Determine whether each of the following improper integrals converges or diverges.

1. $\displaystyle\int_2^\infty \frac{1}{x^3+2}\,dx$

2. $\displaystyle\int_5^\infty \frac{1}{\sqrt{x}-2}\,dx$

3. $\displaystyle\int_3^\infty \frac{1}{x\ln(x)}\,dx$

4. $\displaystyle\int_2^\infty \frac{2}{\sqrt{x}+x^2}\,dx$

5. $\displaystyle\int_0^2 \frac{2}{\sqrt{x}+x^2}\,dx$

6. $\displaystyle\int_0^\infty x\,e^{-x}\,dx$ Hint: Think parts