## AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES

SCHOOLS ENRICHMENT CENTRE (AIMSSEC)
AIMING HIGH

## SHIFTING TIMES TABLES

Count 1 to 100 in 4s saying the 4 times table: $4,8,12,16,20, \ldots 80,84,88, \ldots$
Now shift the 4 times table up 3 and count in 4 s again starting from 7 :
$7,11,15,19,23, \ldots 83,87,87,91, \ldots$


This diagram shows a Function Machine, also called a mapping diagram. You input numbers into the black box and the machine outputs a number.
How does this mapping diagram represent shifting the 4 times table by 3 ?
Which tables were shifted to give the following sequences? By how much?
Explain how you know.
(a) $7,12,17,22,27, \ldots 82,87,92, \ldots$
(b) $9,11,13,15,17, \ldots .89,91,93, \ldots$
(c) $13,20,27,34,41, \ldots 83,90,97, \ldots$
(d) $4,7,10,13,16, \ldots 79,82,85, \ldots$
(e) $5,11,17,23,29, \ldots 71,77,83, \ldots$

Match each of the following rules for mapping the input numbers $n=1,2,3 \ldots$ to output numbers in the sequences above. Explain how you do this.
(1) $n \rightarrow 7 n+6$
(2) $n \rightarrow 5 n+2$
(3) $n \rightarrow 3 n+1$
(4) $n \rightarrow 6 n-1$
(5) $n \rightarrow 2 n+7$

Now make up your own sequence and rule.

## HELP

How well do you know your multiplication tables? It's a handicap not to know your tables but it's never too late to learn. You might like to play the game at https://www.education.com/game/radar-arrays and see how speedy you can get.

Counting $4,8,12,16, \ldots$ is called SKIP COUNTING and the numbers in the sequence are called MULTIPLES OF 4. It might help you to be more successful in maths if you practise skip counting up to 100 (or 150 ) in all the sequences $2 \mathrm{~s}, 3 \mathrm{~s}, 4 \mathrm{~s}$, all the way up to 10 s (that's an easy one). The best way to do this is to write out the sequence. Then read it aloud to yourself a few times. Then cover it so you can't see it. Then repeat it without looking at the list you wrote down until you can do it without hesitation.


Continue the following sequences for the next 3 terms and continue the sequences backwards to the previous 3 terms:
$7,10,13,16,19, \ldots$
$15,18,21,24,27, \ldots$
$1,-2,-5,-8,-11, .$.
The first 2 sequences come from a multiplication table shifted up. Which multiplication table is it?
What do you notice about the third sequence? How do the sequences relate to the red steps in the diagram?

How do these sequences relate to the lines $\mathrm{A}, \mathrm{B}$ and C in the diagram?
Which sequence relates to which line?
https://aiminghigh.aimssec.ac.za/steps/

| 1 | 2 | 23 | 4 | 45 | 56 | 67 | 78 | 89 | 910 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 67 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 213 | 314 | 415 | 516 | 1617 | 1718 | 819 | 1920 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 11 | 12 | 13 | 14 | 15 | 16 | 617 | 71 | 18 | 19 | 20 |
| 21 | 22 | 223 | 324 | 425 | 2526 | 2627 | 2728 | 2829 | 2930 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 21 | 22 | 23 | 24 | 25 | 26 | 627 | 272 | 28 | 29 | 30 |
| 31 | 32 | 233 | 334 | 443 | 3536 | 3637 | 3738 | 3839 | 3940 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 49 | 31 | 32 | 33 | 34 | 35 | 36 | 637 | 37 | 38 | 39 | 40 |
| 41 | 42 | 243 | 344 | 445 | 546 | 4647 | 4748 | 849 | 4950 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 41 | 42 | 43 | 44 | 45 | 46 | 647 | 47 | 48 | 49 | 50 |
| 51 | 52 | 253 | 354 | 455 | 5556 | 5657 | 5758 | 5859 | 5960 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 51 | 52 | 53 | 54 | 55 | 56 | 65 | 575 | 58 | 59 | 60 |
| 61 | 62 | 263 | 364 | 465 | 6566 | 6667 | 6768 | 869 | 6970 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 61 | 62 | 63 | 64 | 65 | 66 | 667 | 676 | 68 | 69 | 70 |
| 71 | 72 | 273 | 374 | 475 | 7576 | 7677 | 7778 | 879 | 7980 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 71 | 72 | 73 | 74 | 75 | 76 | 677 | 77 | 78 | 79 | 80 |
| 81 | 82 | 283 | 384 | 485 | 856 | 8687 | 3788 | 889 | 8990 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 81 | 82 | 83 | 84 | 85 | 86 | 68 | 878 | 88 | 89 | 90 |
| 91 | 92 | 293 | 394 | 495 | 596 | 9697 | 9798 | 899 | 99100 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 91 | 92 | 93 | 94 | 95 | 96 | 697 | 979 | 98 | 99 | 100 |
| Multiples of 2 |  |  |  |  |  |  |  |  |  | Multiples of 3 |  |  |  |  |  |  |  |  |  | Multiples of 4 |  |  |  |  |  |  |  |  |  |  |
| 1 | 2 | 23 | 4 | 45 | 56 | 67 | 78 | 89 | 910 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |  | 89 | 9 | 10 |
| 11 | 12 | 213 | 314 | 415 | 516 | 1617 | 718 | 819 | 920 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |  | 181 | 19 | 20 |
| 21 | 22 | 223 | 324 | 425 | 2526 | 2627 | 2728 | 289 | 2930 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |  | 28 | 29 | 30 |
| 31 | 32 | 233 | 334 | 435 | 3536 | 3637 | 3738 | 839 | 3940 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 31 | 32 | 33 | 34 | 35 | 36 | 37 |  | 38 | 39 | 40 |
| 41 | 42 | 243 | 344 | 445 | 546 | 4647 | 478 | 849 | 4950 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |  | 484 | 49 | 50 |
| 51 | 52 | 253 | 354 | 455 | 556 | 5657 | 5758 | 859 | 5960 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 51 | 52 | 53 | 545 | 55 | 56 | 57 |  | 58 | 59 | 60 |
| 61 | 62 | 263 | 364 | 465 | 566 | 6667 | 6768 | 869 | 6970 | 61 | 62 | 636 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 61 | 62 | 636 | 64 | 65 | 66 | 67 |  | 686 | 69 | 70 |
| 71 | 72 | 273 | 374 | 475 | 576 | 767 | 778 | 879 | 980 | 71 | 72 | 737 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 71 | 72 | 73 | 74 | 75 | 76 | 77 |  | 78 | 79 | 80 |
| 81 | 82 | 283 | 384 | 485 | 586 | 367 | 788 | 889 | 990 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 81 | 82 | 83 | 84 | 85 | 86 | 87 |  | 88 | 89 | 90 |
| 91 | 92 | 293 | 394 | 495 | 596 | 9697 | 9798 | 899 | 99100 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 91 | 92 | 93 | 94 | 95 | 96 | 97 |  | 989 |  |  |
| Multiples of 5 |  |  |  |  |  |  |  |  |  | Multiples of 6 |  |  |  |  |  |  |  |  |  | Multiples of 7 |  |  |  |  |  |  |  |  |  |  |
| 1 | 2 | 3 | 4 | 5 | 6 | 67 | 78 | 9 | 910 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 |
| 11 | 12 | 1213 | 14 | 1415 | 516 | 617 | 718 | 819 | 920 | 11 | 12 | 131 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 11 | 12 | 13 | 14 | 15 | 16 | 617 | 718 | 18 | 19 | 20 |
| 21 | 22 | 223 | 324 | 425 | 526 | 627 | 728 | 829 | 930 | 21 | 22 | 232 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 21 | 22 | 23 | 24 | 25 | 26 | 627 | 728 | 28 | 29 | 30 |
| 31 | 32 | 323 | 34 | 435 | 536 | 637 | 738 | 839 | 940 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 31 | 32 | 33 | 34 | 35 | 36 | 637 | 738 | 38 | 39 | 40 |
| 41 | 42 | 243 | 44 | 445 | 546 | 647 | 748 | 849 | 950 | 41 | 42 | 434 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 41 | 42 | 43 | 44 | 45 | 46 | 647 | 748 | 48 | 49 | 50 |
| 51 | 52 | 253 | 354 | 455 | 556 | 657 | 758 | 859 | 960 | 51 | 52 | 535 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 51 | 52 | 53 | 54 | 55 | 56 | 65 | 758 | 58 | 59 | 60 |
| 61 | 62 | 263 | 64 | 465 | 566 | 667 | 768 | 869 | 970 | 61 | 62 | 636 | 64 | 656 | 66 | 67 | 68 | 69 | 70 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 768 | 68 | 69 | 70 |
| 71 | 72 | 273 | 74 | 475 | 576 | 677 | 778 | 879 | 980 | 71 | 72 | 737 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 71 | 72 | 73 | 74 | 75 | 76 | 677 | 778 | 787 | 79 | 80 |
| 81 | 82 | 283 | 34 | 485 | 586 | 687 | 788 | 889 | 990 | 81 | 828 | 838 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 81 | 82 | 83 | 84 | 85 | 86 | 68 | 88 | 88 | 89 | 90 |
| 91 | 92 | 293 | 94 | 495 | 596 | 697 | 798 |  | 9100 | 91 | 92 | 939 |  | 95 | 96 | 97 | 98 |  | 100 | 91 | 92 | 93 | 94 | 95 | 96 | 697 |  | 98 |  | 100 |
| Multiples of 8 |  |  |  |  |  |  |  |  |  | Multiples of 9 |  |  |  |  |  |  |  |  |  | Multiples of 10 |  |  |  |  |  |  |  |  |  |  |

See https://aiminghigh.aimssec.ac.za/multiple-patterns/

