Sol^n c.d.f $F(x)$ must be defined over 5 intervals

for $x < 0$: $F(x) = \int_{-\infty}^{x} 0 \, dt = 0$

for $0 \le x < 1$: $F(x) = \int_0^x kt\,dt = \frac{1}{2}\int_0^x t\,dt$
$= \frac{1}{2}\left[\frac{t^2}{2}\right]_0^x = \frac{x^2}{4}$

for $1 \le x < 2$:

$F(x) = k\int_0^1 dt + k\int_1^x dt = \frac{1}{2}[t]_0^1 + k[t]_1^x$
$= \frac{1}{2} + \frac{1}{2}(x-1)$
$= \frac{1}{2}(1 + x - 1) = \frac{x}{2}$

for $2 \le x < 3$: $F(x) = \int_0^1 (-kt + 3k)\,dt + \int_1^2 (-kt + 3k)\,dt$
$+ \int_2^x (-kt + 3k)\,dt$

$= k\int_0^1 (3-t)\,dt + k\int_1^2 (3-t)\,dt + k\int_2^x (3-t)\,dt$

$= k\left[3t - \frac{t^2}{2}\right]_0^1 + k\left[3t - \frac{t^2}{2}\right]_1^2 + k\left[3t - \frac{t^2}{2}\right]_2^x$

$= k\left[3 - \frac{1}{2}\right] + k\left[6 - 2 - 3 + \frac{1}{2}\right] + k\left[3x - \frac{x^2}{2} - 6 + 2\right]$

$= \frac{1}{2}\left[\frac{5}{2} + \frac{3}{2} + 3x - \frac{x^2}{2} - 4\right] = \frac{1}{2}\left(3x - \frac{x^2}{2}\right)$

for $x > 3$: $F(x) = \int_{-\infty}^{x} f(t)\,dt = 1$ [$\because$ all probabilities has been accumulated for x beyond 1

Thus c.d.f $F(x)$: $\begin{cases} 0 & \text{for } x < 0 \\ \frac{x^2}{4} & \text{for } 0 \le x < 1 \\ \frac{x}{2} & \text{for } 1 \le x < 2 \\ \frac{1}{2}\left(3x - \frac{x^2}{2}\right) & \text{for } 2 \le x < 3 \\ 1 & \text{for } x > 3 \end{cases}$