

$$\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{\sqrt{n^2 + kn}}$$

$$= \lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{n \sqrt{1 + (k/n)}}$$

$$= \int_0^1 \frac{dx}{\sqrt{1+x}}$$

$$= \int_0^1 (1+x)^{-\frac{1}{2}} dx$$

$$= \left(\frac{(1+x)^{-\frac{1}{2}+1}}{-\frac{1}{2}+1} \right)_0^1 = \left(\frac{(1+x)^{\frac{1}{2}}}{\frac{1}{2}} \right)_0^1$$

$$= \left(2\sqrt{(1+x)} \right)_0^1 = \underline{2(\sqrt{2} - 1)} \quad 9$$