

MIE 200F – Test No. 1
September 21/98

A torpedo is launched horizontally in the ocean with an initial speed $v = 40$ 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:

$$v dv = a dx$$

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

use only for
constant acceleration

Answer:

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

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

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

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

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