Generalized Derivatives.

**Quiz:** When you fire a gun, you exert a very large force on the bullet over a very short period of time. If we integrate $F = ma = mx''$ we see that a large force over a short time creates a sudden change in the momentum, $mx'$. This is called an "impulse."

If the gun is fired straight up, the graph of the elevation of the bullet, plotted against $t$, starts at zero, then rises in an inverted parabola, and then when it hits the ground it stops again.

The velocity (derivative of the position function) is zero for $t < 0$; then it rises to $v_0$ (the initial velocity of the bullet); then it falls at constant rate (the acceleration of gravity) until the instant when it hits the ground, when it returns abruptly to zero.

The graph of $v(t)$ looks like this:

![Graph of v(t)](image)

What does the graph of the generalized derivative of $v(t)$ look like?

**Choices:**

a) ![Graph a](image)

b) ![Graph b](image)

c) ![Graph c](image)

d) ![Graph d](image)

e) None of these.

**Answer:** (a).