1. ANS: -1
2. ANS: 6
3. ANS: \( \frac{x}{\sqrt{1+x^3}} \)
4. ANS: \( s(t) = \frac{3t^2}{2} + t - 4 \)
5. \[
\int \left( \frac{t^3}{4} + \frac{4}{\sqrt{t}} \right) \, dt = \frac{t^4}{16} + t + C \\
\int (e^x + 3) \, dx = e^x + 3x + C \\
\int 3x^{-1} \, dx = 3 \ln |x| + C
\]
6. Evaluate the following integrals:
\[
\int_0^2 (2x - 3) \, dx = -2 \\
\int_{-1}^2 \left( 4x + \frac{2}{x^2} \right) \, dx = 3
\]
7. Given the curves \( y = x^2 + 1 \) and \( y = 1 - x \)
   (a) 
   (b) \( x = -1 \) and \( x = 0 \)
   (c) \[
   \int_{-1}^0 \left[ (1 - x) - (x^2 + 1) \right] \, dx = \frac{1}{6}
   \]
8. Rewrite the following improper integral with limits.
\[
\int_0^3 \frac{2}{x^2 - 1} \, dx = \lim_{t \to 1^-} \int_0^t \frac{2}{x^2 - 1} \, dx + \lim_{t \to 1^+} \frac{2}{x^2 - 1} \, dx
\]
9. Given the region bounded by \( y = e^x, \, x = 0, \, x = 2 \) and \( y = 0 \)
   (a) 
   (b) \[ \int_0^2 e^x \, dx \]
   (c) \[ \int_0^2 \pi (e^x)^2 \, dx = \int_0^2 \pi e^{2x} \, dx \]
10. Given the curve \( y = 2x - x^2 \) on the interval \( 0 \leq x \leq 2 \).
    (a) \[ s = \int_0^2 \sqrt{1 + (2 - 2x)^2} \, dx \]
(b) \[ S = \int_{0}^{2} 2\pi \left(2x - x^2\right) \sqrt{1 + (2 - 2x)^2} \, dx \]

11. Given the function \( f(x) = x^2 \)
   
   (a) \( f_{\text{ave}} = \frac{4}{3} \)
   
   (b) \( x^* = \frac{2}{\sqrt{3}} \)

12. \( x-y \) equation is \( y = 2x + 2 \) and direction of motion is up and to the right.

13. \( x = 2 - 6t \quad y = 3 - 2t \quad 0 \leq t \leq 1 \)

14. rectangular coordinates are \( (3\sqrt{3}, 3) \).

15. equation in polar:
   
   \[ 9r^2 \cos (\theta) \sin (\theta) = 4 \]

16. Given the curve
   
   \[ \begin{cases} x = t^3 - 4t \\ y = t^2 - 3 \end{cases} \]
   
   (a) \( \frac{dy}{dx} = \frac{2t}{3t^2-4} \)
   
   (b) Slope of the tangent line at \( t = -1 \) is 2.
   
   (c) Slope of the tangent line at \( t = 1 \) is -2.
   
   (d) Slope of the tangent line at \( (0,1) \) is \( \frac{1}{2} \).
   
   (e) ANS: Vertical when \( t = \frac{2}{\sqrt{3}} \) and \( t = -\frac{2}{\sqrt{3}} \); Horizontal when \( t = 0 \).

17. The conic section is a parabola and standard form is: \( (y - 2)^2 = x + 2 \) or \( (y - 2)^2 = 4\left(\frac{1}{4}\right)(x + 2) \)