1. Evaluate the integral
\[ \int_{-3}^{0} (1 + \sqrt{9 - x^2}) \, dx \]
by interpreting it as the area of a region involving basic geometric figures.
(a) \( \frac{9\pi}{4} \)  
(b) \( 3 + 9\pi \)  
(c) \( 3 + \frac{9\pi}{4} \)
(d) \( 9 + 3\pi \)  
(e) \( \frac{3\pi}{4} \)  
(f) \( 9 + \frac{3\pi}{4} \)

2. Evaluate the integral
\[ \int_{0}^{3} \frac{x + 4}{x^2 + 8x + 1} \, dx \]
(a) 0  
(b) \( \frac{1}{2} \ln 34 \)  
(c) \( \ln 49 \)  
(d) \( \frac{1}{34} \)  
(e) \( \frac{1}{49} \)  
(f) \( \ln 34 - \frac{1}{2} \)

3. What is the equation of the line tangent to the graph of \( y^3 + 3x^2y^2 + 2x^3 = 4 \) at the point \((1, -1)\)?
(a) \( y = -1 \)  
(b) \( y = x - 2 \)  
(c) \( y = 2x - 3 \)
(d) \( y = 3x - 4 \)  
(e) \( y = 4x - 5 \)  
(f) \( y = 5x - 6 \)

4. A particle moves in such a way that its distance from the origin at time \( t \) is given by \( x(t) = 2\sqrt{t^2 + 4} \). If \( v(t) \) is the velocity of the particle at time \( t \), what is \( \lim_{t \to \infty} v(t) \)?
(a) 2  
(b) \( \frac{1}{2} \)  
(c) \( \frac{1}{4} \)  
(d) \( \frac{1}{\sqrt{2}} \)  
(e) 0  
(f) \( \infty \)

5. What are the global maximum and minimum values of the function \( f(x) = \frac{x}{1 + x^2} \)?
(a) 2 and \(-2\)  
(b) 1 and \(-1\)  
(c) \( \frac{1}{2} \) and \(-\frac{1}{2}\)
(d) 2 and 0  
(e) 4 and \(-4\)  
(f) \( \infty \) and \(-\infty \)
6. The region bounded by the curve \( y = 2\sqrt{x} \), the \( x \)-axis, and the line \( x = 4 \) is revolved about the \( x \)-axis, creating a solid. What is the volume of the solid?
(a) \( 32\pi \)  
(b) \( \frac{32\pi}{3} \)  
(c) \( 64\pi \)  
(d) \( \frac{64\pi}{3} \)  
(e) \( 72\pi \)  
(f) \( \frac{72\pi}{3} \)

7. A stock market analyst sold a monthly newsletter to 320 subscribers at a price of $10 each. She discovered that for each $0.25 increase in the monthly price of the newsletter, she would lose 2 subscriptions. If she sets the price of the newsletters to bring in the greatest total monthly income, what will that income be?
(a) $3200  
(b) $4400  
(c) $5000  
(d) $5800  
(e) $6500  
(f) $7200

8. What is \( \lim_{x \to 1} \frac{x^2 + 2x - 3}{x - 1} \)?
(a) 0  
(b) 1  
(c) 2  
(d) 3  
(e) 4  
(f) does not exist.

9. Water is draining from a conical tank at the rate of 18 cubic feet per minute. The tank has a height of 10 feet and the radius at the top is 5 feet. How fast (in feet per minute) is the water level changing when the depth is 6 feet? (Note: The volume of a cone of radius \( r \) and height \( h \) is \( \pi r^2 h/3 \).)
(a) \( \frac{1}{\pi} \)  
(b) \( \frac{2}{\pi} \)  
(c) \( \frac{3}{\pi} \)  
(d) \( -\frac{1}{\pi} \)  
(e) \( -\frac{2}{\pi} \)  
(f) \( -\frac{3}{\pi} \)
10. Suppose
\[ \int_0^x f(x) \, dx + 2 \sin x = 4x. \]
What is the value of \( f(\pi) \)?
(a) 2  (b) 4  (c) 6  (d) \( 2\pi \)  (e) \( 4\pi \)  (f) \( 6\pi \)

11. Compute \( \int_1^2 3^x \, dx \).
(a) \( \frac{7}{2} \)  (b) \( e^3 \)  (c) \( 3 \ln 6 \)  (d) \( \frac{6}{\ln 3} \)  (e) 6  (f) \( \frac{\ln 3}{6} \)

12. What is the total area enclosed between the graphs of \( y = 4x^3 + 3x^2 - 1 \) and \( y = 3x^2 + 4x - 1 \) ?
(a) 1  (b) 2  (c) 3  (d) 4  (e) 5  (f) 6

Answers

1. C
2. B
3. E
4. A
5. C
6. A
7. C
8. E
9. E
10. C
11. D
12. B