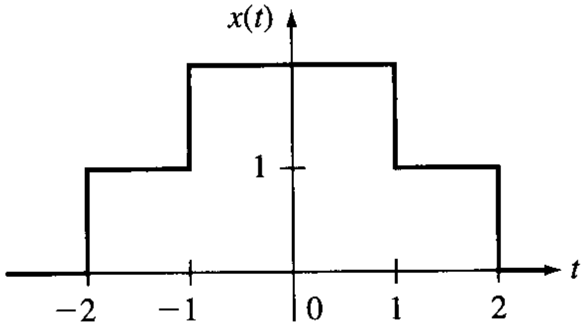
Calculate the generalized derivative of the functions plotted in 1.1a.

For 1.1a,



(a)

Per section 1.1.6, the generalized derivative of $x(t)$ is $\frac{dx(t)}{dt} + \left[x(t_1^+) - x(t_1^-)\right]\delta(t - t_1)$.

For t < -2, we have a regular derivative, i.e., slope, $\frac{dx(t)}{dt} = 0$.

For t = -2, we have a discontinuity. So,

$$\left[x(t_1^+) - x(t_1^-)\right]\delta(t - t_1) = \left[x(-2^+) - x(-2^-)\right]\delta(t - (-2)) = \left[1 - 0\right]\delta(t + 2) = \delta(t + 2).$$

For -2 < t < -1, we have a regular derivative, i.e., slope, $\frac{dx(t)}{dt} = 0$.

For t = -1, we have a discontinuity. So,

$$\left[x(t_1^+) - x(t_1^-)\right]\delta(t - t_1) = \left[x(-1^+) - x(-1^-)\right]\delta(t - (-1)) = \left[2 - 1\right]\delta(t + 1) = \delta(t + 1).$$

For -1 < t < 1, we have a regular derivative, i.e., slope, $\frac{dx(t)}{dt} = 0$.

For t = 1, we have a discontinuity. So,

$$\left[x(t_1^+) - x(t_1^-)\right]\delta(t - t_1) = \left[x(1^+) - x(1^-)\right]\delta(t - 1) = \left[1 - 2\right]\delta(t - 1) = -\delta(t - 1).$$

For 1 < t < 2, we have a regular derivative, i.e., slope, $\frac{dx(t)}{dt} = 0$.

For t = 2, we have a discontinuity. So,

$$\left[x(t_1^+) - x(t_1^-)\right]\delta(t - t_1) = \left[x(2^+) - x(2^-)\right]\delta(t - 2) = \left[0 - 1\right]\delta(t - 2) = -\delta(t - 2).$$

For t > 2, we have a regular derivative, i.e., slope, $\frac{dx(t)}{dt} = 0$.

In summary, $\frac{dx(t)}{dt} + \left[x(t_1^+) - x(t_1^-)\right]\delta(t - t_1) = \delta(t + 2) + \delta(t + 1) - \delta(t - 2) - \delta(t - 2)$