

Integration Problems Fun Pack !

I. Evaluate the integrals below, clearly noting which integration technique(s) you use in your solution. If the integral is improper, say so, and either give its value or say that the integral is divergent. You may only use the tables on the problems specified.

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| 1. $\int \frac{100}{36 + 25x^2} dx$ | 12. $\int_0^1 \frac{\theta + 1}{\sqrt{\theta^2 + 2\theta}} d\theta$ | 23. $\int \frac{\ln x}{x^2} dx$ |
| 2. $\int_0^{1/2\sqrt{2}} \frac{2 dx}{\sqrt{1 + 4x^2}}$ | 13. $\int_0^2 x^3 \sqrt{4x^2 - x^4} dx$, table | 24. $\int e^{2x} \cos 3x dx$ |
| 3. $\int_{-\infty}^{\infty} \cos \pi t dt$ | 14. $\int_0^{\ln \sqrt{3}} \frac{e^x dx}{1 + e^{2x}}$ | 25. $\int_0^{\infty} \frac{1}{\sqrt{x}(1+x)} dx$ |
| 4. $\int \frac{\sqrt{2y^2 - 3}}{y^2} dy$, table | 15. $\int_0^{\pi} \frac{dt}{\sqrt{t} + \sin t}$ | 26. $\int_0^{\ln 4} \frac{e^t dt}{\sqrt{e^{2t} + 9}}$ |
| 5. $\int_0^1 \frac{r^3}{\sqrt{4 + r^2}} dr$ | 16. $\int_1^{\sqrt{3}} \arctan(1/x) dx$ | 27. $\int \frac{8 dw}{w^2 \sqrt{4 - w^2}}$ |
| 6. $\int_{-1}^1 \frac{e^x}{e^x - 1} dx$ | 17. $\int_1^{\infty} \frac{\cos^2 x}{1 + x^2} dx$ | 28. $\int \frac{dx}{\sqrt{3 - 2x - x^2}}$ |
| 7. $\int \frac{\cos y}{\sin^2 y + \sin y - 6} dy$ | 18. $\int e^x \sin e^x dx$ | 29. $\int_0^{\pi} 8 \sin^4 x dx$ |
| 8. $\int_0^{\sqrt[3]{\pi^2}} \sqrt{\theta} \cos^2(\theta^{3/2}) d\theta$ | 19. $\int \sec^4 3x dx$ | 30. $\int_4^8 \frac{y dy}{y^2 - 2y - 3}$ |
| 9. $\int_1^{\infty} \frac{x}{\sqrt{1 + x^6}} dx$ | 20. $\int_0^1 \frac{dx}{(x+1)(x^2+1)}$ | 31. $\int \frac{\sqrt{x^2 - 9}}{x^3} dx$ |
| 10. $\int \frac{x^4}{\sqrt{x^{10} - 2}} dx$, table | 21. $\int_1^2 \frac{ds}{s\sqrt{s^2 - 1}}$ | 32. $\int_0^{\pi/3} \tan^5 x \sec^4 x dx$ |
| 11. $\int_{\pi/3}^{\pi/2} \frac{\sin^2 x}{\sqrt{1 - \cos x}} dx$ | 22. $\int_0^1 \frac{x^3 dx}{x^2 + 2x + 1}$ | 33. $\int_0^1 \sqrt{t^5 + 2t}(5t^4 + 2) dt$ |

II. Find the value of n required to estimate the value of the following definite integrals using the Trapezoid Rule and Simpson's Rule within 10^{-4} .

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|--------------------------|-----------------------------------|------------------------------------|
| 1. $\int_{-2}^0 x^2 - 1$ | 2. $\int_{-1}^1 \cos(x + \pi) dx$ | 3. $\int_0^3 \frac{1}{\sqrt{x+1}}$ |
|--------------------------|-----------------------------------|------------------------------------|

III. Estimate the value of the following definite integrals accurate to within 0.1. [Hint: You must use the Error Bound Theorems first in order to guarantee you have found the required n]

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|------------------------------------|--------------------------------------|--------------------------------------|
| 1. $\int_0^2 \sqrt[4]{1 + x^2} dx$ | 2. $\int_0^4 e^{\sqrt{t}} \sin t dt$ | 3. $\int_1^2 \frac{\ln x}{1 + x} dx$ |
|------------------------------------|--------------------------------------|--------------------------------------|

Integration Problems Fun Pack Answers

Section I

1. trig sub; $\frac{10}{3} \arctan \frac{5x}{6} + C$
2. trig sub; $\ln(\frac{\sqrt{6}+\sqrt{2}}{2})$
3. improper, divergent
4. table, $-\frac{\sqrt{2y^2-3}}{y} + \sqrt{2} \ln|y + \sqrt{y^2 - \frac{3}{2}}| + C$
5. parts, $(16 - 7\sqrt{5})/3$
6. improper, divergent
7. sub, then partial frac, $\frac{1}{5} \ln \left| \frac{\sin y - 2}{\sin y + 3} \right| + C$
8. sub, $\pi/3$
9. converges, compare w $\frac{1}{x^2}$
10. table, $\frac{1}{5} \ln|x^5 + \sqrt{x^{10} - 2}| + C$
11. trig, $\sqrt{\frac{3}{2}} - \frac{2}{3}$
12. improper, $\sqrt{3}$
13. table, ?
14. sub, $\pi/12$
15. improper, compare to $\frac{1}{\sqrt{t}}$, converges
16. parts, $x \arctan(1/x) + (\ln 2)/2$
17. improper, compare to $\frac{1}{x^2}$, converges
18. sub, $-\cos e^x + C$
19. trig, $\frac{\tan(3x)}{3} + \frac{\tan^3(3x)}{9} + c$
20. partial frac, $(\pi + 2 \ln 2)/8$
21. improper, trig sub, $\pi/3$
22. partial frac, $3 \ln 2 - 2$
23. parts, $-\frac{1}{x} \ln x - \frac{1}{x} + C$
24. parts, $\frac{e^{2x}}{13} (3 \sin 3x + 2 \cos 3x) + C$
25. improper x 2, π
26. sub, then trig sub; $\ln 9 - \ln(1 + \sqrt{10})$
27. trig sub, $\frac{-2\sqrt{4-w^2}}{w} + C$
28. complete square, trig sub, $\arcsin((x+1)/2) + C$
29. trig; 3π
30. partial frac, $(\ln 15)/2$
31. trig sub, $\frac{1}{6} \sec^{-1}(x/3) - \sqrt{x^2 - 9}/(2x^2) + C$
32. trig, $117/8$
33. sub, $2\sqrt{3}$

Section II

1. 116, 2
2. 82, 8
3. 130, 18

Section III

1. ?
2. ?
3. ?