

1 Improper Integrals

1. True False It is possible for the integral $\int_1^{\infty} f(x)$ to be neither a finite number nor infinity.
2. True False Since $3 > 1$, the integral $\int_0^{\infty} \frac{1}{x^3} dx$ converges.
3. True False If $\lim_{x \rightarrow \infty} f(x) = 0$, then $\int_1^{\infty} f(x) dx$ converges.
4. Calculate $\int_3^{\infty} \frac{1}{x \ln(x)}$.
5. Calculate $\int_1^{\infty} e^{-5x} dx$.
6. Calculate $\int_1^{\infty} \frac{x}{\sqrt{x^2 + 1}} dx$.
7. Calculate $\int_0^{\infty} \frac{1}{1 + x^2} dx$.

2 Convergence

8. True False If $a < b$ then $ac < bc$.
9. True False If $a < b$, then $\frac{1}{a} > \frac{1}{b}$.
10. True False If $f \leq g$ and $\int_1^{\infty} g(x) dx$ converges, then $\int_1^{\infty} f(x) dx$ converges.
11. True False If we can find a function g such that $0 \leq f \leq g$, then $\int_1^{\infty} f(x) dx$ converges.
12. Does $\int_0^{\infty} \frac{\arctan^2(x)}{\sqrt{1+x^4}} dx$ converge?
13. Does $\int_3^{\infty} \frac{1}{\sqrt{x} \ln(x)}$ converge?

14. Does $\int_1^{\infty} e^{-5x\sqrt{x}} dx$ converge?

15. Does $\int_1^{\infty} \frac{x}{\sqrt{x^2+1} - e^{-x}} dx$ converge?

16. Does $\int_0^{\infty} \frac{1}{(1+x^2)^2} dx$ converge?

17. Does $\int_1^{\infty} \sqrt{x}e^{-2x}$ converge?