# Summations

Simple AP grid.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |

*By folding:* Fold in half vertically (first row 5, 11s; 5 x 13 etc). Fold in half horizontally (each pile = 40; so 25 x 40 = 1000)*. By turning:* Copy and turn one through 180°. Every cell = 20. 100 cells = 2000. Halve because 2 sheets = 1000)

## Multiplication table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 |
| 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 |
| 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 |
| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 |
| 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 |
| 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

**Solution**:

Add these by folding in half (right to left), then half again (bottom to top). Now you have a 5 x 5 square with each total = 121. Total = 121 x 25 = 3025. Prove this always works and generalise.

**AP by AP (Not square)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 8 | 15 | 22 | 29 | 36 | 43 | 50 | 57 | 64 |
| 4 | 11 | 18 | 25 | 32 | 39 | 46 | 53 | 60 | 67 |
| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 |
| 10 | 17 | 24 | 31 | 38 | 45 | 52 | 59 | 66 | 73 |
| 13 | 20 | 27 | 34 | 41 | 48 | 55 | 62 | 69 | 76 |
| 16 | 23 | 30 | 37 | 44 | 51 | 58 | 65 | 72 | 79 |
| 19 | 26 | 33 | 40 | 47 | 54 | 61 | 68 | 75 | 82 |
| 22 | 29 | 36 | 43 | 50 | 57 | 64 | 71 | 78 | 85 |
| 25 | 32 | 39 | 46 | 53 | 60 | 67 | 74 | 81 | 88 |

**Solution:   
*By turning:*** Copy chart and turn through 180°. Sum numbers that cover one another then halve. (89 x number of cells)/2. Prove that this always works and generalise.

## 

## Sundaram sieve

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |

This table is completely defined by the values in the top left four squares.

Add these by folding in half (right to left), then half again (bottom to top).

Now you have a 5 x 5 square with each total = 58. Total = 58 x 25 = 1450.

Prove this always works and generalise to other tables where the top left four squares are altered.