IGCSE (9-1) Edexcel Past Papers

FURTHER PURE MATHEMATICS

Paper 2, 2R

2019 - 2023

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1 - (4PM1/2_Summer_2020_Q4) - *Logarithmic Functions And Indices*

(i) Solve the equation $16\log_r 4 = \log_4 r$

(2)

(ii) Solve the equation $\log_5 9 + \log_5 12 + \log_5 15 + \log_5 18 = 1 + \log_5 x + \log_5 x^2$

(5)

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2 - (4PM1/2_Summer_2020_Q8) - *Logarithmic Functions And Indices*

The curve C_1 has equation $y = 5e^{-2x} + 4$

The curve C_2 has equation $y = e^{2x}$

The curves C_1 and C_2 intersect at the point A.

(a) Find the exact coordinates of A.

(4)

The tangent at A to C_1 intersects the x-axis at the point B.

(b) Show that the x coordinate of B is $\frac{1}{2}(5 + \ln 5)$

(5)

The tangent at A to C_2 intersects the x-axis at the point D.

(c) Find the area of ΔABD.

(6)

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3 - (4PM1/2R_Summer_2020_Q8) - *Logarithmic Functions And Indices*

Solve the equation $\log_3 x - 2\log_x 3 = 1$ (7)

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4 - (4PM1/2_Summer_2021_Q8) - *Logarithmic Functions And Indices*

Use an algebraic method to solve the simultaneous equations

$$\log_4 a + 3\log_8 b = \frac{5}{2}$$

$$2^a = \frac{16^4}{4^{b^2}}$$

(8)

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5 - (4PM1/2_Summer_2022_Q10) - *Logarithmic Functions And Indices*

Solve the equation

$$\log_4 x + \log_{16} x + \log_2 x = 10.5$$

Show your working clearly.

(5)

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ANSWERS

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1 - (4PM1/2_Summer_2020_Q4) - *Logarithmic Functions And Indices*

(i)	$\frac{16}{\log_4 r} = \log_4 r \Rightarrow 16 = (\log_4 r)^2 \Rightarrow \log_4 r = \pm 4$	M1
	$r = 4^4 = 256 \quad \text{or } r = 4^{-4} = \frac{1}{256}$	A1 (2)
(ii)	$\log_5 9 + \log_5 12 + \log_5 15 + \log_5 18 = \log_5 (9\times12\times15\times18) = \log_5 29160$	M1
	$1 + \log_5 x + \log_5 x^2 = \log_5 5 + \log_5 x + \log_5 x^2 = \log_5 5x^3$	M1A1
	$5x^3 = 29160$	dM1
	$x = 18$	A1 (5) [7]
ALT 1		
	$\text{LHS} = \log_5 29160$	M1
	$\text{RHS} = 1 + \log_5 x^3$	M1
	$\left(\frac{\log_{10} 29160}{\log_{10} 5}\right) = 6.387... \left(= \log_5 x^3 + 1\right)$	A1
	$5.387... = 3\log_5 x$	dM1
	$\log_5 x = 1.795...$	
	$x = 18$	A1
ALT 2	$\text{LHS} = \log_5 29160$	M1
	$\text{RHS} = \log_5 5 + \log_5 x^3$	M1A1
	$\log_5 29160 = \log_5 5 + \log_5 5832$	
	$5832 = x^3$	dM1
	$x = 18$	A1
ALT 3	$\text{LHS} = \log_5 5832 + \log_5 5$	M1
	$\text{RHS} = 1 + \log_5 x^3$	M1
	$\text{LHS} = \log_5 5832 + 1$	A1
	$\log_5 5832 = \log_5 x^3$	
	$5832 = x^3$	dM1
	$x = 18$	A1
ALT 4	$\log_5 29160 - \log_5 x^3 = 1$	M1M1
	$\log_5 \frac{29160}{x^3} = 1$	A1
	$\frac{29160}{x^3} = 5 \Rightarrow x^3 = 5832$	dM1
	$x = 18$	A1

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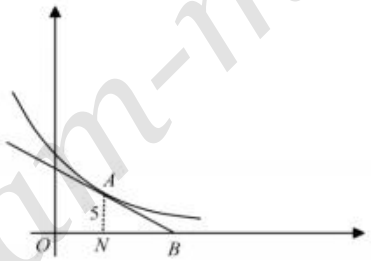
2 – (4PM1/2_Summer_2020_Q8) – *Logarithmic Functions And Indices*

(a)	$5e^{-2x}+4=e^{2x}$ $5e^{-2x}+4-e^{2x}=0$ OR $y=\frac{5}{y}+4\Rightarrow y^2-4y-5=0$	M1
	$(5e^{-x}-e^{x})(e^{-x}+e^{x})=0$ $(y-5)(y+1)=0$	M1
	$5e^{-x}=e^{x}$ $e^{2x}=5$ $x=\frac{1}{2}\ln 5$ $\left(\text{oe eg } \ln\sqrt{5}\right)$ $y=5$	A1
	$(e^{-x}=-e^{x}$ not possible$)$ $e^{2x}=5$ $x=\frac{1}{2}\ln 5$	
	A is $\left(\frac{1}{2}\ln 5, 5\right)$	A1 (4)
(b)	$y=5e^{-2x}+4\Rightarrow \frac{dy}{dx}=-10e^{-2x}$	M1
	At A $\frac{dy}{dx}=-10e^{-2x}=-10\times\frac{1}{5}=-2$	A1ft
	Eqn tgt: $y-5=-2\left(x-\frac{1}{2}\ln 5\right)$	dM1A1
	$y=0\Rightarrow x=\frac{1}{2}(5+\ln 5)$ $(=x$ coordinate of $B)$*	A1cso (5)
ALT	For last 3 marks:	
	Hence $\frac{5}{NB}=2\Rightarrow NB=\frac{5}{2}$	dM1A1
	$ON=\frac{1}{2}\ln 5$	
	$OB=\frac{1}{2}\ln 5+\frac{5}{2}=\frac{1}{2}(5+\ln 5)$ * 	A1cso
(c)	$C_2: \frac{dy}{dx}=2e^{2x}\Rightarrow$ grad tgt at A is $2\times 5=10$	B1ft
	Eqn tgt: $y-5=10\left(x-\frac{1}{2}\ln 5\right)$	M1
	At D: $x=\frac{1}{2}(-1+\ln 5)$	A1
	Area $\Delta ABD=\frac{1}{2}\left(\frac{1}{2}(5+\ln 5)-\frac{1}{2}(-1+\ln 5)\right)\times 5$	M1A1
	$=\frac{15}{2}$ or $7\frac{1}{2}$ $\left(\text{units}^2\right)$	A1 (6)
	See notes for area by "determinant" method	

ALT	For second and third marks:	
	$\frac{5}{ND}=10\Rightarrow ND=\frac{1}{2}$	M1
	$OD=\frac{1}{2}\ln 5-\frac{1}{2}$	A1 [15]

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3 - (4PM1/2R_Summer_2020_Q8) - *Logarithmic Functions And Indices*

	$\log_x 3 = \dfrac{1}{1\log_3 x}$	B1
	Let $y = \log_3 x$	
	So $y - \dfrac{2}{y} = 1$	M1
	$y^2 - y - 2 = 0$	A1
	$(y-2)(y+1) = 0$	M1
	$\log_3 x = 2$ or $\log_3 x = -1$	M1
	$x = 9$ or $x = \dfrac{1}{3}$	A1 A1
		[7]

4 - (4PM1/2_Summer_2021_Q8) - *Logarithmic Functions And Indices*

	$\log_4 a + 2\log_4 b = \dfrac{5}{2}$	M1
	$\log_4(ab^2) = \dfrac{5}{2}$	M1
	$32 = ab^2$	A1
	$2^a = \dfrac{2^{16}}{2^{2b^2}}$	M1
	$a = 16 - 2b^2$ or $b^2 = 8 - \dfrac{1}{2}a$	A1
	$32 = a(8 - \dfrac{1}{2}a)$ or $32 = (16 - 2b^2)b^2$	M1
	$a^2 - 16a + 64 = 0$ or $2b^4 - 16b^2 + 32 = 0$	A1
	$a = 8$ $b = 2$	A1
		Total 8 marks

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5 – (4PM1/2_Summer_2022_Q10) – *Logarithmic Functions And Indices*

	$\frac{\log_2 x}{\log_2 4}+\frac{\log_2 x}{\log_2 16}+\log_2 x=10.5$	M1
	$\frac{\log_2 x}{2}+\frac{\log_2 x}{4}+\log_2 x=10.5$	M1
	$\frac{7}{4}\log_2 x=10.5$	M1
	$x=2^{'6'}$	M1
	$x=64$	A1
		(5)
		Total 5 marks

6 – (4PM1/2_Summer_2023_Q1) – *Logarithmic Functions And Indices*

	$\frac{\left(a+2\sqrt{5}\right)}{\left(3-\sqrt{5}\right)}\times\frac{\left(3+\sqrt{5}\right)}{\left(3+\sqrt{5}\right)}=\frac{3a+a\sqrt{5}+6\sqrt{5}+10}{9-5}\left(=\frac{3a+10+(6+a)\sqrt{5}}{4}\right)$	M1
	$\left(\frac{3a+10+(6+a)\sqrt{5}}{4}=\frac{11+b\sqrt{5}}{2}\right)$ $\Rightarrow\frac{3a+10}{4}=\frac{11}{2}$ oe $\Rightarrow a=4\Rightarrow\frac{6+a}{4}=\frac{b}{2}$ oe $\Rightarrow b=5$	M1M1A1A1 [5]
	ALT $\left(\frac{\left(a+2\sqrt{5}\right)}{\left(3-\sqrt{5}\right)}=\frac{11+b\sqrt{5}}{2}\Rightarrow\right)2\left(a+2\sqrt{5}\right)=\left(3-\sqrt{5}\right)\left(11+b\sqrt{5}\right)$ $2a+4\sqrt{5}=33+3b\sqrt{5}-11\sqrt{5}-5b\left(=(33-5b)+(3b-11)\sqrt{5}\right)$ $\Rightarrow 4=3b-11\Rightarrow b=5$ $\Rightarrow 2a=33-5b\Rightarrow a=4$	M1 M1M1A1A1 [5]
		Total 5 marks

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