Improper Integrals

1. For each integral below,

   - Determine if it is an improper integral. If its not improper, say so.

   - If it is an improper integral determine its type (type 1 or type 2) and use a limit (as illustrated in lecture) to evaluate the integral. If the integral converges, give its (limiting) value. Otherwise, state that the integral diverges.

   (a) $\displaystyle\int_0^1 \sqrt{x}\, dx$

   (b) $\displaystyle\int_0^1 \frac{1}{\sqrt{x}}\, dx$

   (c) $\displaystyle\int_1^{+\infty} \frac{1}{\sqrt{x}}\, dx$

   (d) $\displaystyle\int_1^{+\infty} \frac{1}{1+x^2}\, dx$

   (e) $\displaystyle\int_{-\infty}^0 \frac{1}{1+x^2}\, dx$

   (f) $\displaystyle\int_{-\infty}^{+\infty} \frac{1}{1+x^2}\, dx$

2. In the improper integral below determine the values of r for which the integral converges. For those values of r for which the integral does converge, determine the integrals (limiting) value.

   $$\int_1^{+\infty} \frac{1}{x^r}\, dx$$