Website: contoureducation.com.au | **Phone:** 1800 888 300
Email: hello@contoureducation.com.au

VCE Mathematical Methods ¾
Antidifferentiation [4.1]
Homework

Admin Info & Homework Outline:

Student Name	
Questions You Need Help For	
Compulsory Questions	Pg 2 – Pg 16
Supplementary Questions	Pg 17 – Pg 30

Section A: Compulsory Questions

Sub-Section [4.1.1]: Find an Antiderivative Function

Question 1

Evaluate each of the following integrals:

a. $\int (3x^2 - 4x + 1)\, dx$

b. $\int (\sin x + \cos x)\, dx$

c. $\int \left(e^x + \frac{1}{x}\right) dx$, where $x > 0$.

d. $\int (\sec^2 x - 3)\, dx$

e. $\int \left(\frac{2}{x} + 5x^3\right) dx$, where $x < 0$.

f. $\int (4e^x - \sin x)\, dx$

Space for Personal Notes

Question 2

Evaluate each of the following integrals using the reverse chain rule.

a. $\int (3x + 4)^5 \, dx$

b. $\int \cos(2x - \pi) \, dx$

c. $\int e^{5x-7} \, dx$

d. $\int \sec^2(4x) \, dx$

e. $\int \frac{1}{3x-1}\,dx$, where $x > \frac{1}{3}$.

f. $\int \frac{1}{-2x+5}\,dx$, where $x < \frac{5}{2}$.

Question 3

For each of the following, the derivative $f'(x)$ is given, and the function f passes through a specific point. Find the rule for $f(x)$.

a. $f'(x) = 4x^3 + 1$, and $f(1) = 6$.

b. $f'(x) = \sin(2x)$, and $f\left(\frac{\pi}{2}\right) = 0$.

c. $f'(x) = \frac{1}{x+4}$ and $f(0) = 2$, with $x > -4$.

Question 4 Tech-Active.

Find $f(x)$ if $f'(x) = 3x^2 + 9x + \frac{1}{x}$ and $f(1) = 6$ and $x > 0$.

Space for Personal Notes

Sub-Section [4.1.2]: Evaluate Definite Integrals

Question 5

Evaluate the following definite integrals:

a. $\int_1^3 (2x + 5)\, dx$

b. $\int_0^{\pi} \sin(x)\, dx$

c. $\int_1^2 (3x^2 + 4x)\, dx$

d. $\int_0^1 \frac{1}{x+2}\, dx$

e. $\int_0^{\frac{\pi}{12}} \sec^2(3x)\, dx$

f. $\int_1^4 (x^2 + 2x + 1)\, dx$

Space for Personal Notes

Question 6

Evaluate each of the following definite integrals:

a. $\int_0^1 (2x+1)^3 \, dx$

b. $\int_{\pi}^{2\pi} \cos(3x-\pi) \, dx$

c. $\int_0^{\frac{\pi}{12}} \sec^2(4x) \, dx$

d. $\int_0^1 e^{2x+1} \, dx$

e. $\int_0^2 \frac{1}{3x+1}\,dx$

f. $\int_0^1 \frac{1}{2x-5}\,dx$

Question 7

Evaluate the following definite integrals:

a. $\int_0^{\log_e(2)} 4e^{2x} - \frac{3}{1+2x}\,dx$

b. $\int_1^2 \frac{6x+5}{(3x^2+5x+1)^2}\,dx$

HINT: What is the derivative of $\frac{1}{f(x)}$?

c. $\int_0^{\frac{\pi}{4}} \left(\frac{3}{4}\cos\left(2x+\frac{\pi}{3}\right)+\frac{1}{2}\sec^2(x+\pi)\right)dx$

Space for Personal Notes

Question 8 Tech-Active.

Evaluate the following definite integral using technology:

$$\int_0^{\frac{\pi}{4}} \sin^2(x)\cos(x)\,dx$$

Space for Personal Notes

Sub-Section [4.1.3]: Apply Integral Properties to Tackle Integration Questions

Question 9

Evaluate the following integrals given that:

$$\int_0^4 f(x)\,dx = 6 \text{ and } \int_2^4 f(x)\,dx = 5$$

a. $\int_0^2 f(x)\,dx$

b. $\int_0^4 3f(x) - 2dx$

c. $\int_2^4 2f(x) + x\,dx$

Question 10

Evaluate the following integrals given that:

$$\int_1^5 g(x)\,dx = 7 \text{ and } \int_3^5 g(x)\,dx = 4$$

a. $\int_1^3 g(x)\,dx$

b. $\int_1^5 5g(x) - 4\,dx$

c. $\int_1^3 2g(x) + 3x\,dx$

Space for Personal Notes

Question 11

Given that:

$$\int_1^4 g(x)\,dx = 6 \text{ and } \int_4^7 g(x)\,dx = -3$$

Evaluate the following integrals:

a. $\int_2^8 2g\left(\frac{x}{2}\right)\,dx$

b. $\int_1^7 2g(x) + 1\,dx$

c. $\int_6^9 2g(x-5)\,dx$

Space for Personal Notes

Sub-Section: The 'Final Boss'

Question 12

Let $f(x) = 2e^x + \cos(2x)$, and let $F(x)$ be an antiderivative of $f(x)$.

a. Given that $F(0) = 5$, find an explicit expression for $F(x)$.

b. Hence, evaluate $\int_0^{\log_e(2)} f(x)\,dx$.

Let g be a function such that:

$$\int_0^3 g(x)dx = 12$$

c. Evaluate $\int_0^6 \frac{1}{2} g\left(\frac{x}{2}\right) dx$.

Section B: Supplementary Questions

Sub-Section[4.1.1]: Find an Antiderivative Function

Question 13

Evaluate the following:

a. $\int \frac{2}{\sqrt{x}}\, dx$

b. $\int x^4 + 3x - 9\, dx$

c. $\int \left(\frac{1}{x} + e^{7x} + x^{\pi} + 7\right)\, dx$ where $x < 0$.

d. $\int (t-6)^2\, dt$

e. $\int (2\cos(x) + 4\sin(x))\, dx$

f. $\int (3x - \sec^2(x))\, dx$

Question 14

Find an antiderivative of the following functions:

a. $(3x + 1)^5$

b. $5e^{7x}$

c. $\sec^2(4x - 2)$

d. $\sin(-2x + 3)$

e. $(7x - 4)^{\frac{3}{2}}$

f. $\frac{3}{2x+3}$ where $x > -\frac{3}{2}$.

Question 15

a. Given $f'(x) = 4x^3 - 2x + 7$, and $f(1) = 10$, find $f(x)$.

b. Given $f'(x) = \frac{5}{2x+1}$, and $f(0) = 2$, find $f(x)$ for $x > -\frac{1}{2}$.

c. Given $f'(x) = 6e^{3x}$, and $f(0) = 4$, find $f(x)$.

Question 16 Tech-Active.

Find y in terms of x if $\frac{dy}{dx} = 6(2x+1)^2 - \frac{10}{(3x-4)^2}$ and $y = 5$ when $x = 1$.

Space for Personal Notes

Sub-Section [4.1.2]: Solve Definite Integrals

Question 17

Evaluate the following:

a. $\int_0^1 (3x^2 + 2x)\,dx$

b. $\int_1^2 (\sqrt{x} + \frac{4}{3}x^3)\,dx$

c. $\int_0^2 (x^2 + 1)\,dx$

d. $\int_1^e \frac{1}{x}\,dx$

e. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin(\theta)\,d\theta$

f. $\int_0^2 (x+1)^7\,dx$

Space for Personal Notes

Question 18

Evaluate the following:

a. $\int_0^{\frac{\pi}{4}} \frac{\sec^2(x)+\sin(x)}{2}\,dx$

b. $\int_{\pi}^{\frac{3\pi}{2}} (6\sin(2w) - 10\cos(w))\,dw$

c. $\int_0^2 (10x^2 + 10)\,dx$

d. $\int_0^{\frac{\pi}{2}} \sin\left(2\left(\theta+\frac{\pi}{4}\right)\right)\,d\theta$

e. $\int_0^{\frac{\pi}{4}} \cos(2\theta)\,d\theta$

f. $\int_0^{\pi} \sin(4\theta)\,d\theta$

Space for Personal Notes

Question 19

a. Evaluate $\int_1^3 \left(2x^3 - \frac{6}{x+1}\right) dx$.

b. Evaluate $\int_0^1 4\, e^{2x+1}\, dx$.

c. Evaluate $\int_0^{\frac{\pi}{2}} (\sin(3x) + 4\cos(x))\, dx$.

Space for Personal Notes

Question 20 Tech-Active.

Evaluate $\int_0^1 3(4x + x^4)(10x^2 - 2)\,dx$.

Space for Personal Notes

Sub-Section [4.1.3]: Apply Integral Properties to Tackle Integration Questions

Question 21

Let $f(x) = g'(x)$ and $h(x) = k'(x)$, where $g(x) = (x^2 + 1)^4$ and $k(x) = \sin(x^2)$.

Find:

a. $\int f(x)\,dx$

b. $\int f(x) + h(x)\,dx$

c. $\int 3h(x)\,dx$

Space for Personal Notes

Question 22

Suppose $\int_1^4 f(x)\,dx = 2$ and $\int_1^4 g(x)\,dx = 7$. Evaluate the following integrals:

a. $\int_1^4 \left(5f(x) + 3g(x)\right)dx$

b. $\int_1^4 \left(6 - 2f(x)\right)dx$

c. $\int_1^4 (2f(x) + 10g(x) + 3)\,dx$

Space for Personal Notes

Question 23

Suppose it is known that $\int_1^5 f(x)\,dx = -3$ and $\int_2^5 f(x)\,dx = 4$.

a. Evaluate $\int_1^2 f(x)\,dx$.

b. Hence, evaluate $\int_1^2 \left(3 - 4f(x)\right)\,dx$

c. Evaluate $\int_2^1 f(x)\,dx$.

Space for Personal Notes

Question 24 Tech-Active.

Find $\int_0^1 f(3x+1)\,dx$ given that $\int_1^4 f(x)\,dx = 5$.

Space for Personal Notes

CONTOUREDUCATION

Website: contoureducation.com.au | **Phone:** 1800 888 300 | **Email:** hello@contoureducation.com.au

VCE Mathematical Methods ¾

Free 1-on-1 Support

Be Sure to Make The Most of These (Free) Services!

- Experienced Contour tutors (45 + raw scores, 99 + ATARs).
- For fully enrolled Contour students with up-to-date fees.
- After school weekdays and all day weekends.

1-on-1 Video Consults	Text-Based Support
Book via bit.ly/contour-methods-consult-2025 (or QR code below). One active booking at a time (must attend before booking the next).	Message +61 440 138 726 with questions. Save the contact as "Contour Methods".

Booking Link for Consults
bit.ly/contour-methods-consult-2025

Number for Text-Based Support
+61 440 138 726