



COMBINING TRANSFORMATIONS | KEY POINTS

- When one vertical transformation is combined with one horizontal transformation, the order of the transformations does not affect the outcome.
- When two horizontal transformations or two vertical transformations are combined, the order of the transformations does affect the outcome.

TRANSFORMATIONS IN TWO DIFFERENT DIRECTIONS | EXAMPLE-PROBLEM PAIRS

1E. The graph $y = \frac{1}{x}$ is translated by 3 units in the x -direction and stretched by a scaled factor of two in the y -direction.
Find the equation of the new graph,

2E. Describe a sequence of two geometrical transformations that maps the graph of $y = e^x$ onto the graph $y = e^{2x} + 5$.

1P. The graph of $y = \sin x$ is translated by 2 units in the negative y -direction and stretched by a scale factor 3 in the x -direction.
Find the equation of the new graph.

2P. Describe a sequence of two geometrical transformations that maps the graph of $y = \ln x$ onto the graph $y = 3 \ln(x + 4)$.

TRANSFORMATIONS IN THE SAME DIRECTION | EXAMPLE-PROBLEM PAIRS

3E. A graph has equation $y = x^3$. Find the equation of the graph after the following transformations:

(a) A horizontal stretch with scale factor 4, followed by a translation with vector $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$.

(b) A translation with vector $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$, followed by a horizontal stretch with scaled factor 4.

3P. A graph has equation $y = 5^x$. Find the equation of the graph after the following transformations:

(a) A horizontal stretch with scale factor 2, followed by a translation with vector $\begin{pmatrix} -4 \\ 0 \end{pmatrix}$.

(b) A translation with vector $\begin{pmatrix} -4 \\ 0 \end{pmatrix}$, followed by a horizontal stretch with scaled factor 2.

4P. A graph has equation $y = 2^x$, Find the equation of the graph after the following transformations:

(a) A vertical stretch with scale factor 5, following by a translation with vector $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$.

(b) A translation with vector $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$, followed by a stretch with scale factor 5.

5P. Describe a sequence of two geometrical transformations that maps the graph of $y = \sqrt{x}$ onto the graph of $y = \sqrt{\frac{x}{2}} + 7$

Give two different possible answers

6E Describe a sequence of two geometrical transformations that maps the graph of $y = \sqrt[3]{x}$ onto the graph of $y = 6\sqrt[3]{x} - 8$.

Give two possible different answers.

