

MIE 200F – Test No. 1

September 21/98

A torpedo is launched horizontally in the ocean with an initial speed $v = 40 \text{ m/s}$. Water resistance causes it to slow down with an acceleration equal to $-0.02v$ (SI units). How fast will the torpedo be going after it has traveled 300 meters?

Useful formulas that you probably know anyway:

Answer:

$$v \, dv = a \, dx$$

$$v^2 = v_0^2 + 2 a_0 s$$

use only for
constant acceleration

$$\frac{\sqrt{dv}}{a(v)} = \int_{x_{\text{initial}}}^{x_{\text{final}}} dx$$

$$\int_{40}^{V_{\text{final}}} \left(\frac{\sqrt{v}}{-0.02v} \right) dv = 300$$

$$-50V \Big|_{40}^{V_{\text{final}}} = -50V \Big|_{40}^{V_{\text{final}}} = 300$$

$$-50(V_{\text{final}} - 40) = 300$$

$$V_{\text{final}} = 34 \text{ m/s}$$