1. Integrate.

(a) \[
10 \int_0^3 t^2 \sqrt{1 + t} \, dt
\]

(b) \[
10 \int x \arctan x \, dx
\]

(c) \[
10 \int_0^{\pi/2} \sin^3 2\theta \, d\theta
\]
2. Integrate.

(a) \[ 10 \int \frac{x^3}{\sqrt{1 - x^2}} \, dx \]

(b) \[ 10 \int \frac{4x}{x^2 - 4x + 8} \, dx \]

(c) \[ 10 \int \frac{4x^2 + 5x + 3}{x(x+1)^2} \, dx \]
3. Consider the region bounded by the graphs of \( y = x^2 \) and \( y = x + 2 \). Carefully sketch the region. Find the volume of the solid generated by rotating the region about the line \( y = -1 \).

4. Consider the region between the graph of \( y = e^x \) and the \( x \)-axis for \( x \in [0, 1] \). Carefully sketch the region. Find the volume of the solid generated by rotating the region about the \( y \)-axis.
5. **10** Consider the area between the graphs of the functions \( y = x^2 \) and \( y = x \) for \( x \in [0, 2] \). Carefully sketch the graphs and find the area.

6. **10** Calculate the work (in joules) required to pump all of the mystery fluid of density \( \rho \) out of a full tank on the planet Zanabar with gravitational constant \( g \). The tank is in the shape of the graph of \( y = x^4 \) for \( x \in [0, 2] \) rotated about the \( y \)-axis. The mystery fluid is pumped out a spout of length 1 m from the top of the tank.