General Instructions. Write your name on only the outside of your blue books. Do not write on this test sheet, do all of your work inside your blue books. Write neat complete solutions to each of the problems in the blue book. Please put your test sheet inside the blue book as you leave. There are 114 points.

Try cooking a roast on the weekends; slice the meat for sandwiches and snacks throughout the next week.

1. (10 points) Use the fundamental theorem of calculus to compute

\[ \frac{d}{dx} \int_{0}^{x} t \sin(t) \, dt \]

2. Compute the following definite and indefinite integrals (8 points each).

(a) \[ \int_{2}^{5} (12x^2 - 4x + 5) \, dx \]

(b) \[ \int_{0}^{18} (72 - 4x) \, dx \]

(c) \[ \int_{0}^{\pi/3} \cos(x) \, dx \]

(d) \[ \int e^x \cos(x) \, dx \]

(e) \[ \int_{0}^{2} \sqrt{16 - x^2} \, dx \]

(f) \[ \int \frac{x}{\sqrt{x^2 + 1}} \, dx \]

(g) \[ \int \ln(x) \, dx \]

(h) \[ \int \frac{1}{(x + 4)(x - 1)} \, dx \]
3. *(10 points)* Determine the volume that is obtained by revolving the region that is bounded by the curves \( y = x^2, \ y = 0 \) (the \( x \)-axis), \( x = 1 \), and \( x = 3 \) about the \( x \)-axis.

4. *(10 points)* Determine the volume of the cone that is obtained by revolving the triangular region that is bounded by the lines \( y = \frac{7}{10}x, \ y = 0, \ x = 2 \) and \( x = 10 \) about the \( y \)-axis.

5. *(10 points)* A bag of sand, initially weighing 72 lbs, was lifted at a constant rate. As it rose to a height of 18 feet, half of the sand leaked out at a constant rate. How much work was done in lifting the sand?

6. *(10 points)* Use the arc-length formula \( L = \int_a^b \sqrt{1 + (y')^2} \, dx \) to compute the arc length of the curve \( y = x^{3/2} \) from \( x = 0 \) to \( x = 4 \).