

# ADVANCED MATHEMATICAL METHODS

## FOR CHEMISTRY - QUIZ 9 SOLUTIONS

$$\begin{aligned} \text{[1]} \quad \int_{-\infty}^{+\infty} \frac{e^{-2|x|}}{\sqrt{2\pi}} e^{ikx} dx &= \left[ \frac{e^{x(2+ik)}}{2+ik} \right]_{-\infty}^0 + \left[ \frac{e^{x[-2+ik]}}{-2+ik} \right]_0^{+\infty} \frac{1}{\sqrt{2\pi}} \\ &= \frac{1}{\sqrt{2\pi}} \frac{4}{4+k^2} \quad (c) \end{aligned}$$

$$\begin{aligned} \text{[2]} \quad \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{+\infty} e^{-\frac{x^2}{2}} e^{ikx} dx &= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{+\infty} e^{-\frac{1}{2}(x^2 - 2ikx - k^2)} dx \left] e^{-\frac{k^2}{2}} \right. \\ &= e^{-k^2/2} \quad (b) \end{aligned}$$

$$\text{[3]} \quad \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{+\infty} e^{-|kx|} dk = \sqrt{2\pi} \delta(x) \quad (a)$$

$$\text{[4]} \quad \frac{1}{\sqrt{2\pi}} \int e^{ix(k+2\pi)} dx = \sqrt{2\pi} \delta(k-2\pi) \quad (d)$$

$$\begin{aligned} \text{[5]} \quad x e^{-x^2/2} &= -\frac{d}{dz} e^{-x^2/2} \quad \text{F.T.}(x e^{-x^2/2}) = -ik \text{F.T.}(e^{-x^2/2}) \\ &= -ik e^{-k^2/2} \quad (c) \end{aligned}$$

$$\text{[6]} \quad \text{Using shifting property} \quad \mathcal{F}^{-1}(e^{2ik} e^{-k^2/2}) = e^{-(x-2)^2/2} \quad (a)$$

[7] None of above (change answer mapping) (d)

$$\text{[8]} \quad e^{-(x-1)^2/2t} \quad (d)$$

$$\text{[9]} \quad \text{L.T.}(2 + 4t^2) = \frac{2}{s} + \frac{4 \times 2}{s^3} = \frac{2}{s} + \frac{8}{s^3} \quad (d)$$

$$\text{[10]} \quad \text{L.T.}(t e^{-3t}) = \frac{1}{(s+3)^2} \quad (c)$$