

1. [18] Evaluate each integral.

(a)  $\int_0^4 |2x - 5| dx$

(b)  $\int_0^\pi x^2 \sin x dx$

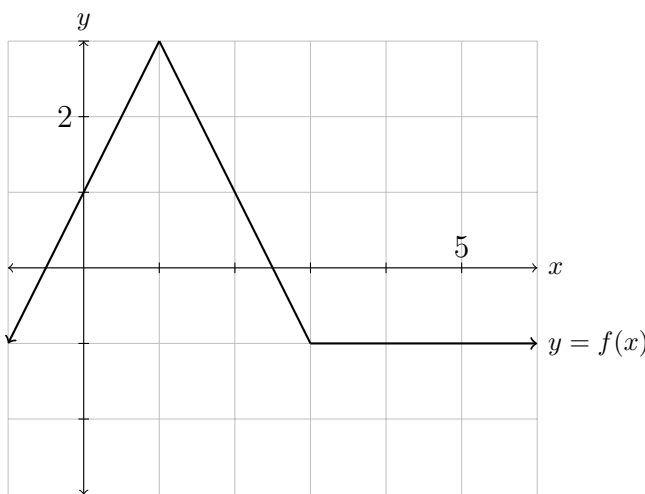
(c)  $\int \frac{6x^4 + 8x^3 - 8x^2 - x + 4}{x^2 + 2x} dx$

(d)  $\int \frac{\sec x \tan x}{(1 + \sec x)^{2/3}} dx$

2. [3] The graph of  $f$  is given below. Find

(a)  $\int_0^6 f(x) dx$ .

(b)  $\int_3^3 f(x) dx$ .



3. [5] The supply function for a deluxe JAC hoodie is  $p = 2x^2 + 4x$  while the demand function is  $p = -2x + 108$ .

- Find the equilibrium point.
- Sketch (roughly) and label the regions that represent the consumers' surplus and the producers' surplus.
- Determine the producers' surplus if the market price is set at the equilibrium price.

4. [4] Solve the differential equation  $x^2 \frac{dy}{dx} = \frac{x+3}{y}$  with condition  $y(1) = -4$ .

5. [5] Evaluate the limit or explain why it does not exist.

(a)  $\lim_{x \rightarrow \infty} \frac{x}{\ln x}$

(b)  $\lim_{x \rightarrow 0} \frac{xe^x - \sin x}{1 - \cos x}$

6. [2] Find an expression  $a_n$  for the general term of the sequence

$$\left\{ \frac{4}{1}, \frac{8}{4}, \frac{16}{7}, \frac{32}{10}, \frac{64}{13}, \dots \right\}$$

7. [3] Assume that  $\lim_{n \rightarrow \infty} a_n = 4$ . Mark each of the following as convergent or divergent. Justify your answers. If convergent, find the limit/sum.

(a) The sequence  $\frac{1}{a_n}$ .

(b) The sequence  $(-1)^n a_n$ .

(c) The series  $\sum_{n=1}^{\infty} a_n$ .

8. [3] For each sequence, find the limit or explain why it diverges.

(a)  $a_n = \frac{n^2}{n^2 + 1}$

(b)  $a_n = \frac{(-1)^n}{n^2 + 1}$

9. [10] Evaluate each improper integral.

(a)  $\int_1^{\infty} x^2 e^{1-x^3} dx$

(b)  $\int_0^1 \frac{\ln x}{x} dx$

10. [9] Determine the convergence or divergence of the following series. Mention any test you use. In the case of a convergent geometric or telescoping series, find the sum.

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

(b)  $\sum_{n=1}^{\infty} \frac{n!}{(3n)!}$

- (c)  $\sum_{n=0}^{\infty} \frac{5^{n+1}}{2^{3n}}$
11. [3] The JAC Calculus II teachers have decided to save money for a post-pandemic trip to Greece. \$20 is put into a savings account once per week, and the savings account pays 2% annual interest, compounded weekly. How much is in the account after five years?
- (b) Divergent
10. (a) Converges to  $\frac{9}{2}$  (telescoping)  
 (b) Convergent (ratio test)  
 (c) Converges to  $\frac{40}{3}$  (geometric)
11. \$5469.89

## ANSWERS

1. (a)  $\frac{17}{2}$   
 (b)  $\pi^2 - 4$   
 (c)  $-3 \ln|x+2| + 2 \ln|x| + 2x^3 - 2x^2 + C$   
 (d)  $3\sqrt[3]{\sec x + 1} + C$
2. (a) 1  
 (b) 0
3. (a) (6, 96)  
 (b)  
 (c) \$360
4.  $y = -\sqrt{22 + 2 \ln|x| - \frac{6}{x}}$
5. (a)  $\infty$   
 (b) 2
6.  $\frac{2^{n+1}}{3n-2}$
7. (a)  $\frac{1}{4}$  (used a limit law)  
 (b) Divergent (oscillating)  
 (c) Divergent (Test for Divergence)
8. (a) 1  
 (b) 0
9. (a)  $\frac{1}{3}$