

## Projectile Fiction

by DEREK BUCHANAN

June 13, 2021

The New Senior Mathematics (Aus & Fitzpatrick, 2019) and Maths in Focus (Green & Hunter, 2019) Extension 2 texts purport that an appropriate model for projectile motion with quadratic drag (where resistance is proportional to the square of the velocity) will be given by  $R_x = -k\dot{x}^2$  and  $R_y = -k\dot{y}^2$ .

However for quadratic drag  $R_x = -k\dot{x}\sqrt{\dot{x}^2 + \dot{y}^2}$  and  $R_y = -k\dot{y}\sqrt{\dot{x}^2 + \dot{y}^2}$  and so if their model is correct this leads to  $\dot{x} = 0$  and/or  $\dot{y} = 0$  in which case the motion is vertical, horizontal or stationary.

They then go on to derive equations for a fictitious trajectory which is not vertical, horizontal or stationary. Hence their model is entirely inappropriate.

Of course the trajectory won't be vertical, horizontal or stationary and a more appropriate solution is to use numerical methods which are outside the scope of the syllabus such as the one used in the youtube video <https://www.youtube.com/watch?v=OukRTF6Bgcc>.

### Acknowledgement

I thank Steve Howard for making this issue apparent to teachers through his online Extension 2 PD course available at <https://tta.edu.au>.

### References

Aus, B. & Fitzpatrick, J.B., New Senior Mathematics Extension 2, 3rd ed., Pearson, 2019

Green, J. & Hunter, J., Maths in Focus Extension 2, Cengage, 2019.