MIRZO ULUG’BEK NOMIDAGI O’ZBEKISTON MILLIY UNIVERSITETI
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$$U_t = U_{xx} + \sin t$$
$$U(x,t)|_{t=0} = 0$$
$$\varphi(x) = 0$$
$$f(x,t) = \sin t$$

Yechim:

$$U(x,t) = \int_0^t \int_{-\infty}^{\infty} \frac{\sin\tau e^{-\frac{|x-\xi|^2}{4a^2(t-\tau)}}}{2a\sqrt{\pi(t-\tau)}} d\xi d\tau = \int_0^t \frac{\sin\tau}{2a\sqrt{\pi(t-\tau)}} \int_{-\infty}^{\infty} e^{-\frac{|x-\xi|^2}{4a^2(t-\tau)}} d\xi d\tau$$

Bizga ma'lumki:

$$\int_{-\infty}^{\infty} e^{-\rho^2} d\rho = \sqrt{\pi}$$
$$\rho^2 = \frac{|x-\xi|^2}{4a^2(t-\tau)}$$
$$\rho = \frac{x-\xi}{2a\sqrt{t-\tau}}$$
$$d\rho = -\frac{d\xi}{2a\sqrt{t-\tau}}$$
$$\xi = -\infty \qquad \rho = \infty$$
$$\xi = \infty \qquad \rho = -\infty$$
$$\int_{-\infty}^{\infty} e^{-\rho^2} 2a\sqrt{t-\tau} d\rho = 2a\sqrt{t-\tau}\sqrt{\pi}$$
$$U(x,t) = \int_0^t \frac{\sin\tau}{2a\sqrt{t-\tau}} 2a\sqrt{t-\tau}\sqrt{\pi} d\tau = \int_0^t \sin\tau = -\cos t|_0^t =$$
$$= -(\cos t - 1) = 1 - \cos t$$
$$Javob:\ U(x,t) = 1 - \cos t$$