

1. [CJC 19 MYE]

The functions f and g are defined by

$$\begin{aligned} f : x &\mapsto x^2 + 2, & x &\in \mathbb{R}, \\ g : x &\mapsto -2x + 5, & x &\in \mathbb{R}. \end{aligned}$$

State a sequence of transformations which transform the graph of $y = f(x)$ to the graph of $y = fg(x)$. [3]

2. [JPJC 19 MYE]

The curve $y = g(x)$ undergoes the transformations A, B and C in succession:

- A : a translation of 1 unit in the positive x -direction,
- B : a scaling parallel to the x -axis with scale factor $\frac{1}{2}$, and
- C : a translation of 3 units in the positive y -direction.

Find an expression for $g(x)$ if the equation of the resulting curve is $y = 3 - \frac{1}{2x - 1}$. [3]

3. [TMJC 19 MYE]

A curve undergoes transformations in the following sequence:

- Stretch by factor 2 parallel to the y -axis.
- Translation of 1 unit in the positive x -direction.
- Reflection in the y -axis.

The resulting curve has equation $y = 3(x + 1)^2 - 10 - \frac{2}{x + 1}$.

Determine the equation of the original curve, showing your steps clearly. [3]

4. [YJC 19 MYE]

A curve has equation $y = \frac{2x - 7}{x - 3}$.

(a) Express the equation of C in the form $y = A + \frac{B}{x - 3}$, where A and B are constants to be found. [1]

(b) Sketch the graph of C , giving the equations of any asymptotes and the coordinates of any points of intersection with x - and y -axes. [2]

(c) Describe a sequence of transformations which transforms the graph of C on to the graph of $y = -\frac{1}{x}$. [2]

5. [EJC 19 MYE]

The graph of $y = f(x)$ undergoes the following sequence of transformations

- A : Stretch with scale factor $\frac{2}{3}$ parallel to the x -axis
- B : Reflect about the x -axis
- C : Translate 4 units in the negative x -direction

Given that the equation of the resulting curve is $y = -\frac{1}{3x + 13}$, find the equation of the curve before the 3 transformations were effected. [4]

6. [EJC 19 MYE]

The curve $y = f(x)$ has asymptotes $x = -1$ and $y = 4$. State the equations of asymptotes of the curve $y = 2f(-x) - 3$.

[3]

7. [NJC 19 MYE]

Describe a pair of transformations which transforms the curve with equation $\frac{x^2}{6^2} + \frac{(y+3)^2}{2^2} = 1$ on to the circle with centre at the origin and radius 6 units.

[3]

8. [SAJC 19 MYE]

(a) Find the exact value of a such that $e^{-ax} = 3^{-x}$. hence show that

$$3^{3-x} \left(x \ln 3 + \frac{1}{3} \right) = 9e^{-(\ln 3)x} (3x \ln 3 + 1).$$

[2]

(b) Describe a series of transformations that maps the graph of $y = e^{-x}(3x+1)$ onto the graph of $y = 3^{3-x} \left(x \ln 3 + \frac{1}{3} \right) + 1$.

[3]

Answers

1.
 1. Translate by 5 units in the negative x -direction.
 2. Reflect about the y -axis.
 3. Scale by a factor of $\frac{1}{2}$ parallel to the x -axis.
(Other answers are possible too: check with me)
2. $g(x) = -\frac{1}{x}$.
3. $y = \frac{3}{2}x^2 - 5x + \frac{1}{x}$.
4. (a) $y = 2 + \frac{-1}{x-3}$.
(c)
 1. Translation of 2 units in the negative y -direction.
 2. Translation of 3 units in the negative x -direction.
(For this question, the order can be swapped.)
5. $y = \frac{1}{2x+1}$.
6. $y = 5, x = 1$.
7.
 1. Translate in the positive y -direction by 3 units.
 2. Scale parallel to the y -axis by a factor of 3.
8. (a) $a = \ln 3$.
(b)
 1. Scale by factor $\frac{1}{\ln 3}$ parallel to the x -axis.
 2. Scale by factor 9 parallel to the y -axis.
 3. Translation of 1 unit in the positive direction of the y -axis.