1. Perform the following operation.

(a) \( \int \sin 2x \sqrt{1 + \cos(2x)} \, dx \)

(b) \( \int \arctan(5x) \, dx \)

(c) \( \frac{d}{dx} \int_0^{3x^2} (4 - \sin^2(u)) \, du \)

(d) \( \int \frac{2}{t \sqrt{9 - 4t^2}} \, dt \)
(e) \[ \int \frac{3x + 4}{x^2 - 5x + 6} \, dx \]

(f) \[ \int \frac{3}{1 - \sqrt{x}} \, dx \]

(g) \[ \int_{0}^{\infty} \frac{4}{9 + x^2} \, dx \]

(h) \[ \int_{4}^{7} \frac{1}{(x - 7)^3} \, dx \]
2. Determine the average value of the function \( \frac{t}{1 + t^2} \) on the interval \([0, 4]\).

3. Determine the area between the curves \( y = x^3 + x^2 \) and \( y = 6x \) in the first quadrant.

(a) Set up (do not evaluate) the integral for the volume of the solid formed by rotating this region about the \( y \)-axis.
(b) Set up (do not evaluate) the integral for the volume of the solid formed by rotating this region about the line $y = -1$.

4. Set up the integral to determine the work applied to empty a tank of water ($62.4 lb/ft^3$) from the top. The tank (in feet) is a truncated cone with bottom radius 6, top radius 12, and height 18. See picture. (Determine the equation of the line connecting the two points shown)