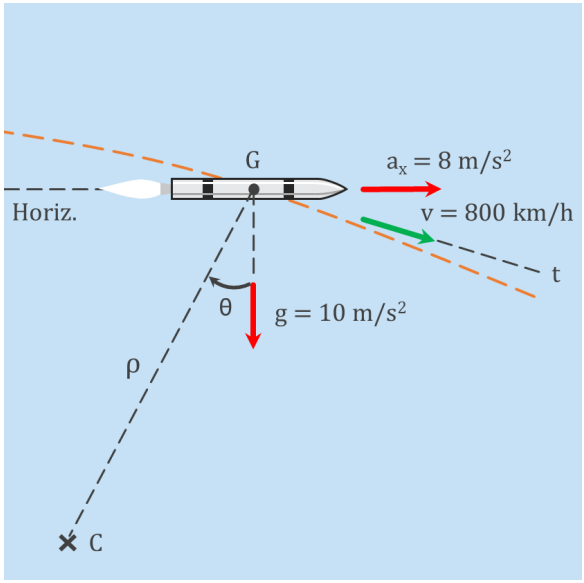
Rocket Accelerates



A rocket maintains at horizontal attitude of its axis during the powered phase of its flight. The acceleration due to horizontal thrust is 8 m/s^2, and the downward acceleration due to gravity is g = 10 m/s^2. At the instant represented, the velocity of the mass centre G of the rocket along the (θ) 15° direction of its trajectory is 800 km/h. Determine the normal acceleration a_n with respect to the centre of curvature C.

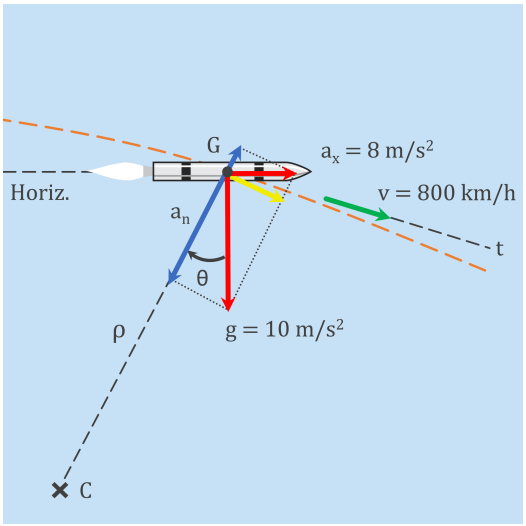


Figure 1: Rocket Accelerates

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 a_n-direction (blue) and the a_t-direction (yellow). From this it can be easily seen that g and a_x deconstructed in the a_n-direction are equal to $g \cdot \cos(\theta)$ and $a_x \cdot \sin(\theta)$ respectively. However, in this case $a_x \cdot \sin(\theta)$ points in the opposite way of a_n (points ↗ instead of ↙). This means that to determine the final value of a_n, the term $a_x \cdot \sin(\theta)$ should be subtracted. Resulting in the final answer:

$$a_n = g \cdot \cos(\theta) – a_x \cdot \sin(\theta) \qquad (1)$$