

I) FIND THE FOLLOWING INTEGRALS:

① $\int \frac{x^3}{x^2 - x - 6} dx$

⑥ $\int x^5 e^{2x^2} dx$

② $\int x^3 \cos x^2 dx$

⑦ $\int \frac{\sqrt{x}}{x-16} dx$

③ $\int_0^{\pi} \sin^3 \theta \cos^6 \theta d\theta$

⑧ $\int \frac{1}{e^{2x} + 8e^x} dx$

④ $\int \frac{\ln x}{(x-5)^2} dx$

⑨ $\int e^{6x} \sin(e^{3x}) dx$

⑤ $\int_0^9 e^{\sqrt{x}} dx$

⑩ $\int \sec \theta d\theta$, using that

$$\int \sec \theta d\theta = \int \frac{1}{\cos \theta} d\theta = \int \frac{\cos \theta}{\cos^2 \theta} d\theta = \int \frac{\cos \theta}{1 - \sin^2 \theta} d\theta$$

II) FIND THE VOLUMES OF THE SOLIDS GENERATED BY REVOLVING THE FOLLOWING REGIONS AROUND THE X-AXIS:

⑪ THE REGION BOUNDED BY THE GRAPHS OF $y = 2 + \cos x$ AND $y = 0$ FOR $\frac{\pi}{4} \leq x \leq \frac{3\pi}{2}$.

⑫ THE REGION BOUNDED BY THE GRAPHS OF $y = \sin \frac{x}{4}$ AND $y = \tan \frac{x}{4}$ FOR $0 \leq x \leq \pi$.

III) EVALUATE EACH OF THE FOLLOWING IMPROPER INTEGRALS, OR SHOW THAT THEY DIVERGE:

⑬ $\int_4^{\infty} \frac{5}{\sqrt{x}(\sqrt{x}+3)^2} dx$

⑭ $\int_0^3 \frac{15x^2}{x^3 - 8} dx$

⑮ $\int_{1/4}^{\infty} \frac{1}{2x^2 + x} dx$

⑯ $\int_e^{\infty} \frac{1}{x(\ln x)^3} dx$

⑰ $\int_2^{\infty} \frac{e^{6/x}}{x^2} dx$

⑱ $\int_0^{1/e^2} \frac{1}{x(\ln x)^3} dx$