



◇「콘텐츠산업 진흥법 시행령」제33조에 의한 표시

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3) 이 콘텐츠는 「콘텐츠산업 진흥법」에 따라 최초 제작일부터 5년간 보호됩니다.

◇「콘텐츠산업 진흥법」외에도「저작권법」에 의하여 보호되는 콘텐츠의 경우, 그 콘텐츠의 전부 또는 일부를 무단으로 복제하거나 전송하는 것은 콘텐츠산업 진흥법 외에도 저작권법에 의한 법적 책임을 질 수 있습니다.

01 정적분의 뜻

(1) 정적분의 정의

닫힌구간 $[a, b]$ 에서 연속인 함수 $f(x)$ 의 한 부정적분을 $F(x)$ 라 할 때,

$$\int_a^b f(x)dx = [F(x)]_a^b = F(b) - F(a)$$

이것을 $f(x)$ 의 a 에서 b 까지의 정적분이라 한다.

(2) 정적분의 기본 정의

$$\textcircled{1} \int_a^a f(x)dx = 0$$

$$\textcircled{2} \int_a^b f(x)dx = - \int_b^a f(x)dx$$

■ 다음 정적분의 값을 구하여라.

$$1. \int_0^2 3dx$$

$$2. \int_1^2 xdx$$

$$3. \int_{-1}^3 (2x+4)dx$$

$$4. \int_0^4 (5x+4)dx$$

$$5. \int_1^2 3x^2 dx$$

$$6. \int_1^0 (x^2 + x) dx$$

$$7. \int_{-1}^2 (3x^2 + 1) dx$$

$$8. \int_{-2}^1 (3y^2 - 1) dy$$

$$9. \int_2^2 (6x^2 - 2) dx$$

$$10. \int_1^{-2} (3x^2 - 4x) dx$$

$$11. \int_3^1 (3x^2 + 6x) dx$$

$$12. \int_1^{-2} (2x - 3x^2) dx$$

$$13. \int_2^2 (x^2 + 2x + 3) dx$$

$$14. \int_1^2 (2t^2 + 3t - 1) dt$$

$$15. \int_1^{-2} (6x^2 + 2x - 5) dx$$

$$16. \int_1^2 x^3 dx$$

$$17. \int_0^{-1} (x^3 - 4x) dx$$

$$18. \int_1^3 (4x^3 + 2x) dx$$

$$19. \int_3^1 (4x^3 - 3x^2 - 2x) dx$$

$$20. \int_1^2 (2x^3 - 3x^2 + 2x - 4) dx$$

$$21. \int_0^1 3x^4 dx$$

$$22. \int_0^1 10x^4 dx$$

$$23. \int_0^{-1} 10x^4 dx$$

$$24. \int_{-1}^0 x(x-4) dx$$

$$25. \int_0^2 (x+1)(x-1) dx$$

$$26. \int_1^3 (x-1)(x+2) dx$$

$$27. \int_0^1 (x-1)(x^2 + x + 1) dx$$

$$28. \int_8^8 (x-1)^8 dx$$

02 정적분과 미분의 관계

닫힌구간 $[a, b]$ 에서 연속인 함수 $f(x)$ 에 대하여

$$\frac{d}{dx} \int_a^x f(t) dt = f(x) \quad (\text{단, } a < x < b)$$

▣ 다음을 구하여라.

$$29. \frac{d}{dx} \int_1^x (t^2 - 2t) dt$$

$$30. \frac{d}{dx} \int_1^x (-t^2 + 4t) dt$$

$$31. \frac{d}{dx} \int_0^x (2t^2 + 3t - 1) dt$$

$$32. \frac{d}{dx} \int_{-1}^x (t^3 - 5t^2 + 6) dt$$

$$33. \frac{d}{dx} \int_{-1}^x (2t^3 + 4t^2 - 1) dt$$

$$34. \frac{d}{dx} \int_2^x (-t^3 + 4t + 2) dt$$

$$37. \int_{-1}^1 (x^2 + 1) dx - \int_{-1}^1 x^2 dx$$

$$38. \int_0^2 (1 + x^2) dx + \int_2^0 (1 - x^2) dx$$

$$39. \int_0^1 (2x - x^2) dx + \int_0^1 (2x + x^2) dx$$

$$40. \int_1^3 (x - 1)^2 dx - \int_3^1 2x dx$$

$$41. \int_{-1}^3 (3x^2 + x - 2) dx - \int_{-1}^3 (x + 3) dx$$

$$42. \int_0^1 (x + 1)^2 dx + \int_1^0 (x - 1)^2 dx$$

$$43. \int_1^3 (x + 1)^2 dx - \int_1^3 (x - 1)^2 dx$$

$$44. \int_0^1 (x + 2)^2 dx - \int_0^1 (x - 2)^2 dx$$

$$45. \int_{-2}^1 (2x^2 + 6) dx - 2 \int_{-2}^1 (x^2 - x + 3) dx$$

03 정적분의 성질

두 함수 $f(x)$, $g(x)$ 가 세 실수 a , b , c 를 포함하는 구간에서 연속일 때,

$$(1) \int_a^b kf(x) dx = k \int_a^b f(x) dx \quad (\text{단, } k \text{는 실수})$$

$$(2) \int_a^b \{f(x) + g(x)\} dx = \int_a^b f(x) dx + \int_a^b g(x) dx$$

$$(3) \int_a^b \{f(x) - g(x)\} dx = \int_a^b f(x) dx - \int_a^b g(x) dx$$

$$(4) \int_a^c f(x) dx + \int_c^b f(x) dx = \int_a^b f(x) dx \quad (a, b, c \text{의 대소에 관계없이 성립한다.})$$

■ 다음 정적분의 값을 구하여라.

$$35. \int_{-1}^2 (2x - 1) dx - \int_{-1}^2 (2x + 1) dx$$

$$36. \int_{-1}^3 (2x - 3) dx - \int_{-1}^3 (-2x + 3) dx$$

$$46. \int_1^2 (x^2 - 2x) dx + \int_1^2 (2x^2 + 2x + 1) dx$$

$$47. \int_0^3 x(x-2) dx + \int_0^3 (y^2 + 2y) dy$$

$$48. \int_0^1 (2x - x^2) dx + \int_0^1 (2x + x^2) dx$$

$$49. \int_{-1}^0 (x^3 - 3x^2 + 2x) dx + \int_0^{-1} (x^3 - 3x^2 - 2x) dx$$

$$50. \int_1^3 (2x+1)^3 dx + \int_1^3 (1-2x)^3 dx$$

■ 다음 정적분의 값을 구하여라.

$$51. \int_{-1}^0 (3x+2) dx + \int_0^2 (3x+2) dx$$

$$52. \int_0^2 (9x+4) dx + \int_2^4 (9x+4) dx$$

$$53. \int_0^1 (x^2+1) dx + \int_1^3 (x^2+1) dx$$

$$54. \int_{-2}^1 (3x^2+1) dx + \int_1^3 (3x^2+1) dx$$

$$55. \int_1^2 (x^2+x) dx - \int_3^2 (t^2+t) dt$$

$$56. \int_0^2 (x-1)^2 dx - \int_3^2 (x-1)^2 dx$$

$$57. \int_0^1 (x+1)^2 dx - \int_3^1 (x+1)^2 dx$$

$$58. \int_0^2 x(3x-2) dx - \int_3^2 x(3x-2) dx$$

$$59. \int_{-2}^{-1} (x^2-4x+5) dx + \int_{-1}^1 (y^2-4y+5) dy$$

$$60. \int_{-2}^1 (x^3-x) dx + \int_1^2 (x^3-x) dx$$

$$61. \int_{-2}^1 (4x^3+2) dx + \int_1^2 (4x^3+2) dx$$

$$62. \int_0^2 (x^3-2x^2) dx + \int_2^1 (x^3-2x^2) dx$$

$$63. \int_{-1}^2 (4x^3-6x-1) dx - \int_3^2 (4x^3-6x-1) dx$$

64. $\int_{-1}^0 (x^3 - 3x^2 + 2x) dx + \int_0^{-1} (x^3 - 3x^2 + 2x) dx$

65. $\int_{-1}^2 (5x^4 - 6x - 1) dx - \int_3^2 (5x^4 - 6x - 1) dx$

66. $\int_1^2 (3x^2 - 2x) dx + \int_2^3 (3x^2 - 2x) dx$
 $+ \int_3^4 (3x^2 - 2x) dx$



정답 및 해설

1) 6

$$\Rightarrow \int_0^2 3dx = [3x]_0^2 = 6 - 0 = 6$$

2) $\frac{3}{2}$

$$\Rightarrow \int_1^2 xdx = \left[\frac{1}{2}x^2\right]_1^2 = 2 - \frac{1}{2} = \frac{3}{2}$$

3) 24

$$\Rightarrow \int_{-1}^3 (2x+4)dx = [x^2+4x]_{-1}^3 = (9+12) - (1-4) = 24$$

4) 56

$$\Rightarrow \int_0^4 (5x+4)dx = \left[\frac{5}{2}x^2+4x\right]_0^4 = 40+16=56$$

5) 7

$$\Rightarrow \int_1^2 3x^2dx = [x^3]_1^2 = 8-1=7$$

6) $-\frac{5}{6}$

$$\Rightarrow \int_1^0 (x^2+x)dx = \left[\frac{1}{3}x^3+\frac{1}{2}x^2\right]_1^0 = 0 - \left(\frac{1}{3}+\frac{1}{2}\right) = -\frac{5}{6}$$

7) 12

$$\Rightarrow \int_{-1}^2 (3x^2+1)dx = [x^3+x]_{-1}^2 = (8+2) - (-1-1) = 12$$

8) 6

$$\Rightarrow \int_{-2}^1 (3y^2-1)dy = [y^3-y]_{-2}^1 = (1-1) - (-8+2) = 6$$

9) 0

$$\Rightarrow \int_2^2 (6x^2-2)dx = 0$$

10) -15

$$\Rightarrow \int_1^{-2} (3x^2-4x)dx = [x^3-2x^2]_1^{-2} = (-8-8) - (1-2) = -16+1 = -15$$

11) -50

$$\Rightarrow \int_3^1 (3x^2+6x)dx = [x^3+3x^2]_3^1 = (1+3) - (27+27) = -50$$

12) 12

$$\Rightarrow \int_1^{-2} (2x-3x^2)dx = [x^2-x^3]_1^{-2} = (4+8) - (1-1) = 12$$

13) 0

$$\Rightarrow \int_2^2 (x^2+2x+3)dx = 0$$

14) $\frac{49}{6}$

$$\begin{aligned} \Rightarrow \int_1^2 (2t^2+3t-1)dt &= \left[\frac{2}{3}t^3+\frac{3}{2}t^2-t\right]_1^2 \\ &= \left(\frac{16}{3}+6-2\right) - \left(\frac{2}{3}+\frac{3}{2}-1\right) \\ &= \frac{49}{6} \end{aligned}$$

15) 0

$$\begin{aligned} \Rightarrow \int_1^{-2} (6x^2+2x-5)dx &= -\int_{-2}^1 (6x^2+2x-5)dx \\ &= -[2x^3+x^2-5x]_{-2}^1 \\ &= -\{(2+1-5) - (-16+4+10)\} \\ &= 0 \end{aligned}$$

16) $\frac{15}{4}$

$$\Rightarrow \int_1^2 x^3dx = \left[\frac{1}{4}x^4\right]_1^2 = 4 - \frac{1}{4} = \frac{15}{4}$$

17) $-\frac{7}{4}$

$$\begin{aligned} \Rightarrow \int_0^{-1} (x^3-4x)dx &= -\int_{-1}^0 (x^3-4x)dx \\ &= -\left[\frac{1}{4}x^4-2x^2\right]_{-1}^0 = -\left\{0 - \left(\frac{1}{4}-2\right)\right\} = -\frac{7}{4} \end{aligned}$$

18) 88

$$\begin{aligned} \Rightarrow \int_1^3 (4x^3+2x)dx &= [x^4+x^2]_1^3 = (81+9) - (1+1) \\ &= 88 \end{aligned}$$

19) -46

$$\begin{aligned} \Rightarrow \int_3^1 (4x^3-3x^2-2x)dx &= -\int_1^3 (4x^3-3x^2-2x)dx \\ &= -[x^4-x^3-x^2]_1^3 \\ &= -\{(81-27-9) - (1-1-1)\} \\ &= -46 \end{aligned}$$

20) $-\frac{1}{2}$

$$\begin{aligned} \Rightarrow \int_1^2 (2x^3 - 3x^2 + 2x - 4) dx &= \left[\frac{1}{2}x^4 - x^3 + x^2 - 4x \right]_1^2 \\ &= \left(\frac{1}{2} \cdot 2^4 - 2^3 + 2^2 - 4 \cdot 2 \right) - \left(\frac{1}{2} - 1 + 1 - 4 \right) = -\frac{1}{2} \end{aligned}$$

$$21) \frac{3}{5}$$

$$\Rightarrow \int_0^1 3x^4 dx = \left[\frac{3}{5}x^5 \right]_0^1 = \frac{3}{5}$$

$$22) 2$$

$$\Rightarrow \int_0^1 10x^4 dx = [2x^5]_0^1 = 2 - 0 = 2$$

$$23) -2$$

$$\Rightarrow \int_0^{-1} 10x^4 dx = [2x^5]_0^{-1} = -2$$

$$24) \frac{7}{3}$$

$$\begin{aligned} \Rightarrow \int_{-1}^0 x(x-4) dx &= \int_{-1}^0 (x^2 - 4x) dx \\ &= \left[\frac{1}{3}x^3 - 2x^2 \right]_{-1}^0 = 0 - \left(-\frac{1}{3} - 2 \right) = \frac{7}{3} \end{aligned}$$

$$25) \frac{2}{3}$$

$$\begin{aligned} \Rightarrow \int_0^2 (x+1)(x-1) dx &= \int_0^2 (x^2 - 1) dx \\ &= \left[\frac{1}{3}x^3 - x \right]_0^2 = \frac{8}{3} - 2 = \frac{2}{3} \end{aligned}$$

$$26) \frac{26}{3}$$

$$\begin{aligned} \Rightarrow \int_1^3 (x-1)(x+2) dx &= \int_1^3 (x^2 + x - 2) dx = \left[\frac{1}{3}x^3 + \frac{1}{2}x^2 - 2x \right]_1^3 \\ &= \left(\frac{1}{3} \cdot 3^3 + \frac{1}{2} \cdot 3^2 - 2 \cdot 3 \right) - \left(\frac{1}{3} + \frac{1}{2} - 2 \right) = \frac{26}{3} \end{aligned}$$

$$27) -\frac{3}{4}$$

$$\begin{aligned} \Rightarrow \int_0^1 (x-1)(x^2+x+1) dx &= \int_0^1 (x^3-1) dx \\ &= \left[\frac{1}{4}x^4 - x \right]_0^1 = \frac{1}{4} - 1 = -\frac{3}{4} \end{aligned}$$

$$28) 0$$

$$\Rightarrow \int_8^8 (x-1)^8 dx = 0$$

$$29) x^2 - 2x$$

$$\Rightarrow \frac{d}{dx} \int_1^x (t^2 - 2t) dt = x^2 - 2x$$

$$30) -x^2 + 4x$$

$$\Rightarrow \frac{d}{dx} \int_1^x (-t^2 + 4t) dt = -x^2 + 4x$$

$$31) 2x^2 + 3x - 1$$

$$\Rightarrow \frac{d}{dx} \int_0^x (2t^2 + 3t - 1) dt = 2x^2 + 3x - 1$$

$$32) x^3 - 5x^2 + 6$$

$$\Rightarrow \frac{d}{dx} \int_{-1}^x (t^3 - 5t^2 + 6) dt = x^3 - 5x^2 + 6$$

$$33) 2x^3 + 4x^2 - 1$$

$$\Rightarrow \frac{d}{dx} \int_{-1}^x (2t^3 + 4t^2 - 1) dt = 2x^3 + 4x^2 - 1$$

$$34) -x^3 + 4x + 2$$

$$\Rightarrow \frac{d}{dx} \int_2^x (-t^3 + 4t + 2) dt = -x^3 + 4x + 2$$

$$35) -6$$

$$\begin{aligned} \Rightarrow \int_{-1}^2 (2x-1) dx - \int_{-1}^2 (2x+1) dx \\ &= \int_{-1}^2 \{(2x-1) - (2x+1)\} dx \\ &= \int_{-1}^2 -2 dx = [-2x]_{-1}^2 = -4 - 2 = -6 \end{aligned}$$

$$36) -8$$

$$\begin{aligned} \Rightarrow \int_{-1}^3 (2x-3) dx - \int_{-1}^3 (-2x+3) dx \\ &= \int_{-1}^3 \{(2x-3) - (-2x+3)\} dx \\ &= \int_{-1}^3 (4x-6) dx \\ &= [2x^2 - 6x]_{-1}^3 \\ &= 0 - 8 = -8 \end{aligned}$$

$$37) 2$$

$$\begin{aligned} \Rightarrow \int_{-1}^1 (x^2+1) dx - \int_{-1}^1 x^2 dx &= \int_{-1}^1 \{(x^2+1) - x^2\} dx \\ &= \int_{-1}^1 1 dx = [x]_{-1}^1 = 2 \end{aligned}$$

$$38) \frac{16}{3}$$

$$\begin{aligned} \Rightarrow \int_0^2 (1+x^2) dx + \int_2^0 (1-x^2) dx \\ &= \int_0^2 (1+x^2) dx - \int_0^2 (1-x^2) dx \\ &= \int_0^2 \{(1+x^2) - (1-x^2)\} dx \end{aligned}$$

$$= \int_0^2 2x^2 dx = \left[\frac{2}{3} x^3 \right]_0^2 = \frac{16}{3}$$

39) 2

$$\Rightarrow \int_0^1 (2x - x^2) dx + \int_0^1 (2x + x^2) dx$$

$$= \int_0^1 \{(2x - x^2) + (2x + x^2)\} dx$$

$$= \int_0^1 4x dx = [2x^2]_0^1 = 2 - 0 = 2$$

40) $\frac{32}{3}$

$$\Rightarrow \int_1^3 (x-1)^2 dx - \int_3^1 2x dx$$

$$= \int_1^3 (x-1)^2 dx + \int_1^3 2x dx$$

$$= \int_1^3 \{(x^2 - 2x + 1) + 2x\} dx$$

$$= \int_1^3 (x^2 + 1) dx = \left[\frac{1}{3} x^3 + x \right]_1^3$$

$$= (9 + 3) - \left(\frac{1}{3} + 1 \right) = \frac{32}{3}$$

41) 8

$$\Rightarrow \int_{-1}^3 (3x^2 + x - 2) dx - \int_{-1}^3 (x + 3) dx$$

$$= \int_{-1}^3 (3x^2 + x - 2 - x - 3) dx$$

$$= \int_{-1}^3 (3x^2 - 5) dx = [x^3 - 5x]_{-1}^3 = 12 - 4 = 8$$

42) 2

$$\Rightarrow \int_0^1 (x+1)^2 dx + \int_1^0 (x-1)^2 dx$$

$$= \int_0^1 (x^2 + 2x + 1) dx - \int_0^1 (x^2 - 2x + 1) dx$$

$$= \int_0^1 (x^2 + 2x + 1 - x^2 + 2x - 1) dx$$

$$= \int_0^1 4x dx = [2x^2]_0^1 = 2$$

43) 16

$$\Rightarrow \int_1^3 (x+1)^2 dx - \int_1^3 (x-1)^2 dx$$

$$= \int_1^3 \{(x+1)^2 - (x-1)^2\} dx$$

$$= \int_1^3 4x dx = [2x^2]_1^3 = 18 - 2 = 16$$

44) 4

$$\Rightarrow \int_0^1 (x+2)^2 dx - \int_0^1 (x-2)^2 dx$$

$$= \int_0^1 \{(x+2)^2 - (x-2)^2\} dx$$

$$= \int_0^1 8x dx = [4x^2]_0^1 = 4$$

45) -3

$$\Rightarrow \int_{-2}^1 (2x^2 + 6) dx - 2 \int_{-2}^1 (x^2 - x + 3) dx$$

$$= \int_{-2}^1 (2x^2 + 6) dx - \int_{-2}^1 (2x^2 - 2x + 6) dx$$

$$= \int_{-2}^1 (2x^2 + 6 - 2x^2 + 2x - 6) dx$$

$$= \int_{-2}^1 2x dx = [x^2]_{-2}^1$$

$$= 1 - 4 = -3$$

46) 8

$$\Rightarrow \int_1^2 (x^2 - 2x) dx + \int_1^2 (2x^2 + 2x + 1) dx$$

$$= \int_1^2 (3x^2 + 1) dx = [x^3 + x]_1^2$$

$$= 10 - 2 = 8$$

47) 18

$$\Rightarrow \int_0^3 x(x-2) dx + \int_0^3 (y^2 + 2y) dy$$

$$= \int_0^3 (x^2 - 2x) dx + \int_0^3 (x^2 + 2x) dx$$

$$= \int_0^3 (x^2 - 2x + x^2 + 2x) dx$$

$$= \int_0^3 2x^2 dx = \left[\frac{2}{3} x^3 \right]_0^3$$

$$= 18$$

48) 2

$$\Rightarrow \int_0^1 (2x - x^2) dx + \int_0^1 (2x + x^2) dx$$

$$= \int_0^1 \{(2x - x^2) + (2x + x^2)\} dx$$

$$= \int_0^1 4x dx = [2x^2]_0^1 = 2$$

49) -2

$$\Rightarrow \int_{-1}^0 (x^3 - 3x^2 + 2x) dx + \int_0^{-1} (x^3 - 3x^2 - 2x) dx$$

$$= \int_{-1}^0 (x^3 - 3x^2 + 2x) dx - \int_{-1}^0 (x^3 - 3x^2 - 2x) dx$$

$$= \int_{-1}^0 \{(x^3 - 3x^2 + 2x) - (x^3 - 3x^2 - 2x)\} dx$$

$$= \int_{-1}^0 4x dx = [2x^2]_{-1}^0 = 0 - 2 = -2$$

50) 212

$$\begin{aligned} &\Rightarrow \int_1^3 (2x+1)^3 dx + \int_1^3 (1-2x)^3 dx \\ &= \int_1^3 (24x^2+2) dx = [8x^3+2x]_1^3 \\ &= 222-10=212 \end{aligned}$$

51) $\frac{21}{2}$

$$\begin{aligned} &\Rightarrow \int_{-1}^0 (3x+2) dx + \int_0^2 (3x+2) dx \\ &= \int_{-1}^2 (3x+2) dx = \left[\frac{3}{2}x^2 + 2x \right]_{-1}^2 \\ &= 10 - \left(-\frac{1}{2} \right) = \frac{21}{2} \end{aligned}$$

52) 88

$$\begin{aligned} &\Rightarrow \int_0^2 (9x+4) dx + \int_2^4 (9x+4) dx \\ &= \int_0^4 (9x+4) dx = \left[\frac{9}{2}x^2 + 4x \right]_0^4 = 72 + 16 = 88 \end{aligned}$$

53) 12

$$\begin{aligned} &\Rightarrow \int_0^1 (x^2+1) dx + \int_1^3 (x^2+1) dx = \int_0^3 (x^2+1) dx \\ &= \left[\frac{1}{3}x^3 + x \right]_0^3 = (9+3) - 0 = 12 \end{aligned}$$

54) 40

$$\begin{aligned} &\Rightarrow \int_{-2}^1 (3x^2+1) dx + \int_1^3 (3x^2+1) dx \\ &= \int_{-2}^3 (3x^2+1) dx = [x^3+x]_{-2}^3 = 30 - (-10) = 40 \end{aligned}$$

55) $\frac{38}{3}$

$$\begin{aligned} &\Rightarrow \int_1^2 (x^2+x) dx - \int_3^2 (t^2+t) dx \\ &= \int_1^2 (x^2+x) dx - \int_3^2 (x^2+x) dx \\ &= \int_1^2 (x^2+x) dx + \int_2^3 (x^2+x) dx = \int_1^3 (x^2+x) dx \\ &= \left[\frac{1}{3}x^3 + \frac{1}{2}x^2 \right]_1^3 = \left(9 + \frac{9}{2} \right) - \left(\frac{1}{3} + \frac{1}{2} \right) = \frac{38}{3} \end{aligned}$$

56) 3

$$\begin{aligned} &\Rightarrow \int_0^2 (x-1)^2 dx - \int_3^2 (x-1)^2 dx \\ &= \int_0^2 (x-1)^2 dx + \int_2^3 (x-1)^2 dx \\ &= \int_0^3 (x-1)^2 dx = \int_0^3 (x^2-2x+1) dx \\ &= \left[\frac{1}{3}x^3 - x^2 + x \right]_0^3 = (9-9+3) - 0 = 3 \end{aligned}$$

57) 21

$$\begin{aligned} &\Rightarrow \int_0^1 (x+1)^2 dx - \int_3^1 (x+1)^2 dx \\ &= \int_0^1 (x+1)^2 dx + \int_1^3 (x+1)^2 dx \\ &= \int_0^3 (x+1)^2 dx \\ &= \int_0^3 (x^2+2x+1) dx \\ &= \left[\frac{1}{3}x^3 + x^2 + x \right]_0^3 \\ &= 9+9+3=21 \end{aligned}$$

58) 18

$$\begin{aligned} &\Rightarrow \int_0^2 x(3x-2) dx - \int_3^2 x(3x-2) dx \\ &= \int_0^2 (3x^2-2x) dx - \int_3^2 (3x^2-2x) dx \\ &= \int_0^2 (3x^2-2x) dx + \int_2^3 (3x^2-2x) dx \\ &= \int_0^3 (3x^2-2x) dx = [x^3-x^2]_0^3 \\ &= 27-9=18 \end{aligned}$$

59) 24

$$\begin{aligned} &\Rightarrow \int_{-2}^{-1} (x^2-4x+5) dx + \int_{-1}^1 (y^2-4y+5) dy \\ &= \int_{-2}^{-1} (x^2-4x+5) dx + \int_{-1}^1 (x^2-4x+5) dx \\ &= \int_{-2}^1 (x^2-4x+5) dx = \left[\frac{1}{3}x^3 - 2x^2 + 5x \right]_{-2}^1 \\ &= \frac{10}{3} - \left(-\frac{62}{3} \right) = 24 \end{aligned}$$

60) 0

$$\begin{aligned} &\Rightarrow \int_{-2}^1 (x^3-x) dx + \int_1^2 (x^3-x) dx \\ &= \int_{-2}^2 (x^3-x) dx = \left[\frac{1}{4}x^4 - \frac{1}{2}x^2 \right]_{-2}^2 \\ &= (4-2) - (4-2) = 0 \end{aligned}$$

61) 8

$$\begin{aligned} &\Rightarrow \int_{-2}^1 (4x^3+2) dx + \int_1^2 (4x^3+2) dx \\ &= \int_{-2}^2 (4x^3+2) dx \\ &= [x^4+2x]_{-2}^2 = (16+4) - (16-4) = 8 \end{aligned}$$

62) $-\frac{5}{12}$

$$\Rightarrow \int_0^2 (x^3-2x^2) dx + \int_2^1 (x^3-2x^2) dx$$

$$\begin{aligned}
 &= \int_0^1 (x^3 - 2x^2) dx \\
 &= \left[\frac{1}{4}x^4 - \frac{2}{3}x^3 \right]_0^1 \\
 &= \frac{1}{4} - \frac{2}{3} = -\frac{5}{12}
 \end{aligned}$$

63) 52

$$\begin{aligned}
 &\Rightarrow \int_{-1}^2 (4x^3 - 6x - 1) dx - \int_3^2 (4x^3 - 6x - 1) dx \\
 &= \int_{-1}^2 (4x^3 - 6x - 1) dx + \int_2^3 (4x^3 - 6x - 1) dx \\
 &= \int_{-1}^3 (4x^3 - 6x - 1) dx = [x^4 - 3x^2 - x]_{-1}^3 \\
 &= (81 - 27 - 3) - (1 - 3 + 1) = 51 + 1 = 52
 \end{aligned}$$

64) 0

$$\begin{aligned}
 &\Rightarrow \int_{-1}^0 (x^3 - 3x^2 + 2x) dx + \int_0^{-1} (x^3 - 3x^2 + 2x) dx \\
 &= \int_{-1}^{-1} (x^3 - 3x^2 + 2x) dx = 0
 \end{aligned}$$

65) 216

$$\begin{aligned}
 &\Rightarrow \int_{-1}^2 (5x^4 - 6x - 1) dx - \int_3^2 (5x^4 - 6x - 1) dx \\
 &= \int_{-1}^2 (5x^4 - 6x - 1) dx + \int_2^3 (5x^4 - 6x - 1) dx \\
 &= \int_{-1}^3 (5x^4 - 6x - 1) dx \\
 &= [x^5 - 3x^2 - x]_{-1}^3 \\
 &= 213 - (-3) = 216
 \end{aligned}$$

66) 48

$$\begin{aligned}
 &\Rightarrow \int_1^2 (3x^2 - 2x) dx + \int_2^3 (3x^2 - 2x) dx \\
 &+ \int_3^4 (3x^2 - 2x) dx = \int_1^4 (3x^2 - 2x) dx \\
 &= [x^3 - x^2]_1^4 \\
 &= (64 - 16) - (1 - 1) \\
 &= 48
 \end{aligned}$$