$$Z = X_1 + X_2$$

$$h(z) = \int_{-\infty}^{\infty} f_1(x) \cdot f_2(z-x)\, dx = \int_0^1 2x \cdot f_2(z-x)\, dx =$$

$$= \begin{cases} 0<z<1 & \int_0^z 2x \cdot 2(z-x)\, dx = \int_0^z 4xz - 4x^2\, dx = 2z^3 - \frac{4}{3}z^3 = \frac{2z^3}{3} \\ 1<z<2 & \int_{z-1}^1 4xz - 4x^2\, dx = 2z\big(\underbrace{1-(z-1)^2}_{-z^2+2z}\big) - \frac{4}{3}\big(\underbrace{1-(z-1)^3}_{-z^3+3z^2-3z+2}\big) = \end{cases}$$

$$= -\frac{2}{3}z^3 + 4z - \frac{8}{3}$$

$$P\left(\frac{1}{4} < \frac{X_1+X_2}{2} < \frac{3}{4}\right) = P\left(\frac{1}{2} < X_1+X_2 < \frac{3}{2}\right) =$$

$$= \int_{\frac{1}{2}}^{1} \frac{2z^3}{3}\, dz + \int_1^{\frac{3}{2}} -\frac{2}{3}z^3 + 4z - \frac{8}{3}\, dz = \frac{31}{48} \approx 0.645833$$