Practice with Improper Integrals

Determine whether each integral is convergent or divergent. Evaluate those that are convergent.

1. $\displaystyle\int_1^\infty \frac{1}{(3x+1)^2}\,dx$
2. $\displaystyle\int_{-\infty}^0 \frac{1}{2x-5}\,dx$
3. $\displaystyle\int_{-\infty}^{-1} \frac{1}{\sqrt{2-x}}\,dx$
4. $\displaystyle\int_0^\infty \frac{x}{(x^2+2)^2}\,dx$
5. $\displaystyle\int_4^\infty e^{-y/2}\,dy$
6. $\displaystyle\int_{-\infty}^{-1} e^{-2t}\,dt$
7. $\displaystyle\int_{2\pi}^\infty \sin(\theta)\,d\theta$
8. $\displaystyle\int_{-\infty}^\infty x^2 e^{-x^3}\,dx$
9. $\displaystyle\int_1^\infty \frac{\ln x}{x}\,dx$
10. $\displaystyle\int_1^\infty \frac{\ln x}{x^2}\,dx$
11. $\displaystyle\int_1^\infty \frac{\ln x}{x^3}\,dx$
12. $\displaystyle\int_2^3 \frac{1}{\sqrt{3-x}}\,dx$
13. $\displaystyle\int_6^8 \frac{4}{(x-6)^3}\,dx$
14. $\displaystyle\int_0^1 \frac{1}{4y-1}\,dy$

15. $\displaystyle\int_{-1}^{1} \frac{e^x}{e^x - 1}\, dx$

16. $\displaystyle\int_{0}^{1} \frac{\ln x}{\sqrt{x}}\, dx$

17. Find the values of p for which the integral

$$\int_{2}^{\infty} \frac{1}{x(\ln x)^p}\, dx$$

converges and evaluate the integral for those values of p.

Use the Comparison Theorem to determine whether each integral is convergent or divergent.

1. $\displaystyle\int_{1}^{\infty} \frac{2 + e^{-x}}{x}\, dx$

2. $\displaystyle\int_{1}^{\infty} \frac{1}{x^2 + e^{2x}}\, dx$

3. $\displaystyle\int_{1}^{\infty} \frac{x}{\sqrt{1 + x^6}}\, dx$

4. $\displaystyle\int_{1}^{\infty} \frac{x^3}{x^5 + 2}\, dx$