

Worksheet: Integration by Parts

1. Evaluate the following indefinite integrals.

$$(1) \int x \cos 2x \, dx \quad (2) \int \frac{\ln x}{x^2} \, dx \quad (3) \int x^2 \sin x \, dx$$

$$(4) \int e^x \sin x \, dx \quad (5) \int x e^x \sin x \, dx \quad (6) \int \frac{\ln x}{\sqrt{x}} \, dx$$

$$(7) \int \arcsin x \, dx \quad (8) \int x^2 e^{3x} \, dx \quad (9) \int (\ln x)^2 \, dx$$

$$(10) \int \arctan x \, dx \quad (11) \int x \sec^{-1} x \, dx \quad (12) \int e^{2x} \cos x \, dx$$

$$(13) \int \arccos x \, dx \quad (14) \int e^{\sqrt{x}} \, dx \quad (15) \int x \arctan x \, dx$$

$$(16) \int \sec^{-1} x \, dx \quad (17) \int e^x \sin x \, dx \quad (18) \int \sin(\ln x) \, dx$$

$$(19) \int \sec^2 \sqrt{x} \, dx \quad (20) \int x \sec^2 x \, dx \quad (21) \int x^2 e^{-x} \, dx$$

$$(22) \int x^n \ln x \, dx \quad (23) \int x^3 3^x \, dx \quad (24) \int \frac{\ln x}{x^5} \, dx$$

$$(25) \int x^3 \ln 5x \, dx \quad (26) \int x^3 \cos(x^2) \, dx \quad (27) \int \sin(\sqrt{x}) \, dx$$

ANSWERS

1. $\frac{1}{2}x \sin 2x + \frac{1}{4} \cos 2x + C$
2. $-\frac{1}{x} - \left(\frac{\ln x}{x}\right) + C$
3. $(2 - x^2) \cos x + 2x \sin x + C$
4. $\frac{e^x}{2}(\sin x - \cos x) + C$
5. $\frac{e^x}{2}(\cos x + x \sin x - x \cos x) + C$
6. $2(\ln |x| - 2)\sqrt{x} + C$
7. $x \arcsin x + \sqrt{1 - x^2} + C$
8. $\frac{1}{27}(9x^2 - 6x + 2)e^{3x} + C$
9. $2(\ln^2 x - 2 \ln x + 2) + C$
10. $x \arctan x - \frac{1}{2} \ln(1 + x^2) + C$
11. $\frac{1}{2}x^2 \sec^{-1} x - \frac{1}{2}\sqrt{x^2 - 1} + C$
12. $\frac{1}{5}e^{2x}(2 \cos x + \sin x) + C$
13. $x \arccos x - \sqrt{1 - x^2} + C$
14. $2(\sqrt{x} - 1)e^{\sqrt{x}} + C$
15. $\frac{1}{2}(x^2 + 1) \arctan x - \frac{1}{2}x + C$
16. $x \sec^{-1} x - \ln |x + \sqrt{x^2 - 1}| + C$
17. $\frac{1}{5}e^x(\sin 2x - 2 \cos 2x) + C$
18. $\frac{1}{2}x(\sin(\ln |x|) - \cos(\ln |x|)) + C$
19. $2\sqrt{x} \tan \sqrt{x} - 2 \ln |\sec \sqrt{x}| + C$
20. $x \tan x + \ln |\cos x| + C$
21. $-e^{-x}(x^2 + 2x + 2) + C$
22. $\frac{1}{n+1}x^{n+1} \ln |x| - \frac{1}{(n+1)^2}x^{n+1} + C$
23. $3^x\left(\frac{x^3}{\ln 3} - \frac{3x^2}{\ln^2 3} + \frac{6x}{\ln^3 3} - \frac{6}{\ln^4 3}\right) + C$
24. $-\frac{\ln |x|}{4x^4} - \frac{1}{16x^4} + C$
25. $\frac{x^4}{4} \ln 5x - \frac{1}{16}x^4 + C$
26. $\frac{1}{2}x^2 \sin(x^2) + \frac{1}{2} \cos(x^2) + C$
27. $-2\sqrt{x} \cos \sqrt{x} + 2 \sin \sqrt{x} + C$