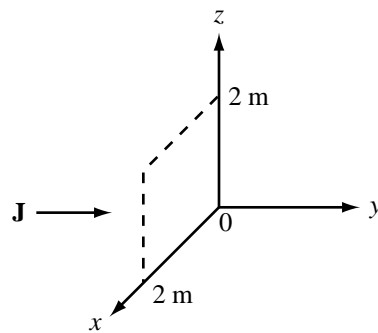


**Problem 4.6** If  $\mathbf{J} = \hat{\mathbf{y}}4xz$  (A/m<sup>2</sup>), find the current  $I$  flowing through a square with corners at  $(0,0,0)$ ,  $(2,0,0)$ ,  $(2,0,2)$ , and  $(0,0,2)$ .

**Solution:** Using Eq. (4.12), the net current flowing through the square shown in Fig. P4.6 is

$$I = \int_S \mathbf{J} \cdot d\mathbf{s} = \int_{x=0}^2 \int_{z=0}^2 (\hat{\mathbf{y}}4xz) \Big|_{y=0} \cdot (\hat{\mathbf{y}} dx dz) = (x^2 z^2) \Big|_{x=0}^2 \Big|_{z=0}^2 = 16 \text{ A}.$$



**Figure P4.6:** Square surface.