Chapter 8 / **Example 4**

Sinusoidal regression

For the function $f(x) = a\sin(b(x + c)) + d$, the graph of $y = f(x)$ is drawn. The first maximum point shown has coordinates (1, 2) and the first minimum point has coordinates (5, −8).

a State the equation of the principal axis.

b Hence find the value of d.

c Find the amplitude of the function.

d Hence find the value of a.

e Find the period of the function.

f Hence find the value of b.

g By considering the effect of the horizontal stretch on the first maximum point of $y = \sin x$ find the value of c.

h State the values of $f(x)$ for $x = 0, 1, 5, 8, 9$ and use those data points to verify a sinusoidal regression calculation on your GDC gives the same result.

The principal axis is $y = -3$. $d = -3$.

The amplitude is 5. $a = 5$.

The period is 8. $b = \frac{\pi}{4}$.

$c = 1$.

The equation is $f(x) = 5\sin\left(\frac{\pi}{4}(x+1)\right) - 3$.

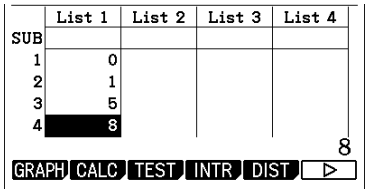
$f(0) = f(8) = 5\sin\left(\frac{\pi}{4}\right) - 3$.

$f(1) = f(9) = 2$ and $f(5) = -8$.

Press MENU 2 to display the List Editor screen.

Enter the x-coordinates in the first column.

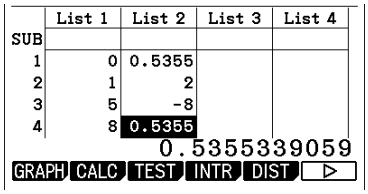
Press EXE after each number to move to the next cell.



Press ▶ to move to the next column.

Enter the y-coordinates in the second column.

Type $5\sin(\pi \div 4) - 3$ directly, the GDC will calculate this value.



Chapter 8 / **Example 4**

Sinusoidal regression

Press F2 CALC, F3 REG, F6 ▷ F4 Sin.

The equation of the curve is given by the equation $f(x) = 5\sin(0.785x + 0.785) - 3$.

Note that $\frac{\pi}{4} = 0.785$.

The equations are the same.