

Transforming function

Af(B(x+C))+D

- A: Vertical stretch
- B: Horizontal stretch
- C: Horizontal translation
- **D**: Vertical translation



Α

A f(x)

A multiplies the y-coordinates.

The effect of **A** is to **vertically stretch** the graph by the scale factor **A**.

1. (a) Sketch the graph of $f(x) = x^2$. (b) On the same set of axes, sketch the graph of (i) 3 f(x) (ii) $\frac{1}{2}$ f(x)



2. (a) Sketch the graph of f(x) = e^x.
(b) On the same set of axes, sketch the graph of
(i) 5 f(x)
(ii) ¹/₄ f(x)



В

f(Bx)

The x-coordinates are divided by **B**.

The effect of **B** is to **horizontally stretch** the graph by the scale factor $\frac{1}{B}$.

1. (a) Sketch the graph of $f(x) = x^2$.

(b) On the same set of axes, sketch the graph of

(i) f(2x)

(ii) $f(\frac{1}{2}x)$



2. (a) Sketch the graph of f(x) = ln x.
(b) On the same set of axes, sketch the graph of
(i) f(4x)
(ii) f(¹/₃x)



f(x + C)

The effect of **C** is to **horizontally translate** the graph through **C** units.

If C is Positive, shift to Left

If C is Negative, shift to Right

1. (a) Sketch the graph of f(x) = x².
(b) On the same set of axes, sketch the graph of
(i) f(x - 3)
(ii) f(x + 1)



2. (a) Sketch the graph of f(x) = e^x.
(b) On the same set of axes, sketch the graph of

- (i) f(x + 4)
- (ii) f(x 2)



D

f(x) + D

The effect of **D** is to **vertically translate** the graph through **D** units. If D is Positive, shift Up If D is Negative, shift Down

1. (a) Sketch the graph of $f(x) = x^2$. (b) On the same set of axes, sketch the graph of (i) f(x) - 3(ii) f(x) + 2



2. (a) Sketch the graph of f(x) = e^x.
(b) On the same set of axes, sketch the graph of
(i) f(x) + 2
(ii) f(x) - 1

Exercise Paper 1



1. Use $f(x) = 2 \ln x$ and $g(x) = \ln 5x^2$.

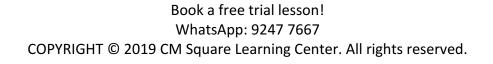
(a) Express g(x) in the form f(x) + ln a, where a ∈ Z⁺.
(b) The graph of g is a transformation of the graph of f. Give a full geometric description of this transformation.





2. Et f(x) =
$$x^2$$
 + 4 and g(x) = x - 1.

(a) Find (f ∘ g)(x).
The vector (³₋₁) translates the graph of (f ∘ g) to the graph of h.
(b) Find the coordinates of the vertex of the graph of h.
(c) Show that h(x) = x² - 8x + 19.
(d) The line y = 2x - 6 is a tangent to the graph of h at the point P. Find the x-coordinate of P.





Paper 2

1. Let $f(t) = 2t^2 + 7$, where t > 0. The function v is obtained when the graph of f is transformed by a stretch by a scale factor of $\frac{1}{3}$ parallel to the y-axis, followed by a translation by the vector $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$.

(a) Find v(t), giving your answer in the form $a(t - b)^2 + c$.

(b) A particle moves along a straight line so that its velocity in ms^{-1} , at time t seconds, is given by v. Find the distance the particle travels between t = 5.9 and t = 6.8.



2. Het $f(x) = 3x^2$. The graph of f is translated 1 unit to the right and 2 units down.

The graph of g is the image of the graph of f after this translation.

(a) Write down the coordinates of the vertex of the graph of g.

(b) Express g in the form $g(x) = 3(x - p)^2 + q$.

The graph of h is the reflection of the graph of g in the x-axis. (c) Write down the coordinates of the vertex of the graph of h.

