Step-1

Let $P=(1,0,-1), Q=(1,1,1), R=(2,2,1)$ and

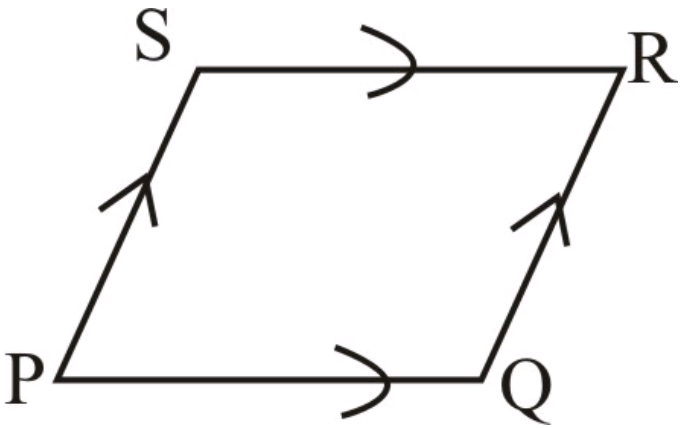
Let $S=(x,y,z)$ be the fourth vertex so that PQRS is a parallelogram. Then we have

$$\left.\begin{array}{l}1+2=x+1\\0+2=y+1\\-1+1=2+1\end{array}\right\}\Rightarrow(x,y,z)=(2,1,-1)$$

So,

Step-2

Coordinates of $S=(2,1,-1)$



$\overrightarrow{PQ}=(0,1,2),\ \overrightarrow{PS}=(1,1,0)$

Step-3

Area of parallelogram PQRS = length of vector $\begin{vmatrix} i & j & k \\ 0 & 1 & 2 \\ 1 & 1 & 0 \end{vmatrix}$

$=\left|-2i+2j-k\right|$

$=\sqrt{4+4+1}$

= 3 sq.units

Step-4

We can choose

$T=(0,1,2), U=(1,1,0), V=(1,2,2)$ to get a parallelepiped OPQRSTUV and its volume is given by

$$\left[\overrightarrow{OP}\ \ \overrightarrow{OT}\ \overrightarrow{OU}\right]=\begin{vmatrix}1 & 0 & -1\\ 0 & 1 & 2\\ 1 & 1 & 0\end{vmatrix}$$

$$=\left|1(0-2)-1(0-1)\right|$$
$$=\left|-2+1\right|$$
$$=1$$

$$\boxed{=1 \text{ cubic units}}$$