Evaluate the integral.

19. $\int_{-1}^{2} (x^3 - 2x)\,dx$

21. $\int_{1}^{4} (5 - 2t + 3t^2)\,dt$

23. $\int_{1}^{9} \sqrt{x}\,dx$

25. $\int_{\pi/6}^{\pi} \sin\theta\,d\theta$

27. $\int_{0}^{1} (u + 2)(u - 3)\,du$

29. $\int_{1}^{9} \frac{x - 1}{\sqrt{x}}\,dx$

31. $\int_{0}^{\pi/4} \sec^2 t\,dt$

33. $\int_{1}^{2} (1 + 2y)^2\,dy$

35. $\int_{1}^{2} \frac{v^3 + 3v^6}{v^4}\,dv$

37. $\int_{0}^{1} (x^e + e^x)\,dx$

39. $\int_{1/\sqrt{3}}^{\sqrt{3}} \frac{8}{1 + x^2}\,dx$

41. $\int_{-1}^{1} e^{u+1}\,du$

43. $\int_{0}^{\pi} f(x)\,dx$ where $f(x) = \begin{cases} \sin x & \text{if } 0 \le x < \pi/2 \\ \cos x & \text{if } \pi/2 \le x \le \pi \end{cases}$

(19) $\frac{x^4}{4} - \frac{\cancel{2}x^2}{\cancel{2}}\Big|_{-1}^{2} = \left(\frac{(2)^4}{4} - (2)^2\right) - \left(\frac{(-1)^4}{4} - (-1)^2\right)$

$= (4-4) - \left(\frac{1}{4} - 1\right)$

$= 0 - (-3/4) = 3/4$

---

(21) $5t - \frac{\cancel{2}t^2}{\cancel{2}} + \frac{\cancel{3}t^3}{\cancel{3}}\Big|_{1}^{4} = \left(5(4) - (4)^2 + (4)^3\right) - \left(5(1) - (1)^2 + (1)^3\right)$

$= (20 - 16 + 64) - (5 - 1 + 1)$

$= 68 - 5 = 63$

---

(23) $\frac{x^{3/2}}{3/2}\Big|_{1}^{9} = \frac{2}{3}(9)^{3/2} - \frac{2}{3}(1)^{3/2} = 18 - \frac{2}{3} = 17\frac{1}{3}$

$-\cos\theta\Big|_{\pi/6}^{\pi} = (-\cos\pi) - (-\cos\pi/6) = (1) - \left(-\frac{\sqrt{3}}{2}\right)$

$= 1 + \frac{\sqrt{3}}{2}$

---

(27) $\int_0^1 u^2 - u - 6 \, du = \frac{u^3}{3} - \frac{u^2}{2} - 6u\Big|_0^1$

$= \left(\frac{1}{3}(1)^3 - \frac{1}{2}(1)^2 - 6(1)\right) - (0)$

$= \frac{1}{3} - \frac{1}{2} - 6 = \frac{2}{6} - \frac{3}{6} - \frac{36}{6} = \frac{-37}{6}$

---

(29) $\int_1^9 \frac{x}{x^{1/2}} - \frac{1}{x^{1/2}} \, dx = \int_1^9 x^{1/2} - x^{-1/2} \, dx = \frac{x^{3/2}}{3/2} - \frac{x^{1/2}}{1/2}\Big|_1^9$

$= \left(\frac{2}{3}(9)^{3/2} - 2(9)^{1/2}\right) - \left(\frac{2}{3}(1)^{3/2} - 2(1)^{1/2}\right)$

$= \left(\frac{2}{3}\cdot 27 - 6\right) - \left(\frac{2}{3} - 2\right) = (12) - \left(-\frac{4}{3}\right) = \frac{40}{3}$

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(31) $\int_0^{\pi/4} \sec^2(t)\, dt = \tan t\,\Big]_0^{\pi/4} = \tan\pi/4 - \tan 0 = 1 - 0 = 1$

(33) $\int_1^2 (1+2y)^2\,dy = \int_1^2 (1+2y+2y+4y^2)\,dy = \int_1^2 1+4y+4y^2\,dy$

$= y + \frac{4y^2}{2} + \frac{4y^3}{3}\Big]_1^2 = y + 2y^2 + \frac{4}{3}y^3\Big]_1^2$

$= (2 + 2(2)^2 + \frac{4}{3}(2)^3) - (1 + 2(1)^2 + \frac{4}{3}(1)^3)$

$= 2 + 8 + \frac{32}{3} - 1 - 2 - \frac{4}{3}$

$= 7 + \frac{28}{3} = \frac{21}{3} + \frac{28}{3} = \frac{49}{3}$

---

(35) $\int_1^2 \frac{v^3+3v^6}{v^4}\,dv = \int_1^2 \frac{v^3}{v^4} + \frac{3v^6}{v^4}\,dv = \int_1^2 \frac{1}{v} + 3v^2\,dv$

$= \ln|v| + v^3\Big]_1^2 = (\ln 2 + 8) - (\ln 1 - 1) = \ln(2) + 7$

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(37) $\int_0^1 (x^e + e^x)\,dx = \frac{x^{e+1}}{e+1} + e^x\Big]_0^1$

$= \left(\frac{1^{e+1}}{e+1} + e^1\right) - (0 + e^0) = \frac{1}{e+1} + e - 1$

---

(39) $\int_{1/\sqrt{3}}^{\sqrt{3}} \frac{8}{1+x^2}\,dx = 8\int_{1/\sqrt{3}}^{\sqrt{3}} \frac{\cancel{8}\,1}{1+x^2}\,dx = 8\arctan x\Big]_{1/\sqrt{3}}^{\sqrt{3}}$

$= 8\arctan\sqrt{3} - 8\arctan 1/\sqrt{3} = 8\cdot\pi/3 - 8\,\pi/6 = 8\,\pi/6 = \frac{4\pi}{3}$

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(41) $\int_{-1}^1 e^{u+1}\,du = e^{u+1}\Big]_{-1}^1 = e^2 - e^0 = e^2 - 1$

31 $\tan(t)\Big|_0^{\pi/4} = \tan\frac{\pi}{4} - \tan 0 = \frac{\sqrt{2}}{2} - 0 = \frac{\sqrt{2}}{2}$

43 $$\int_0^{\pi/2} \sin x \, dx + \int_{\pi/2}^{\pi} \cos x \, dx$$

$$= -\cos x \Big|_0^{\pi/2} + \sin x \Big|_{\pi/2}^{\pi}$$

$$= \left[\left(-\cos \tfrac{\pi}{2}\right) - \left(-\cos 0\right)\right] + \left[\left(\sin \pi\right) - \left(\sin \tfrac{\pi}{2}\right)\right]$$

$$= (0 - (-1)) + (0 - 1)$$

$$= 1 - 1 = \boxed{0}$$