№2 $\xi \sim N(a, \sigma^2)$

$$f_\xi(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left\{-\frac{(x-a)^2}{2\sigma^2}\right\}$$

$$\mathbb{E}\xi = a$$

$$\mathbb{E}\xi^2 = \int_{-\infty}^{+\infty} t^2 \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left\{-\frac{(t-a)^2}{2\sigma^2}\right\} dt =$$

$$= \cancel{\frac{1}{\sqrt{2\pi}\sigma}\int_{-\infty}^{+\infty}(t-a)^2 \ldots}$$

$$= \frac{1}{\sqrt{2\pi}\sigma}\left(\int_{-\infty}^{+\infty}(t-a)^2 \exp\left\{-\frac{(t-a)^2}{2\sigma^2}\right\}dt\right.$$

$$\left.+ 2a\int_{-\infty}^{+\infty} t \exp\left\{-\frac{(t-a)^2}{2\sigma^2}\right\}dt - a^2\int_{-\infty}^{+\infty}\exp\left\{-\frac{(t-a)^2}{2\sigma^2}\right\}dt\right)$$

$$= \left\{\begin{array}{ll} y = \frac{t-a}{\sigma} & t = \sigma y + a \\ dy = \frac{dt}{\sigma} & \end{array}\right\} = \frac{1}{\sqrt{2\pi}\sigma}\left(\int_{-\infty}^{+\infty}\sigma^3 y^2 e^{-\frac{y^2}{2}}dy + \right.$$

$$\left. + 2a^2\sigma\sqrt{2\pi} - a^2\sigma\int_{-\infty}^{+\infty} e^{-\frac{y^2}{2}}dy\right) = \frac{\sigma^2}{\sqrt{2\pi}}\int_{-\infty}^{+\infty} y^2 e^{-\frac{y^2}{2}}dy +$$

$$+ 2a^2 - a^2 = \cancel{\frac{\sigma^2}{\sqrt{2\pi}}\left(\int_{-\infty}^{+\infty} x e^{-\frac{x^2}{2}}\right.} =$$

$$= \frac{\sigma^2}{\sqrt{2\pi}}\int_{-\infty}^{+\infty} y^2 e^{-\frac{y^2}{2}}dy + a^2 = \frac{\sigma^2}{\sqrt{2\pi}}\left(\frac{\sqrt{\pi}}{\sqrt{2}}\varphi\left(\frac{y}{\sqrt{2}}\right) - \right.$$

$$\left. - \underbrace{y e^{-\frac{y^2}{2}}}_{0}\right)\Bigg|_{-\infty}^{+\infty} + a^2 = \frac{\sigma^2}{\sqrt{2\pi}}\left(\frac{\sqrt{\pi}}{\sqrt{2}}\overset{=1}{\varphi(+\infty)} - \frac{\sqrt{\pi}}{\sqrt{2}}\overset{=-1}{\varphi(-\infty)}\right) +$$

$$+ a^2 = \frac{\sigma^2}{\sqrt{2\pi}}\cdot\sqrt{2\pi} + a^2 = \sigma^2 + a^2$$

$$\mathbb{D}\xi = \mathbb{E}\xi^2 - (\mathbb{E}\xi)^2 = \sigma^2$$

Ответ: $\mathbb{D}\xi = \sigma^2$