1. Given $\int_{-1}^{2} f(x) \, dx = 5$ and $\int_{-1}^{2} g(x) \, dx = -3$, find $\int_{-1}^{2} [f(x) + 2g(x)] \, dx$.

2. Use the Fundamental Theorem of Calculus Part I to evaluate the following integral:

$$\int_{1}^{4} (x^2 - 2x) \, dx =$$

3. Use the Fundamental Theorem of Calculus Part II, find the derivative:

$$\frac{d}{dx} \int_{2}^{x} \frac{t}{\sqrt{1 + t^3}} \, dt$$

4. A particle moves along an $x$-axis with velocity $v(t) = 3t + 1$. If we also know that $s(2) = 4$, find the position function of the particle.

5. Evaluate the following integrals:

$$\int \left( \frac{t^3}{4} + \frac{4}{\sqrt{t}} \right) \, dt$$

$$\int (e^x + 3) \, dx$$

$$\int 3x^{-1} \, dx$$

6. Evaluate the following integrals:

$$\int_{0}^{2} (2x - 3) \, dx$$

$$\int_{-1}^{2} \left( 4x + \frac{2}{x^2} \right) \, dx$$

7. Given the curves $y = x^2 + 1$ and $y = 1 - x$

   (a) Make a sketch of the region, shading in the area of interest and labeling your curves.
   (b) Determine the intersection points of the two given curves.
   (c) Set-up and the integral(s) needed to find the area between the two curves.

8. Rewrite the following improper integral with limits.

$$\int_{0}^{3} \frac{2}{x^2 - 1} \, dx$$

9. Given the region bounded by $y = e^x$, $x = 0$, $x = 2$ and $y = 0$
(a) (Assume graph of curves \( y = e^x \) is given) Shade in the area of interest on the graph given below.

(b) Set-up but do not evaluate the integral(s) needed to compute the area of the region.

(c) Set-up but do not evaluate the integral(s) needed to compute the volume of the solid formed by revolving the given region about the \( x \)-axis.

10. Given the curve \( y = 2x - x^2 \) on the interval \( 0 \leq x \leq 2 \).

(a) Set-up but do not evaluate the integral(s) needed to compute the arc length.

(b) Set-up but do not evaluate the integral(s) needed to compute the surface area of the surface of revolution if the given curve is revolved about the \( x \)-axis.

11. Given the function \( f(x) = x^2 \)

(a) Find \( f_{\text{ave}} \) of \( f \) over the interval \( [0, 2] \)

(b) Find a point \( x^* \) in \( [0, 2] \) such that \( f(x^*) = f_{\text{ave}} \).

12. Sketch the plane curve defined by the parametric equations \( x = -1 + t \quad y = 2t \) on the axes below AND find a corresponding \( x-y \) equation for the curve. Be sure to indicate the direction of motion on your sketch.

13. Find parametric equations describing the line segment from \((2,3)\) to \((-4,1)\).

14. Find the rectangular coordinates for the polar point \((-6, \frac{5\pi}{6})\).

15. Express the given equation in polar:

\[ 9xy = 4 \]

16. Given the curve

\[
\begin{cases}
x = t^3 - 4t \\
y = t^2 - 3
\end{cases}
\]

(a) Find the equation for the slope of the tangent line to the curve at any given point. 
This is a function of \( t \)!

(b) Find the slope of the tangent line at \( t = -1 \).

(c) Find the slope of the tangent line at \( t = 1 \).

(d) Find the slope of the tangent line at \((0,3)\).

(e) For what \( t \) values does the curve have vertical or horizontal tangent lines?

17. Given the equation \( x = y^2 - 4y + 2 \), identify the conic section and write the equation in standard form.