

Graph Transformations: Where Does the Point Go? *extend*

ANSWERS

1



(a, b) is on the graph of $y = f(x)$.
Show that it moves to $(2a, b)$ on the graph of $y = -f(x - a) + 2b$.

a right, y changes sign: $(2a, -b)$

up $2b$: $(2a, b)$

Show *$(2a, b)$*

2



The graph of $y = f(x)$ has a maximum at $(-1, 4)$ and a minimum at $(3, -4)$.
Find the turning points of $y = 3 - f(x)$ and say which is the maximum.

$3 - f(x) = -f(x) + 3$: reflect, then up 3

$(-1, 4) \rightarrow (-1, -1); (3, -4) \rightarrow (3, 7)$

Answer *max $(3, 7)$, min $(-1, -1)$*

3



$(2, 5)$ is on the graph of $y = f(x)$.
On the graph of $y = -f(x + a) + b$ it is at $(-1, -2)$. Find a and b .

$x: 2 - a = -1$

$y: -5 + b = -2$

Answer *$a = 3, b = 3$*

4



$f(x) = x^2 - 4x + 1$. Find the turning point of $y = f(x - 3) + 2$ without expanding, then write $y = f(x - 3) + 2$ in the form $x^2 + bx + c$.

$f(x) = (x - 2)^2 - 3$: $(2, -3) \rightarrow (5, -1)$

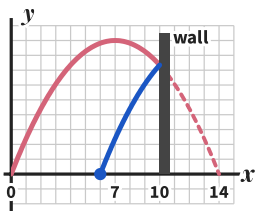
$(x - 5)^2 - 1 = x^2 - 10x + 24$

Answer *$(5, -1); y = x^2 - 10x + 24$*

5



A ball would follow $y = f(x)$ from $(0, 0)$ to $(14, 0)$ but bounces off a wall at $x = 10$. Then its path is the reflection in the wall. Write its equation and where it lands.



$f(20 - x)$: $(14, 0) \rightarrow (6, 0)$

$y = f(20 - x); (6, 0)$

Answer

6



Show that if (p, q) is on the graph of $y = f(x)$ then $(-p, -q)$ is on the graph of $y = -f(-x)$.
Describe the single transformation.

at $x = -p$: $-f(-(-p)) = -f(p) = -q$

both coordinates change sign

Answer *Rotation 180° about $(0, 0)$*

7



The graph of $y = f(x)$ is translated 3 to the right, then reflected in the y axis. Mo says the new equation is $y = f(3 - x)$. Use the point $(5, 1)$ to show that Mo is wrong, and give the right equation.

$(5, 1) \rightarrow (8, 1) \rightarrow (-8, 1)$

$f(3 - (-8)) = f(11)$, not $f(5)$

Answer *$y = f(-x - 3)$*

8



The graph of $y = f(x)$ is symmetrical about the line $x = 2$. Explain why the graph of $y = f(x + 2)$ is symmetrical about the y axis, and show that $f(x + 2) = f(2 - x)$.

$f(2 + t) = f(2 - t)$ for every t

put $t = x$: $f(x + 2) = f(2 - x)$

Reason *Mirror line moves to $x = 0$*