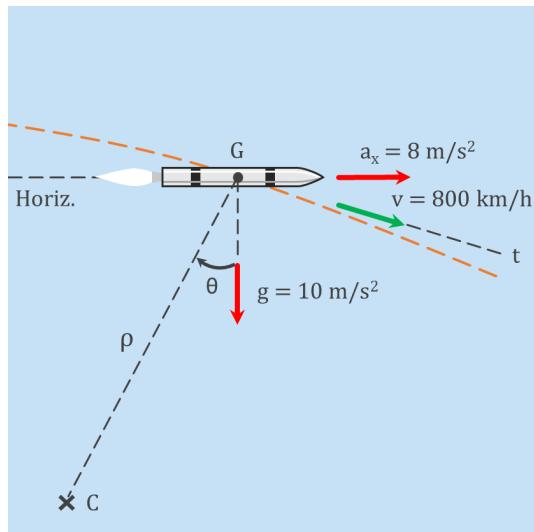


Rocket Accelerates



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/s^2 , and the downward acceleration due to gravity is $g = 10 \text{ m/s}^2$. At the instant represented, the velocity of the centre of mass G of the rocket along the $\theta = 15^\circ$ direction of its trajectory is 800 km/h . Determine the normal acceleration a_n with respect to the centre of curvature C in terms of g, a_x and θ .

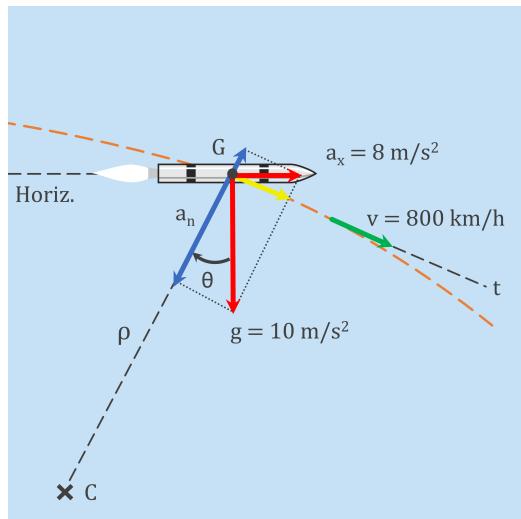


Figure 1: Rocket Accelerates

The normal acceleration a_n points towards the centre of curvature C . 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 normal-direction are equal to $g \cos \theta$ and $a_x \sin \theta$ respectively. However, in this case, $a_x \sin \theta$ points in the opposite way of a_n (points \nearrow instead of \swarrow). This means that to determine the final value of a_n , the term $a_x \sin \theta$ should be negative. Adding both terms results in the final answer:

$$a_n = g \cos \theta - a_x \sin \theta \quad (1)$$