

Evaluate the integrals

1. $\int_0^{\infty} \frac{16 \tan^{-1} x}{1+x^2} dx$

2. $\int_0^2 \frac{2x}{x^2-4} dx$

3. $\int_{-\infty}^{\infty} \frac{2x}{(x^2+1)^2} dx$

4. $\int_0^1 \frac{1}{\sqrt{x}} dx$

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

6. $\int_0^2 \frac{h+1}{\sqrt{4-h^2}} dh$

7. $\int_{-\infty}^0 \theta e^{\theta} d\theta$

8. $\int_1^{\infty} \frac{1}{r^2} dr$

9. $\int_1^{\infty} \frac{1}{r} dr$

10. $\int_1^{\infty} \frac{1}{r^{0.5}} dr$

11. $\int_1^{\infty} \frac{1}{r^{1.0001}} dr$

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

13. $\int_0^4 \frac{1}{\sqrt{4-x}} dx$

14. $\int_1^{\infty} \frac{1}{\sqrt{e^x-1}} dx$

Explain why each of these integrals is improper

1. $\int_0^{\infty} x^4 e^{-x^4} dx$

2. $\int_0^2 \frac{x}{x^2-5x+6} dx$

3. $\int_0^{\pi/2} \sec x dx$

4. $\int_{-\infty}^0 \frac{1}{x^2+5} dx$

Test the following integrals for convergence

1. $\int_0^{\pi/2} \tan \theta d\theta$

2. $\int_0^{\infty} \frac{x}{x^3+1} dx$

3. $\int_0^1 \frac{e^{-\sqrt{x}}}{\sqrt{x}} dx$

4. $\int_0^{\ln 2} x^{-2} e^{-1/x} dx$

5. $\int_{\pi}^{\infty} \frac{1+\sin x}{x^2} dx$

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