

3-3 Applied Calculus Solutions

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For problems 1-10, find the indicated antiderivative.

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

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

3. $\int 12.3 dy$

$$12.3y + C$$

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.

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

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

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

$$\begin{aligned} \left[\frac{x^3}{3} + 4 \frac{x^2}{2} - 3x \right]_1^3 &= \left[\frac{x^3}{3} + 2x^2 - 3x \right]_1^3 \\ &= \left(\frac{3^3}{3} + 2(3)^2 - 3(3) \right) - \left(\frac{1^3}{3} + 2(1)^2 - 3(1) \right) \\ &= (9 + 18 - 9) - \left(\frac{1}{3} + 2 - 3 \right) = (18) - \left(-\frac{2}{3} \right) = \boxed{\frac{56}{3}} \end{aligned}$$

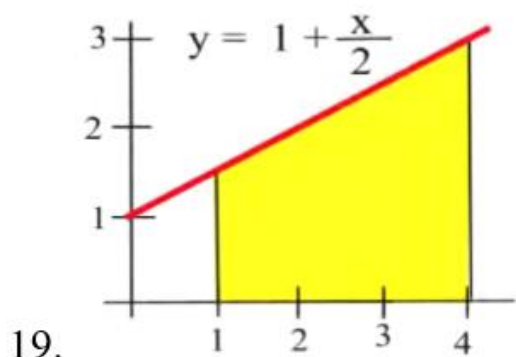
$$15. \int_{25}^{100} \sqrt{x} \, dx$$

$$\begin{aligned}
 \int_{25}^{100} x^{1/2} dx &= \left[\frac{x^{1/2+1}}{1/2+1} \right]_{25}^{100} = \left[\frac{x^{3/2}}{3/2} \right]_{25}^{100} = \left[\frac{2x^{3/2}}{3} \right]_{25}^{100} \\
 &= \left[\frac{2(\sqrt{x})^3}{3} \right]_{25}^{100} = \left(\frac{2(\sqrt{100})^3}{3} \right) - \left(\frac{2(\sqrt{25})^3}{3} \right) \\
 &= \left(\frac{2(10)^3}{3} \right) - \left(\frac{2(5)^3}{3} \right) = \left(\frac{2000}{3} \right) - \left(\frac{250}{3} \right) = \boxed{\frac{1750}{3}}
 \end{aligned}$$

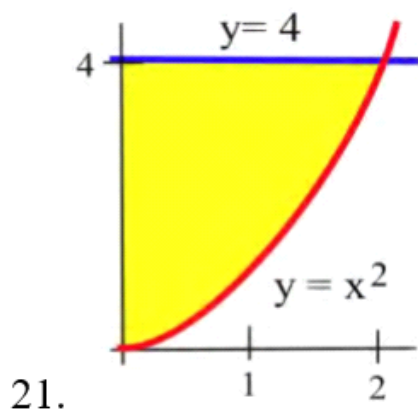
17. $\int_1^{10} \frac{1}{x^2} dx$

$$\begin{aligned}
 \int_1^{10} x^{-2} dx &= \left[\frac{x^{-2+1}}{-2+1} \right]_1^{10} = \left[\frac{x^{-1}}{-1} \right]_1^{10} \\
 &= \left[-\frac{1}{x} \right]_1^{10} = \left(-\frac{1}{10} \right) - \left(-\frac{1}{1} \right) = -\frac{1}{10} + 1 = \boxed{\frac{9}{10}}
 \end{aligned}$$

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



$$\begin{aligned}
 \text{Area} &= \int_1^4 \left(1 + \frac{x}{2} \right) dx = \left[x + \frac{x^2}{4} \right]_1^4 = \left(4 + \frac{4^2}{4} \right) - \left(1 + \frac{1^2}{4} \right) \\
 &= (4 + 4) - \left(1 + \frac{1}{4} \right) = 8 - \frac{5}{4} = \boxed{\frac{27}{4}}
 \end{aligned}$$



$$\begin{aligned}\text{Area} &= \int_0^2 (4 - x^2) dx = \left[4x - \frac{x^3}{3} \right]_0^2 = \left(4(2) - \frac{2^3}{3} \right) - \left(4(0) - \frac{0^3}{3} \right) \\ &= 8 - \frac{8}{3} = \boxed{\frac{16}{3}}\end{aligned}$$

These solutions were created by Donald R. Goral from exercises in *Applied Calculus, Edition 1*
by Shana Calaway, Dale Hoffman, David Lippman

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