

1st Semester Exam.	Time: 2 hours	Code: 105J
Subject: Differentiation and integration (1)	Degree: 60	Date: 5/1/2026
Math. Department-Faculty of science-Zag. university		

Question 1: Choose the correct answer

(40 Marks)

1. $\int \frac{\ln x^2}{x} dx = \dots + c$	A. $\frac{(\ln x^2)^2}{2}$	B. $\frac{(\ln x^2)^2}{4}$	C. $\frac{1}{x^2}$	D. $\ln(\ln x)$
2. $\int \frac{\sin x + \cos x}{\cos x} dx = \dots + c$	A. $x + \ln(\sec x)$	B. $x - \ln(\sin x)$	C. $x + \ln(\sin x)$	D. $\ln(\cos x)$
3. $\int \frac{4x^3}{1+x^6} dx = \dots + c$	A. $\cot^{-1}(x^4)$	B. $\ln(1+x^4)$	C. $x^4 + \frac{2}{3}x^6$	D. $\tan^{-1}(x^4)$
4. $\int \sin^2 x dx = \dots + c$	A. $\frac{1}{2} [x + \sin x \cos x]$	B. $\frac{\sin^3 x}{3}$	C. $\frac{-\cos^3 x}{3}$	D. $\frac{1}{2} [x - \sin x \cos x]$
5. $\int_0^1 \frac{dx}{\sqrt{2-x^2}} = \dots$	A. $\sin^{-1}\left(\frac{x}{\sqrt{2}}\right) + c$	B. $\frac{\pi}{2}$	C. $\frac{\pi}{4}$	D. $\frac{-\pi}{4}$
* (6-7): For $I = \int \frac{\sqrt{4-x^2}}{x^2} dx$				
6. The suitable substitution is:	A. $x = \sin \theta$	B. $x = 2 \sin \theta$	C. $x = \tan \theta$	D. $x = 2 \sec \theta$
7. The final result is	A. $2\sqrt{4-x^2} - \sin^{-1}(2x)$	B. $\frac{\sqrt{4-x^2}}{2} + \tan^{-1}\left(\frac{x}{2}\right)$	C. $\frac{\sqrt{4-x^2}}{x} + \sin^{-1}\left(\frac{x}{2}\right)$	D. $\frac{-\sqrt{4-x^2}}{x} - \sin^{-1}\left(\frac{x}{2}\right)$
8. $\int \frac{dx}{9+4x^2} = \dots + c$	A. $\tan^{-1}\left(\frac{2x}{3}\right)$	B. $\frac{1}{6} \tan^{-1}\left(\frac{2x}{3}\right)$	C. $\frac{2}{3} \tan^{-1}\left(\frac{2x}{3}\right)$	D. $\frac{1}{6} \cosh^{-1} x$
9. $\int \frac{1+\tan^2 x}{\sin^2 x} dx = \dots + c$	A. $\frac{1}{2} [x - \sin x \cos x] - \csc^2 x$	B. $\tan x + \cot x$	C. $\frac{1}{2} [x + \sin x \cos x] - \cot x$	D. $\tan x - \cot x$
10. The area enclosed by the following two functions $y = x^2$ and $y = x - x^2$ equals:				
A. $\frac{1}{3}$ Square unit	B. $\frac{2}{3}$ Square unit	A. $\frac{1}{6}$ Square unit	C. Not Given	
11. $\int \frac{-\csc^2 x}{\sqrt{1-\cot^2 x}} dx$				
A. $\sin^{-1}(\cot x) + c$	B. $\sinh^{-1}(\cot x) + c$	C. $\sin^{-1}(\csc x) + c$	D. Not Given	
12. $\int \sin^{-1} x dx$				
A. $x \sin^{-1} x + \sqrt{1-x^2} + c$	B. $x \sin^{-1} x + 2\sqrt{1-x^2} + c$	C. $x \sin^{-1} x + \frac{1}{\sqrt{1-x^2}} + c$	D. Not Given	
* (13-14): For $I = \int \frac{1}{x^2-6x+8} dx$. The solution is obtained by using partial fraction method				
13. $\frac{1}{x^2-6x+8} = \dots$	A. $\frac{Ax+B}{x^2-6x+8}$	B. $\frac{Ax+B}{x^2} + \frac{C}{x}$	C. $\frac{A}{x-4} + \frac{B}{x-2}$	D. $\frac{A}{x-4} + \frac{B}{x+2}$
14. $I = \dots + c$	A. $\ln \sqrt{\frac{x-4}{x-2}}$	B. $\ln \sqrt{\frac{x-2}{x-4}}$	C. $\ln \sqrt{\frac{x-1}{x-8}}$	D. $\frac{x^3}{3} - 3x^2 + 8x$

All the best

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15. If $y = \sec^{-1}(e^x)$, then $y'(0) = \dots$	A. ∞	B. 0.5	C. 1	D. 1.5
16. $\lim_{x \rightarrow 0} \frac{e^x - 1}{x} = \dots$	A. 0	B. 1	C. -1	D. Not Given
17. If $y = \sec(2 \tan x)$, then $\dot{y} = \dots$	A. $\sec^2 x (2 \sec^2 x)$	B. $\sec^2 x$	C. $2 \sec^3 x \tan x$	D. $2 \sec(2 \tan x) \tan(2 \tan x) \sec^2 x$
18. If $y = (\sin x)^x$, then $y' = \dots$	A. $\ln \sin x + x \cot x$	B. $\cos x \cdot \ln x + \frac{\sin x}{x}$	C. $y \left[\cos x \cdot \ln x + \frac{\sin x}{x} \right]$	D. $y [\ln \sin x + x \cot x]$
19. If $y = \tanh^{-1} 2^x$, then $y' = \dots$	A. $\frac{2^x \ln 2}{1+2^{2x}}$	B. $\frac{2^x \ln 2}{1-x^2}$	C. $\frac{2^x \ln 2}{1-4^x}$	D. $\frac{2^x \ln 2}{1+x^2}$
20. If $y = \sqrt{\sec^{-1}(3^x)}$, then $y' = \dots$	A. $\frac{1}{2\sqrt{\sec^{-1}(3^x)}} \cdot \frac{1}{x\sqrt{x^2-1}}$	B. $\frac{1}{2\sqrt{\sec^{-1}(3^x)}} \cdot \frac{\ln 3}{\sqrt{3^{2x}-1}}$	C. $\frac{1}{2\sqrt{\sec^{-1}(3^x)}} \cdot \frac{1}{3^x\sqrt{3^{2x}-1}}$	D. Not Given

Question 2: Use integration methods to solve the following (10 Marks)

- A. $I = \int \frac{x dx}{(x-1)(x^2+2)}$ (Use integration by partial fractions)
- B. $I = \int x^2 e^{2x} dx$ (use integration by parts)

Questions 3: Use differentiation methods to solve the following (10 Marks)

- A. Prove that if $y = \tan^{-1} x$, then $y' = \frac{1}{1+x^2}$.
- B. Expand the function $f(x) = \ln(x+1)$ by using Taylor's expansion at $x=1$. (Find only four terms)