

CUET Mathematics Test - Set 18

Chapter: Calculus - Integrals (Intermediate)

SOLUTIONS

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Solutions

- Solution:** Put $t = a^2 \sin^2 x + b^2 \cos^2 x \Rightarrow dt = (2a^2 \sin x \cos x - 2b^2 \cos x \sin x)dx = (a^2 - b^2) \sin 2x dx$. Integral becomes $\frac{1}{a^2 - b^2} \int \frac{dt}{t} = \frac{1}{a^2 - b^2} \log |t|$. **Correct Option: (A)**
- Solution:** $\int \frac{e^x}{e^{2x} + 1} dx$. Put $e^x = t, e^x dx = dt \Rightarrow \int \frac{dt}{t^2 + 1} = \tan^{-1} t = \tan^{-1}(e^x) + C$. **Correct Option: (A)**
- Solution:** $\int \frac{2(\cos^2 x - \cos^2 \alpha)}{\cos x - \cos \alpha} dx = \int 2(\cos x + \cos \alpha) dx = 2(\sin x + x \cos \alpha) + C$. **Correct Option: (A)**
- Solution:** Put $x^3 = t, 3x^2 dx = dt$. $\int \frac{1/3 dt}{\sqrt{1-t^2}} = \frac{1}{3} \sin^{-1} t = \frac{1}{3} \sin^{-1}(x^3) + C$. **Correct Option: (A)**
- Solution:** $\int \frac{dx}{x(1+\log x)}$. Put $1 + \log x = t, \frac{1}{x} dx = dt$. $\int \frac{dt}{t} = \log |t| = \log |1 + \log x| + C$. **Correct Option: (A)**
- Solution:** Standard derivative of $\sec^{-1} x$. **Correct Option: (A)**
- Solution:** $\int \frac{(x+1)+1}{(x+1)^2} dx = \int \left(\frac{1}{x+1} + \frac{1}{(x+1)^2} \right) dx = \log |x+1| - \frac{1}{x+1} + C$. **Correct Option: (A)**
- Solution:** $\int \left(\frac{1}{\cos^2 x} - \frac{1}{\sin^2 x} \right) dx = \int (\sec^2 x - \operatorname{cosec}^2 x) dx = \tan x + \cot x + C$. **Correct Option: (A)**
- Solution:** $\int e^x \left[\frac{(x+1)-1}{(x+1)^2} \right] dx = \int e^x \left[\frac{1}{x+1} + \frac{-1}{(x+1)^2} \right] dx$. Using $\int e^x (f(x) + f'(x))$, we get $\frac{e^x}{x+1} + C$. **Correct Option: (A)**
- Solution:** $\int \frac{1}{\cos(x/2) + \sin(x/2)} dx$. Rationalize or convert to $\sin(x/2 + \pi/4)$. Integration of \sec leads to $\log |\tan|$. **Correct Option: (A)**
- Solution:** $\int \frac{dx}{\sqrt{x(1+\sqrt{x})}}$. Put $\sqrt{x} = t, \frac{1}{2\sqrt{x}} dx = dt \Rightarrow 2 \int \frac{dt}{1+t} = 2 \log |1 + \sqrt{x}| + C$. Thus $k = 2$. **Correct Option: (B)**
- Solution:** $f(x) = 1/x, f'(x) = -1/x^2$. Result is $e^x f(x) = e^x/x + C$. **Correct Option: (A)**
- Solution:** Put $x - a = t, x = t + a, dx = dt$. $\int \frac{\sin(t+a)}{\sin t} dt = \int \frac{\sin t \cos a + \cos t \sin a}{\sin t} dt = \int (\cos a + \sin a \cot t) dt = t \cos a + \sin a \log |\sin t| = (x - a) \cos a + \sin a \log |\sin(x - a)|$. Adjusting constant. **Correct Option: (A)**
- Solution:** $\int \sqrt{(\sin x + \cos x)^2} dx = \int (\sin x + \cos x) dx = -\cos x + \sin x + C$. **Correct Option: (A)**
- Solution:** $\int \frac{dx}{(x+2)^2 + 9} = \frac{1}{3} \tan^{-1} \left(\frac{x+2}{3} \right) + C$. **Correct Option: (A)**