(3) **1.** Let $f''(x) = 20x^3 - 18x + 4$. Find $f(x)$, given $f'(1) = 3$ and $f(1) = 4$.

2. Evaluate the following integrals.

(4) (a) $\displaystyle\int \left(\sec(x) + \frac{1}{\sqrt[4]{x^5}} + \frac{5}{\sec(3x)} - \pi^5\right)\, dx$

(4) (b) $\displaystyle\int \frac{(\tan x)(x^2 - x\cot x)}{x^2}\, dx$

(4) (c) $\displaystyle\int (e^{7x} - 2x^6)\sqrt[3]{e^{7x} - 2x^7}\, dx$

(4) (d) $\displaystyle\int x^2 e^{3x}\, dx$

(4) (e) $\displaystyle\int_2^4 |x-3|\, dx$

(4) (f) $\displaystyle\int \frac{\ln\sqrt{5x+1}}{5x+1}\, dx$

(4) (g) $\displaystyle\int \frac{x^3 - 4x^2 + 3x + 1}{x^2 - 3x}\, dx$

(4) (h) $\displaystyle\int_0^{\pi/2} (2x+1)\sin(x)\, dx$

(4) **3.** Find the area of the region enclosed by $f(x) = x^2 - 6x + 5$ and $g(x) = -x^2 + 4x - 3$.

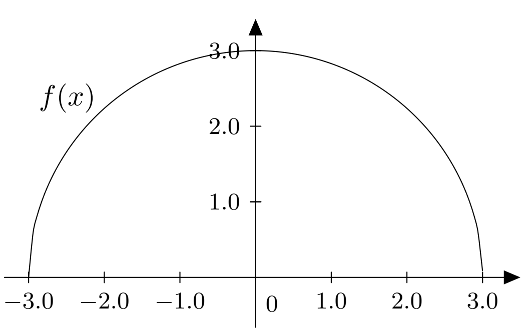
(4) **4.** Given that $\displaystyle\int_1^6 f(x)\, dx = 7$, $\displaystyle\int_1^{12} f(x)\, dx = 3$ and $\displaystyle\int_3^{12} f(x)\, dx = -4$, find $\displaystyle\int_3^6 f(x)\, dx$.

(5) **5.** Given the supply function $p(x) = x + 3$ and the demand function $p(x) = \sqrt{144 - 16x}$

(a) Find the equilibrium point.

(b) Determine the producers' surplus.

(5) **6.** (a) The function $f(x) = \sqrt{9 - x^2}$ represents the semicircle shown below. Use it to evaluate $\displaystyle\int_0^3 \sqrt{9 - x^2}\, dx$.



(b) Find an approximation to the integral $\int_0^3 \sqrt{9-x^2}\,dx$ using a Riemann sum with right endpoints and $n = 3$. Round your answer to 4 decimal places.

(c) When using a Riemann sum to approximate the area under a curve as in the above question, how can the accuracy of the approximation be improved?

(4) **7.** Evaluate the following limits, if possible.

(a) $\lim_{x\to\pi} \dfrac{\sec(x)+1}{x-\pi}$

(b) $\lim_{x\to 0^+} \dfrac{e^{1/x}}{1/x}$

(4) **8.** Solve the differential equation for y, given, $\dfrac{dy}{dx} = \dfrac{x}{x^2y+y}$ with initial condition $y(0) = -4$.

(4) **9.** The rate of change in price P of a carbon tax charged to travelers flying overseas is proportional to the square root of its price. If the initial price is \$81 and the price after two years is \$196, what will the price be after four years?

(8) **10.** Determine whether the following improper integrals converge or diverge. If an integral converges, find its value.

(a) $\int_1^5 \dfrac{2x}{\sqrt{x^2-1}}\,dx$

(b) $\int_2^\infty \dfrac{1}{x\ln x}\,dx$

(2) **11.** Determine if the sequence $a_n = \left(\dfrac{-2}{3}\right)^{2n-1}$ is convergent or divergent. If it is convergent, find its limit.

(4) **12.** Determine whether the series $\sum_{n=0}^{\infty} \dfrac{4+3^n}{5^n}$ converges or diverges. If it converges, find its sum.

(2) **13.** If $\lim_{n\to\infty} a_n = 0$, what can you conclude, if anything, about the series $\sum_{n=1}^{\infty} a_n$?

(14) **14.** Determine whether the following series converge or diverge. Justify your answers. In the case of a convergent geometric or telescoping series, find its sum.

(a) $\sum_{n=3}^{\infty} \dfrac{2}{n(n-2)}$

(b) $\sum_{n=2}^{\infty} \dfrac{n^{e-1} - \sqrt[3]{n^2}}{n^3}$

(c) $\displaystyle\sum_{n=1}^{\infty} \frac{n \cdot 2^n}{(n+1)!}$

(d) $\displaystyle\sum_{n=1}^{\infty} \frac{(-5)^{n+1}}{4^n}$

(5) **15.** A deposit of \$300 is made every 3 months for a period of 15 years in an account that pays an annual interest rate of 6% compounded quarterly. Find the total balance in this account at the end of 15 years.

Answers

1. $f(x) = x^5 - 3x^3 + 2x^2 + 3x + 1$

2. (a) $\ln|\sec x + \tan x| - \dfrac{4}{\sqrt[4]{x}} + \dfrac{5}{3}\sin(3x) - \pi^5 x + C$

(b) $\ln|\sec x| - \ln|x| + C$

(c) $\dfrac{3}{28}(e^{7x} - 2x^7)^{4/3} + C$

(d) $\dfrac{1}{3}x^2e^{3x} - \dfrac{2}{9}xe^{3x} + \dfrac{2}{27}e^{3x} + C$

(e) 1

(f) $\dfrac{1}{5}(\ln\sqrt{5x+1})^2 + C$

(g) $\dfrac{1}{2}x^2 - x - \dfrac{1}{3}\ln|x| + \dfrac{1}{3}\ln|x-3| + C$

(h) 3

3. 9

4. 0

5. (a) $(5, 8)$

(b) \$12.50

6. (a) $\dfrac{9}{4}\pi$

(b) 5.0645

(c) The accuracy may be improved by increasing the number of retangles n.

7. (a) 0, Convergent

(b) ∞ , Divergent

8. $-\sqrt{\ln|x^2+1| + 16}$

9. \$361.00

10. (a) $2\sqrt{24}$

(b) ∞, Divergent

11. 0, Convergent

12. $\dfrac{15}{2}$, Convergent

13. You can't conclude anything about the convergence or divergence of the series.

14. (a) $\frac{3}{2}$, Convergent (Telescoping series)

(b) Convergent (p-series)

(c) Convergent (by Ratio test)

(d) Divergent (G-series $r = -\frac{5}{4}$)

15. \$29 297.36