3-3 Applied Calculus Solutions

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For problems 1-10, find the indicated antiderivative.

1. $\int \left(x^3 - 14x + 5\right)dx$

$\frac{x^3}{3} - 14\frac{x^2}{2} + 5x + C$

3. $\int 12.3dy$

$12.3y + C$

5. $\int e^P dP$

$e^P + C$

7. $\int \frac{1}{x}dx$

$\ln|x| + C$

9. $\int (x-2)(x+2)dx$

$$\int (x-2)(x+2)dx = \int (x^2-4)dx$$

$$= \boxed{\frac{x^3}{3} - 4x + C}$$

For problems 11-18, find an antiderivative of the integrand and use the Fundamental Theorem to evaluate the definite integral.

11. $\int_2^5 3x^2 \, dx$

$$\left[(3)\frac{x^3}{3}\right]_2^5 = [x^3]_2^5 = 5^3 - 2^3 = 125 - 8 = \boxed{117}$$

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

$$\left[\frac{x^3}{3} + 4\frac{x^2}{2} - 3x\right]_1^3 = \left[\frac{x^3}{3} + 2x^2 - 3x\right]_1^3$$

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

$$= (9 + 18 - 9) - \left(\frac{1}{3} + 2 - 3\right) = (18) - \left(-\frac{2}{3}\right) = \boxed{\frac{56}{3}}$$

15. $\int_{25}^{100} \sqrt{x} \, dx$

$$\int_{25}^{100} x^{1/2}dx = \left[\frac{x^{1/2+1}}{1/2+1}\right]_{25}^{100} = \left[\frac{x^{\frac{3}{2}}}{\frac{3}{2}}\right]_{25}^{100} = \left[\frac{2x^{\frac{3}{2}}}{3}\right]_{25}^{100}$$

$$= \left[\frac{2(\sqrt{x})^3}{3}\right]_{25}^{100} = \left(\frac{2\left(\sqrt{100}\right)^3}{3}\right) - \left(\frac{2\left(\sqrt{25}\right)^3}{3}\right)$$

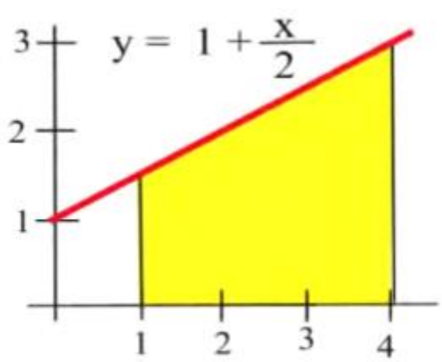
$$= \left(\frac{2(10)^3}{3}\right) - \left(\frac{2(5)^3}{3}\right) = \left(\frac{2000}{3}\right) - \left(\frac{250}{3}\right) = \boxed{\frac{1750}{3}}$$

17. $\displaystyle\int_1^{10} \frac{1}{x^2}\,dx$

$$\int_1^{10} x^{-2}dx = \left[\frac{x^{-2+1}}{-2+1}\right]_1^{10} = \left[\frac{x^{-1}}{-1}\right]_1^{10}$$

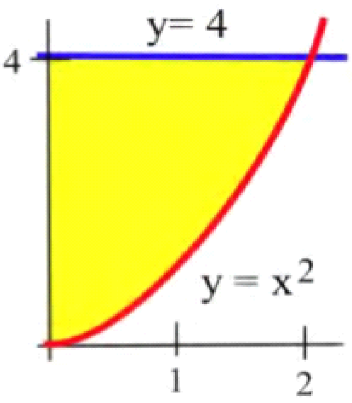
$$= \left[-\frac{1}{x}\right]_1^{10} = \left(-\frac{1}{10}\right) - \left(-\frac{1}{1}\right) = -\frac{1}{10} + 1 = \boxed{\frac{9}{10}}$$

For problems 19 - 21 find the area shown in the figure.

19. 

$$\text{Area} = \int_1^4\left(1+\frac{x}{2}\right)dx = \left[x+\frac{x^2}{4}\right]_1^4 = \left(4+\frac{4^2}{4}\right) - \left(1+\frac{1^2}{4}\right)$$

$$= (4+4) - \left(1+\frac{1}{4}\right) = 8 - \frac{5}{4} = \boxed{\frac{27}{4}}$$

21. 

Area $= \int_0^2 (4 - x^2)dx = \left[4x - \frac{x^3}{3}\right]_0^2 = \left(4(2) - \frac{2^3}{3}\right) - \left(4(0) - \frac{0^3}{3}\right)$

$= 8 - \frac{8}{3} = \boxed{\frac{16}{3}}$

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