

- No electronic or mechanical devices which have calculating or programming function.

1. (15%) Find

$$\int \frac{\tan^3 x}{\sqrt{\sec x}} dx.$$

2. (15%) Evaluate

$$\int_4^6 \frac{x^2}{\sqrt{x^2 - 9}} dx.$$

3. (15%) Find

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

4. (15%) Evaluate

$$\int_0^\infty \frac{dx}{\sqrt{x}(x+1)}.$$

5. (10%) Consider the plane region bounded by the graph of

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{c}\right)^2 = 1$$

where $a > 0$ and $b > 0$. Show that the volume of the ellipsoid formed when this region revolves about the y -axis is $\frac{4\pi a^2 b}{3}$.

6. (10%) Find the area of the surface generated by revolving the graph of the function $y = \sqrt[3]{x} + 2$ define on $[1, 8]$ about the y -axis.

7. (10%) Find

$$\int e^{ax} \sin bx dx.$$

8. (10%) Find

$$\lim_{x \rightarrow 0^+} (\sin x)^x.$$