

CHALLENGE 30 ON DEFINITE INTEGRALS

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Q01. $\int_0^{\pi/2} \frac{1}{2 - \sin x} dx$

Q02. $\int_{\pi/3}^{\pi/2} \frac{\sqrt{1 + \cos x}}{(1 - \cos x)^{3/2}} dx$

Q03. $\int_0^1 \frac{x}{(1-x)^{3/4}} dx$

Q04. $\int_0^{\pi/2} \frac{\sec^2 x}{\sec^2 x + \operatorname{cosec}^2 x} dx$

Q05. $\int_0^{\pi} \frac{x}{1 + \cos \alpha \sin x} dx, 0 < \alpha < \pi$

Q06. $\int_{-1/2}^{1/2} \left| x \cos \frac{\pi x}{2} \right| dx$

Q07. $\int_0^{2\pi} (\sin x + |\sin x|) dx$

Q08. $\int_0^1 \frac{dx}{x^2 + 2x \cos \alpha + 1}$

Q09. $\int_0^m \frac{x^4}{\sqrt{m^2 - x^2}} dx$

Q10. $\int_0^{\pi/2} \frac{dx}{(a^2 \cos^2 x + b^2 \sin^2 x)^2}$

Q11. $\int_0^{\pi/2} \log \sec x dx$

Q12. $\int_{-2}^2 \frac{dx}{1 + |x-1|}$

Q13. $\int_0^{\pi} \log(1 + \cos x) dx$

Q14. $\int_0^{\pi/2} \frac{\cos x}{1 + \cos x + \sin x} dx$

Q15. $\int_{-1}^{1/2} \frac{e^x (2 - x^2)}{(1-x)\sqrt{1-x^2}} dx$

Q16. $\int_0^m [f(x) + xf'(x)] dx$

Q17. $\int_0^m [f(x) + f(-x)] dx$

Q18. $\int_0^{\pi} x \log \sin x dx$

Q19. $\int_0^{2\pi} \log(1 + \sin x) dx$

Q20. $\int_0^{\infty} \log \left(x + \frac{1}{x} \right) \frac{dx}{1+x^2}$

Q21. $\int_{-1}^1 \frac{\sin x - x^2}{3 - |x|} dx$

Q22. Solve : $\int_3^x \sqrt{x+1} dx = 0$

Q23. Solve : $\int \frac{1}{\sqrt{2} x \sqrt{x^2 - 1}} dx = \frac{\pi}{2}$

Q24. Evaluate : $\int_0^{\infty} \frac{dx}{[x + \sqrt{1+x^2}]^n}, n \in \mathbb{Z}, n > 1$

Q25. Evaluate : $\int_{-1/2}^{1/2} \left\{ [x] + \log \left(\frac{1+x}{1-x} \right) \right\} dx$, where $[.]$ is greatest integer function.

Q26. If $x = \int_0^y \frac{dt}{\sqrt{1+4t^2}}$, then find $\frac{d^2y}{dx^2}$.

Q27. Evaluate : $\int_0^{\pi} [x] dx$, where $[.]$ is greatest integer function.

Q28. Evaluate : $\lim_{x \rightarrow 0} \frac{\int_0^{x^2} \cos t^2 dt}{x \sin x}$

Q29. Using properties of definite integrals, evaluate : $\int_{-m}^m \sqrt{\frac{m-x}{m+x}} dx$.

Q30. Prove that $\int_0^1 \tan^{-1} \left(\frac{1}{1-x+x^2} \right) dx = 2 \int_0^1 \tan^{-1} x dx$. Hence, evaluate : $\int_0^1 \tan^{-1}(1-x+x^2) dx$.

“Challenge 30” assignments are prepared by OP Gupta (*Indira Award Winner*).

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