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① + ①

1. $\int_1^{\infty} \frac{\cos x + 2}{\sqrt{x}}$ diverges why?

$\cos x$ oscillates between 1 and -1 so $f(x)$ stays positive.

$$\frac{1}{\sqrt{x}} \leq \frac{\cos x + 2}{\sqrt{x}} \leq \frac{3}{\sqrt{x}}$$

$$\int_1^{\infty} \frac{1}{\sqrt{x}} dx \quad \int_1^{\infty} \frac{3}{\sqrt{x}} dx$$

so using the comparison of $\int_1^{\infty} \frac{1}{x^p}$
 $p \leq 1$ diverges, then comparison tells
us that the original integral diverges.

2. $\int_1^{\infty} e^{-x^2}$

Since e^{-x} goes rapidly to zero as
 $x \rightarrow \infty$, then if we compare it to
 e^{-x^2} ,

$$0 \leq e^{-x^2} \leq e^{-x} \text{ and}$$

$\int_1^{\infty} e^{-x} dx$ converges then $\int_1^{\infty} e^{-x^2} dx$ also
converges.