1 Evaluate \( \lim_{{x \to -2}} \frac{x^2 + 6x + 3}{x^2 - 3x + 9} \). Express your answer in simplified form.

2 Evaluate the possibly infinite limit

\[
\lim_{{x \to -\infty}} \frac{1 - x - x^2}{8x^2 - 8x}
\]

Express your answer in simplified form.

3 Let \( f(t) = 2t^{1/2} + t^{-1/2} \). Find \( \frac{df(t)}{dt} \) at \( t = 4 \). Express your answer in simplified form.

4 Differentiate the function \( y(x) = \frac{\theta^x}{5 + 9x} \) and express your answer explicitly in terms of elementary functions.
5 Differentiate the function \( f(x) = 2x \cos(x) \).

Express your answer in terms of elementary functions.

6 Find an equation of the tangent line to the curve \( y = -2 \sin(x) - \sin^2(x) \) at the point \( (0, 0) \).

Express your answer in the form \( y = ax + \beta \) where \( a \) and \( \beta \) are in simplified form.

7 Suppose that \( y \) is a differentiable function of \( x \) defined in a neighborhood of \( x = 2 \) and that \( y \) is given implicitly by \( x^2 y + 5y + x \cos(y) = 3x - 4 \).

Evaluate \( \frac{dy}{dx} \) when \( x = 2 \) and \( y = 0 \). Express your answer in simplified form.

8 Let \( f(t) = (5 + 2t)^5 \). Express \( \frac{d^2}{dt^2} f(t) \) in the form \( a(5 + 2t)^\beta \) where \( a \) and \( \beta \) are rational numbers in simplified form.
9 Let \( f(x) = \ln\left(7e^{-2x} + 5xe^{3x}\right) \). Express \( \frac{df(x)}{dx} \) in terms of elementary functions.

10 A particle moves along the curve \( y = \sqrt[3]{9 + x^2} \). As it reaches the point \((3, 6)\), the \( y \) coordinate is increasing at a rate of 4. How fast is the \( x \) coordinate of the particle changing at that instant?

11 Find the absolute maximum value of \( f(x) \) on the given closed interval.

\[ f(x) = -5x^2 + 20x + 3, \ [1, 4] \]

12 Evaluate the possibly infinite limit \( \lim_{t \to 0^+} \frac{e^t - 1}{t^6} \).

Express your answer in simplified form.
13 Express in simplified form the value of \[ \int_{1}^{15} \frac{30 + u^2}{u^3} \, du \, . \]

14 Express the indefinite integral in terms of elementary functions. Use the symbol \( C \) to denote an arbitrary constant.

\[ \int x \left( 1 + 4x^4 \right) \, dx \]

15 Express in simplified form the value of

\[ \int_{0}^{1} x^2 \left( 1 - 2x^3 \right)^2 \, dx \, . \]

16 Find the area of the bounded region enclosed by the graphs of \( y = x^2 - 5x - 1 \), \( y = -5x + 3 \), \( x = 0 \) and \( x = 1 \) given that the first two graphs intersect at the points \( \{-3, 13\} \) and \( \{2, -7\} \).
1. $\frac{-5}{19}$
2. $\frac{-1}{8}$
3. $\frac{7}{16}$
4. $\frac{9x^8 - 4e^x}{(5+9x)^2}$
   $y'(x) = \frac{9x^8 - 4e^x}{(5+9x)^2}$
   $\frac{dy}{dx} = \frac{9x^8 - 4e^x}{(5+9x)^2}$
5. $f(x) = 2\cos(x) - 2x\sin(x)$
   $f'(x) = 2\cos(x) - 2x\sin(x)$
6. $y = -2x$
   $y(x) = -2x$
7. $\frac{2}{9}$
8. $80(5+2)^3$
9. $\frac{(-14e^{2x} + 5e^{3x} + 15e^{3x})}{(7e^{2x} + 5e^{3x})}$
10. $\frac{16}{9}$
11. $-3$
12. $\infty$
13. $\frac{224 + \ln(15)}{15}$
14. $\frac{1}{2}x^2 + \frac{2}{3}x + C$
15. $\frac{1}{9}$
16. $\frac{11}{3}$