

Chapter 4 / **Example 18****Sum of an arithmetic series**

- a** Find the sum of the arithmetic series  $-10 + (-6) + (-2) + \dots + 90$ .  
**b** Write down this series in sigma notation.  
**c** Find the least number of terms from this series needed to obtain a sum greater than 100.

$$u_1 = -10 \text{ and } d = 4.$$

$$u_n = -10 + 4(n-1).$$

Press **MENU** 8 **RECUR** to display the sequence entry screen.

Press **F3** TYPE **F1**  $a_n$ .

Type  $-10 + 4(n-1)$  and press **EXE** to enter the first sequence as  $a_n$ .

Press **F1** to enter  $n$ .

Recursion  
 $a_n = -10 + 4(n-1)$  [—]  
 $D_n :$  [—]  
 $C_n :$  [—]  
**SEL+S** **DELETE** **TYPE** **n** **SET** **TABLE**

Press **F5** **SET** and change the settings to start at 1 and end at 30.

Press **EXIT**.

Table Setting  $n$   
 Start: 1  
 End : 30

Press **F6** **TABLE**.

The GDC displays a table of values of the sequence  $a_n$ .

n	$a_n$
1	-10
2	-6
3	-2
4	2

**FORMULA** **DELETE** **GPH-CON** **GPH-PLT** 1

You can scroll down the table using **▼**.

From the table,  $u_n = 90$  when  $n = 26$

$$S_{26} = \frac{26}{2}(-10 + 90) = 1040.$$

n	$a_n$
24	82
25	86
26	90
27	94

**FORMULA** **DELETE** **GPH-CON** **GPH-PLT** 90

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## Sum of an arithmetic series

In calculation mode, the fx-CG50 has a summation function, however this is not available when working in sequence mode. Instead of using the summation function, you must use the

$$\text{result: } \sum_{i=1}^n -10 + 4(i-1) = \frac{n}{2}(2(-10) + 4(n-1)).$$

Type  $\frac{n}{2}(2(-10) + 4(n-1))$  and press **EXE** to enter the function as  $b_n$ .

Recursion  
 $a_n = -10 + 4(n-1)$  [—]  
 $b_n = \frac{n}{2}(2(-10) + 4(n-1))$  [—]  
 $C_n :$  [—]  
**SEL+S** **DELETE** **TYPE** **n** **SET** **TABLE**

Press **F6** TABLE.

You can scroll down the table using **▼**.

The sum is smaller than 100 when  $n = 10$ , and larger when  $n = 11$ .

The the least number of terms is 11.

$b_n = \frac{(n) \downarrow 2}{2} (2(-10) + 4(n))$   

n	$a_n$	$b_n$
8	18	32
9	22	54
10	26	80
11	30	110

80  
**FORMULA** **DELETE** **PHASE** **GPH-CON** **GPH-PLT**

You can also approach this problem graphically.

Press **MENU** 5 **GRAPH** **Y-VIEW** to display the equation entry screen.

Type  $\frac{x}{2}(2(-10) + 4(x-1))$  and press **EXE** to enter the equation as Y1.

Graph Func : Y=  
 $Y1 = \frac{x}{2}(2(-10) + 4(x-1))$  [—]  
 $Y2 :$  [—]  
 $Y3 :$  [—]  
 $Y4 :$  [—]  
 $Y5 :$  [—]  
**SELECT** **DELETE** **TYPE** **TOOL** **MODIFY** **DRAW**

Choose suitable window settings to display the graphs.

Press **SHIFT** **F3** V-WIN.

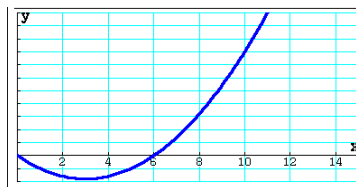
Set the axes to show  $0 \leq x \leq 15$  with a scale of 2 and  $-20 \leq y \leq 110$  with a scale of 10. Leave other items the same.

Press **EXIT** when you have finished.

View Window  
Xmin : 0  
max : 15  
scale : 2  
dot : 0.03968253  
Ymin : -20  
max : 110  
**INITIAL** **TRIG** **STANDARD** **V-MEM** **SQUARE**

Press **F6** DRAW to display the graph screen.

The GDC now displays the curve in a suitable window.



Press **EXIT** to display the equation entry screen.

Type 100 and press **EXE** to enter the equation as Y2.

Graph Func : Y=  
 $Y1 = \frac{x}{2}(2(-10) + 4(x-1))$  [—]  
 $Y2 = 100$  [—]  
 $Y3 :$  [—]  
 $Y4 :$  [—]  
 $Y5 :$  [—]  
**SELECT** **DELETE** **TYPE** **TOOL** **MODIFY** **DRAW**

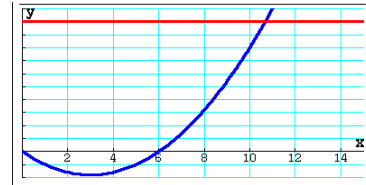
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# Sum of an arithmetic series

The GDC now displays the curve and the straight-line graph:

$$Y1 = \frac{x}{2}(2(-10) + 4(x-1))$$

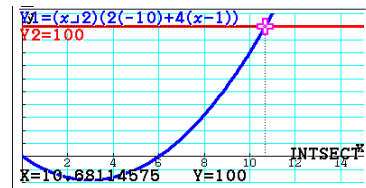
$$Y2 = 100$$



To find the intersection press **F5** G-Solv **F5** Intersect.

Press **EXE** to display the coordinates.

Press **EXIT** to leave G-Solv mode and **F6** DRAW to display the graph screen again.



The GDC displays the intersection of the two straight lines at the point (10.7, 100).

As  $n$  must be a whole number and the sum must be greater than 100, you choose the next largest whole number, so  $n = 11$ .

