Step-1

The quantity $V'(x)$ gives the slope of the graph.

From $x=0$ to $x=\frac{1}{2}$, $V'(x)=2$.

From $x=\frac{1}{2}$ to $x=1$, $V'(x)=-2$.

Thus,

$$\begin{aligned}\int (V')^2\,dx &= \int_0^1 (V')^2\,dx\\ &= \int_0^{\frac{1}{2}} (2)^2\,dx + \int_{\frac{1}{2}}^1 (-2)^2\,dx\\ &= 4\left(\frac{1}{2}\right)+4\left(\frac{1}{2}\right)\\ &= 4\end{aligned}$$

Thus, $A=4$.

Step-2

Let $M=\int V^2 dx$.

From $x=0$ to $x=\frac{1}{2}$, $V(x)=2x$.

From $x=\frac{1}{2}$ to $x=1$, $V(x)=-2x$.

Thus,

$$\begin{aligned}\int (V)^2\,dx &= \int_0^1 (V)^2\,dx\\ &= \int_0^{\frac{1}{2}} (2x)^2\,dx + \int_{\frac{1}{2}}^1 (-2x)^2\,dx\\ &= 4\left[\frac{x^3}{3}\right]_0^{\frac{1}{2}} + 4\left[\frac{x^3}{3}\right]_0^{\frac{1}{2}}\end{aligned}$$

$$\int (V')^2\,dx = \frac{4}{24}+\frac{4}{24}$$
$$= \frac{8}{24}$$
$$= \frac{1}{3}$$

Therefore, $M = \frac{1}{3}$.

Step-3

Consider the following:

$$\frac{A}{M} = \frac{4}{\frac{1}{3}}$$
$$= 12$$

We know that $\pi^2 = 9.8696$

Thus, $\lambda = \frac{A}{M}$ is larger than the true eigenvalue $\lambda = \pi^2$.