(**12pts**)**Problem 1.**
Evaluate the following integrals

1. $\int_0^1 (x-1)\, e^{-x} dx$

2. $\int x^{11} \ln x dx$

(11pts)Problem 2.

Find the area of the region bounded by the graphs of $y = \dfrac{2}{x}$ and $y = 3 - x$.

(10pts)Problem 3
Sketch the region bounded by the curves $y = x^2$ and $y = 4x - x^2$, and use the method of **cylindrical shells** to find the volume obtained by rotating the region about the line $x = 2$.

(10pts)Problem 4.
Sketch the region above the x-axis bounded by the curve $y = \sqrt{x}$, $y = x - 2$ use the **disk method** to find the volume obtained by rotating the region about the y-axis.

(10pts)Problem 5.

Find the arc length of the curve $y = \frac{3}{2}x^{2/3} + 4$ from $x = 1$ to $x = 27$.

(10pts)Problem 6.
Use trigonometric substitution to evaluate the integral

$$\int \frac{x^2}{\sqrt{16-x^2}} dx.$$

(11pts)Problem 7.
Use partial fraction decomposition to evaluate

$$\int \frac{3x-4}{x^2-2x+1}dx$$

(13pts)Problem 8.
Evaluate the following integrals

$$\int \frac{\sqrt{x}dx}{x-4}, \qquad 2. \int \frac{x^3+2x^2-4}{x^2-x}dx$$

(13pts)Problem 9.
Determine the convergence or divergence the following improper integrals. If the integral is convergent, then find its value.

1. $\int_0^{12} \frac{9}{\sqrt{12-x}} dx,$

2. $\int_0^{\infty} \frac{e^x}{1+e^x} dx$