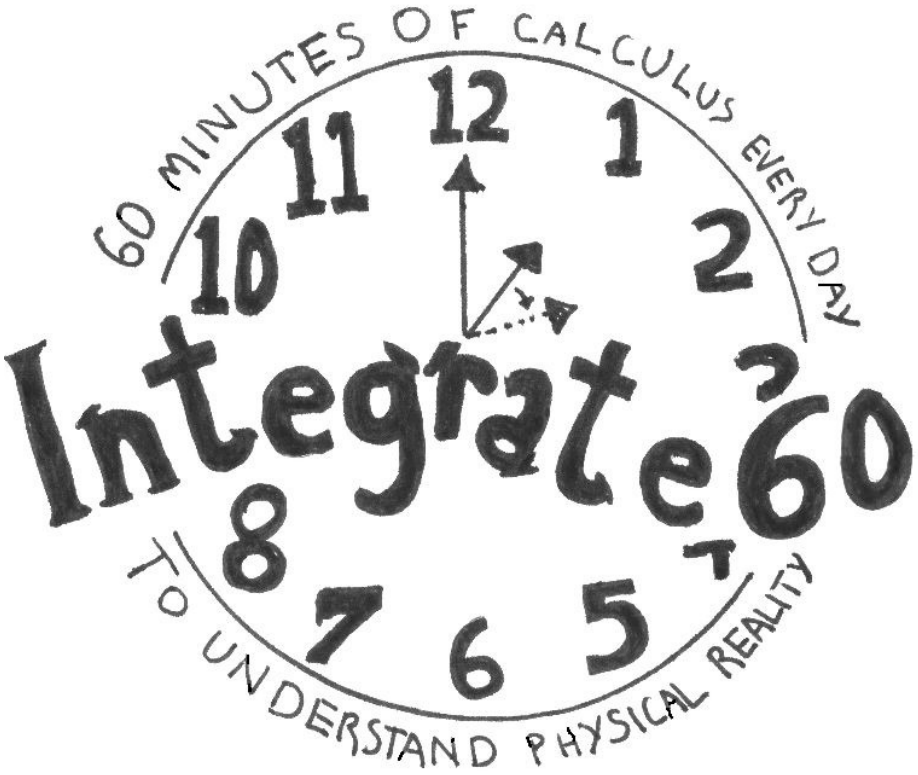
2012 Integration Bee

2241 Chamberlin Hall

April 26, 2012



No textbooks, notes, tables of integrals, calculators, math T-shirts, tattoos, cell phones, calculus-based video games, or cheating. 60 minutes to solve the 47 integrals and three derivatives on the exam. "log" is the natural logarithm. Answers must be circled. No partial credit will be given. All problems count equally. The top 10 scores advance to the finals.

1. $\int x^{2012}\,dx$

2. $\int \sqrt{x^{2012}}\ dx$

3. $\int \sin\left(2012\,x\right)\ dx$

4. $\int e^{2012\,x}\ dx$

5. $\int \left(2 + \left(0 + \left(1 + 2x\right)\right)\right)\ dx$

6. $\int \left(x^2 + 7x + 53\right)\ dx$

7. $\int \sqrt{x^2 + 7x + 53}\ dx$

8. $\int \left(x^2 + 7x + 53\right)\ \sin x\ dx$

9. $\int (x^2 + 7x + 53)\, e^x \; dx$

10. $\int \frac{\frac{x^2}{7x}}{53} \; dx$

11. $\int \log x \; dx$

12. $\int \log \sqrt{x} \; dx$

13. $\int \sin(\log x) \; dx$

14. $\int e^{\log x} \; dx$

15. $\frac{1}{\int \frac{1}{x} \, dx}$

16. $\int (x+2)^4 \ dx$

17. $\int \sqrt{(x+2)^4} \ dx$

18. $\int \sin^4(x+2) \ dx$

19. $\int \left(e^{x+2}\right)^4 \ dx$

20. $\int \frac{\frac{x+2}{x+2}}{\frac{x+2}{x+2}} \ dx$

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

22. $\int \frac{dx}{\sqrt{2x^2+3x+1}}$

23. $\int \frac{dx}{\sin(2x+3)}$

24. $\int \frac{(2x+1)(x+1)}{2x^2e^x+3xe^x+e^x}\ dx$

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

26. $\int \frac{dx}{x^3-1}$

27. $\int \frac{dx}{(x^3-1)^{-1}}$

28. $\int \frac{dx}{\sqrt{e+\pi x}}$

29. $\int \frac{dx}{\sin x \cos x}$

30. $\int \cos x \cos(\sin x)\ dx$

31. $\int \sec x\ dx$

32. $\int \sec^2 x\ dx$

33. $\int \sec^3 x\ dx$

34. $\int \sec^4 x\ dx$

35. $\int e^{ex} \cos(\pi x)\ dx$

36. $\int \sin(\cos^{-1} x)\ dx$

37. $\int \sqrt{x^2 + 2241}\ \ x\ dx$

38. $\int \cos^3 x\ dx$

39. $\int \tan^3 x\ dx$

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

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

42. $\int (x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1)\ dx$

43. $\int e^x e^{5x} e^{10x} e^{10x} e^{5x} e^x\ dx$

Time for three derivatives:

44. $\dfrac{d}{dx}\left(\log x\right)^{\log x}$

45. $\dfrac{d}{dx}\left(\sqrt{x}\right)^{\sqrt{x}}$

46. $\dfrac{d}{dx}\left(\sin x\right)^{\sin x}$

Back to integrals:

47. $\displaystyle\int \sin x \cos(2x)\ dx$

48. $\displaystyle\int \sin^{-1}(\cos x)\ dx$

49. $\displaystyle\int \cos^2 x\ dx$

50. $\displaystyle\int e^x \tan e^x\ dx$