

## Predict The Total Magic Grid

Ask your student to draw a 4 by 4 grid on a sheet of paper. Have the student put a 1 in the upper right corner of the grid and continue filling in the squares using the counting numbers in order starting at 1 and counting 1 , 2 ,3 ,4 ,5 etc. You may like to model this on the board. If you want you can hand out the work page that appears on page 3.

Have them follow the directions as you read them to the class. Go slowly. You may like to model this on the board. If you want you can hand out the work page that appears on page 3.

1. Select any number in any square and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
2. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
3. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
4. There is only one number remaining that has not been crossed out or circled. It is 19. Circle that number.

When they are done ask 1 student what their 4 numbers were and what their total was,. Ask another student what their 4 numbers were and what their total was, Ask a third student what their 4 numbers were and what their total was, Appear stunned that they all got 34 even when they selected 4 different numbers.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

## Example

1. Select any number and circle it.  
Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.

1	<del>2</del>	3	4
5	<del>6</del>	7	8
<del>9</del>	10	<del>11</del>	<del>12</del>
13	<del>14</del>	15	16

2. Select an unmarked number and circle it.  
Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.

<del>1</del>	<del>2</del>	3	<del>4</del>
5	<del>6</del>	<del>7</del>	8
<del>9</del>	10	<del>11</del>	<del>12</del>
13	<del>14</del>	<del>15</del>	16

3. Select any unmarked and circle it.  
Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.

<del>1</del>	<del>2</del>	3	<del>4</del>
<del>5</del>	<del>6</del>	<del>7</del>	8
<del>9</del>	10	<del>11</del>	<del>12</del>
13	<del>14</del>	<del>15</del>	<del>16</del>

4. There is only one number remaining that has not been crossed out or circled. Circle that number.

<del>1</del>	<del>2</del>	3	<del>4</del>
<del>5</del>	<del>6</del>	<del>7</del>	8
<del>9</del>	10	<del>11</del>	<del>12</del>
13	<del>14</del>	<del>15</del>	<del>16</del>

The total of  $10 + 3 + 8 + 13$  is **34**

## Predict The Total Magic Grid

1. Select any number in any square and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
2. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
3. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
4. There is one number remaining that has not been crossed out or circled. Circle that number.
5. Add the 4 circled numbers. What was the total \_\_\_\_\_

### First Attempt

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

What is the  
total of the  
4 circled  
numbers?

\_\_\_\_\_

### Try it a second time and try to use different numbers

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

What is the  
total of the  
4 circled  
numbers?

\_\_\_\_\_

### Try it a third time and try to use different numbers

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

What is the  
total of the  
4 circled  
numbers?

\_\_\_\_\_

### Try it one last time and try to use different numbers

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

What is the  
total of the  
4 circled  
numbers?

\_\_\_\_\_

## Predict The Total Magic Grid (5 by 5 )

1. Select any number in any square and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
2. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
3. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
4. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
5. There is one number remaining that has not been crossed out or circled. Circle that number.
6. Add the 5 circled numbers. What was the total \_\_\_\_\_

### First Attempt

1	2	3	4	5
6	7	8	9	10
11	12	13	13	15
16	17	18	19	20
21	22	23	24	25

What is the total of the 5 circled numbers?

\_\_\_\_\_

### Try it a second time and try to use different numbers

1	2	3	4	5
6	7	8	9	10
11	12	13	13	15
16	17	18	19	20
21	22	23	24	25

What is the total of the 5 circled numbers?

\_\_\_\_\_

### Try it a third time and try to use different numbers

1	2	3	4	5
6	7	8	9	10
11	12	13	13	15
16	17	18	19	20
21	22	23	24	25

What is the total of the 5 circled numbers?

\_\_\_\_\_

### Try it one last time and try to use different numbers

1	2	3	4	5
6	7	8	9	10
11	12	13	13	15
16	17	18	19	20
21	22	23	24	25

What is the total of the 5 circled numbers?

\_\_\_\_\_

## Predict The Total Magic Grid (6 by 6 )

1. Select any number in any square and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
2. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
3. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
4. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
5. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
6. There is one number remaining that has not been crossed out or circled. Circle that number.
7. Add the 6 circled numbers. What was the total \_\_\_\_\_

### First Attempt

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

What is the total of the 6 circled numbers?

**Total =** \_\_\_\_\_

### Try it a second time and try to use different numbers

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

What is the total of the 6 circled numbers?

**Total =** \_\_\_\_\_

## Predict The Total Magic Grid Formula (N by N )

1. Select any number in any square on the grid and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you circled.

2. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.

..... continue this until you have 1 number remaining. Circle that number. Add the circled numbers. What was the total \_\_\_\_\_

Try the steps listed above on each of the grids to find the total for that grid.

1
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Total = 1

1	2
3	4

Total = \_\_\_\_\_

1	2	3
4	5	6
7	8	9

Total = \_\_\_\_\_

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Total = \_\_\_\_\_

1	2	3	4	5
6	7	8	9	10
11	12	13	13	15
16	17	18	19	20
21	22	23	24	25

Total = \_\_\_\_\_

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

Total = \_\_\_\_\_

Complete the table using the information found about the grids above.

N	1	2	3	4	5	6	?
Total							?

### Completed table for the Magic Grid.

N	1	2	3	4	5	6	?
Total	1	5	15	34	65	111	?

The purpose of the last page was to have them collect data and fill out a table with 2 variables. This is a key skill in graphing lines.

It will not be possible for your student to discover the general formula unless they know the method of Finite Differences. **The general formula for the Magic Grid is**  $T = N \cdot \left( \frac{N^2 + 1}{2} \right)$

You may use the formula to show it works for the what the data they collected

If  $N = 1$  then

$$T = N \cdot \left( \frac{N^2 + 1}{2} \right)$$

$$T = 1 \cdot \left( \frac{1^2 + 1}{2} \right)$$

$$= 1 \cdot \left( \frac{1+1}{2} \right)$$

$$= 1 \cdot \left( \frac{2}{2} \right)$$

$$= 1 \cdot (1)$$

$$= 1$$

If  $N = 3$  then

$$T = N \cdot \left( \frac{N^2 + 1}{2} \right)$$

$$T = 3 \cdot \left( \frac{3^2 + 1}{2} \right)$$

$$= 3 \cdot \left( \frac{9+1}{2} \right)$$

$$= 3 \cdot \left( \frac{10}{2} \right)$$

$$= 3 \cdot (5)$$

$$= 15$$

If  $N = 6$  then

$$T = N \cdot \left( \frac{N^2 + 1}{2} \right)$$

$$T = 6 \cdot \left( \frac{6^2 + 1}{2} \right)$$

$$= 6 \cdot \left( \frac{36+1}{2} \right)$$

$$= 6 \cdot \left( \frac{37}{2} \right)$$

$$= 3 \cdot (37)$$

$$= 111$$

The formula can be used to find what the total would be for larger grids

If  $N = 9$  then

$$T = 9 \cdot \left( \frac{9^2 + 1}{2} \right)$$

$$= 9 \cdot \left( \frac{81+1}{2} \right)$$

$$= 9 \cdot \left( \frac{82}{2} \right)$$

$$= 9 \cdot (41)$$

$$= 369$$

If  $N = 10$  then

$$T = 10 \cdot \left( \frac{10^2 + 1}{2} \right)$$

$$= 10 \cdot \left( \frac{100+1}{2} \right)$$

$$= 10 \cdot \left( \frac{101}{2} \right)$$

$$= 5 \cdot (101)$$

$$= 505$$

If  $N = 21$  then

$$T = 21 \cdot \left( \frac{21^2 + 1}{2} \right)$$

$$= 21 \cdot \left( \frac{441+1}{2} \right)$$

$$= 21 \cdot \left( \frac{442}{2} \right)$$

$$= 21 \cdot (221)$$

$$= 4641$$

### Background on addition grids

The development of grids like this was taught in the trick titled “Predict a total Add grid part 1”. It can be viewed at [amagicclassroom.com](http://amagicclassroom.com)

+	0	1	2	3
1				
5				
9				
13				

To complete the addition table add a top row number and side column number. Put that total in the cell that intersects at row and column of the numbers used to get the total.

For example add the 1 from the top row to the 9 in the right column to get 10. Put 10 in the row below the 1 and to the right of 9. The second row 3rd row and third column.

+	0	1	2	3
1	1	2	3	4
5	5	6	7	8
9	9	10	11	12
13	13	14	15	16

This trick uses grids like that but produces them in a different way. It just counts starting at one to fill in the cells. The counting must start at the LEFT SIDE OF THE ROW EACH TIME  
It uses the same procedure used in “Predict a total Add grid part 1”. to get the 4 numbers on the grid to add for the “Magic Total”




Starting at 1 fill in the rows using the counting number 1, 2,3 ,4 ect.

The completed grid is shown at the right

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

It uses the same procedure used in “Predict a total Add grid part 1”. to get the 4 numbers on the grid to add for the “Magic Total”

### Procedure

1. Select any number in any square on the grid and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you circled.
  2. Select a number from the remaining ones and circle it. Cross out all the other numbers in the SAME ROW and all the other numbers in the SAME COLUMN as the number that you just circled.
- ..... continue this until you have 1 number remaining. Circle that number.

**Add the circled numbers. What was the total** \_\_\_\_\_