1. Use integration by parts to get
\[ \int x \cos \pi x \, dx = \frac{\cos \pi x}{\pi^2} + \frac{x \sin \pi x}{\pi} + C. \]

2. Use substitution \( u = x^2 \) to get
\[ \int x^5 e^{x^2} \, dx = \frac{1}{2} \int u^2 e^u \, du, \]
and then integrate this by parts twice to get
\[ \frac{1}{2} e^{x^2} (2 - 2x^2 + x^4) + C. \]

3. Use double-angle formulas to get
\[ \int_{\pi/2}^{0} \sin^2 x \cos^2 x \, dx = \frac{\pi}{16}. \]

4. Save \( \sec^2 t \) and express \( \sec^4 t \) in terms of \( \tan t \), and then use \( u = \tan t \) to get
\[ \tan t + \frac{2}{3} \tan^3 t + \frac{1}{5} \tan^5 t + C. \]

5. Use substitution \( x = \frac{3}{4} \sec u \) to obtain
\[ \int \frac{dx}{x^2 \sqrt{16x^2 - 9}} = \frac{4}{9} \sin u + C. \]
Then use a right triangle to express this in terms of \( x \) as
\[ \frac{\sqrt{16x^2 - 9}}{9x} + C. \]

6. Factor the denominator and use partial fractions to get
\[ \int \frac{x - 1}{x^3 + x} \, dx = \arctan x - \ln x + \frac{1}{2} \ln(1 + x^2) + C. \]

7. Use long division and factor the denominator. Then use partial fractions to get
\[ \frac{x^3}{x^2 + 4x + 3} = x - 4 - \frac{1}{2(1 + x)} + \frac{27}{2(3 + x)}. \]

8. Integrate by parts to get
\[ \int_{1}^{\infty} \frac{\ln x}{x^2} \, dx = \lim_{t \to \infty} \left( \frac{1}{x} - \ln x \right) \bigg|_{1}^{t} = 1. \]

9. The graph of the equation
\[ 4x^2 + 4y^2 + 4z^2 - 8x + 16y = 1 \]
is the sphere centered at \((1, -2, 0)\) of radius \( \frac{\sqrt{21}}{2} \).

10. The horizontal component is \( 50 \cos 38^\circ \approx 39.4 \) N and the vertical component is \( 50 \sin 38^\circ \approx 30.8 \) N.