Q- A curve in a road forms part of a horizontal circle. As a car goes around it at a constant speed 14.0 m/s, the total force on the driver has magnitude 130N. What is the total vector force on the driver if the speed is 18.0m/s instead?

To move a body on a curved path with constant speed, its direction of motion is to be changed continuously. For that we require a force to act in such a way that it always acts perpendicular to the direction of its motion, towards the center of circular path. This force is called centripetal force and its magnitude is given by

$F_{centripetal} = mv^2/R$

Where m is the mass of the body, v is the magnitude of its velocity and R is the radius of curvature of the curved path.

Now in our problem we have to compare the force when the same car of mass m is moving on the same curve of radius R with different speeds.

Hence the centripetal force in the two cases are given by

$$F_1 = \frac{mv_1^2}{R}$$

And $$F_2 = \frac{mv_2^2}{R}$$

Dividing the two equations we have

$$\frac{F_1}{F_2} = \frac{v_1^2}{v_2^2}$$

$v_1 = 14.0$ m/s; $F_1 = 130$ N; $v_2 = 18.0$ m/s; $F_2 = ?$

Substituting we have

$$\frac{130}{F_2} = \frac{14^2}{18^2}$$

or $$F_2 = \frac{130 * 18^2}{14^2} = 214.89 \text{ N.}$$