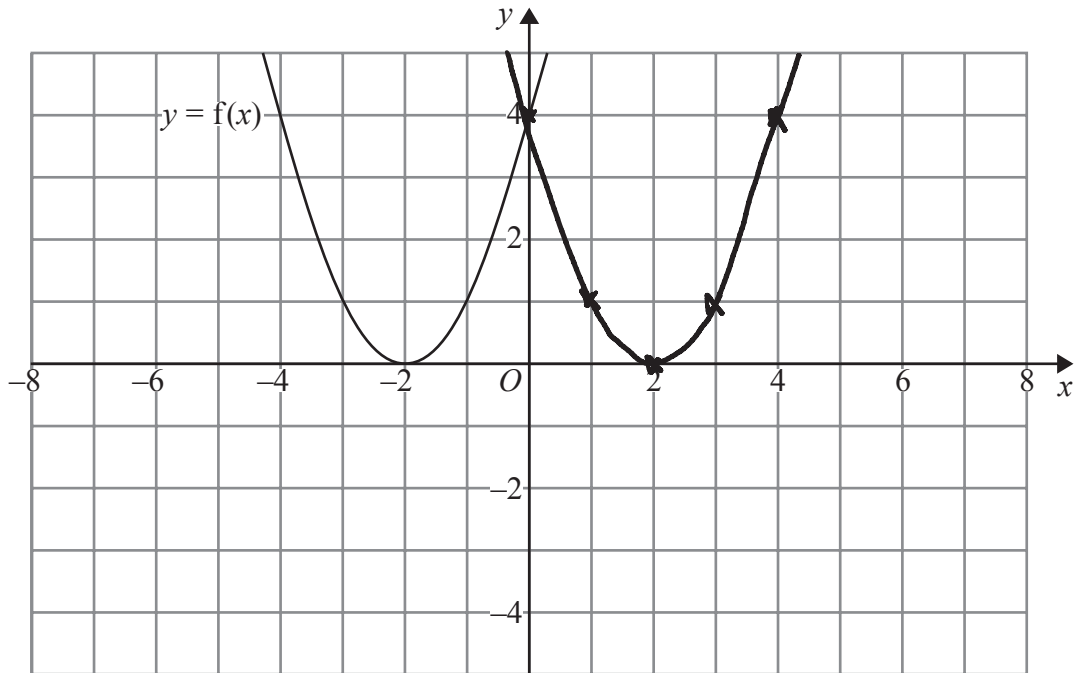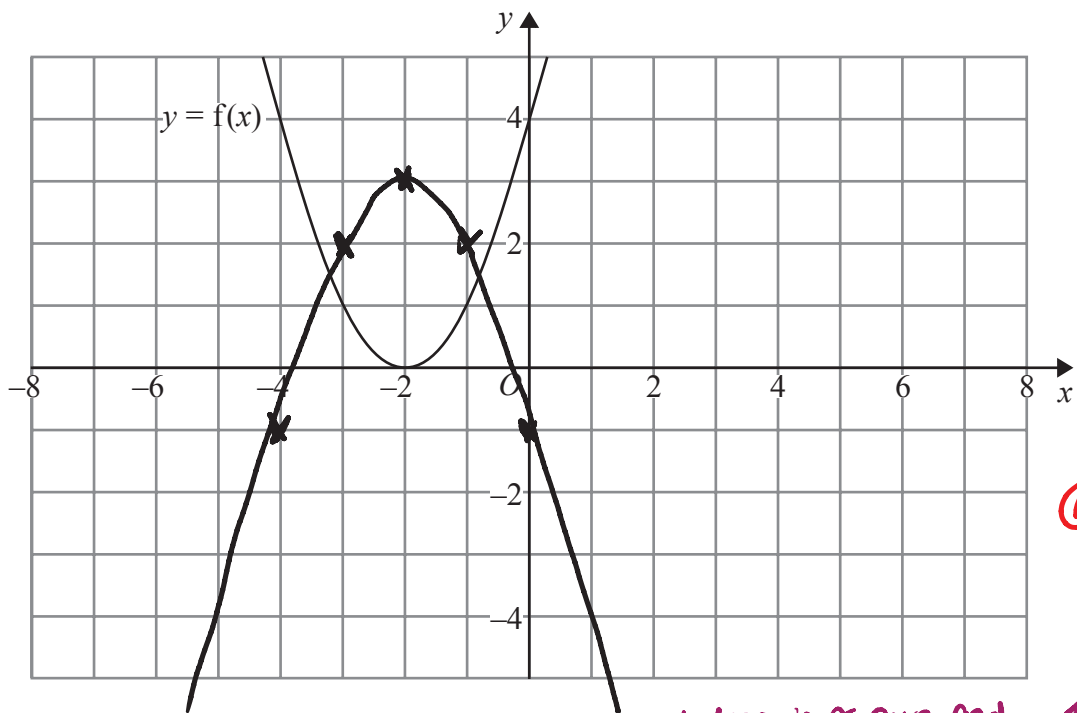1.   The graph of $y = f(x)$ is shown on both grids below.

$y = f(x)$

①

(a) On the grid above, sketch the graph of $y = f(-x)$ ← *reflection in y axis*
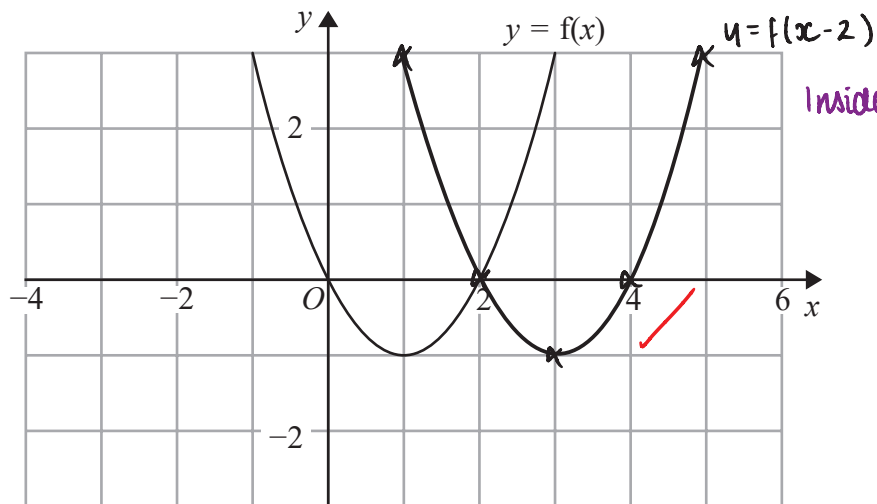
(1)

$y = f(x)$

①

(b) On this grid, sketch the graph of $y = -f(x) + 3$ ← *reflection in x axis and translation by vector* $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$ $\begin{pmatrix} \leftrightarrow \\ \updownarrow \end{pmatrix}$ ∴ *translate 'up' by 3*
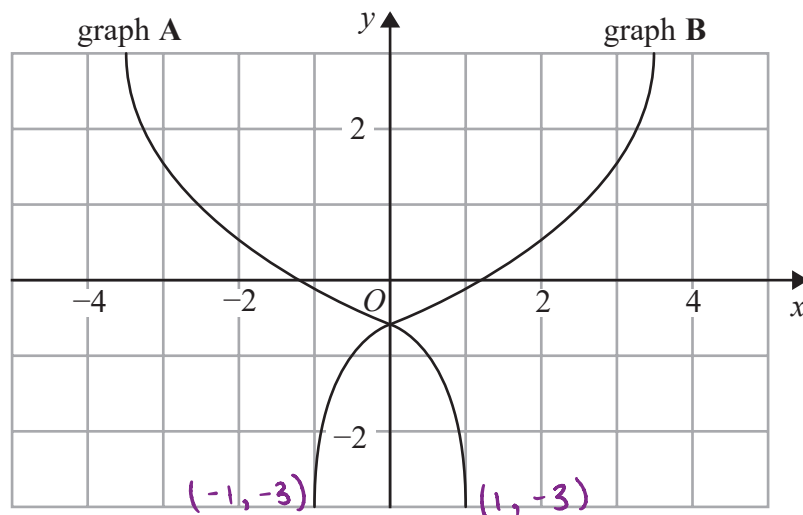
(1)

2.   The graph of $y = f(x)$ is shown on the grid below.

$y = f(x)$ $y = f(x-2)$

Inside brackets →
do opposite of
what is expected
on x-axis

(a) On the grid above, sketch the graph of $y = f(x - 2)$

$+2$ all x coordinates   **(1)**

graph **A**   graph **B**

$(-1, -3)$ $(1, -3)$

On the grid, graph **A** has been reflected to give graph **B**.

The equation of graph **A** is $y = g(x)$ $y = g(-x)$

(b) Write down the equation of graph **B**.

$y = g(-x)$

(1)

3. The graph of the curve C with equation $y = f(x)$ is transformed to give the graph of the curve S with equation $y = f(-x) - 3$

The point on C with coordinates (7, 2) is mapped to the point Q on S.

Find the coordinates of Q.

$y = f(x) \longrightarrow (7, 2)$

$y = f(-x) \longrightarrow (-7, 2)$

$\Big($ MULTIPLY the x-coordinate by $-\frac{1}{1}$ ①

NOTE:
$f(-ax)$ would mean multiply x-coordinate by $-\frac{1}{a}$

$y = f(-x) - 3 \longrightarrow (-7, -1)$ ①
$\Big)$

subtract 3 from the y-coordinate

(...–7..... , ...–1.....)

(Total for Question   is 2 marks)

4. The graph of $y = f(x)$ is shown on the grid.

$y = f(x)$

$f(x+k)$ is translation by $\begin{pmatrix} -k \\ 0 \end{pmatrix}$

$B(2,1)$

$y = f(x+1) - 3$

②

$A(-2, 1)$

$f(x) + k$ is translation by $\begin{pmatrix} 0 \\ k \end{pmatrix}$
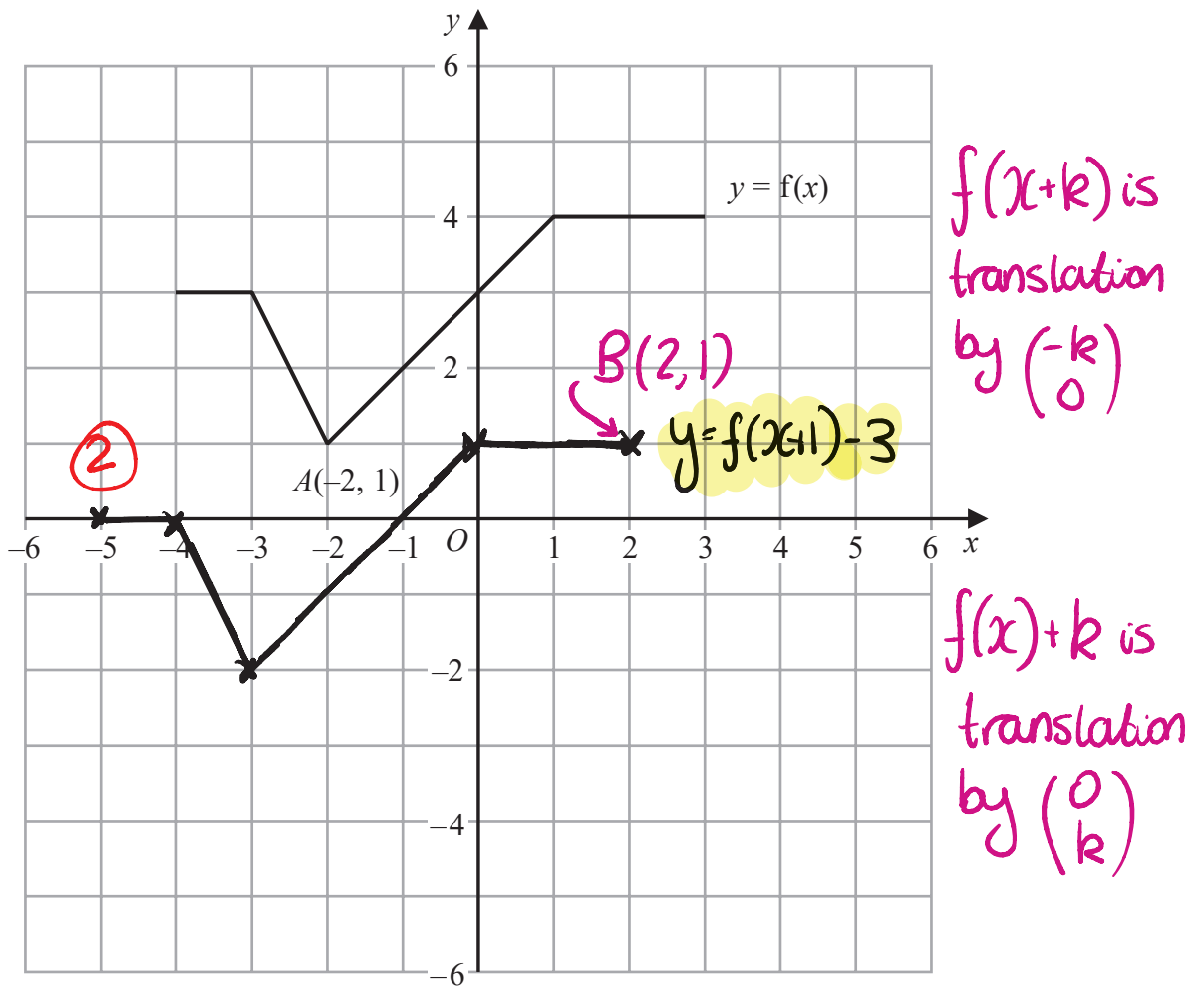
(a) On the grid, draw the graph with equation $y = f(x + 1) - 3$

translation by vector $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$

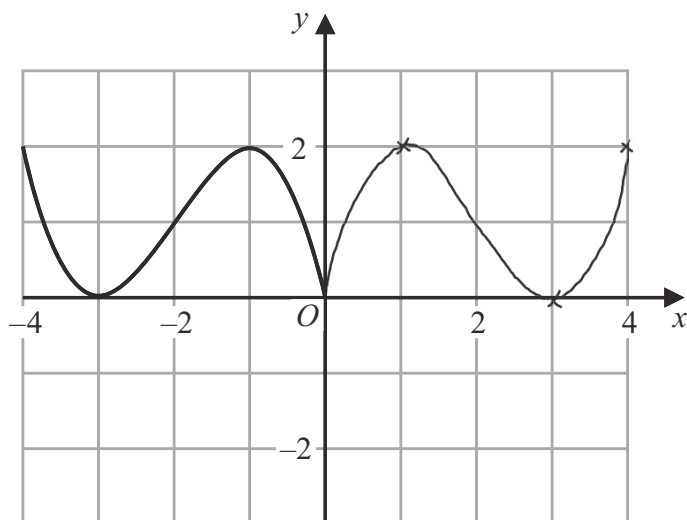**(2)**

Point $A(-2, 1)$ lies on the graph of $y = f(x)$.

When the graph of $y = f(x)$ is transformed to the graph with equation $y = f(-x)$, point A is mapped to point B.

(b) Write down the coordinates of point B.
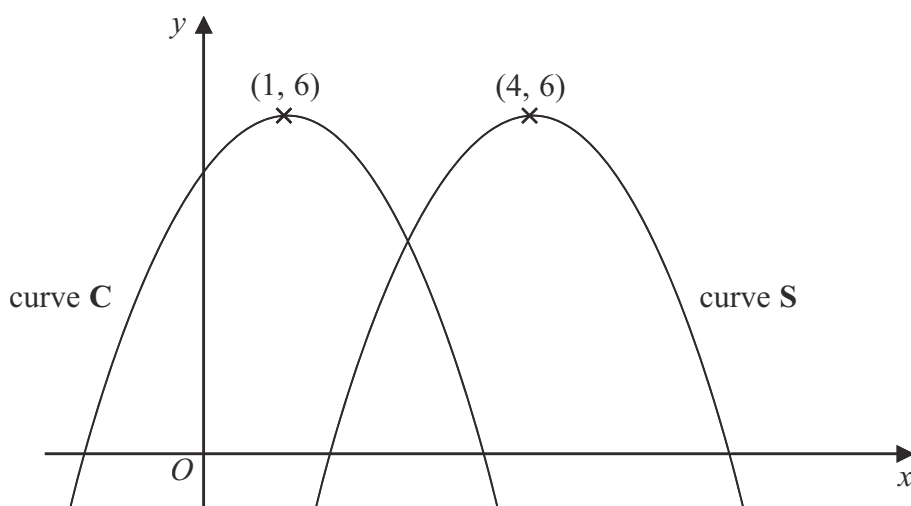
$f(-x)$ is a reflection in the y axis

①

(........2........, ...1.......)

(1)

5. The graph of the curve with equation $y = f(x)$ is shown on the grid below.

(a) On the grid above, sketch the graph of the curve with equation $y = f(-x)$

(2)

The curve **C** with equation $y = 5 + 2x - x^2$ is transformed by a translation to give the curve **S** such that the point $(1, 6)$ on **C** is mapped to the point $(4, 6)$ on **S**.
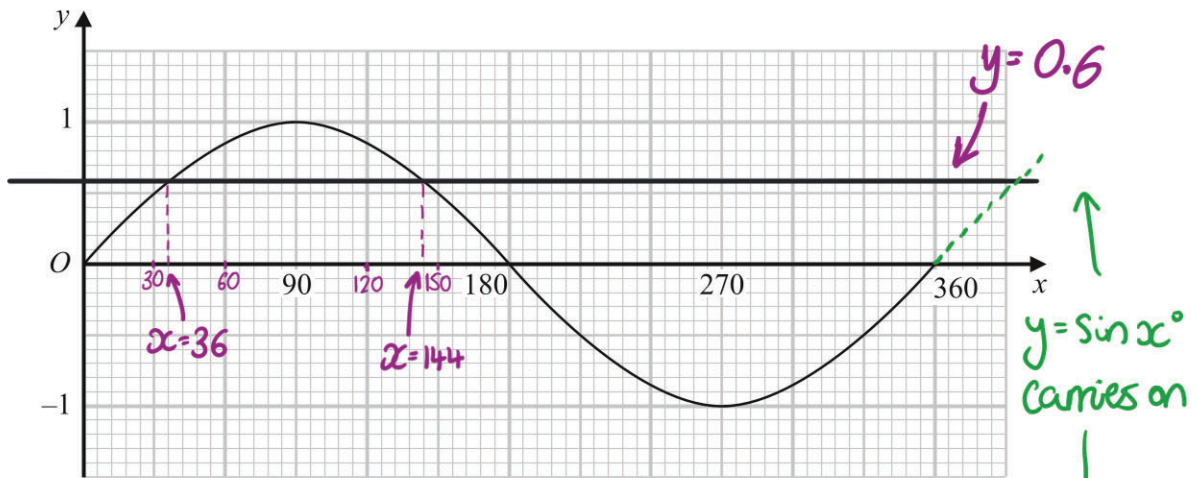
(b) Find an equation for **S**.

$$y = 5 + 2(x - 3) - (x - 3)^2$$

....

(2)

(Total for Question   is 4 marks)

6. Here is a graph of $y = \sin x°$ for $0 \leqslant x \leqslant 360$

$y = 0.6$

$x = 36$

$x = 144$

$y = \sin x°$
Carries on

(a) Using this graph, find estimates of all **four** solutions of

$$\sin x° = 0.6 \quad \text{for } 0 \leqslant x \leqslant 720$$

② So next two
Solutions are at
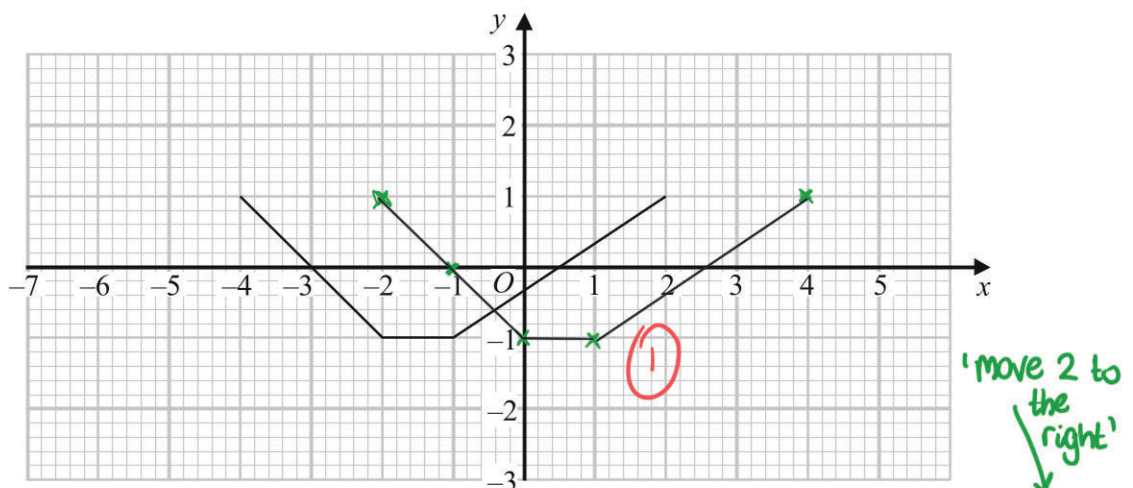$x = 360 + 36 = 396°$
$x = 360 + 144 = 504°$

$x = 36, \ x = 144, x = 396, x = 504$

(2)

The graph of $y = \sin x°$ is reflected in the x-axis.

(b) Write down an equation of the reflected graph.

$$y = -\sin x° \ ①$$

(1)

Here is a graph of $y = f(x)$

① 'move 2 to the right'

(c) On the grid, draw the graph of $y = f(x - 2)$ → translation by vector $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

(1)