Differentiation 1 Answers   P1 non calc

1)

$\frac{d}{dx}\left(e^{\frac{x}{3}}\right)=\frac{1}{3}e^{\frac{x}{3}}$ ***(A1)(A1)***

$\frac{d}{dx}\left(5\cos^2 x\right)=-10\cos x\sin x$ ***(A1)(A1)(A1)***

$f'(x)=\frac{1}{3}e^{\frac{x}{3}}-10\cos x\sin x$ ***(A1)*** ***(C6)***

2)

(a) $f'(x)=3x^2-4x-0$ ***(A1)(A1)(A1)***

$=3x^2-4x$ ***(C3)***

(b) Gradient $=f'(2)$ ***(M1)***

$=3\times 4-4\times 2$ ***(A1)***

$=4$ ***(A1)*** ***(C3)***

3)

METHOD 1

$f(x)=6x^{\frac{2}{3}}$ ***(A2)***

$f'(x)=4x^{-\frac{1}{3}}\left(=\frac{4}{x^{\frac{1}{3}}}=\frac{4}{\sqrt[3]{x}}\right)$ ***(A2)(A2)*** ***(C6)***

METHOD 2

$f(x)=6(x^2)^{\frac{1}{3}}$ ***(A1)***

$f'(x)=6\times\frac{1}{3}(x^2)^{-\frac{2}{3}}\times 2x$ ***(A2)(A2)***

$f'(x)=4x^{-\frac{1}{3}}$ ***(A1)*** ***(C6)***

4)

(a) $f'(x)=5(3x+4)^4\times 3\ \left(=15(3x+4)^4\right)$ ***(A1)(A1)(A1)*** ***(C3)***

5)

(a) $f'(x)=3(2x+7)^2\times 2$ ***(A1)(A1)***

$=6(2x+7)^2\ (=24x^2+168x+294)$ ***(C2)***

(b) $g'(x)=2\cos(4x)\left(-\sin(4x)\right)(4)$ ***(A1)(A1)(A1)(A1)***

$=-8\cos(4x)\sin(4x)\ \left(=-4\sin(8x)\right)$ ***(C4)***

6) (a) $f'(x) = 5e^{5x}$ *A1A1* *N2*

(b) $g'(x) = 2\cos 2x$ *A1A1* *N2*

(c) $h' = fg' + gf'$ *(M1)*

$= e^{5x}(2\cos 2x) + \sin 2x(5e^{5x})$ *A1* *N2*

7) (a) **METHOD 1**

$f'(x) = -6\sin 2x + 2\sin x\cos x$ *A1A1A1*

$= -6\sin 2x + \sin 2x$ *A1*

$= -5\sin 2x$ *AG* *N0*

8) (a) $\dfrac{dy}{dx} = 3\cos 3x$ *A1* *N1*

(b) $\dfrac{dy}{dx} = \dfrac{x}{\cos^2 x} + \tan x$ accept $x\sec^2 x + \tan x$ *A1A1* *N2*

(c) **METHOD 1**

Evidence of using the quotient rule *(M1)*

$\dfrac{dy}{dx} = \dfrac{x \times \frac{1}{x} - \ln x}{x^2}$ *A1A1*

$\dfrac{dy}{dx} = \dfrac{1 - \ln x}{x^2}$ *N3*

METHOD 2

$y = x^{-1}\ln x$

Evidence of using the product rule *(M1)*

$\dfrac{dy}{dx} = x^{-1} \times \dfrac{1}{x} + \ln x(-1)(x^{-2})$ *A1A1*

$\dfrac{dy}{dx} = \dfrac{1}{x^2} - \dfrac{\ln x}{x^2}$ *N3*

9)

(a) **METHOD 1**

$f''(x) = 3(x-3)^2$ ***A2*** ***N2***

METHOD 2

attempt to expand $(x-3)^3$ ***(M1)***

e.g. $f'(x) = x^3 - 9x^2 + 27x - 27$

$f''(x) = 3x^2 - 18x + 27$ ***A1*** ***N2***

(b) $f'(3) = 0$, $f''(3) = 0$ ***A1*** ***N1***

(c) **METHOD 1**

f'' does not change sign at P ***R1***

evidence for this ***R1*** ***N0***

METHOD 2

f' changes sign at P so P is a maximum/minimum (*i.e.* not inflexion) ***R1***

evidence for this ***R1*** ***N0***

METHOD 3

finding $f(x) = \frac{1}{4}(x-3)^4 + c$ and sketching this function ***R1***

indicating minimum at $x = 3$ ***R1*** ***N0***

[5 marks]

10)

(a) evidence of choosing the product rule ***(M1)***

e.g. $uv' + vu'$

correct derivatives $\cos x$, 2 ***(A1)(A1)***

$g'(x) = 2x\cos x + 2\sin x$ ***A1*** ***N4***