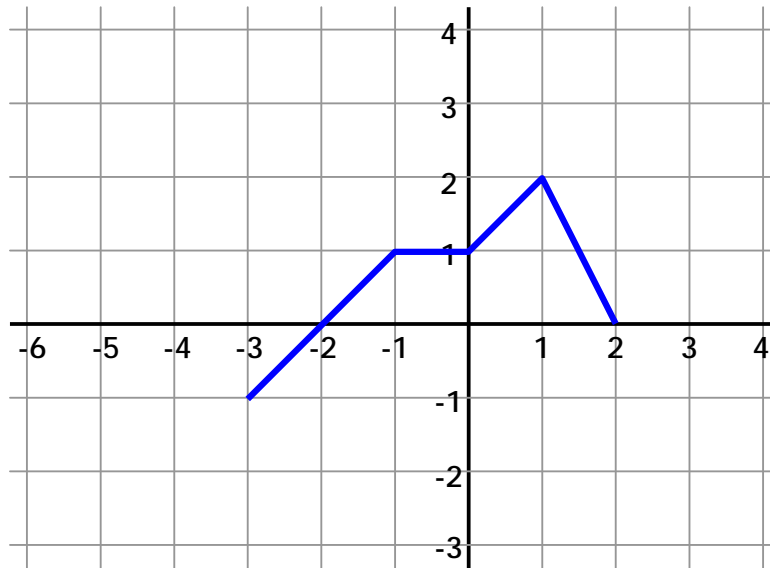The graph below shows the function $f(x)$:

Task one

On separate axes similar to the ones shown above, sketch the graph of the following functions. For each one, state the transformation that has occurred from the original graph.

1. $f(x) + 1$
2. $f(x + 1)$
3. $2f(x)$
4. $f(2x)$
5. $-f(x)$
6. $f(-x)$
7. $f(x) - 2$
8. $f(\frac{1}{2}x)$
9. $f(x - 2)$
10. $\frac{1}{2} f(x)$

Task two

Match up the following statements to create full sentences that are true when **k > 0**. Use your graphs from task one to help.

Adding k outside the brackets ...

Adding k inside the brackets ...

Multiplying the whole function by k ...

Multiplying x by k ...

... **stretches** the graph along the x-axis by scale factor $^1/_k$ (or compresses by scale factor k).

... shifts the graph **up** the **y-axis** by k units.

... shifts the graph **left** on the x-axis by k units.

... **stretches** the graph along the **y-axis** by scale factor k.

Answers

Task one

1.
$$f(x) + 1$$
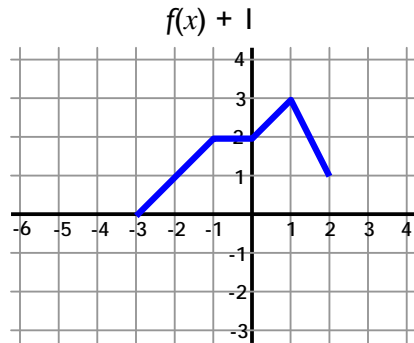
Translation, 1 unit up

2.
$$f(x + 1)$$
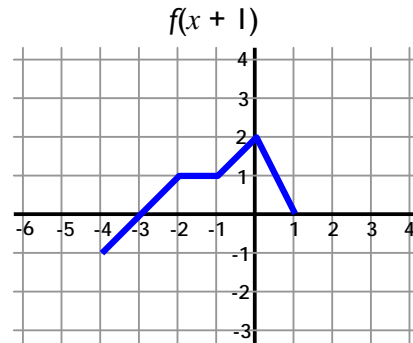
Translation, 1 unit left

3.
$$2f(x)$$
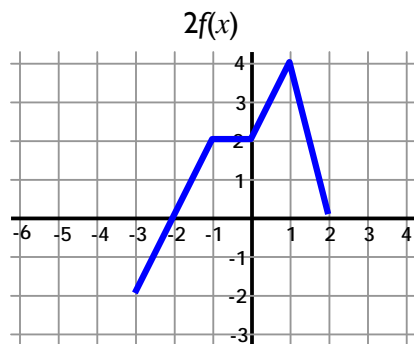
Vertical stretch, scale factor 2

4.
$$f(2x)$$

Horizontal stretch, scale factor ½

5.
$$-f(x)$$
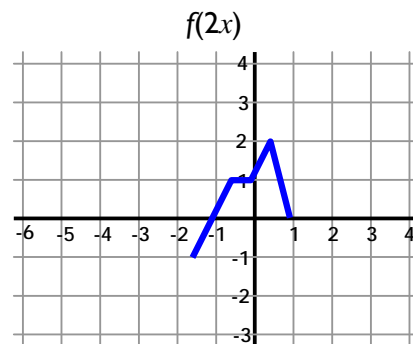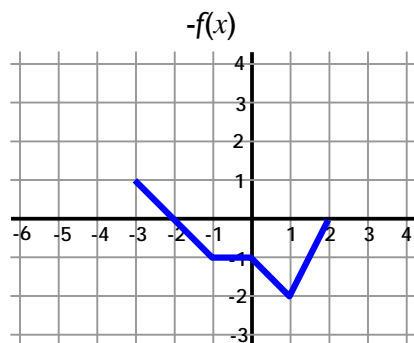
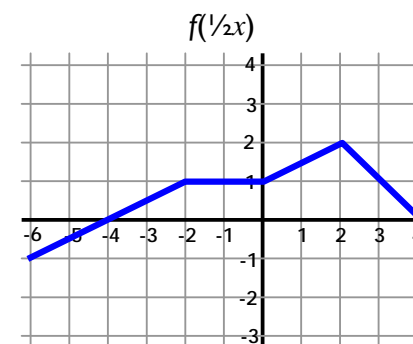Reflection in the x-axis

6.
$$f(-x)$$
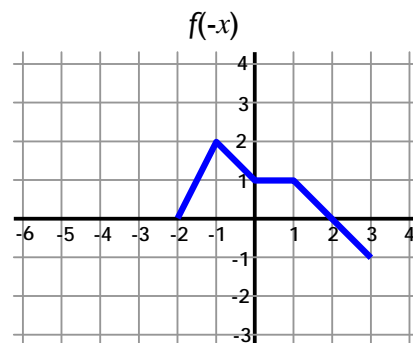
Reflection in the y-axis

7.
$$f(x) - 2$$
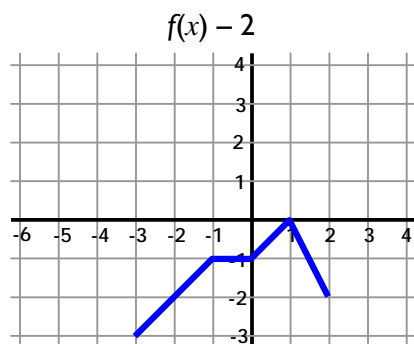
Translation, 2 units down

8.
$$f(½x)$$
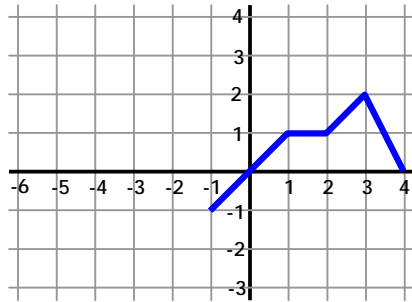
Horizontal stretch, scale factor 2

9. $f(x-2)$

Translation, 2 units right

10. $\frac{1}{2} f(x)$
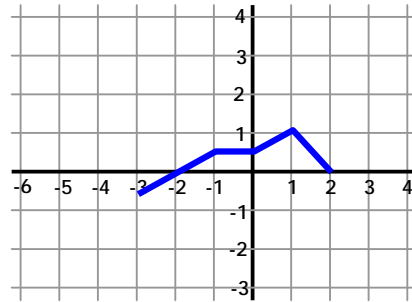
Vertical stretch, scale factor ½

Task two

When k > 0:

Adding k outside the brackets …	… shifts the graph **up** the **y-axis** by k units.
Adding k inside the brackets …	… shifts the graph **left** on the x-axis by k units.
Multiplying the whole function by k …	… **stretches** the graph along the **y-axis** by scale factor k.
Multiplying x by k …	… **stretches** the graph along the x-axis by scale factor $\frac{1}{k}$ (or compresses by scale factor k).