I [6] Place the answers in the blanks to the right of the question:

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

2. $\frac{dy}{dx} \sinh(x)$ _____

3. $\int e^x \cos(e^x) dx$ _____

4. $\int \frac{e}{1+ex} dx$ _____

5. $\int (\sinh x \cosh x) dx$ _____

6. $\int e^{-2x} dx$ _____

II [6] Show a step or two, even if you think you can do it within your cranium

7. $\int \frac{1}{x \ln x} dx$

8. $\int e^{\sin x} \cos x dx$

9. $\int \frac{x dx}{\sqrt{1-3x^2}}$

III [16] Do four of these, clearly indicating which ones you want marked

10. $\int \frac{\cos 2x - 1}{\cos 2x + 1} dx$

11. $\int \frac{\sin\theta}{(1+\cos\theta)(1-\cos\theta)} d\theta$

12. $\int \cosh^2 x \sinh x \, dx$

13. $\int_1^\infty \frac{1}{x} dx$

14. $\int \frac{x-1}{\sqrt{x^2-2x+1}} dx$

15. $\int x^2 \sin 2x dx$

[5] Do ONE of these, clearly indicating which one you want marked

16. $\int \frac{m^3+m+2}{m^2+2m+1} dm$

17. $\int \frac{x-2}{x(x+1)} dx$

18. $\int_0^1 x^3 \sqrt{1-x^2} \, dx$

IV [9] Do THREE of these, clearly indicating which ones you want marked.
For the first two, it is sufficient to say whether the integral converges or not (and why).

19. $\int_1^{\infty} \ln x \, dx$

20. $\int_0^3 2x^{-3} \, dx$

21. What is wrong with the argument:

$$\int_{\frac{-\pi}{4}}^{\frac{\pi}{4}} \sqrt{\sec^2 x - 1} \, dx$$

$$= \int_{\frac{-\pi}{4}}^{\frac{\pi}{4}} \sqrt{\tan^2 x} \, dx$$

$$= \int_{\frac{-\pi}{4}}^{\frac{\pi}{4}} \tan x \, dx$$

22. $\int_0^1 6x^3 e^{3x} \, dx$

= 0 because tan x is odd

V [8] Do TWO of the questions in this section

23. Using n = 4, find a trapezoidal estimate for the value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x \sin x \, dx$

24. What is the average speed of a particle that traverses the part of the curve $y = \frac{2}{3}x^{\frac{3}{2}}$ that is between the y-axis and x = 6 in a total of 2s?

25. The area bounded by $y = 2x^2$, y = 3, and x = 5 is rotated around the x=axis. Set up, but you need not evaluate, the integral for the surface area of the resulting solid.

26. The area bounded by one full loop (half a period) of the cosine function is rotated around the x-axis. Whet is the volume of the resulting solid?

27. Find the centroid of the region $y = 2\sin x$ from x = 0 to $x = \frac{\pi}{2}$

28. Compare the accuracy of the midpoint rule, the trapezoidal rule and Simpson's rule.

VI [+3] Bonus (not marked unless you have 75% above)

27. $\int_0^{\frac{\pi}{2}} \frac{2\sin x}{-\sin^2 x - \cos x - 5} dx$