Some Definitions:

If $f(x)$ is integrable on $[a, \infty)$ for some constant c,

$\int_a^{\infty} f(x)\, dx =$ if _____.

If $f(x)$ is continuous on $[a, b]$ except for at some point c between a and b,

$\int_a^{c} f(x)\, dx =$ if _____,

$\int_c^{b} f(x)\, dx =$ if _____,

and $\int_a^{b} f(x)\, dx =$ if _____.

These types of integrals are called _____.

In all of these cases, if the desired limits exist, we say the integral _____.

If the desired limit does not exist, we say the integral _____.

Determine if the following integrals converge or diverge.

1. $\int_1^{\infty} \frac{1}{x}\, dx$
2. $\int_1^{\infty} \frac{1}{x^2}\, dx$
3. $\int_1^{\infty} \frac{1}{x^{10}}\, dx$
4. $\int_1^{\infty} \frac{1}{x^{1/2}}\, dx$
5. $\int_1^{\infty} \frac{1}{x^{1/3}}\, dx$

P-Test for Improper Integrals:

Determine if the following integrals converge or diverge.

1. $\displaystyle\int_1^4 \frac{2}{\sqrt[3]{x-2}}\,dx$
2. $\displaystyle\int_{-1}^1 \frac{1}{x}\,dx$
3. $\displaystyle\int_3^\infty \frac{x^2}{x^4+4}\,dx$
4. $\displaystyle\int_{-1}^1 \frac{1}{x^2}\,dx$
5. $\displaystyle\int_0^1 \ln(x)\,dx$
6. $\displaystyle\int_0^\infty \frac{1}{(x-2)^2}\,dx$
7. **Challenge:** For what values of p does $\displaystyle\int_{-1}^1 \frac{1}{x^p}\,dx$ converge?