayed, but they are required to confirm your comments.**

When you enter your name and email address, you'll be sent a link to confirm your comment. If you want to be remembered, the check box above will store a cookie with your name and email address on your computer.

Line breaks and paragraphs are automatically converted – no need to use <p> or <br> tags.

Article created on 10-April-2008. Views: 72563

This page was last modified on 12-April-2008, at 10:10.

All text is copyright and for personal use only but may be reproduced with the permission of the author.

Copyright [Andrew Stuart @ Scanraid Ltd](#), 2008