# Young's inequality

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Let $\phi : \mathbb{R} \to \mathbb{R}$ be a continuous , strictly increasing function such that $\phi(0) = 0$ . Then the following inequality holds:

$$ab \leq \int_0^a \phi(x)dx + \int_0^b \phi^{-1}(y)dy$$

Equality only holds when $b = \phi(a)$. This inequality can be demonstrated by drawing the graph of $\phi(x)$ and by observing that the sum of the two areas represented by the integrals above is greater than the area of a rectangle of sides $a$ and $b$, as is illustrated in `http://planetmath.org/node/5575`an attachment.