

1. Nov/2023/Paper_9709/11/No.4

The transformation R denotes a reflection in the x -axis and the transformation T denotes a translation of $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$.

(a) Find the equation, $y = g(x)$, of the curve with equation $y = x^2$ after it has been transformed by the sequence of transformations R followed by T. [2]

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(b) Find the equation, $y = h(x)$, of the curve with equation $y = x^2$ after it has been transformed by the sequence of transformations T followed by R. [2]

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(c) State fully the transformation that maps the curve $y = g(x)$ onto the curve $y = h(x)$. [2]

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(a) Express $4x^2 - 12x + 13$ in the form $(2x + a)^2 + b$, where a and b are constants. [2]

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The function f is defined by $f(x) = 4x^2 - 12x + 13$ for $p < x < q$, where p and q are constants. The function g is defined by $g(x) = 3x + 1$ for $x < 8$.

(b) Given that it is possible to form the composite function gf , find the least possible value of p and the greatest possible value of q . [3]

The logo for Papac is a stylized graphic. It features a red and blue rocket ship-like shape with a green and red base. The word "Papac" is written in a large, slanted, grey font across the top of the graphic. The background is white with a dotted grid pattern.

(c) Find an expression for $gf(x)$.

[1]

The function h is defined by $h(x) = 4x^2 - 12x + 13$ for $x < 0$.

(d) Find an expression for $h^{-1}(x)$.

[3]

3. Nov/2023/Paper_9709/12/No.6

The equation of a curve is $y = x^2 - 8x + 5$.

(a) Find the coordinates of the minimum point of the curve.

[2]

The curve is stretched by a factor of 2 parallel to the y -axis and then translated by $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$.

(b) Find the coordinates of the minimum point of the transformed curve.

[2]

A decorative graphic element located in the top left corner of the slide. It consists of a large, tilted red and blue geometric shape (resembling a house or a stylized 'M') with a green and red diamond pattern on its base. The background of the slide features a light beige color with a subtle, faint grid pattern.

(c) Find the equation of the transformed curve. Give the answer in the form $y = ax^2 + bx + c$, where a , b and c are integers to be found. [4]

Functions f and g are defined by

$$f(x) = (x + a)^2 - a \text{ for } x \leq -a,$$

$$g(x) = 2x - 1 \text{ for } x \in \mathbb{R},$$

where a is a positive constant.

(a) Find an expression for $f^{-1}(x)$. [3]

(b) (i) State the domain of the function f^{-1} . [1]

(ii) State the range of the function f^{-1} . [1]

(c) Given that $a = \frac{7}{2}$, solve the equation $gf(x) = 0$. [3]

A large, diagonal watermark in red text reads "PapaCambridge". To the left of the text is a graphic element consisting of a red speech bubble containing a blue speech bubble, with small colored dots (red, green, blue) at the bottom left corner of the red bubble.

5. Nov/2023/Paper_9709/13/No.7

The function f is defined by $f(x) = 1 + \frac{3}{x-2}$ for $x > 2$.

(a) State the range of f . [1]

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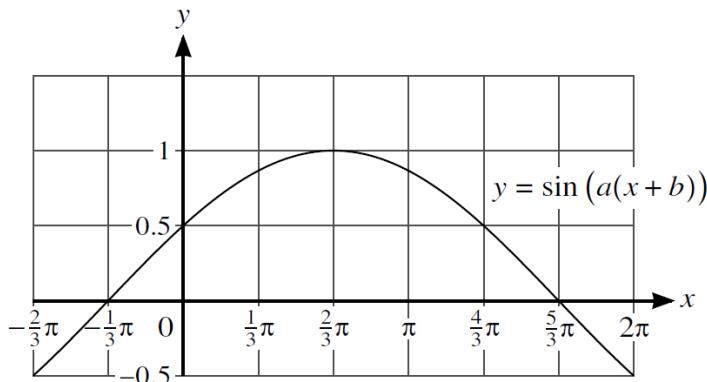
(b) Obtain an expression for $f^{-1}(x)$ and state the domain of f^{-1} . [4]

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The function g is defined by $g(x) = 2x - 2$ for $x > 0$.

(c) Obtain a simplified expression for $gf(x)$. [2]

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The diagram shows part of the graph of $y = \sin(a(x + b))$, where a and b are positive constants.

(a) State the value of a and one possible value of b . [2]

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Another curve, with equation $y = f(x)$, has a single stationary point at the point (p, q) , where p and q are constants. This curve is transformed to a curve with equation

$$y = -3f\left(\frac{1}{4}(x + 8)\right).$$

(b) For the transformed curve, find the coordinates of the stationary point, giving your answer in terms of p and q . [3]

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7. **March/2023/Paper_9709/12/No.2**

A function f is defined by $f(x) = x^2 - 2x + 5$ for $x \in \mathbb{R}$. A sequence of transformations is applied in the following order to the graph of $y = f(x)$ to give the graph of $y = g(x)$.

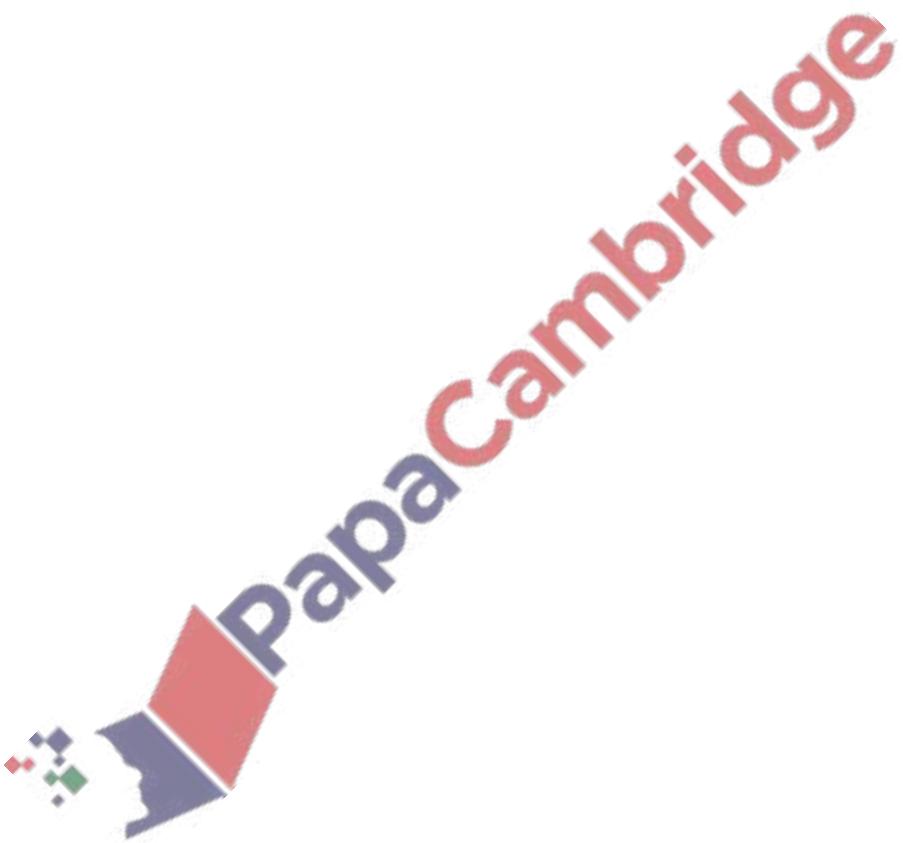
Stretch parallel to the x -axis with scale factor $\frac{1}{2}$

Reflection in the y -axis

Stretch parallel to the y -axis with scale factor 3

Find $g(x)$, giving your answer in the form $ax^2 + bx + c$, where a , b and c are constants.

[4]



8. March/2023/Paper_9709/12/No.9

The function f is defined by $f(x) = -3x^2 + 2$ for $x \leq -1$.

(a) State the range of f . [1]

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(b) Find an expression for $f^{-1}(x)$. [3]

A large, semi-transparent watermark is positioned diagonally across the page. The watermark features the text "PapaCambridge" in a bold, sans-serif font. The letters are primarily a faded red color, with the "P" and "C" being a slightly darker shade of red. The "Papa" is on the first line and "Cambridge" is on the second line. Below the text is a stylized icon of a pen or pencil. The icon has a blue body, a red eraser, and a grey tip. At the top of the pen, there are small colored dots in red, green, and blue.

The function g is defined by $g(x) = -x^2 - 1$ for $x \leq -1$.

(c) Solve the equation $fg(x) - gf(x) + 8 = 0$.

[5]

