

I'M DOING THIS FOR
CLASS CREDIT!

CLASS _____

SECTION _____

NAME _____

E-MAIL _____

CIRCLE
ONE : GRADUATE
UNDERGRADUATE

INTEGRATION BEE

2009

NO CALCULATORS, BOOKS, HEADPHONES, PERSONAL
ELECTRONIC DEVICES, STOCK OPTIONS, FUNNY T-SHIRTS,
CHEATING

60 MINUTES. CIRCLE ANSWERS. ALL PROBLEMS
COUNT EQUALLY. NO PARTIAL CREDIT. START AND
STOP WHEN TOLD. TAKE ALL "LN" OR "LOG" TO BASE E.

1. $\int x^{2009} dx$ $\frac{x^{2010}}{2010}$

$$2. \int \frac{1}{x^{1/2}} dx \quad 2x^{1/2}$$

$$3. \int \frac{1}{x^{1/4}} dx \quad \frac{4}{3} x^{3/4}$$

$$4. \int \frac{1}{x^{1/2} + x^{1/4}} dx$$

$4 \left(\frac{(1+x^{1/4})^2}{2} - 2(1+x^{1/4}) + \ln|1+x^{1/4}| \right)$
 ~~$n \cdot x^2 + \ln(x^2 + 1)$~~

$$\frac{4}{3} x^{3/4} - \frac{4}{3} (1+x^{1/4})^3 + 6(1+x^{1/4})^2 - 12(1+x^{1/4}) + 4 \ln|1+x^{1/4}|$$

$$5. \int \frac{1}{x^4 + 1} dx \quad \frac{1}{4\sqrt{2}} \left[\log \frac{x^2 + \sqrt{2}x + 1}{x^2 - \sqrt{2}x + 1} + 2 \text{TAN}^{-1} \frac{\sqrt{2}x}{1-x^2} \right]$$

OR

 ~~$\frac{4}{3} x^{3/4} - \frac{4}{3} (1+x^{1/4})^3 + 6(1+x^{1/4})^2 - 12(1+x^{1/4}) + 4 \ln|1+x^{1/4}|$~~

$$6. \int x^2 dx \quad \frac{x^3}{3}$$

$$7. \int e^x dx \quad e^x$$

$$8. \int x^2 e^x dx \quad (x^2 - 2x + 2)e^x$$

$$9. \int \sin 20x \, dx$$

$$-\frac{\cos 20x}{20}$$

$$10. \int \cos 9x \, dx$$

$$\frac{\sin 9x}{9}$$

$$11. \int \sin 20x \cos 9x \, dx$$

$$\frac{\frac{1}{9} \sin 9x \sin 20x + \frac{20}{81} \cos 20x \cos 9x}{1 - \frac{400}{81}}$$

$$-\frac{1}{2} \left(\frac{\cos 29x}{29} + \frac{\cos 11x}{11} \right)$$

$$12. \int \frac{1}{1 + 2009 \sin^2 x} \, dx$$

$$\frac{1}{\sqrt{2010}} \tan^{-1} \sqrt{2010} \tan x$$

$$13. \int \frac{1}{2 + 3x^2} \, dx$$

$$\frac{1}{\sqrt{6}} \tan^{-1} \sqrt{\frac{3}{2}} x$$

$$14. \int \frac{4x}{5 + 6x^2} \, dx$$

$$\frac{1}{3} \ln(5 + 6x^2)$$

$$15. \int \frac{7x^2}{8 + 9x^2} \, dx$$

~~$$\frac{7}{9} \left(x - \frac{1}{\sqrt{72}} \tan^{-1} \sqrt{72} x \right)$$~~

$$\frac{7}{9} \left(x - \frac{2\sqrt{2}}{3} \tan^{-1} \frac{3x}{2\sqrt{2}} \right)$$

$$16. \int \sec x \, dx$$

$$\log |\sec x + \tan x|$$

$$17. \int \sec^2 x \, dx$$

$$\tan x$$

$$18. \int \sec^3 x \, dx$$

$$\frac{1}{2} \sec x \tan x + \frac{1}{2} \ln |\sec x + \tan x|$$

$$19. \int x (1+2009x)^{2009/2} \, dx$$

$$\frac{2(1+2009x)^{2011/2}}{2009 \cdot 2011} \left(x - \frac{2(1+2009x)}{2013 \cdot 2009} \right) - \frac{1}{2009^2} \left[\frac{2}{2013} (1+2009x)^{2013/2} - \frac{2}{2011} (1+2009x)^{2011/2} \right]$$

$$20. \int \tan^3 x \, dx$$

$$\frac{1}{2} \tan^2 x + \ln |\cos x|$$

$$21. \int \tan^4 x \, dx$$

$$x - \tan x + \frac{\tan^3 x}{3}$$

$$22. \int \tan^5 x \, dx$$

$$\frac{\tan^4 x}{4} - \frac{1}{2} \tan^2 x - \ln |\cos x|$$

DUE TO BUDGET CUTS, THIS YEAR'S INTEGRATION BEE WILL ALSO FEATURE DERIVATIVES

$$23. \frac{d}{dx} \sqrt[3]{x} \quad \frac{1}{3} x^{-2/3}$$

$$24. \frac{d}{dx} \sqrt[x]{3} \quad -\frac{1}{x^2} \ln 3 \sqrt[x]{3}$$

$$25. \frac{d}{dx} \sin^{\sin x} x \quad \cos x (\ln \sin x + 1) \sin^{\sin x} x$$

$$26. \frac{d}{dx} \ln^{\ln x} x \quad \frac{1}{x} (\ln |\ln x| + 1) \ln^{\ln x} x$$

$$27. \frac{d}{dx} \frac{1}{1 + \frac{1}{1 + \frac{1}{x}}} \quad \frac{-1}{(2x+1)^2}$$

$$28. \frac{d}{dx} \sqrt{1 + \left(\frac{1}{x}\right)^2} \quad \frac{1}{2} \frac{1}{\sqrt{1 + \left(\frac{1}{x}\right)^2}} \left(-\frac{2}{x^3}\right) = \frac{-1}{x^2 \sqrt{x^2 + 1}}$$

$$29. \frac{d}{dx} \frac{1}{\ln x} \quad \frac{-1}{x \ln^2 x}$$

$$30. \frac{d}{dx} \tan x$$

$$\sec^2 x$$

$$31. \frac{d}{dx} \tan(\tan x)$$

$$\sec^2(\tan x) \sec^2 x$$

$$32. \frac{d}{dx} \tan(\tan(\tan x))$$

$$\sec^2(\tan(\tan x)) \sec^2(\tan x) \sec^2 x$$

$$33. \frac{d}{dx} \sin^2 \sqrt{x}$$

$$\frac{\sin \sqrt{x} \cos \sqrt{x}}{\sqrt{x}}$$

$$34. \frac{d}{dx} \ln^{\sqrt{x}} e$$

$$\emptyset$$

$$35. \frac{d}{dx} \cos^{-1}(\cos^{-1} x)$$

$$\frac{1}{\sqrt{1-x^2}} \frac{1}{\sqrt{1-(\cos^{-1} x)^2}}$$

$$36. \frac{d}{dx} \text{pwnd}$$

$$\emptyset$$

OK, BACK TO INTEGRALS

$$37. \int \frac{a da}{\sqrt{b+x^2}} \quad \frac{a^2/2}{\sqrt{b+x^2}}$$

$$38. \int \frac{a db}{\sqrt{b+x^2}} \quad 2a\sqrt{b+x^2}$$

$$39. \int \frac{a dx}{\sqrt{b+x^2}} \quad \begin{array}{l} a \sinh^{-1} \frac{x}{\sqrt{b}} \\ a \log (x + \sqrt{b+x^2}) \\ a \log \left[\sec \left(\tan^{-1} \left(\frac{x}{\sqrt{b}} \right) \right) + \frac{x}{\sqrt{b}} \right] \end{array}$$

$$40. \int \text{RAINDRAIN} \quad \frac{(\text{RAIN})^2}{2}$$

$$41. \int x^{0.001} dx \quad \frac{x^{1.001}}{1.001}$$

$$42. \int x^{0.000} dx \quad x$$

$$43. \int x^{-0.001} dx \quad \frac{x^{0.999}}{0.999}$$

$$44. \int \frac{\sin x}{1 + \cos x} dx$$

$$-\ln |1 + \cos x| \\ -\ln |\csc x + \cot x| - \ln |\sin x|$$

$$45. \int \frac{x + \sin x}{1 + \cos x} dx$$

$$x \tan \frac{x}{2}$$

$$\tan \frac{x}{2} = \frac{\sin x}{1 + \cos x} \\ = \csc x - \cot x$$

$$46. \int \frac{x}{1 + \cos x} dx$$

$$x \tan \frac{x}{2} + \ln |1 + \cos x|$$

$$47. \int x^{2009} \log x dx$$

$$x^{2010} \left[\frac{\log x}{2010} - \frac{1}{(2010)^2} \right]$$

$$48. \int (e^x - 1) dx$$

$$e^x - x$$

$$49. \int (e^x - 1)^3 dx$$

$$\frac{1}{3} e^{3x} - \frac{3}{2} e^{2x} + 3e^x - x$$

$$50. \int (e^x - 1)^{-1} dx$$

$$\ln \frac{e^x - 1}{e^x}$$