

Provident

MM · T 1 · SEP · 2026 (A)

CALCULATOR FREE

Question 1 (3 marks)

- a. Let $y = e^{e^x}$.

Find $\frac{dy}{dx}$.

1 mark

- b. Let $f(x) = \frac{x}{\cos(x)}$.

Find $f'(\pi)$.

2 marks

Question 2 (5 marks)

Let $f(x) = x \log_e(x)$, where $x > 0$.

a. Find $f'(x)$.

1 mark

b. Find the coordinates of the stationary point of the graph of $f(x)$.

1 mark

c. Find the equation of the tangent to the graph of $f(x)$ that is parallel to the line $y = 3x - 1$.

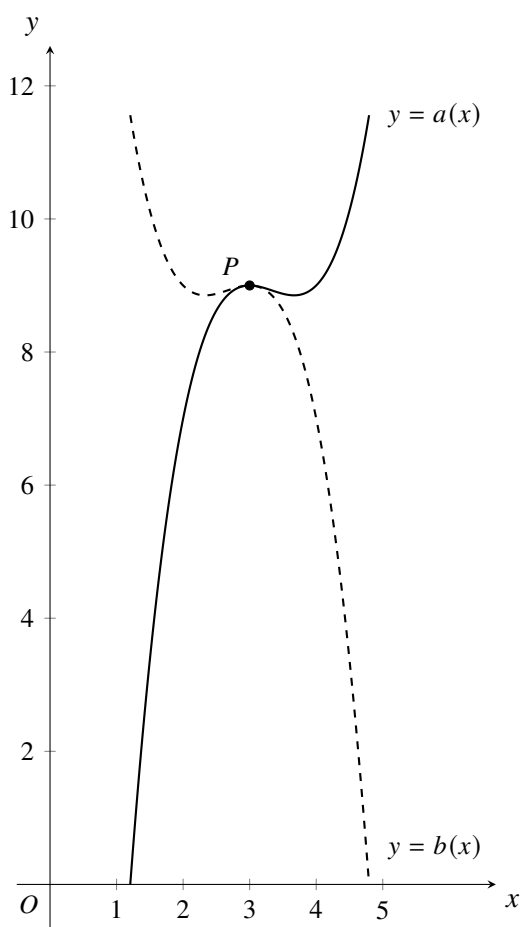
Give your answer in the form $y = mx + c$.

3 marks

Question 3 (5 marks)

Let $a(x) = x^3 - 10x^2 + 33x - 27$ and $b(x) = -x^3 + 8x^2 - 21x + 27$.

Part of each graph is shown below. The graphs meet at the point $P(3, 9)$.



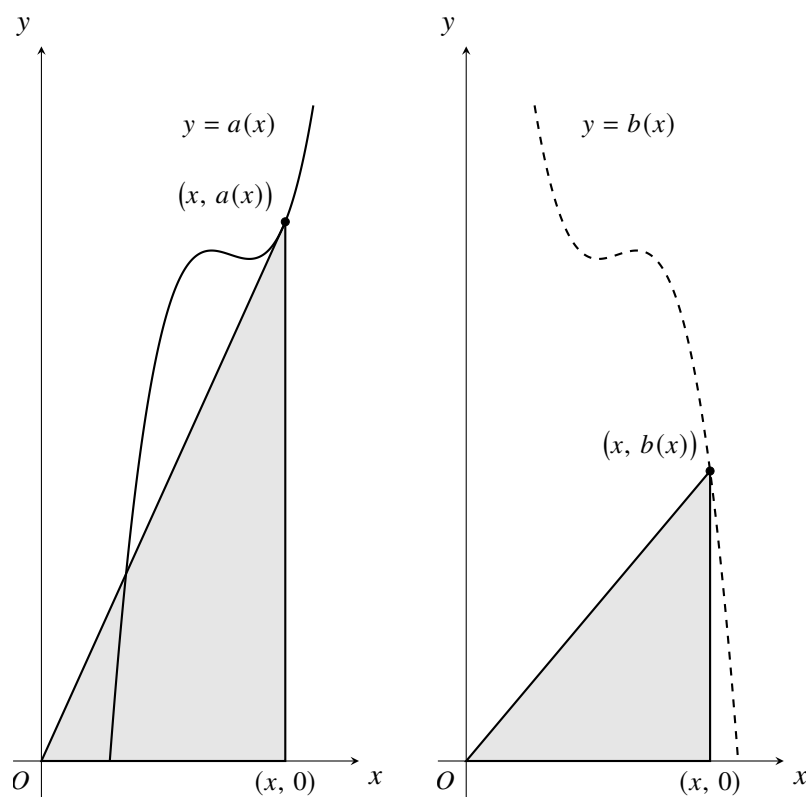
- a. Show that the graphs of $y = a(x)$ and $y = b(x)$ have equal gradient at P .

2 marks

TURN OVER

b. For $x \in [2, 4.5]$, two triangles are formed:

- one with vertices at the origin, $(x, 0)$ and $(x, a(x))$
- one with vertices at the origin, $(x, 0)$ and $(x, b(x))$



Find the maximum value of the sum of the total areas of the two triangles.

3 marks

TURN OVER

Let $f(x) = \frac{x+e}{e^x}$, where $x \in [-2, 1]$.

1 mark

3 marks

c. You may use the following facts:

$$f(-2) = (e - 2)e^2 \approx 5.31, \quad f(1) = 1 + \frac{1}{e} \approx 1.37, \quad \max f = e^{e-1} \approx 5.57.$$

Find the number of turning points the graph of $y = \cos(f(x))$ has for $x \in [-2, 1]$. 3 marks

END OF TEST