1.14 Pure: Differentiation Depth: 30-minute Pack

EDEXCEL 9MA0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A curve C has parametric equations $x = 2t^2 - 3$, $y = 3t^3 - t$, t in R.

(a) Find dy/dx in terms of t. **(3)**

(b) Find an equation of the tangent to C at the point where t = 1, in the form ax + by + c = 0 with integer coefficients. **(3)**

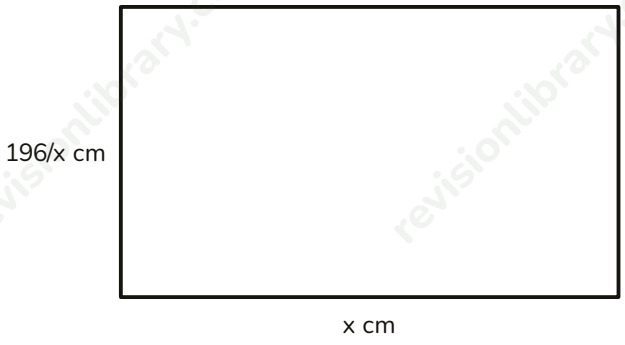
(c) The tangent in part (b) meets the x-axis at the point Q. Find the x coordinate of Q. **(2)**

(Total for Question 1 is 8 marks)

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2 A rectangle has area 196 cm^2 and width x cm.

Diagram NOT accurately drawn



(a) Show that the perimeter of the rectangle is p = 2x + 392/x. **(2)**

(b) Find the minimum value of the perimeter, justifying your answer. **(4)**

(Total for Question 2 is 6 marks)

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3 A curve has equation $y = x^2 * e^{3x}$.

(a) Show that dy/dx can be written as $x * e^{3x} * (3x + 2)$. **(4)**

(b) Hence find the exact value(s) of x for which the tangent to the curve is horizontal. **(2)**

(Total for Question 3 is 6 marks)

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4 A curve has equation $y = e^{\cos(2x)}$.

(a) Find dy/dx. **(2)**

(b) Find the exact value of dy/dx when $x = \pi/6$, giving your answer in the form $-\sqrt{ke}$ for an integer k. **(3)**

(Total for Question 4 is 5 marks)

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Mark scheme · 1.14 Pure: Differentiation Depth: 30-minute Pack

Question 1

(a) $dx/dt = 4t$ and $dy/dt = 9t^2 - 1$	**M1**
(a) $dy/dx = (dy/dt)/(dx/dt)$	**M1**
(a) $dy/dx = (9t^2 - 1)/(4t)$	**A1**
(a) Answer: $dy/dx = (9t^2 - 1)/(4t)$	
(b) the point is (-1, 2)	**B1**
(b) gradient = 2	**M1**
(b) $2x - y + 4 = 0$	**A1**
(b) Answer: $2x - y + 4 = 0$	
(c) sets $y = 0$ in the tangent	**M1**
(c) $x = -2$	**A1**
(c) Answer: $x = -2$	

Question 2

(a) length = $196/x$	**M1**
(a) $p = 2x + 2(196/x) = 2x + 392/x$ (cso)	**A1**
(a) Answer: $p = 2x + 392/x$	
(b) $dp/dx = 2 - 392/x^2$	**M1**
(b) = 0 gives $x^2 = 196$, $x = 14$	**A1**
(b) $d^2p/dx^2 = 784/x^3 > 0$, so a minimum	**B1**
(b) minimum perimeter 56 cm (the rectangle is a square)	**A1**
(b) Answer: 56 cm	

Question 3

(a) attempt at the product rule with $u=x^2$, $v=e^{3x}$	**M1**
(a) correct unsimplified derivative $2x*e^{3x} + 3x^2*e^{3x}$	**A1**
(a) factorise out the common factor $x*e^{3x}$, dependent on the previous M1	**dM1**
(a) $dy/dx = x*e^{3x}*(3x+2)$ cso	**A1**
(a) Answer: $dy/dx = x * e^{3x} * (3x + 2)$	
(b) set $dy/dx=0$ and use that e^{3x} is never zero to obtain $x(3x+2)=0$	**M1**
(b) $x = 0$ or $x = -2/3$ both stated oe	**A1**
(b) Answer: $x = 0$ or $x = -2/3$	

Question 4

(a) attempt at the chain rule to the form $k*\sin(2x)*e^{\cos(2x)}$	**M1**
(a) $dy/dx = -2*\sin(2x)*e^{\cos(2x)}$ cao	**A1**
(a) Answer: $dy/dx = -2 * \sin(2x) * e^{\cos(2x)}$	
(b) substitute $x=\pi/6$ using the exact values $\sin(\pi/3)=\sqrt{3}/2$ and $\cos(\pi/3)=1/2$	**M1**
(b) correct unsimplified exact value $-\sqrt{3} * e^{1/2}$	**A1**
(b) $dy/dx = -\sqrt{3e}$ cao	**A1**
(b) Answer: $dy/dx = -\sqrt{3e}$, equivalently $-\sqrt{3} * e^{1/2}$ (awrt -2.856)	

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