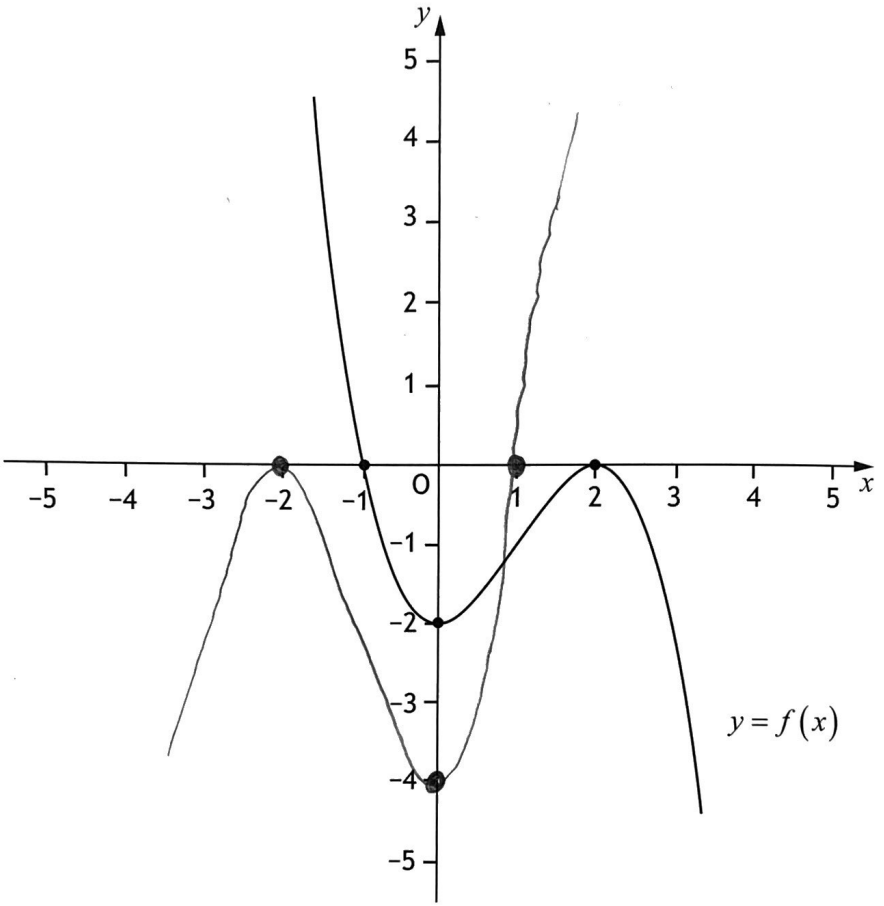
QUESTION NUMBER

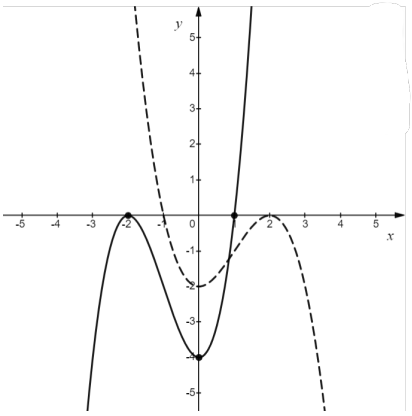
4.

An additional diagram, if required, can be found on *page 16*.

DO NOT WRITE IN THIS MARGIN



$f(x)$	$f(-x)$	$2f(-x)$
$(-1, 0)$	$(1, 0)$	$(1, 0)$
$(0, -2)$	$(0, -2)$	$(0, -4)$
$(2, 0)$	$(-2, 0)$	$(-2, 0)$

Question	Generic scheme	Illustrative scheme	Max mark
4.	•[1] reflect in the y-axis •[2] apply appropriate vertical scaling	•[1] cubic graph with max at $(-2, 0)$ and passing through $(1, 0)$ •[2] 	**2**

Notes:

1. Where candidates do not sketch a cubic function award 0/2.
2. For transformations of the form $f(-x)+k$ or $-f(x+k)$ award 0/2.
3. If the transformation has not been applied to all coordinates, award 0/2.

Question	Generic scheme	Illustrative scheme	Max mark
4.	(continued)		

Commonly Observed Responses:

Function	Transformation of $(-1,0)$ and $(2,0)$	Transformation of $(0,-2)$	Shape	Award
Incorrect orientation	$(-2,0)$ and $(1,0)$	$(0,-4)$		0/2
$-2f(x)$	$(-1,0)$ and $(2,0)$	$(0,4)$		1/2
$-2f(-x)$	$(-2,0)$ and $(1,0)$	$(0,4)$		1/2
$-2f(-2x)$	$(-1,0)$ and $(\frac{1}{2},0)$	$(0,4)$		0/2
$-2f\left(-\frac{x}{2}\right)$	$(-4,0)$ and $(2,0)$	$(0,4)$		0/2
$2f(x)$	$(-1,0)$ and $(2,0)$	$(0,-4)$		1/2
$2f(2x)$	$(-\frac{1}{2},0)$ and $(1,0)$	$(0,-4)$		1/2
$2f\left(\frac{x}{2}\right)$	$(-2,0)$ and $(4,0)$	$(0,-4)$		1/2
$2f\left(-\frac{x}{2}\right)$	$(-4,0)$ and $(2,0)$	$(0,-4)$		1/2
$2f(x-1)$	$(0,0)$ and $(3,0)$	$(1,-4)$		1/2
$f(-x)$	$(-2,0)$ and $(1,0)$	$(0,-2)$		1/2
$\frac{1}{2}f(-x)$	$(-2,0)$ and $(1,0)$	$(0,-1)$		1/2
$f(2x)$	$(-\frac{1}{2},0)$ and $(1,0)$	$(0,-2)$		0/2
$f(-2x)$	$(-1,0)$ and $(\frac{1}{2},0)$	$(0,-2)$		0/2
$f\left(-\frac{x}{2}\right)$	$(-4,0)$ and $(2,0)$	$(0,-2)$		0/2
$-f\left(\frac{x}{2}\right)$	$(-2,0)$ and $(4,0)$	$(0,2)$		0/2
$-f\left(-\frac{x}{2}\right)$	$(-4,0)$ and $(2,0)$	$(0,2)$		0/2