Let $f(x) = x + \sqrt{x^2+2x}$

We need $x^2 + 2x \geqslant 0 \Rightarrow x(x+2) \geqslant 0 \Rightarrow$ $x \leqslant -2$ (because we are heading towards $-\infty$). So the domain of f is $(-\infty, -2]$. On that domain, $|x| = -x \Rightarrow \sqrt{x^2} = -x$. We can now write

$$f(x) = \frac{\left(x + \sqrt{x^2+2x}\right)\left(x - \sqrt{x^2+2x}\right)}{\left(x - \sqrt{x^2+2x}\right)}$$

$$= \frac{x^2 - \left(\sqrt{x^2+2x}\right)^2}{x - |x|\sqrt{1 + \frac{2}{x}}}$$

$$= \frac{x^2 - (x^2+2x)}{x + x\sqrt{1+\frac{2}{x}}}$$

(remember, $|x| = -x$)

$$= \frac{-2x}{x + x\sqrt{1+\frac{2}{x}}}$$

$$= \frac{-2}{1 + \sqrt{1+\frac{2}{x}}}$$

for all finite x.

So $$\lim_{x \to -\infty} f(x) = \lim_{x \to -\infty} \frac{-2}{1 + \sqrt{1 + \frac{2}{x}}}$$

$$= \frac{-2}{1+\sqrt{1+0}} = \frac{-2}{1+1} = -1$$