$$W = \vec{F}.\vec{S} = (-i + 2j + 3k).(4\hat{k}) = 12J$$

Example 5: A cyclist comes to a skidding stop in 10m. During this process, the force on the cycle due to road is 200 N and is directly opposed to the motion. (a) How much work does the road do on the cycle? (b) How much work does the cycle do on the road? (NCERT) Ans: (a) -2000J (b) zero.

Solution: Since the direction of force is opposite to the direction of motion, $\theta = 180^{\circ}$. So, $\cos\theta = -1$.

So, work done by the road on the cycle is

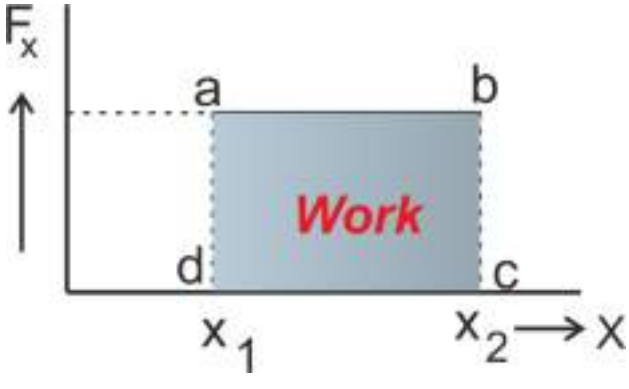
$$W = F.S \cos\theta = 200 \times 10 \times (-1) = -2000J$$

(b) In this case a reaction force is applied by the cycle on the road. But, as there is no displacement of the road, work done on the road is zero.

Determination of work using graph

(A) For constant Force:

In this case Fx versus x graph is a straight line parallel to the x – axis



Area under the f_x – x graph = area of rectangle abcd

$= ad \times dc$

$= f_x . [x_2 - x_1] = F_x . \Delta x$

= **Work done**