A car has a mass of 1200 kg. It is travelling east with a velocity of 120 km/h. It slows to a stop in a time interval of 12 seconds. What is the magnitude and direction of the net force that acted on the car to bring it to a stop?

Given:

Mass of the car: m = 1200 kg

Initial velocity of the car: v_i = 120 km/h = (120 × 1000) / 3600 = 33.33 m/s direction east

Final velocity of the car: v_f= 0 m/s

Time interval for the car to stop: Δt =12 seconds

Determine: force acting on the car to bring it to rest: F

Use formula for force:

$$F = ma \quad \text{----------(1)}$$

Acceleration "a" is unknown.

To calculate "a" use equation of motion:

$$v_f = v_i + a(\Delta t) \quad \text{----------(2)}$$

Substituting for v_f, v_i and Δt in (2):

$$0 = 33.33 + a\,(12)$$

$$a = -\,33.33 / 12 = -2.78 \text{ m/s}^2$$

Substituting for “m” and “a” in (1):

$$\mathbf{F = 1200 \times (- 2.78) = - 3{,}336\ N}$$

Magnitude of the force acting on the car is 3,336 N.

Negative sign on the force value signifies that the force is acting in a direction opposite to the initial direction of motion of the car in order to bring it to a stop. So the direction of the force is WEST.

N is Newtons, the unit of force.
1 N = 1 kg m / s^2.