0606 Additional Mathematics Paper 2 - Functions

Topical questions | 8 questions

1. Question | 0606 Feb-March 2025 P2 V2 Q7

7 It is given that $\mathrm{f}(x) = 2\mathrm{e}^{x} + a$ for $x \geqslant 0$, where a is an integer

and $\mathrm{g}(x) = \sqrt{x-1}$ for $x \geqslant 1$.

(a) Find the least value of a so that the function gf exists for all $x \geqslant 0$. [2]

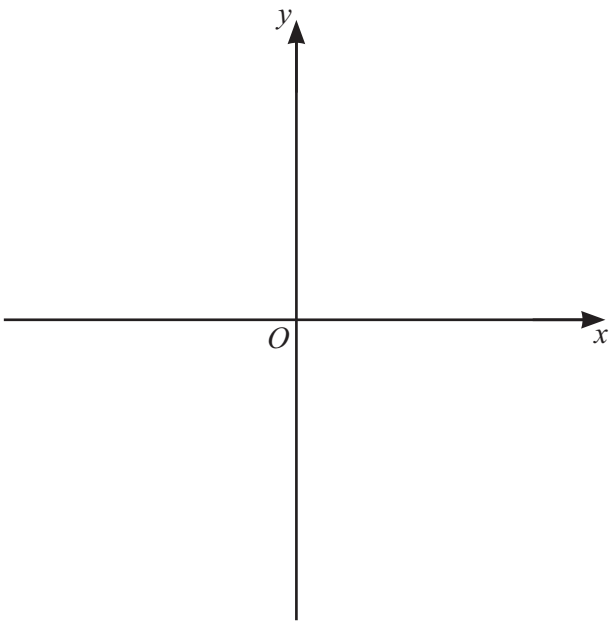
(b) In the case where $a = 5$, solve the equation $\mathrm{gf}(x) = 3$.
Give your answer correct to 3 decimal places. [3]

2. Question part 1/2 | 0606 May-June 2025 P2 V1 Q7

7 **(a)** The function f is defined by $\mathrm{f}(x) = 2\mathrm{e}^{-x} + 3$ for $x \in \mathbb{R}$.

On the axes, sketch the graph of $y = \mathrm{f}(x)$ and hence, on the same axes, sketch the graph of $y = \mathrm{f}^{-1}(x)$.
Show clearly

- the positions of any points where your graphs meet the coordinate axes
- the positions of any asymptotes. [4]



2. Question part 2/2 | 0606 May-June 2025 P2 V1 Q7

(b) The function g is defined by $\mathrm{g}(x) = 2 - \dfrac{3}{\mathrm{e}^x + 2}$ for $x \geqslant 0$.

Given that g^{-1} exists, find an expression for $\mathrm{g}^{-1}(x)$ and state its domain. [4]

3. Question | 0606 May-June 2025 P2 V2 Q3

3 Functions f and g are such that

$$\mathrm{f}(x) = \frac{3x}{x+4} \quad \text{for } x > 0$$

$$\mathrm{g}(x) = \sqrt{x+2} \quad \text{for } x > -2\,.$$

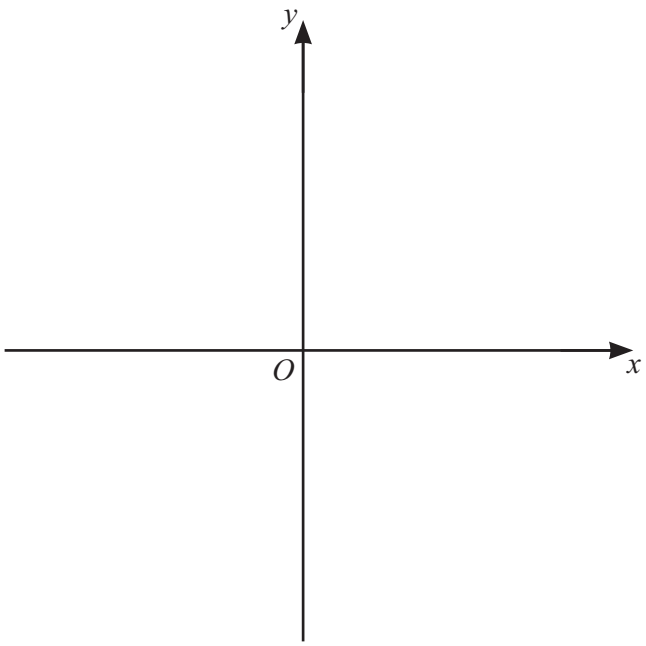
Solve the equation $\mathrm{fg}(x) = 1$. [4]

4. Question | 0606 May-June 2025 P2 V3 Q4

4 The function f is defined by $\mathrm{f}(x) = 2x - 1$ for $x \in \mathbb{R}$.

(a) Explain why the function f^2 can be formed. [1]

(b) On the axes, sketch the graph of $y = \left|\mathrm{f}^2(x)\right|$.
State any intercepts with the coordinate axes. [4]



(c) It is given that $\left|\mathrm{f}^2(x)\right| \leqslant ax + b$ for $-1 \leqslant x \leqslant 3$ and for **no other** values of x.

Find the values of a and b. [3]

5. Question | 0606 Oct-Nov 2025 P2 V2 Q9

9 It is given that $f(x) = \ln(2x+5)$ for $x > a$, where a is a constant.

(a) Write down the least possible value of a. [1]

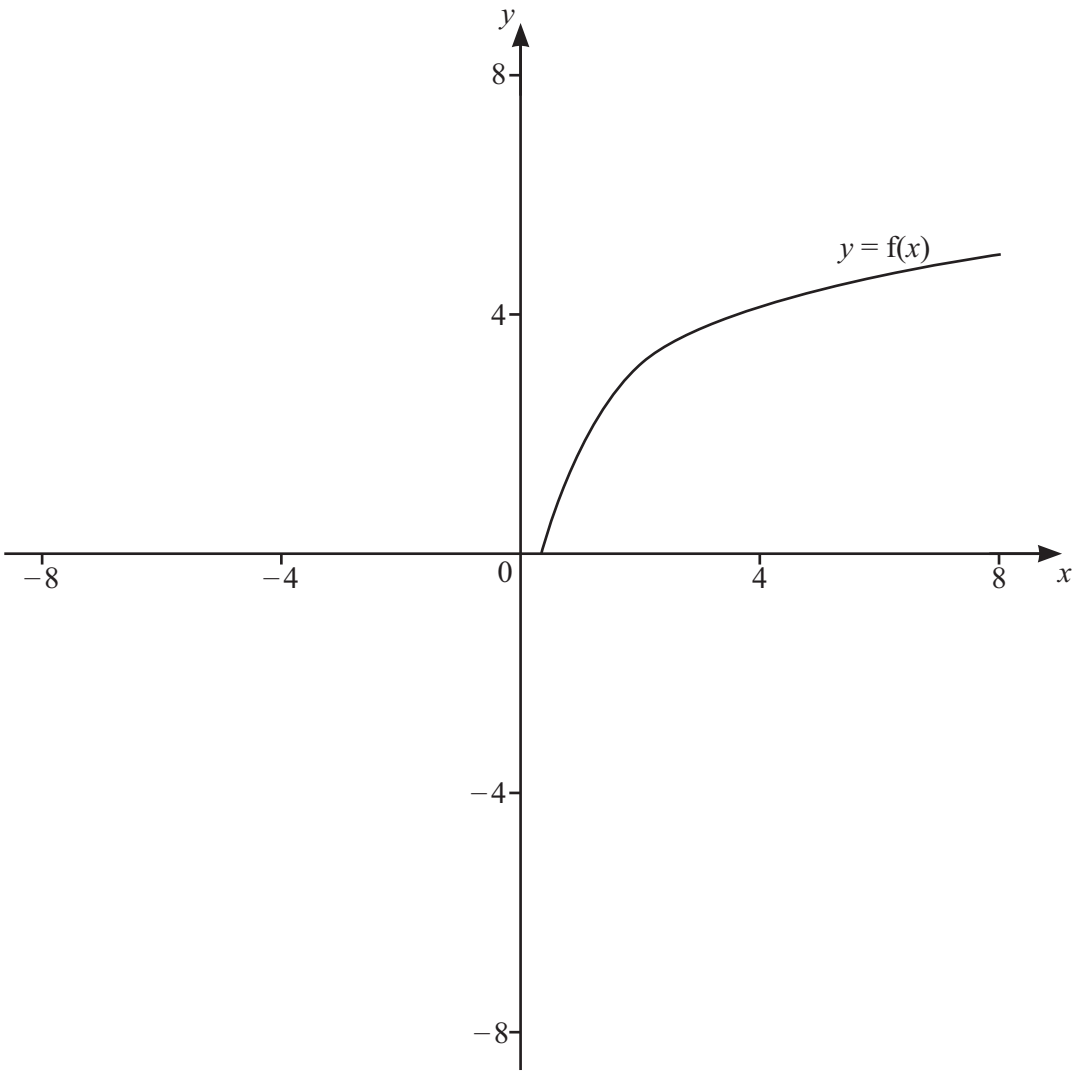
(b) Using your value of a, write down the range of f. [1]

It is also given that $g(x) = x^2 + 1$ for $x \in \mathbb{R}$.

(c) Using your value of a, solve the equation $fg(x) = 4$.
Give your answers in exact form. [3]

6. Question part 1/2 | 0606 Oct-Nov 2025 P2 V3 Q2

2 (a) (i)



The diagram shows the graph of $y = \mathrm{f}(x)$.

On the same diagram sketch the graph of $y = \mathrm{f}^{-1}(x)$. [1]

(ii) Describe the relationship between the graph of $\mathrm{f}(x)$ and the graph of $\mathrm{f}^{-1}(x)$. [1]

(b) A function g is defined by $\mathrm{g}(x) = \mathrm{e}^{\sqrt{x-2}}$ for $x \geqslant 2$.

(i) Find an expression for $\mathrm{g}^{-1}(x)$. [3]

(ii) Write down the range of g^{-1}. [1]

(iii) A function h is defined by $\mathrm{h}(x) = \frac{1}{x^2} + 2$ for $x > 0$.

Find an expression for $\mathrm{gh}(x)$ in its simplest form. [2]

7. Question | 0606 Feb-March 2026 P2 V2 Q1

1 The function f is defined by $\mathrm{f}(x) = 2x^2 - 6x + 4$ for all real values of x.

(a) Write $\mathrm{f}(x)$ in the form $a(x+b)^2 + c$ where a, b and c are constants. [3]

(b) Hence find the range of f. [1]

(c) The function g is defined by $\mathrm{g}(x) = 2x^2 - 6x + 4$ for $x \leqslant k$, where k is a constant.

Given that g has an inverse, state the largest possible value of k. [1]

(d) The function h is defined by $\mathrm{h}(x) = \mathrm{e}^{3x} - 1$ for $x \leqslant 0$.

Given that $\mathrm{gh}(x)$ exists, find $\mathrm{gh}(x)$, simplifying your answer. [3]

8. Question part 1/2 | 0606 May-June 2026 P2 V2 Q8

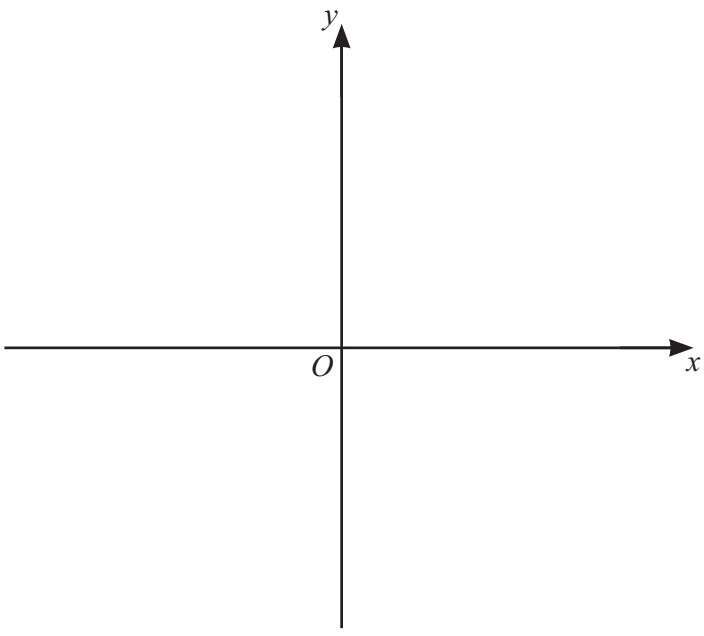
8 The function f is defined, for $x \geqslant -1$, by $\mathrm{f}(x) = 1 + 2^x$.

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

(b) **(i)** Write down the domain of f^{-1}. [1]

(ii) Find an expression for $\mathrm{f}^{-1}(x)$. [2]

(iii) On the axes, sketch the graph of $y = \mathrm{f}(x)$ and hence the graph of $y = \mathrm{f}^{-1}(x)$.
State any intercepts with the coordinate axes. [4]



8. Question part 2/2 | 0606 May-June 2026 P2 V2 Q8

(c) The function g is defined, for $x \geqslant -1$, by $g(x) = x(x+k)$ where k is a constant.

(i) Explain why gf exists. [1]

(ii) Find an expression for $gf(x)$. [1]

(iii) It is given that $gf(3) = 126$.

Find the value of k. [2]