

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

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

$$f(1) = f(9) = 2 \text{ and } f(5) = -8$$

Press **[STAT]** 1:Edit and press **[ENTER]**

Enter the  $x$ -coordinates in the first column.

Press **ENTER** or **▼** after each number to move to the next cell.

[illegible]

## Chapter 8 / Example 4

# Sinusoidal regression

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.

[illegible]

To calculate the equation of sinusoidal regression

Press **STAT** and **▶** to access the CALC menu.

Select C:SinReg and press **ENTER**.

Leave the X List as  $L_1$  and the Y List as  $L_2$ . Change Iterations to 8 and leave other items the same.

Navigate down to Calculate and press **ENTER**.

**SinReg**  
Iterations:8  
Xlist:L1  
Ylist:L2  
Period:  
Store RegEQ:  
Calculate

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.

**SinReg**  
y=a\*sin(bx+c)+d  
a=5  
b=.7853981634  
c=.7853981634  
d=-3