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**7** The polynomial  $p(x)$  is defined by

$$p(x) = 2x^4 + kx^3 + kx^2 + 17x + 18,$$

where  $k$  is a constant. It is given that  $(x+2)$  is a factor of  $p(x)$ .

**(a)** Find the value of  $k$ .

[2]

[illegible]

It is given that the equation  $p(x) = 0$  has exactly two real roots, denoted by  $\alpha$  and  $\beta$ , where  $\alpha$  is an integer and  $\beta$  is not an integer.

**(b)** State the value of  $\alpha$  and show that  $\beta$  satisfies the equation  $x = \sqrt[3]{-2x-4.5}$ .

[4]

[illegible]

(c) Show by calculation that  $-1.4 < \beta < -1.0$ .

[2]

[illegible]

**(d)** Use an iterative formula, based on the equation in part **(b)**, to find the value of  $\beta$  correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

[3]

This image shows a full page of white paper with horizontal dotted lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

A-Level Mathematics: 9709 Mathematics November 2025 Question Paper 22

6

(a)

$$J_{-2a}$$

$\left(\frac{1}{2}e^{2x} + \frac{1}{4}e^{-x}\right)dx = 5$ , where  $a$  is a positive constant, show that

[4]

[illegible]

(b) Hence show by calculation that the value of  $a$  lies between 1.0 and 1.2. [2]

(c) Use the iterative formula

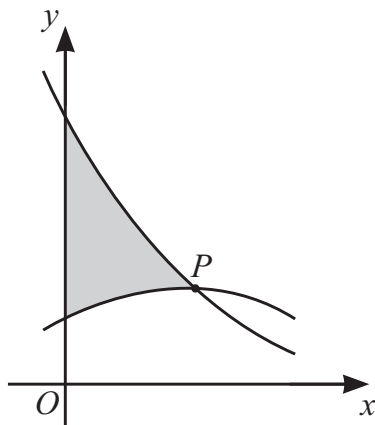
$$a_{n+1} = \frac{1}{2} \ln \left( 10 + \frac{1}{2} e^{-a_n} + \frac{1}{2} e^{-4a_n} \right)$$

to find the value of  $a$  correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

3 (a) Sketch, on a single diagram, the graphs of  $y = 3e^{-2x}$  and  $y = \sec x$  for values of  $x$  such that  $0 \leq x < \frac{1}{2}\pi$ . [2]

(b) Show that the  $x$ -coordinate of the point of intersection of the two graphs satisfies the equation  $x = \frac{1}{2}\ln(3\cos x)$ . [2]

(c) Use an iterative formula, based on the equation in part (b), to find the  $x$ -coordinate of the point of intersection correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]



The diagram shows parts of the curves with equations  $y = 4e^{-2x}$  and  $y = 1 + 0.5 \sin 3x$ . Point  $P$  is a point of intersection of the curves, and the shaded region is bounded by the two curves and the  $y$ -axis.

- (a)** Show that the  $x$ -coordinate of  $P$  satisfies the equation  $x = -0.5 \ln(0.25 + 0.125 \sin 3x)$ . [1]

[illegible]

- (b)** Use an iterative formula, based on the equation in part **(a)**, to find the  $x$ -coordinate of  $P$  correct to 4 significant figures. Use an initial value of 0.5 and give the result of each iteration to 6 significant figures. [3]

Handwriting practice lines (dotted lines) for the letter '6'.

