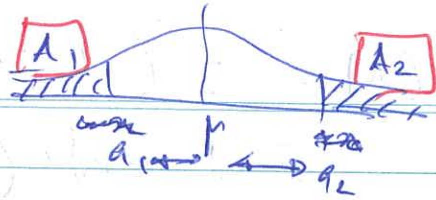
$$f_X(x) = \frac{1}{\sqrt{2\pi}\,\sigma} e^{-(x-\mu)^2/2\sigma^2}$$



$$\boxed{A_1} = \int_{-\infty}^{a_1} f_X(x)\,dx$$

$$= \frac{1}{\sqrt{2\pi}\,\sigma}\int_{-\infty}^{a_1} e^{-(x-\mu)^2/2\sigma^2}$$

$$\frac{x-\mu}{\sigma} = t$$

$$dx = \sigma\,dt.$$

$$x = -\infty \Rightarrow t = -\infty$$

$$x = a_1 \Rightarrow t = \frac{a_1-\mu}{\sigma}$$

$$= \frac{1}{\sqrt{2\pi}\,\cancel{\sigma}}\int_{-\infty}^{(a_1-\mu)/\sigma} e^{-t^2/2}\cdot\cancel{\sigma}\,dt$$

$$= \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{(a_1-\mu)/\sigma} e^{-t^2/2}\cdot dt$$

$$t = -y.$$

$$dt = -dy.$$

$$t \to -\infty \Rightarrow y = \infty$$

$$t = \frac{a_1-\mu}{\sigma} \Rightarrow y = \frac{\mu-a_1}{\sigma}.$$

$$= \frac{1}{\sqrt{2\pi}}\int_{\infty}^{(\mu-a_1)/\sigma} e^{-t^2/2}\,(-dy)$$

$$= \frac{1}{\sqrt{2\pi}}\int_{(\mu-a_1)/\sigma}^{\infty} e^{-y^2/2}\,dy$$

$$= Q\left(\frac{\mu-a_1}{\sigma}\right) \quad (1) \quad \text{lower tail}$$

$$\boxed{A_2} = \int_{a_2}^{\infty} \frac{1}{\sqrt{2\pi}\,\sigma} e^{-(x-\mu)^2/2\sigma^2}\,dx$$

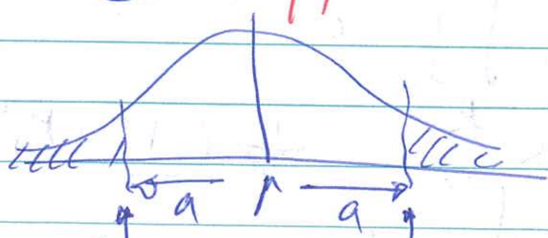
$$= \int_{(a_2-\mu)/\sigma}^{\infty} \frac{1}{\sqrt{2\pi}\,\cancel{\sigma}} e^{-t^2/2}\cdot\cancel{\sigma}\,dt$$

$$= Q\left(\frac{a_2-\mu}{\sigma}\right) \quad (2) \quad \text{upper tail,}$$

$$A_1 = Q\left(\frac{\mu-a_1}{\sigma}\right)$$

$$A_2 = Q\left(\frac{a_2-\mu}{\sigma}\right)$$

$$Q(x) = 1 - Q(-x)$$



$$a_1 = (\mu - a) \qquad a_2 = (\mu + a)$$

$$\left.\begin{aligned} A_1 &= Q\left(\frac{\mu-\mu+a}{\sigma}\right) = Q(a/\sigma) \\ A_2 &= Q\left(\frac{\mu+a-\mu}{\sigma}\right) = Q(a/\sigma)\end{aligned}\right\} =$$