

## AREA OF THE TRIANGLE

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Let be  $A(1, 1, 0); B(0, 1, 1); C(2, 2, 2)$ .

Find the area of  $\triangle ABC$ .

$$\begin{aligned}\overrightarrow{AB} &= (x_B - x_A)\overrightarrow{i} + (y_B - y_A)\overrightarrow{j} + (z_B - z_A)\overrightarrow{k} \\ \overrightarrow{AB} &= (0 - 1)\overrightarrow{i} + (1 - 1)\overrightarrow{j} + (1 - 0)\overrightarrow{k} = -\overrightarrow{i} + \overrightarrow{k} \\ \overrightarrow{AC} &= (x_C - x_A)\overrightarrow{i} + (y_C - y_A)\overrightarrow{j} + (z_C - z_A)\overrightarrow{k} \\ \overrightarrow{AC} &= (2 - 1)\overrightarrow{i} + (2 - 1)\overrightarrow{j} + (2 - 0)\overrightarrow{k} = \overrightarrow{i} + \overrightarrow{j} + 2\overrightarrow{k} \\ \overrightarrow{AB} \times \overrightarrow{AC} &= \begin{vmatrix} \overrightarrow{i} & \overrightarrow{j} & \overrightarrow{k} \\ -1 & 0 & 1 \\ 1 & 1 & 2 \end{vmatrix} = \overrightarrow{j} - \overrightarrow{k} - \overrightarrow{i} + 2\overrightarrow{j} \\ \overrightarrow{AB} \times \overrightarrow{AC} &= -\overrightarrow{i} + 3\overrightarrow{j} - \overrightarrow{k} \\ |\overrightarrow{AB} \times \overrightarrow{AC}| &= \sqrt{(-1)^2 + 3^2 + (-1)^2} = \sqrt{11} \\ \text{Area}(\triangle ABC) &= \frac{1}{2}|\overrightarrow{AB} \times \overrightarrow{AC}| = \frac{\sqrt{11}}{2}\end{aligned}$$

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