

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

1.  $\int_1^{\infty} \frac{1}{x^p} dx$  diverges if \_\_\_\_\_

4.  $\int \frac{\pi}{3+2x} dx$  \_\_\_\_\_

2.  $\frac{dy}{dx} \tanh(x)$  \_\_\_\_\_

5.  $\int (\sin^2 x \cos x) dx$  \_\_\_\_\_

3.  $\int \sec^2(8x) dx$  \_\_\_\_\_

6. The flux through a pipe turned out to be proportional to what power of the radius? \_\_\_\_\_

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

7.  $\int \frac{\ln^6 u}{u} du$

8.  $\int e^{\sec x} \sec x \tan x dx$

9.  $\int \frac{xdx}{\sqrt{3x^2 - 7\pi}}$

**III [24] Do SIX of these, clearly indicating which ones you want marked**

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

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

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

next time put in a parts one beside the table one on the next page instead of three trig subs.

13.  $\int_0^1 \frac{1}{\sqrt[3]{e^x}} dx$

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

15.  $\int_0^{32} \frac{dy}{y^{\frac{1}{5}} \sqrt{1 + y^{\frac{4}{5}}}}$

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

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

**IV [6] Do TWO 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).

18.  $\int_1^{\infty} e^{-2x} dx$

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

20.  $\int_0^1 3x^3 e^{2x} dx$

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

21. Using  $n = 4$ , find a trapezoidal estimate for the value of  $\int_0^1 e^x dx$

22. How large would  $n$  have to be to compute the integral in #21 correct to .0001 using Simpson's rule?

23. A demand curve is given by  $p(x) = 1000 - .2x - .0003x^2$ . If the sales level is 900, what is the consumer surplus?

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

25. The area bounded by  $y = 2x^3$ , the  $y$ -axis and  $x = 1$  is rotated around the  $x$ -axis. Find the surface area of the resulting solid.

26. Find the centroid of the region  $y = -x^2 + 4$  bounded by its intercepts.

27. Decompose  $\frac{x+3}{x^4+5x^2}$  into partial fractions.

**VI Bonus (you should not waste time on these unless you are sure you have 75%+ above)**

28. [+3]  $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{5 \cos x}{-\cos^2 x - \sin x - 1} dx$

29. [+2] Do an additional question from part V