AQA, Edexcel, OCR, MEI

A Level

A Level Mathematics

C4 Calculus (Answers)

Name:

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Total Marks: /75

C4 - Calculus
MEI, OCR, AQA, Edexcel

1. Evaluate the following integrals by expressing the integrand in partial fractions. *Remember to include a constant of integration*:

   (a) $\int \frac{1}{(x+1)(x+2)}\,dx = \ln(x+1) - \ln(x+2) + c.$ [3]

   (b) $\int \frac{x}{(x+1)(x+3)}\,dx = \frac{3}{2}\ln(x+3) - \frac{1}{2}\ln(x+1) + c.$ [3]

   (c) $\int \frac{x^2}{(x+1)(x+2)}\,dx = x + \ln(x+1) - 4\ln(x+2) + c.$ [3]

   (d) $\int \frac{1}{(x+1)(x+2)(x+3)}\,dx = \frac{1}{2}\ln(x+1) - \ln(x+2) + \frac{1}{2}\ln(x+3) + c.$ [3]

   (e) $\int \frac{x^3}{(x-4)(x+2)}\,dx = \frac{1}{6}\left[3(x^2+4x-32) + 64\ln(x-4) + 8\ln(x+2)\right] + c.$ [4]

   (f) $\int \frac{2x}{(x-1)^2(x+4)}\,dx = \frac{2}{25}\left[\frac{5}{1-x} + 4\ln(1-x) - 4\ln(x+4)\right] + c.$ [4]

2. Find the volumes of the solids generated by revolving the following functions around the x axis:

   (a) $\frac{32\pi}{5}$. [2]

   (b) $\frac{242\pi}{5}$. [2]

   (c) $\frac{\pi}{2}$. [3]

   (d) $\frac{\pi}{4}(e^4 - 1)$. [2]

   (e) 2π. [3]

3. Find the volumes of the solids generated by revolving the following functions around the y axis:

   (a) $\frac{32\pi}{3}$. [2]

   (b) $\frac{\pi^2}{4}$. [2]

   (c) $\frac{\pi}{2}$. [2]

   (d) $\frac{\pi}{4}(e^4 - 1)$. [3]

4. The gradient function of a function $y(x)$ is given by $2x$:

   (a) $\frac{dy}{dx} = 2x$. [2]

   (b) $y = x^2 + c$. [2]

   (c) $y = x^2 + 2$. [1]

5. Consider the function $y = \sin x + x$:

   (a) $\frac{dy}{dx} = \cos x + 1$. [2]

   (b) $y = \sin x + x + c$. [2]

6. You are given that $\frac{dx}{dt} = \frac{1}{2\sqrt{t}}$ and $\frac{dy}{dt} = 2t$, for some parametric equations $x(t)$ and $y(t)$:

   (a) $\frac{dy}{dx} = 4x^3$. [4]

   (b) $y = x^4 + c$. [2]

7. Solve the following differential equations:

   (a) $y = 2x^2 + c$. [2]

   (b) $y = \sin x + c$. [2]

   (c) $y = e^{x^2} + c$. [2]

   (d) $y = Ae^{\frac{x^3}{3}}$. [3]

   (e) $y = Axe^x$. [3]

8. Consider the ODE $\frac{dy}{dx} = -\frac{x}{y}$:

   (a) $x^2 + y^2 = c$. [4]

   (b) $x^2 + y^2 = 4$ [2]

   (c) This is the equation of a circle centred at the origin of radius 2. [1]