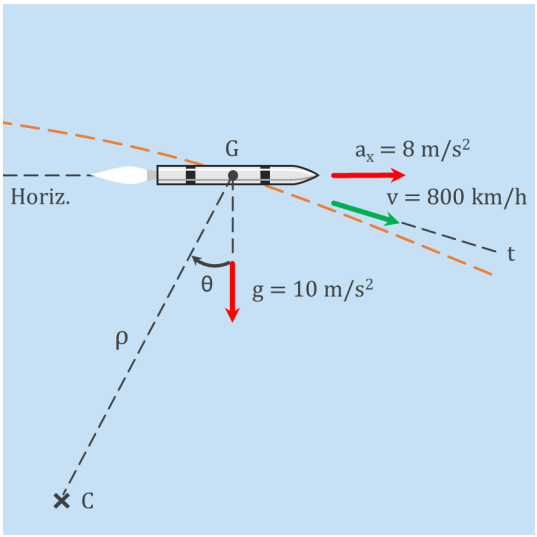
Rocket Accelerates



A rocket maintains at horizontal attitude of its axis during the powered phase of its flight (see the Figure). The acceleration due to horizontal thrust is 8 m/s², and the downward acceleration due to gravity is $g = 10$ m/s². At the instant represented, the velocity of the centre of mass G of the rocket along the $\theta = 15°$ direction of its trajectory is 800 km/h. Determine the tangential acceleration a_t with respect to the centre of curvature C in terms of g,a_x and θ.

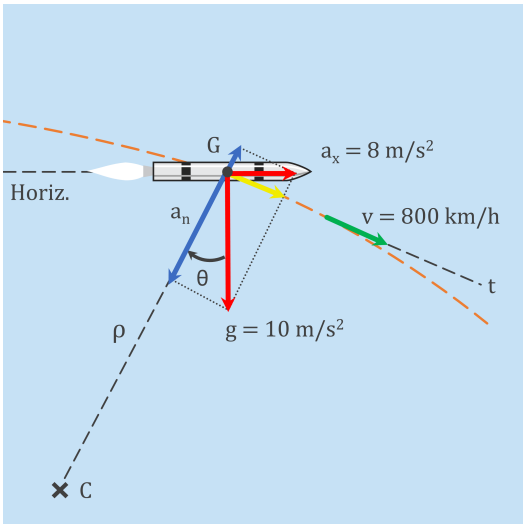


Figure 1: Rocket Accelerates

The tangential acceleration a_t is parallel to v. Figure 1 shows the acceleration vectors a_x and g deconstructed in the normal direction (blue) and the tangential direction (yellow). It can be easily seen that g and a_x deconstructed in the tangential-direction are equal to $g \sin\theta$ and $a_x \cos\theta$, respectively. Resulting in the final answer:

$$a_t = g \sin\theta + a_x \cos\theta \qquad (1)$$