

1. (60%) Evaluate the following expressions:

(a) (5%)  $\int_0^1 \sqrt{1-x^2} dx$

(b) (5%)  $\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{e^x - 1} \right)$

(c) (5%)  $\lim_{x \rightarrow 0} \left( \csc^2 x - \frac{1}{x^2} \right)$

(d) (5%)  $\lim_{x \rightarrow -\infty} x^n e^{-x}$

(e) (5%)  $\int \sin^3 x dx$

(f) (5%)  $\int \ln x dx$

(g) (5%)  $\frac{d}{dx} \int_x^{2x} \frac{e^u}{t} dt$

(h) (5%)  $\frac{d}{dx} \int_x^{x^2} \frac{1}{\ln(x+u)} du$

(i) (5%)  $\int \frac{(1+1/t)^5}{t^2} dt$

(j) (5%)  $\int a^x dx$

(k) (5%)  $\int \frac{dx}{(4-x^2)^{3/2}}$

(l) (5%)  $\frac{d^n}{dx^n} (1/x)$

2 (10%) show that

$$\int \sin^{2n} x dx = \frac{2n-1}{2n} \frac{2n-3}{2n-2} \frac{2n-5}{2n-4} \cdots \frac{5}{6} \frac{3}{4} \frac{1}{2} \pi$$

3. (10%) Find the area enclosed by  $r=1+\sin\theta$

4. (10%) Find the volume of the solid bounded by the coordinate planes and the plane  $2x+y+z=0$

5. (10%) Evaluate  $\oint_C (x^3+y^3)dx + (2y^3-x^3)dy$ , where  $C$  is the unit circle.