Integrals

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

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

(a) $-x^3 + 2x^2 + 2x + C$ **(b)** $-6x + 4 + C$

(c) $-3x^3 + 4x^2 + 2x + C$ **(d)** $-x^3 + 2x^2 - 2x + C$

2. $\int \sec^2 9x\,dx$ equals:

(a) $9\tan 9x + C$ **(b)** $(1/9)\sec 9x \tan 9x + C$

(c) $\tan 9x + C$ **(d)** $(1/9)\tan 9x + C$

3. $\int_{-2}^{1} (3x + 1)\,dx$ equals:

(a) $-3/2$ **(b)** $5/2$ **(c)** $13/2$ **(d)** $3/2$

4. $\int_{-1}^{1} (-4x^3 + x^2 + 3x - 5)\,dx$ equals:

(a) $-28/3$ **(b)** $-14/3$ **(c)** 0 **(d)** $-25/6$

5. $\int dx/x$ equals:

(a) $\log|x| + C$ **(b)** $-1/x^2 + C$ **(c)** $x + C$ **(d)** $1/x^2 + C$

6. $\int x \cos x\,dx$ equals:

(a) $x \sin x + \cos x + C$ **(b)** $x \sin x + C$

(c) $x \sin x - \cos x + C$ **(d)** $-x \sin x + \cos x + C$

7. $\int dx/((x + 1)(x + 6))$ equals:

(a) $(1/5)\log|(x + 1)/(x + 6)| + C$ **(b)** $(1/5)\log|(x + 6)/(x + 1)| + C$

(c) $-(1/5)\log|(x + 1)/(x + 6)| + C$ **(d)** $\log|(x + 1)(x + 6)| + C$

8. Assertion (A): $\int_{-1}^{1} (4x^2 + 5)\,dx = 0$.
Reason (R): If f is an odd function, $\int_{-1}^{1} f(x)\,dx = 0$.

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. Find $\int (9x^5 + 5/x + 8e^x)\,dx$.

10. Find $\int x(x^2 + 4)^2\,dx$.

11. Evaluate $\int_1^3 (6x^2 + 4x - 5)\,dx$.

12. Find $\int 1/(x^2 - 16)\,dx$.

13. Find $\int xe^{6x}\,dx$.

14. Find $\int (5x - 2)/((x - 5)(x - 2))\,dx$.

15. Evaluate $\int_0^6 |x - 4|\,dx$.

16. Find $\int \cos^2 6x\,dx$.

Section C — Word problems — 4 × 4 = 16 marks

17. Find $\int dx/((x - 3)(x - 5)(x - 6))$.

18. Evaluate $\int_5^{13} \sqrt{x}/(\sqrt{x} + \sqrt{(18 - x)})\,dx$.

19. Find $\int (x^2 - 1)e^{-4x}\,dx$.

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

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Answer key

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Q	Answer	Working
1	**(a) $-x^3 + 2x^2 + 2x + C$**	raise each power by one and divide by the new power
2	**(d) (1/9) tan 9x + C**	a standard integral
3	**(a) −3/2**	$[(3/2)x^2 + x]$ from −2 to 1
4	**(a) −28/3**	the odd terms integrate to 0; $2\int_0^1 (x^2 - 5)\,dx$
5	**(a) log|x| + C**	—
6	**(a) x sin x + cos x + C**	integrate by parts with u = x
7	**(a) (1/5) log|(x + 1)/(x + 6)| + C**	$1/((x + 1)(x + 6)) = (1/5)[1/(x + 1) - 1/(x + 6)]$
8	**(d) A is false, but R is true.**	A is false: $4x^2 + 5$ is even, so the integral is $2\int_0^1 (4x^2 + 5)\,dx = 38/3$. R is true.
9	**$(3/2)x^6 + 5\log\|x\| + 8e^x + C$**	$\int x^n\,dx = x^{n+1}/(n + 1)$, $\int dx/x = \log\|x\|$, $\int e^x\,dx = e^x$
10	**$(1/6)(x^2 + 4)^3 + C$**	put $t = x^2 + 4$, $dt = 2x\,dx$
11	**58**	$[2x^3 + 2x^2 - 5x]$ from 1 to 3
12	**(1/8) log|(x − 4)/(x + 4)| + C**	use the standard form
13	**$e^{6x}((1/6)x - 1/36) + C$**	by parts: $\int u\,dv = uv - \int v\,du$, with u = x
14	**(23/3) log|x − 5| − (8/3) log|x − 2| + C**	$(5x - 2)/((x - 5)(x - 2)) = A/(x - 5) + B/(x - 2)$ with A = 23/3, B = −8/3
15	**10**	split at x = 4: 8 + 2
16	**(1/2)x + (1/24) sin 12x + C**	$\cos^2 6x = (1 + \cos 12x)/2$
17	**(1/6) log|x − 3| − (1/2) log|x − 5| + (1/3) log|x − 6| + C**	partial fractions: A = 1/6, B = −1/2, C = 1/3 (cover-up rule)
18	**4**	replace x by 18 − x and add the two forms: $2I = \int_5^{13} 1\,dx = 8$
19	**$e^{-4x}(-(1/4)x^2 - (1/8)x + 7/32) + C$**	integrate by parts twice, with $u = x^2$ and then u = x
20	**6**	put $t = x^2 + 1$: $(1/2)\int_1^5 t\,dt = [t^2/4]$ from 1 to 5

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