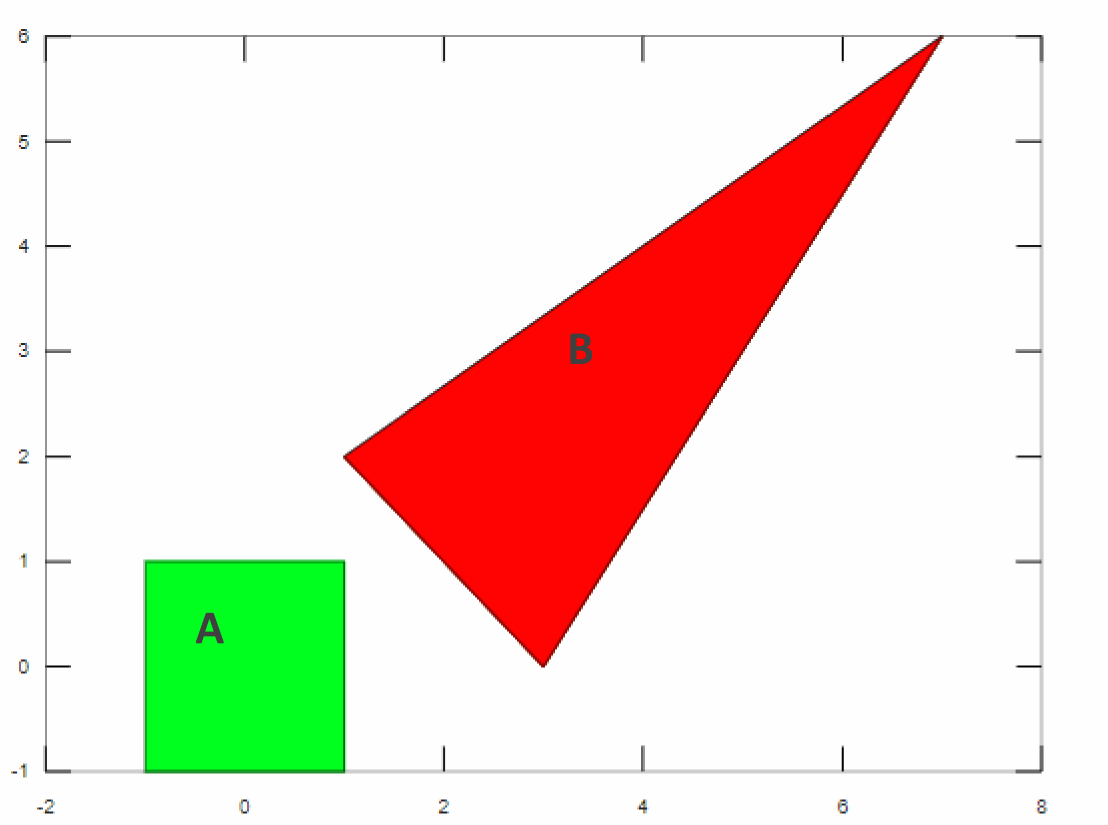
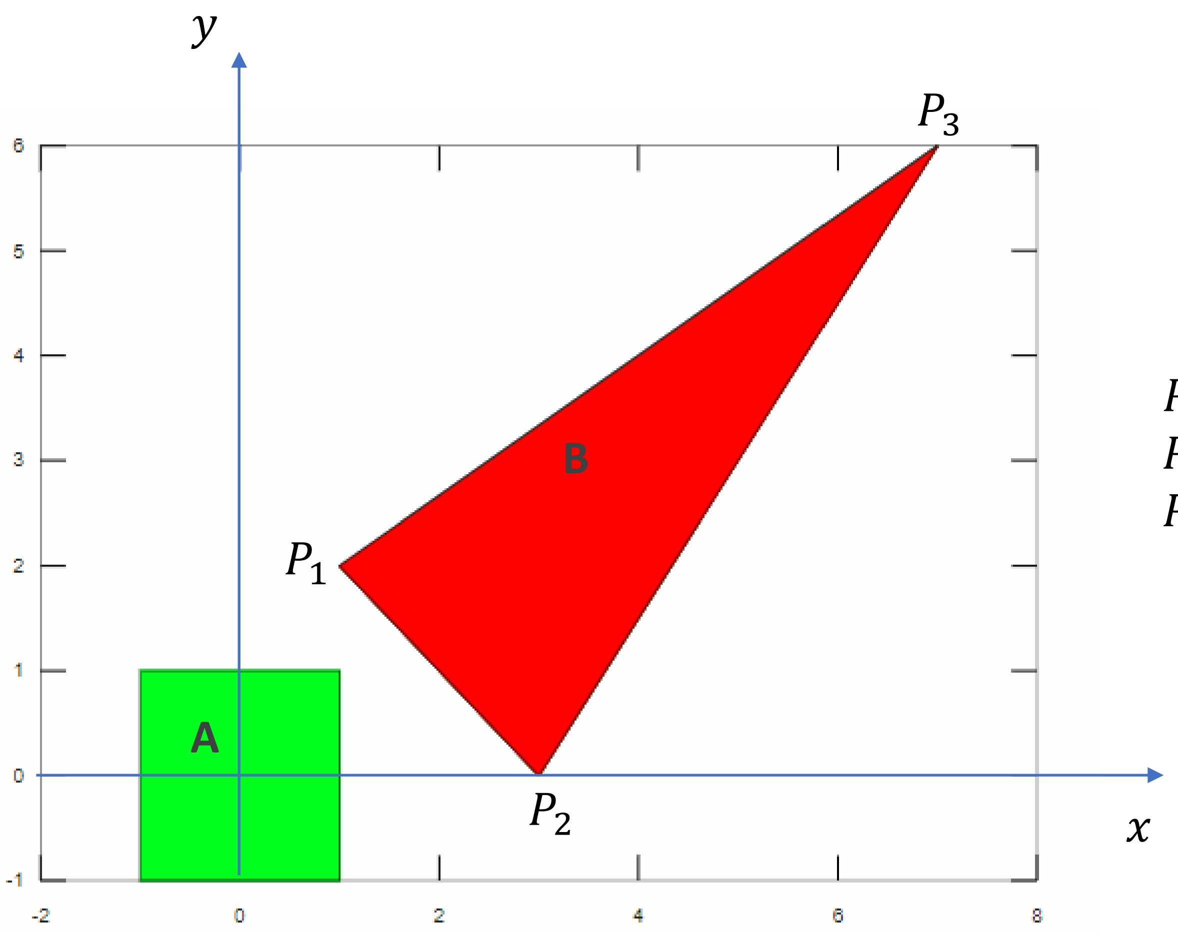
Separating Axis Theorem

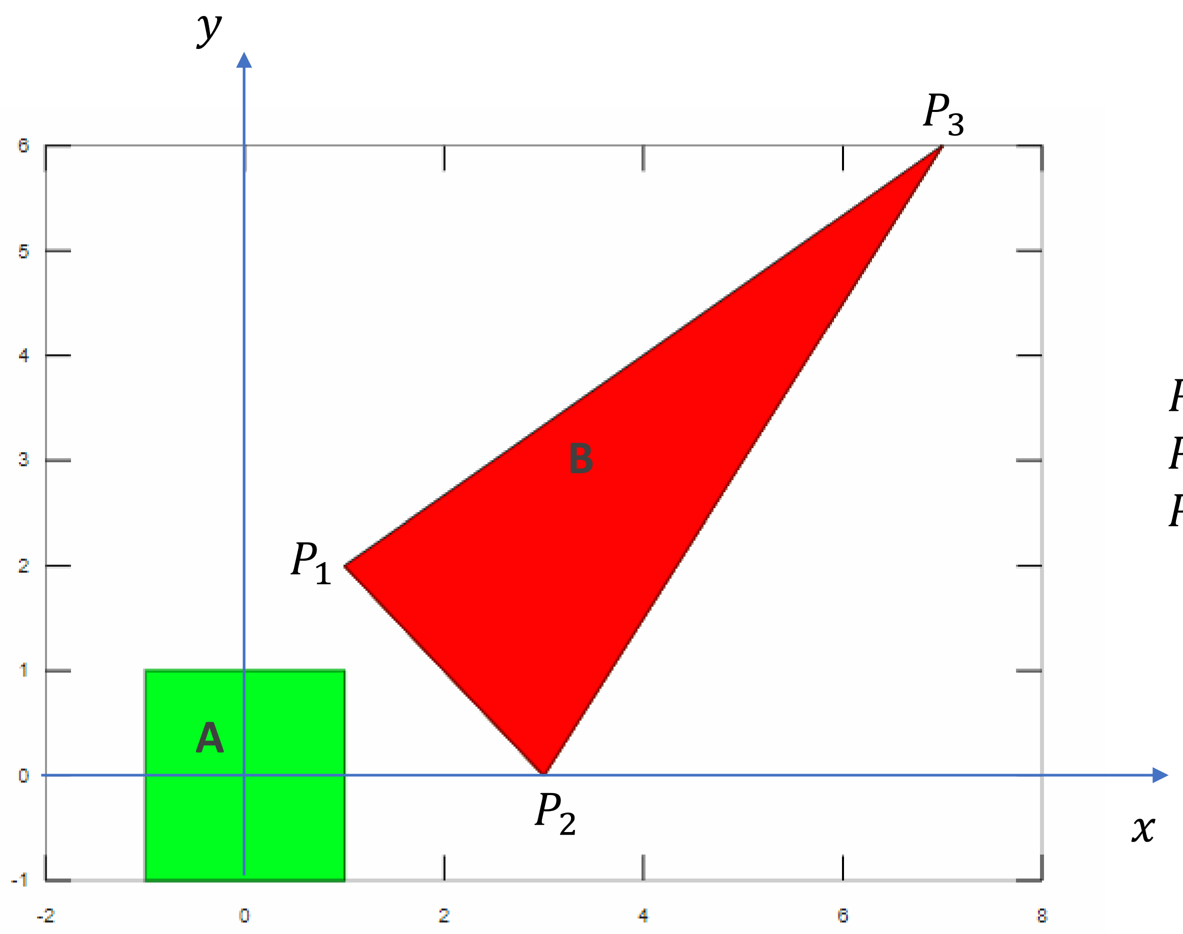


Separating Axis Theorem



$P_1 = (1,2)$
$P_2 = (3,0)$
$P_3 = (7,6)$

Separating Axis Theorem

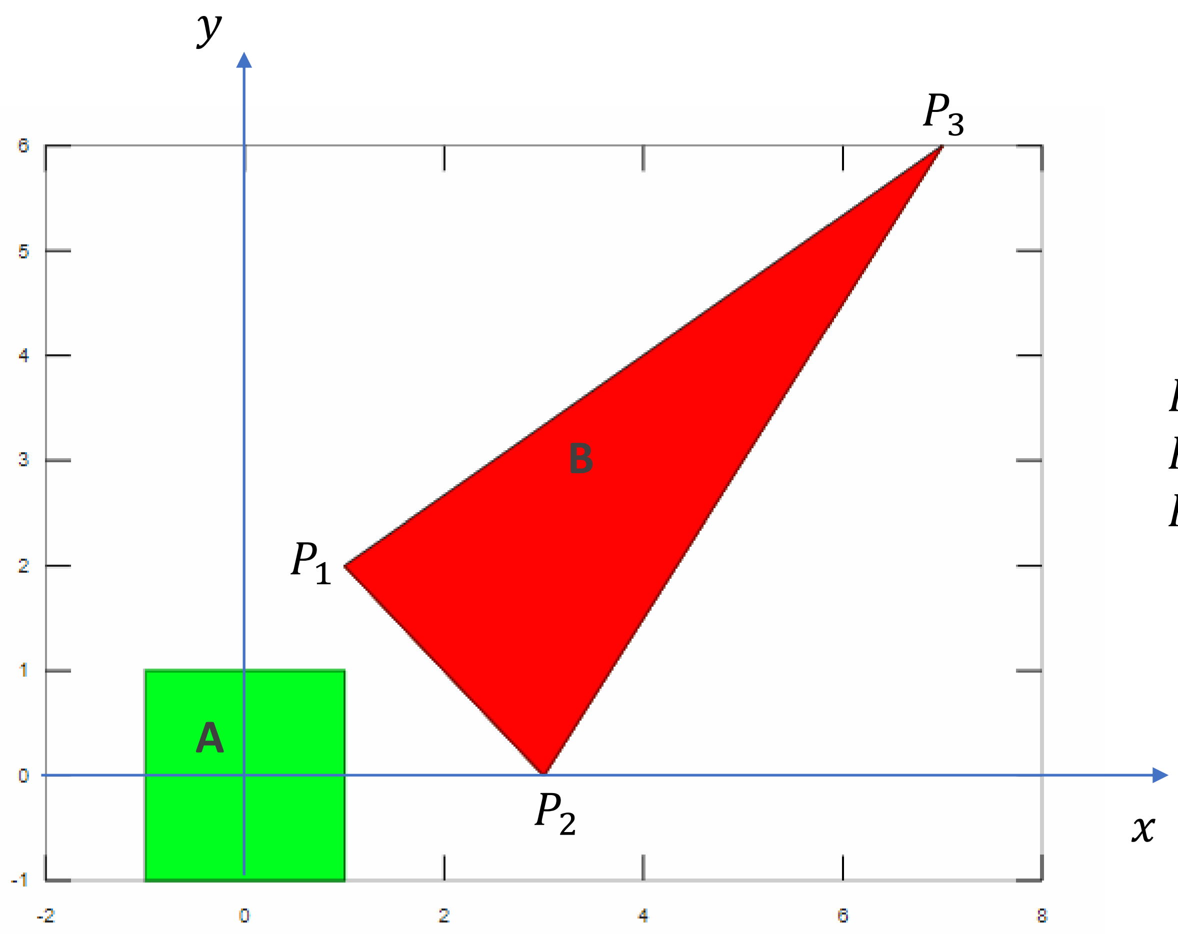


$P_1 = (1,2)$
$P_2 = (3,0)$
$P_3 = (7,6)$

$$K = \begin{pmatrix} \operatorname{cov}(x,y) & \operatorname{cov}(x,y) \\ \operatorname{cov}(x,y) & \operatorname{cov}(y,y) \end{pmatrix}$$

$$\operatorname{cov}(x,y) = \frac{1}{n}\sum_{i=1}^{n}(x-\bar{x})(y-\bar{y})$$

Separating Axis Theorem



$P_1 = (1,2)$
$P_2 = (3,0)$
$P_3 = (7,6)$

$$\bar{x} = \frac{1+3+7}{3} = \frac{11}{3}$$

$$\bar{y} = \frac{2+0+6}{3} = \frac{8}{3}$$

Separating Axis Theorem

$$\operatorname{cov}(x,x) = \frac{1}{3}\left[\left(1-\frac{11}{3}\right)^2 + \left(3-\frac{11}{3}\right)^2 + \left(7-\frac{11}{3}\right)^2\right] = \frac{(-8)^2+(-2)^2+10^2}{3\cdot 3^2} = \frac{56}{9}$$

$$\operatorname{cov}(x,y) = \operatorname{cov}(y,x) = \frac{1}{3}\left[\left(1-\frac{11}{3}\right)\left(2-\frac{8}{3}\right) + \left(3-\frac{11}{3}\right)\left(0-\frac{8}{3}\right) + \left(7-\frac{11}{3}\right)\left(6-\frac{8}{3}\right)\right] = \frac{44}{9}$$

$$\operatorname{cov}(y,y) = \frac{1}{3}\left[\left(2-\frac{8}{3}\right)^2 + \left(0-\frac{8}{3}\right)^2 + \left(6-\frac{8}{3}\right)^2\right] = \frac{(-2)^2+(-8)^2+10^2}{3\cdot 3^2} = \frac{56}{9}$$

$$P_1 = (1,2)$$
$$P_2 = (3,0)$$
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$$\bar{x} = \frac{1+3+7}{3} = \frac{11}{3}$$

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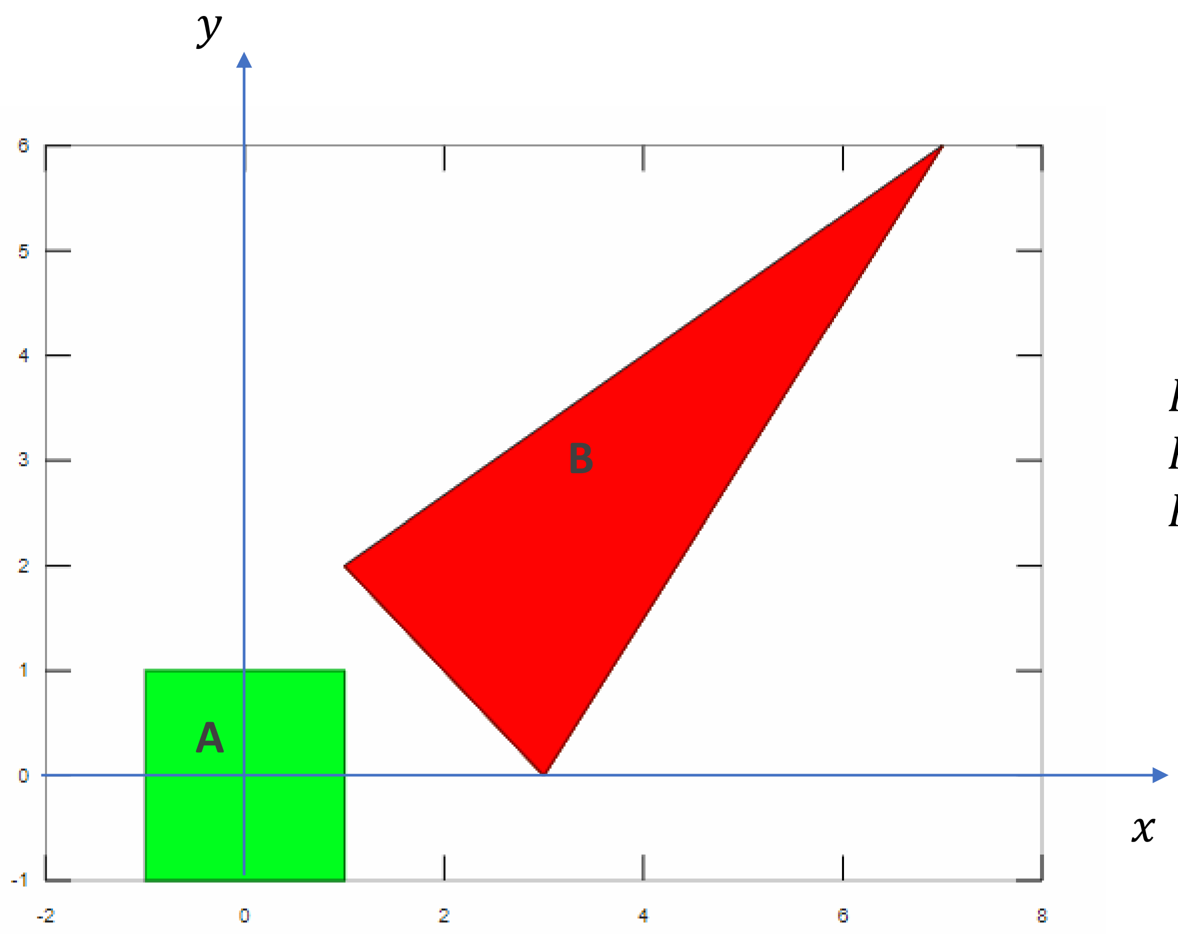
Separating Axis Theorem



$$P_1 = (1,2)$$
$$P_2 = (3,0)$$
$$P_3 = (7,6)$$

$$K = \begin{pmatrix} \frac{56}{9} & \frac{44}{9} \\ \frac{44}{9} & \frac{56}{9} \end{pmatrix}$$

$$K\vec{v} = \lambda\vec{v}$$
$$K - \lambda I = M$$
$$M\vec{v} = \mathbf{0}$$
$$|M| = 0$$

Separating Axis Theorem

$$|M| = \begin{vmatrix} \frac{56}{9} - \lambda & \frac{44}{9} \\ \frac{44}{9} & \frac{56}{9} - \lambda \end{vmatrix} = \left(\frac{56}{9} - \lambda\right)^2 - \left(\frac{44}{9}\right)^2$$

$$|M| = 0 \Rightarrow \frac{56^2}{9^2} - \frac{112\lambda}{9} + \lambda^2 - \frac{44^2}{9^2} = 0$$

$$\lambda_{1,2} = \frac{-\left(-\frac{112}{9}\right) \pm \sqrt{\left(-\frac{112}{9}\right)^2 - 4\,\frac{56^2 - 44^2}{81}}}{2}$$

Separating Axis Theorem

$$\left(\frac{56}{9} - \lambda\right)^2 - \left(\frac{44}{9}\right)^2 = 0$$

$$\Downarrow$$

$$\left|\frac{56}{9} - \lambda\right| = \frac{44}{9}$$

Separating Axis Theorem

$$\left(\frac{56}{9} - \lambda\right)^2 - \left(\frac{44}{9}\right)^2 = 0$$

$$\Downarrow$$

$$\left|\frac{56}{9} - \lambda\right| = \frac{44}{9} \Rightarrow \frac{56}{9} - \lambda = -\frac{44}{9} \vee \frac{56}{9} - \lambda = \frac{44}{9}$$

Separating Axis Theorem

$$\left(\frac{56}{9} - \lambda\right)^2 - \left(\frac{44}{9}\right)^2 = 0$$

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$$\left|\frac{56}{9} - \lambda\right| = \frac{44}{9} \Rightarrow \frac{56}{9} - \lambda = -\frac{44}{9} \vee \frac{56}{9} - \lambda = \frac{44}{9}$$

$$\lambda_1 = \frac{100}{9}; \lambda_2 = \frac{12}{9} = \frac{4}{3}$$

Separating Axis Theorem

$\lambda_1 = \frac{100}{9}$:

$$(K + \lambda_1 I)\binom{x}{y} = \binom{0}{0}$$

$\lambda_2 = \frac{4}{3}$:

$$(K + \lambda_2 I)\binom{x}{y} = \binom{0}{0}$$

Separating Axis Theorem

$\lambda_1 = \frac{100}{9}$:

$$\begin{pmatrix} \frac{56-100}{9} & \frac{44}{9} \\ \frac{44}{9} & \frac{56-100}{9} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \Rightarrow \begin{array}{c} \left(\frac{56}{9} - \frac{100}{9}\right) x + \frac{44}{9} y = 0 \\ 44x - 44y = 0 \end{array} \Rightarrow \quad x = y \quad \Rightarrow \quad \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$$

$\lambda_2 = \frac{4}{3}$:

$$(K + \lambda_2 I) \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

Separating Axis Theorem

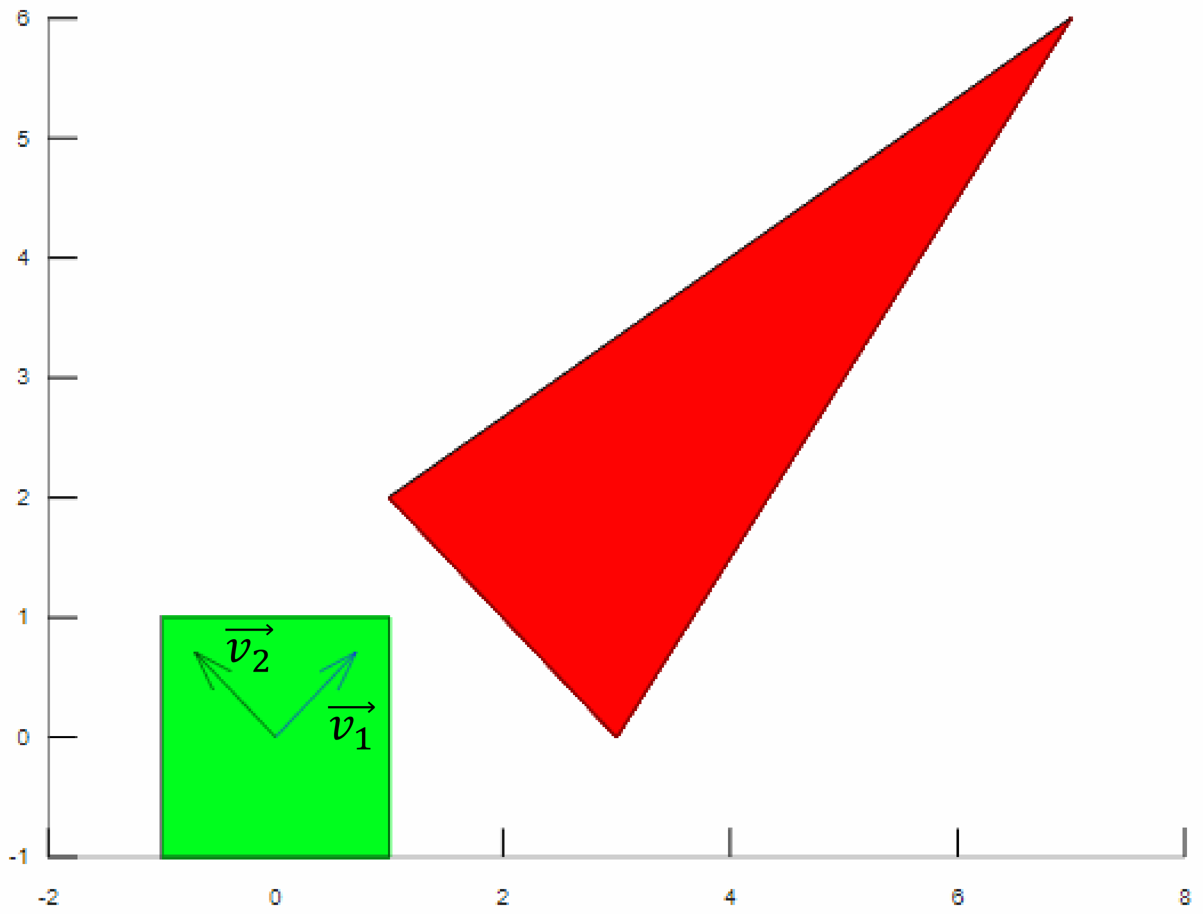
$\lambda_1 = \frac{100}{9}$:

$$\begin{pmatrix} \frac{56-100}{9} & \frac{44}{9} \\ \frac{44}{9} & \frac{56-100}{9} \end{pmatrix} \binom{x}{y} = \binom{0}{0} \Rightarrow \begin{matrix} \left(\frac{56}{9} - \frac{100}{9}\right) x + \frac{44}{9} y = 0 \\ \\ 44x - 44y = 0 \end{matrix} \Rightarrow \quad x = y \quad \Rightarrow \quad \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$$

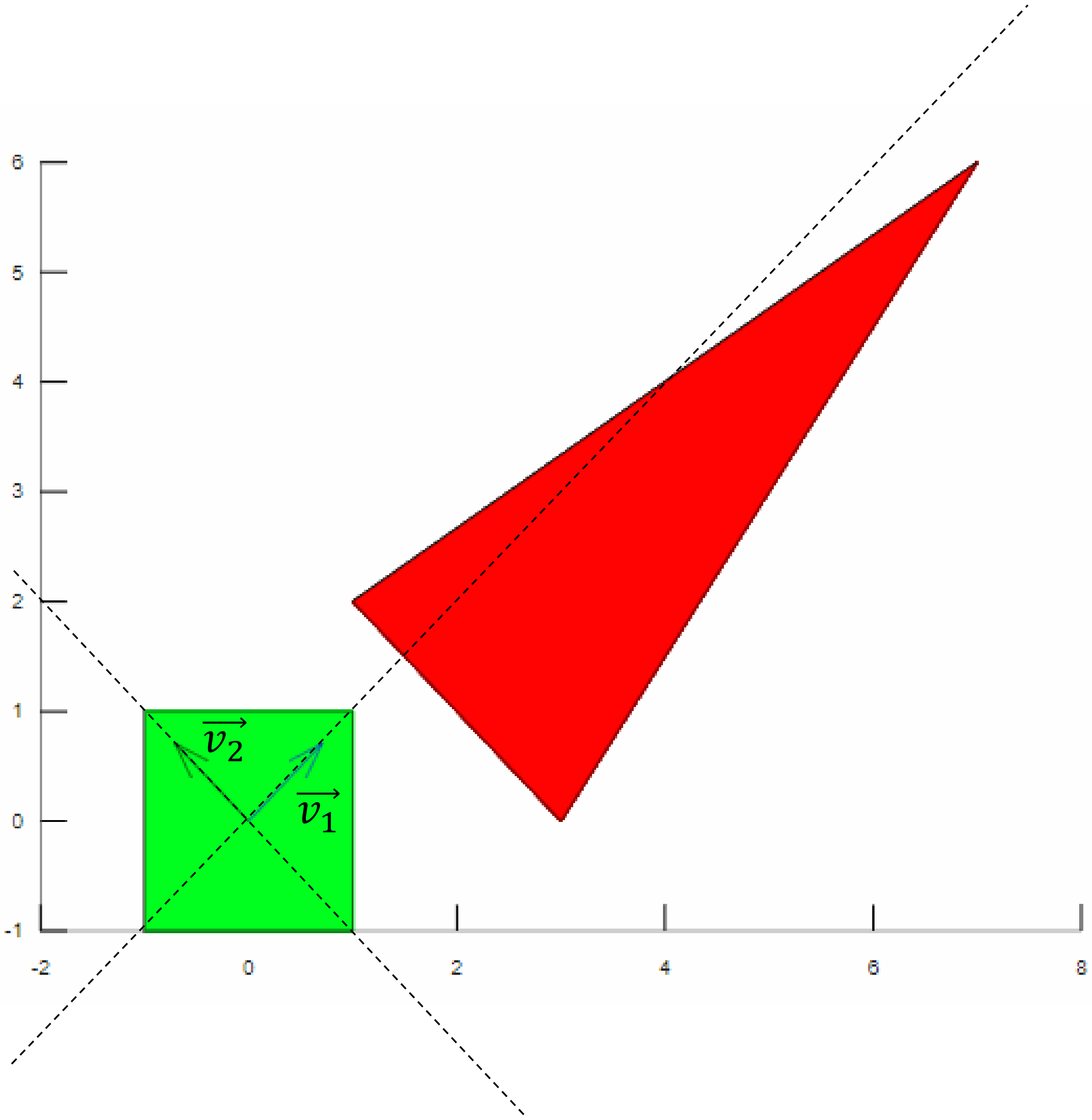
$\lambda_2 = \frac{4}{3}$:

$$\begin{pmatrix} \frac{56-12}{9} & \frac{44}{9} \\ \frac{44}{9} & \frac{56-12}{9} \end{pmatrix} \binom{x}{y} = \binom{0}{0} \Rightarrow \begin{matrix} \left(\frac{56}{9} - \frac{12}{9}\right) x + \frac{44}{9} y = 0 \\ \\ 44x + 44y = 0 \end{matrix} \Rightarrow \quad -x = y \quad \Rightarrow \quad \overrightarrow{v_2} = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$$

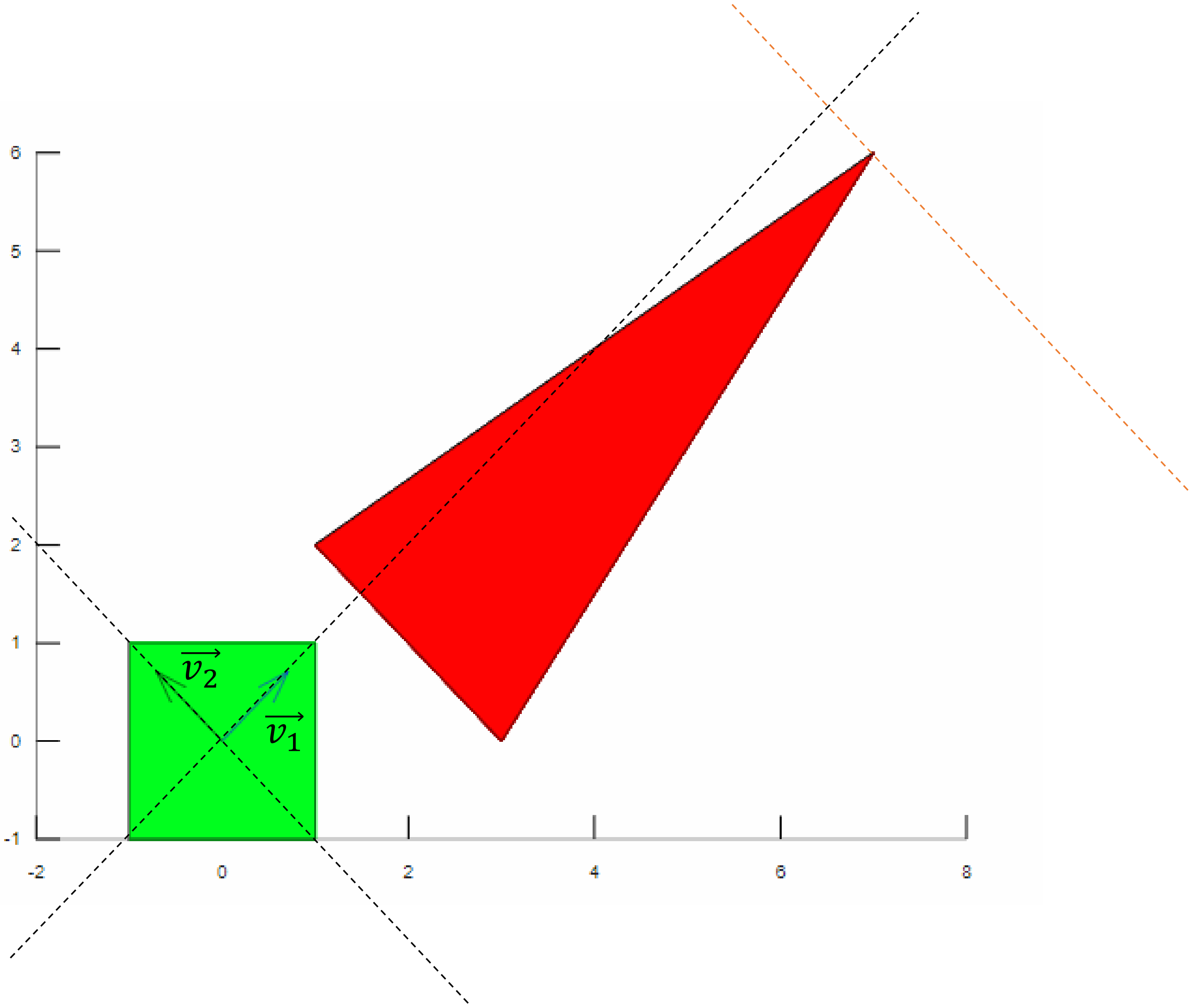
Separating Axis Theorem



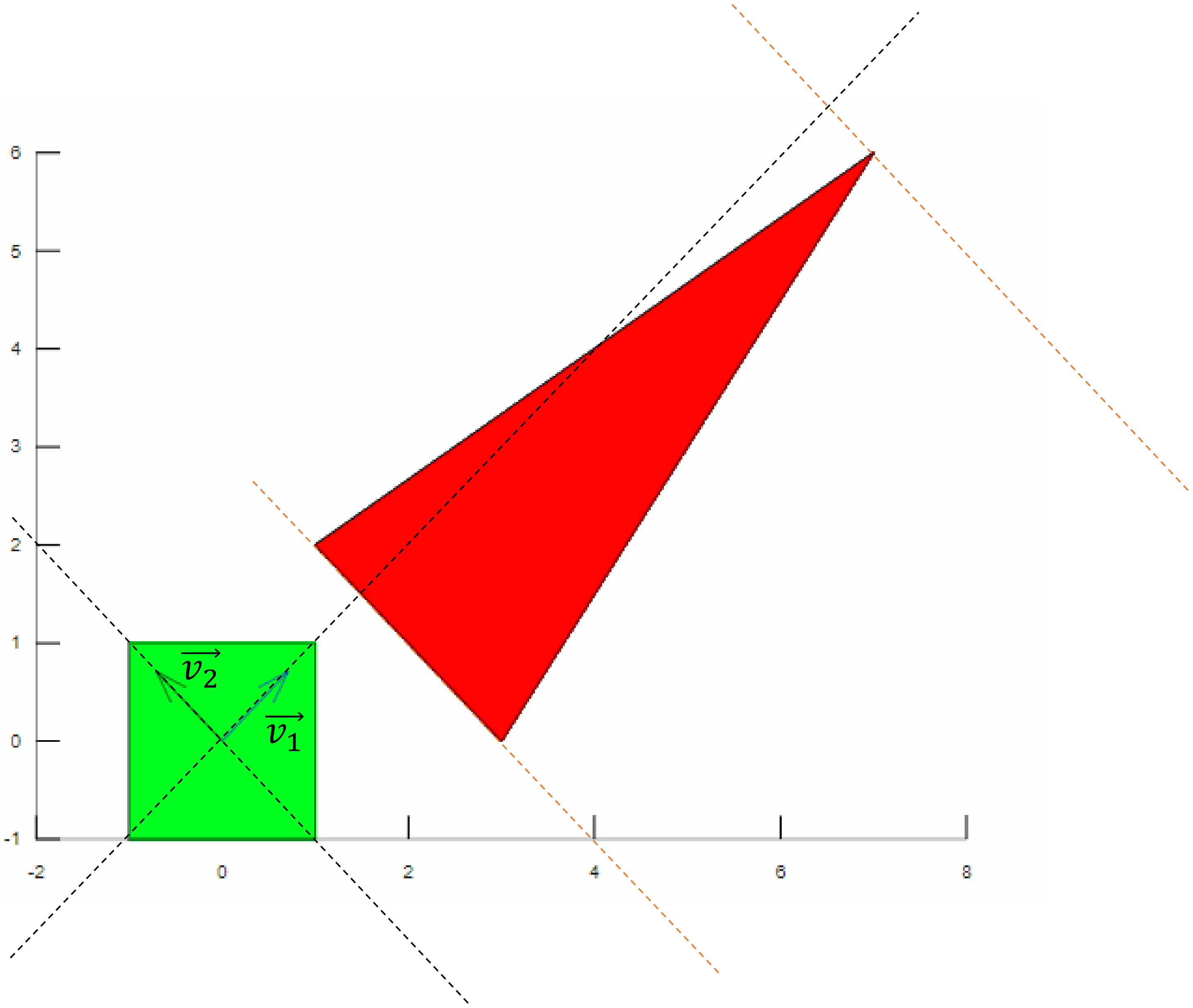
Separating Axis Theorem



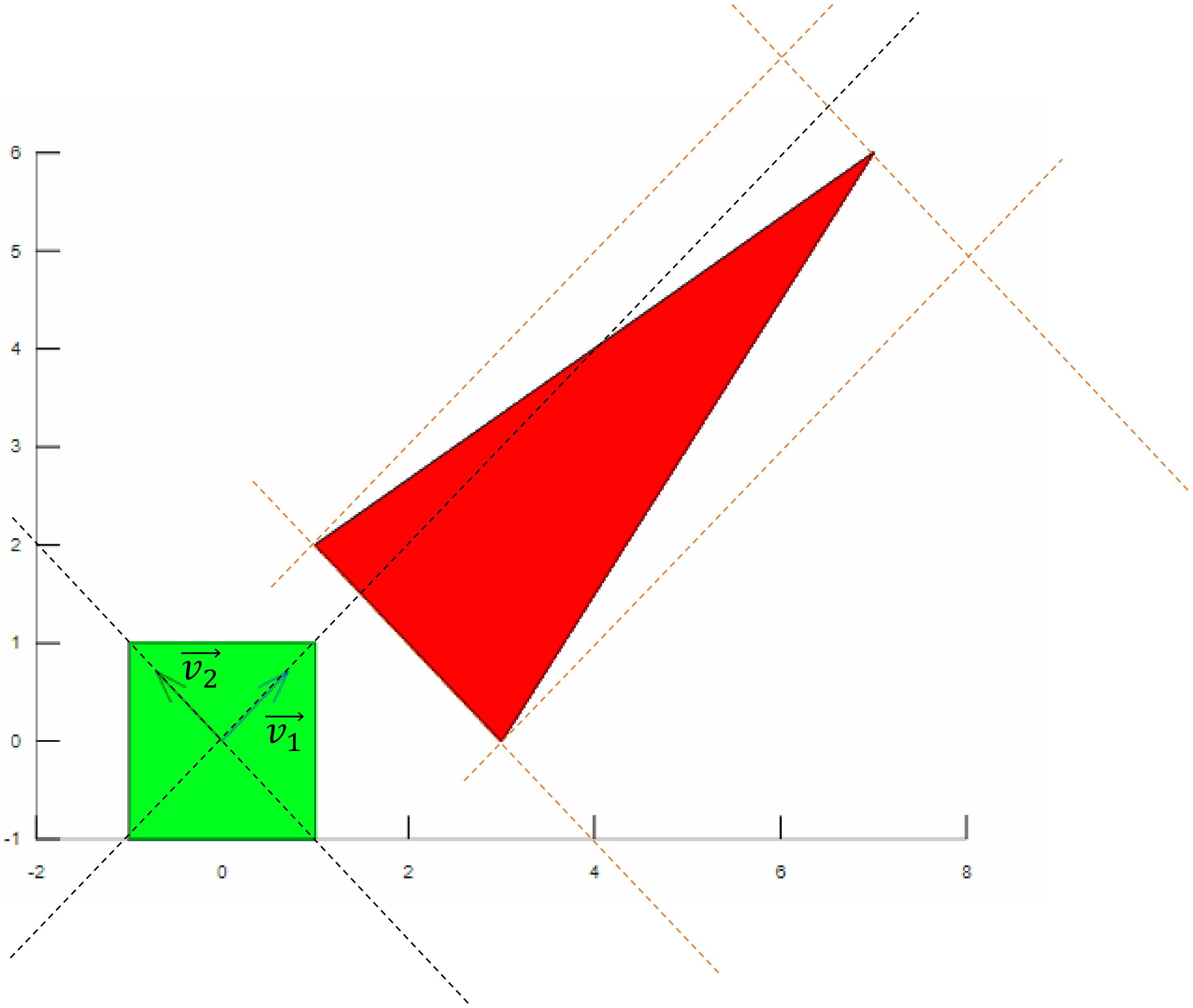
Separating Axis Theorem



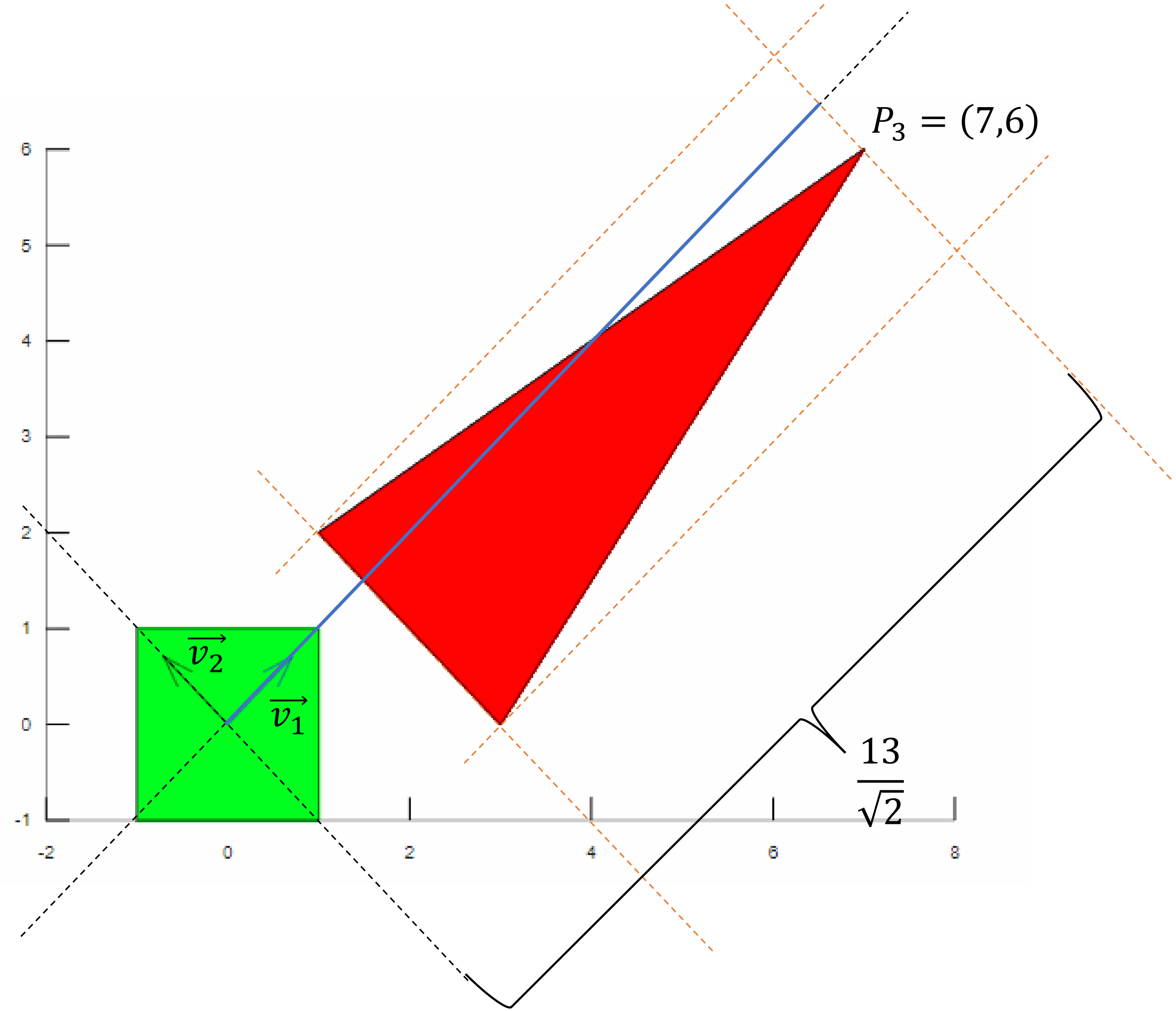
Separating Axis Theorem



Separating Axis Theorem

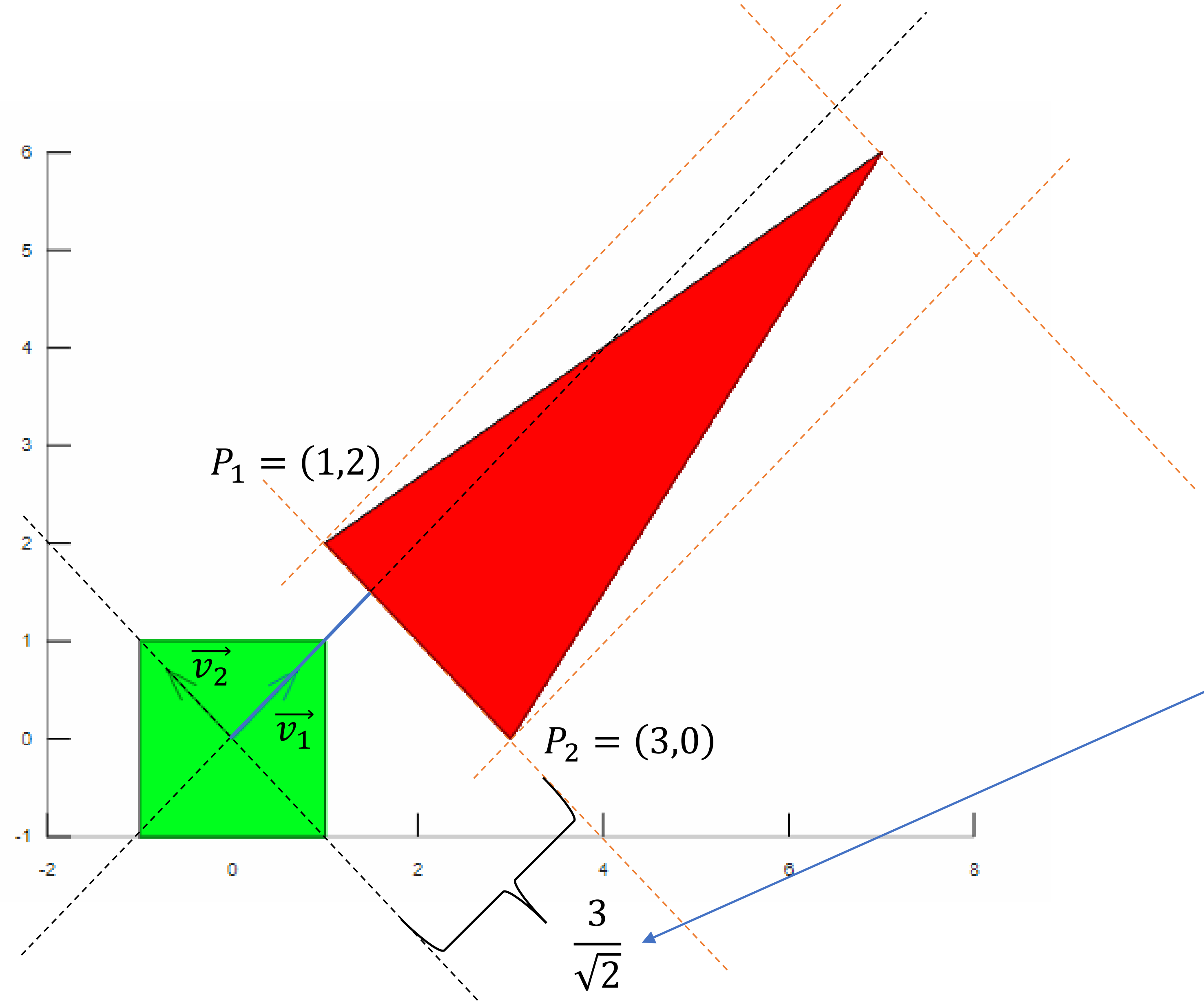


Separating Axis Theorem



$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

Separating Axis Theorem

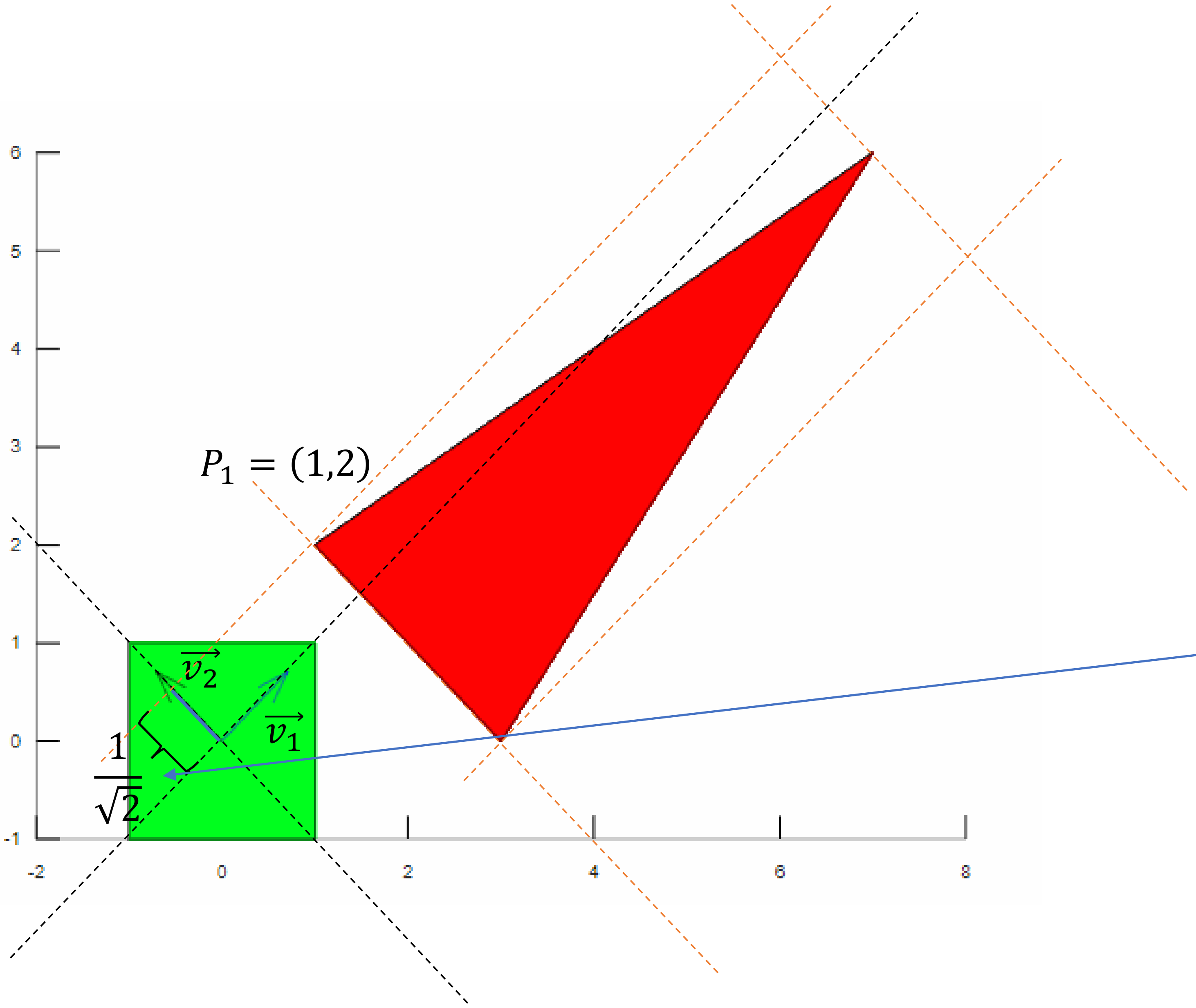


$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (3,0) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (1,2) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{3}{\sqrt{2}}$$

Separating Axis Theorem



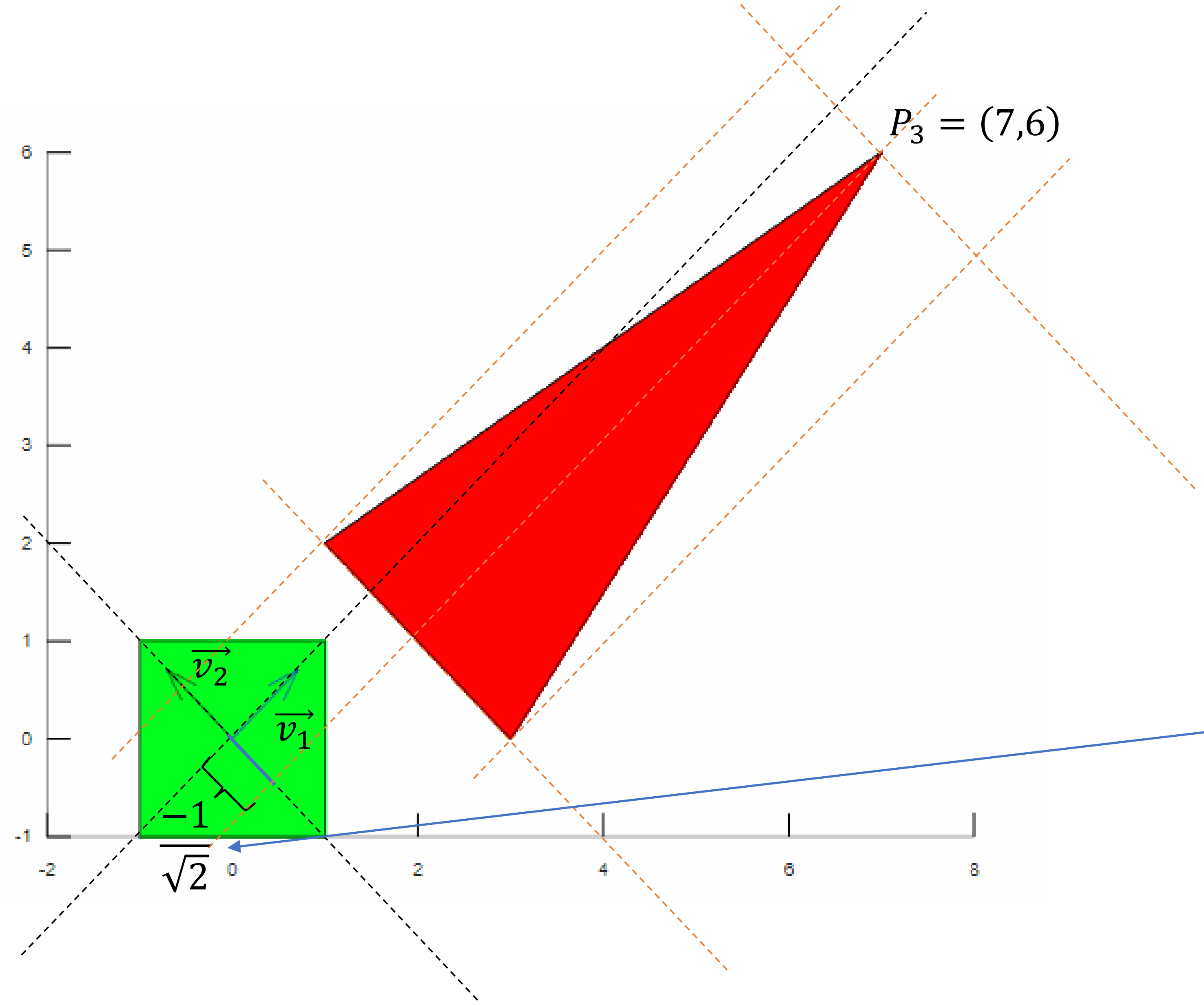
$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (3,0) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (1,2) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_2} \cdot (1,2) = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{1}{\sqrt{2}}$$

Separating Axis Theorem



$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

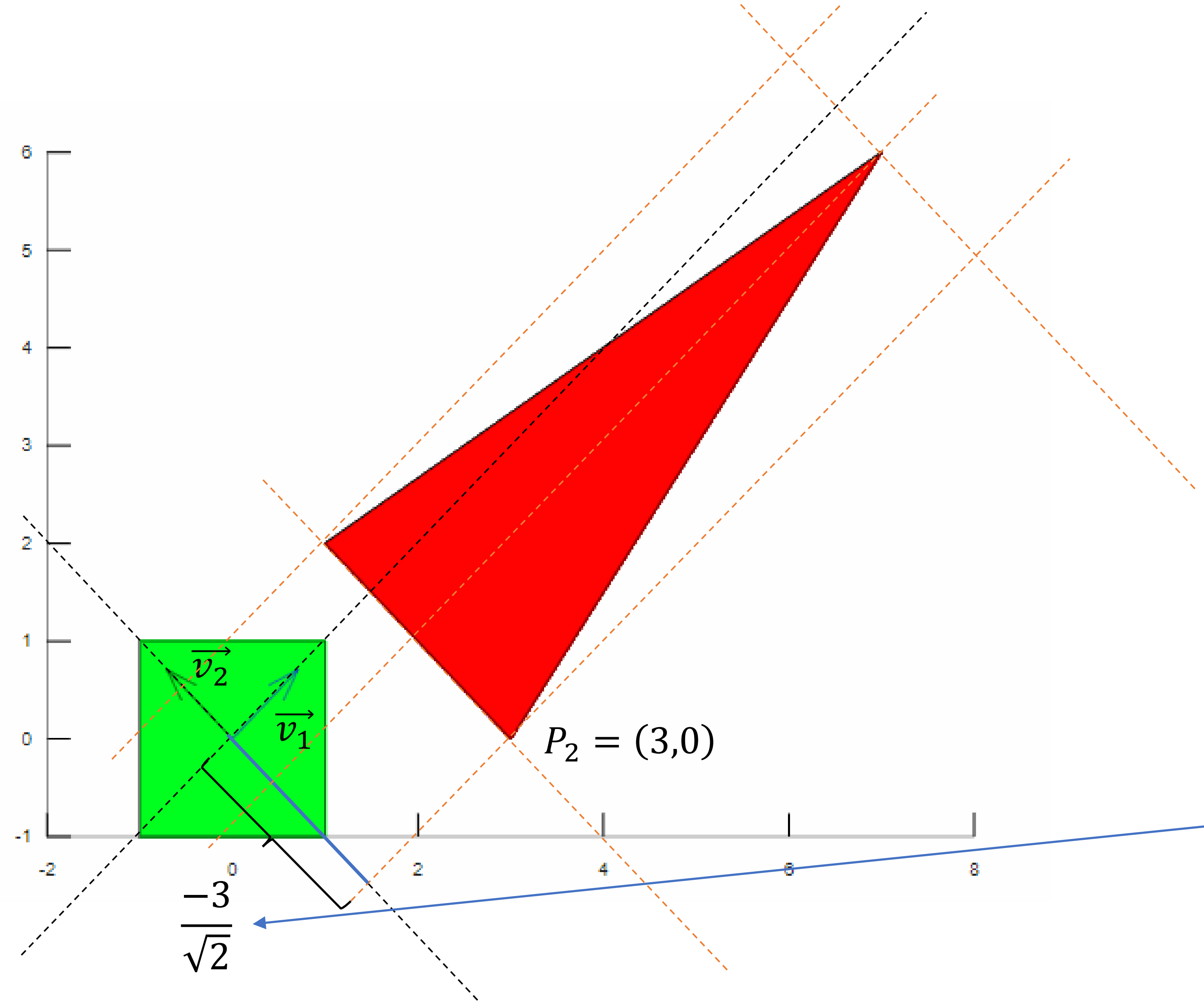
$$\overrightarrow{v_1} \cdot (3,0) = \left(\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (1,2) = \left(\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_2} \cdot (1,2) = \left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{1}{\sqrt{2}}$$

$$\overrightarrow{v_2} \cdot (7,6) = \left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{-1}{\sqrt{2}}$$

Separating Axis Theorem



$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (3,0) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{3}{\sqrt{2}}$$

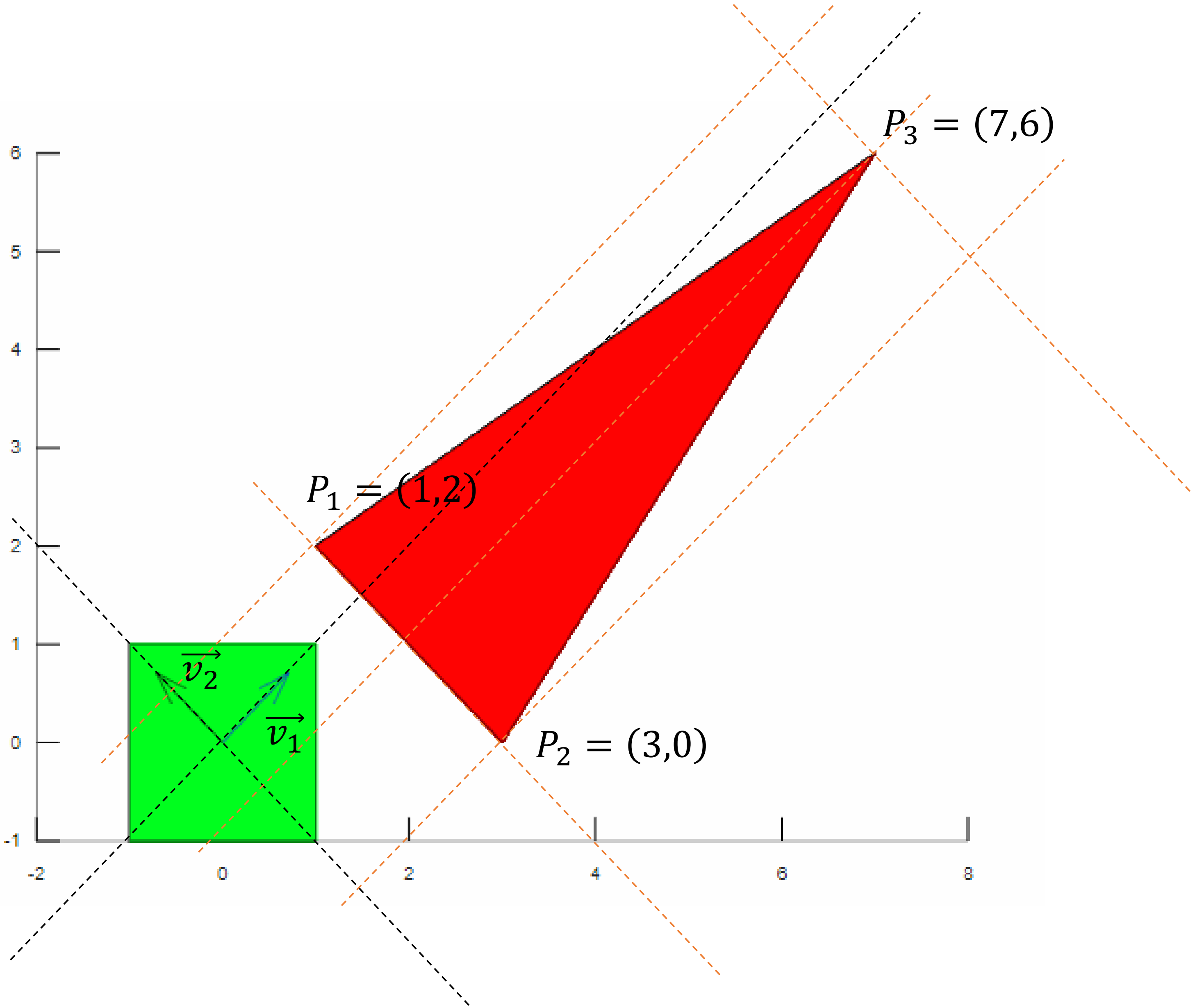
$$\overrightarrow{v_1} \cdot (1,2) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_2} \cdot (1,2) = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{1}{\sqrt{2}}$$

$$\overrightarrow{v_2} \cdot (7,6) = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{-1}{\sqrt{2}}$$

$$\overrightarrow{v_2} \cdot (3,0) = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{-3}{\sqrt{2}}$$

Separating Axis Theorem



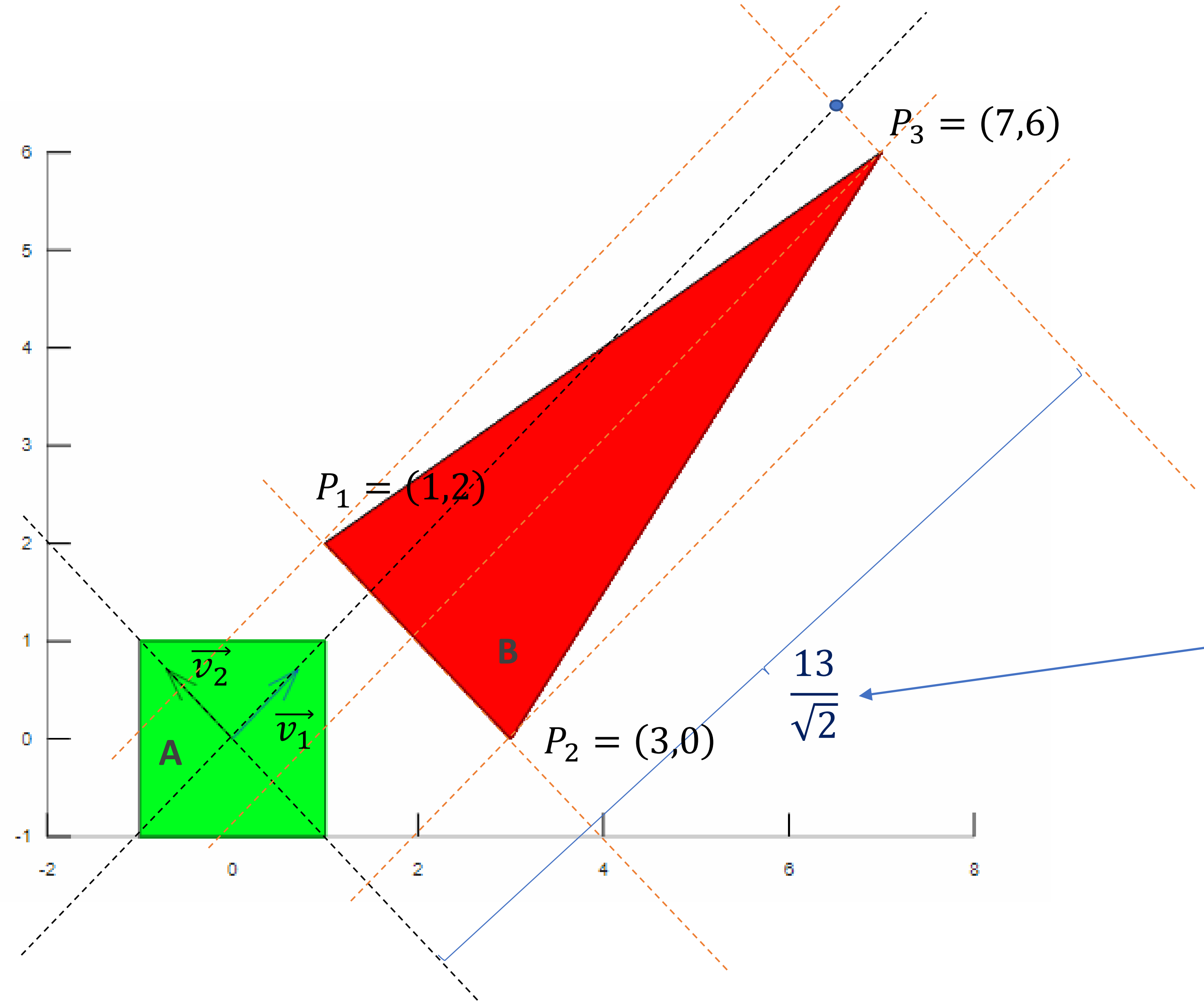
$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (3,0) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (1,2) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_1} \cdot (7,6), \overrightarrow{v_1} \cdot (3,0), \overrightarrow{v_1} \cdot (1,2)\} = ?$$

Separating Axis Theorem



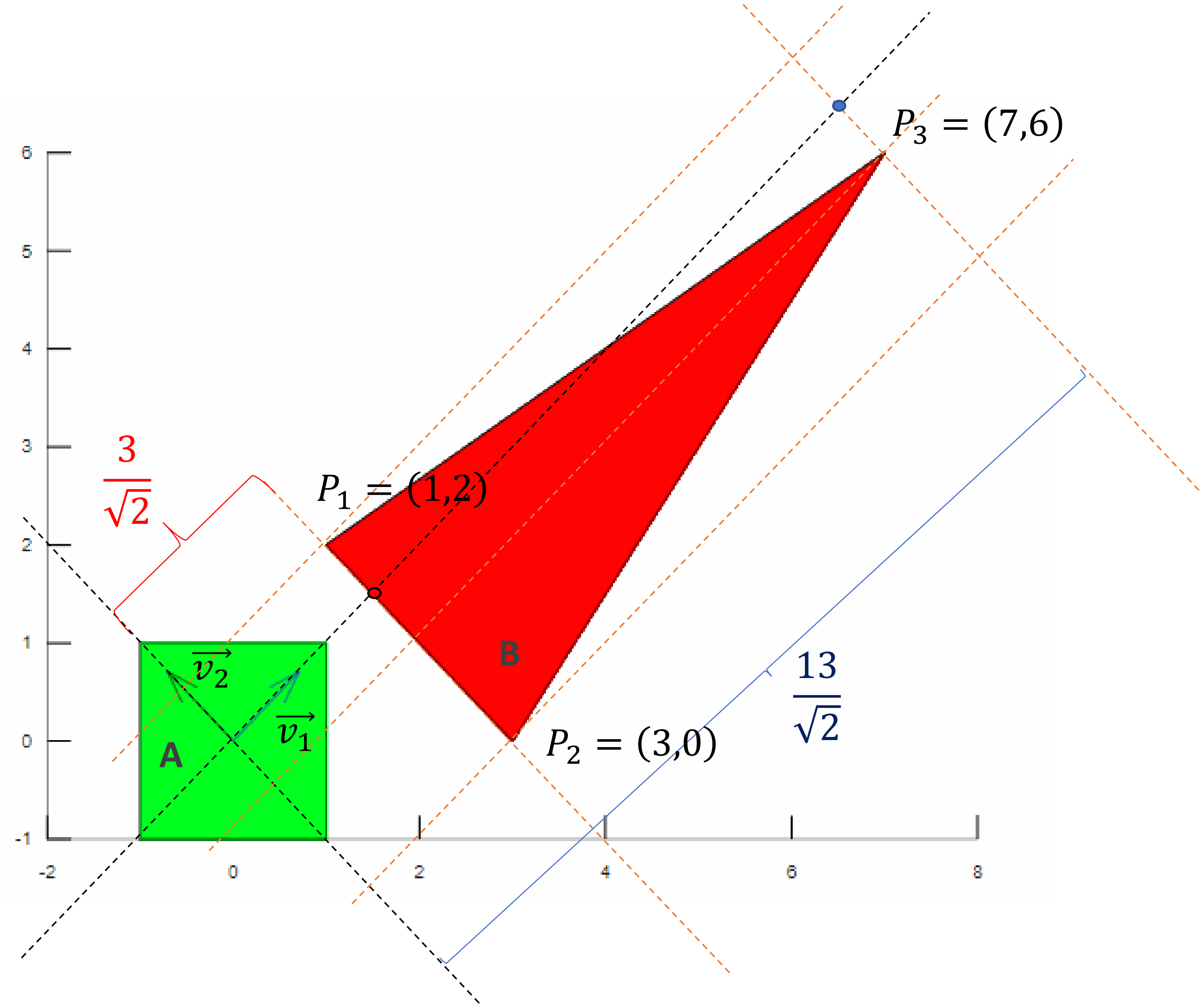
$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (3,0) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (1,2) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_1} \cdot (7,6), \overrightarrow{v_1} \cdot (3,0), \overrightarrow{v_1} \cdot (1,2)\} = \frac{13}{\sqrt{2}}$$

Separating Axis Theorem



$$\overrightarrow{v_1} \cdot (7,6) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (7,6) = \frac{13}{\sqrt{2}}$$

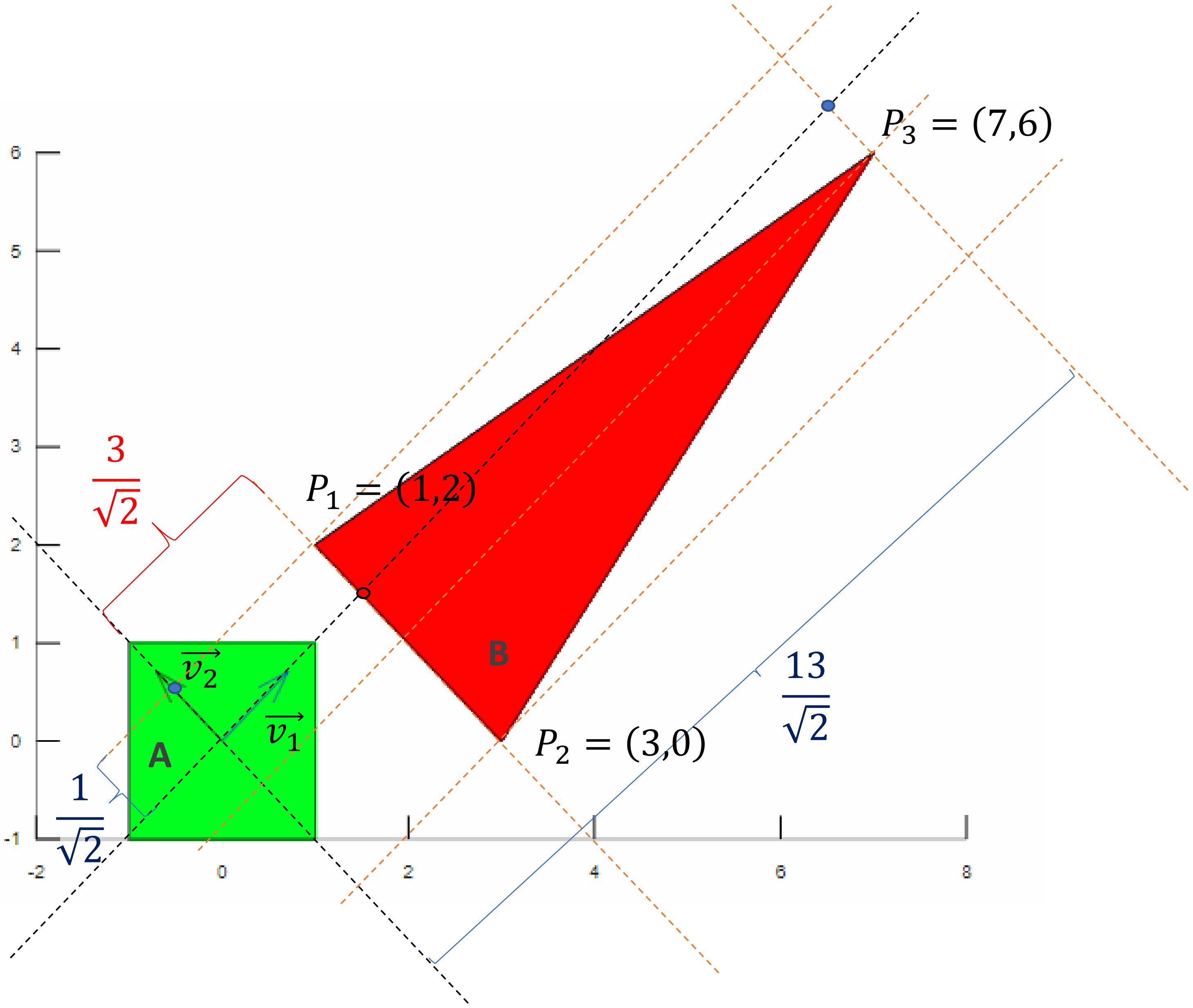
$$\overrightarrow{v_1} \cdot (3,0) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (3,0) = \frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_1} \cdot (1,2) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,2) = \frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_1} \cdot (7,6), \overrightarrow{v_1} \cdot (3,0), \overrightarrow{v_1} \cdot (1,2)\} = \frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1} \cdot (7,6), \overrightarrow{v_1} \cdot (3,0), \overrightarrow{v_1} \cdot (1,2)\} = \frac{3}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

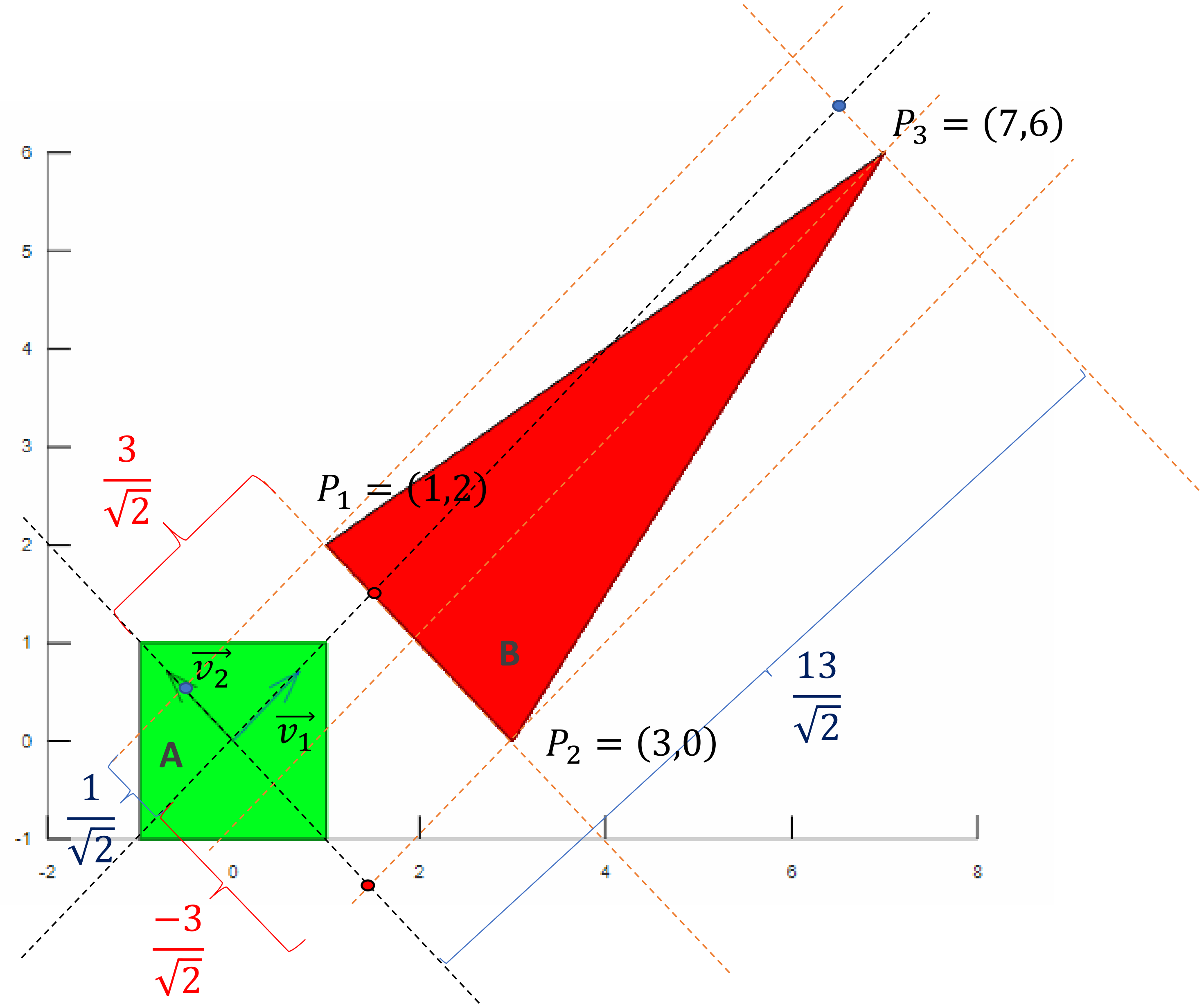
$$\overrightarrow{v_2}\cdot(1,2)=\left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)\cdot(1,2)=\frac{1}{\sqrt{2}}$$

$$\overrightarrow{v_2}\cdot(7,6)=\left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)\cdot(7,6)=\frac{-1}{\sqrt{2}}$$

$$\overrightarrow{v_2}\cdot(3,0)=\left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)\cdot(3,0)=\frac{-3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$\overrightarrow{v_2}\cdot(1,2)=\left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)\cdot(1,2)=\frac{1}{\sqrt{2}}$$

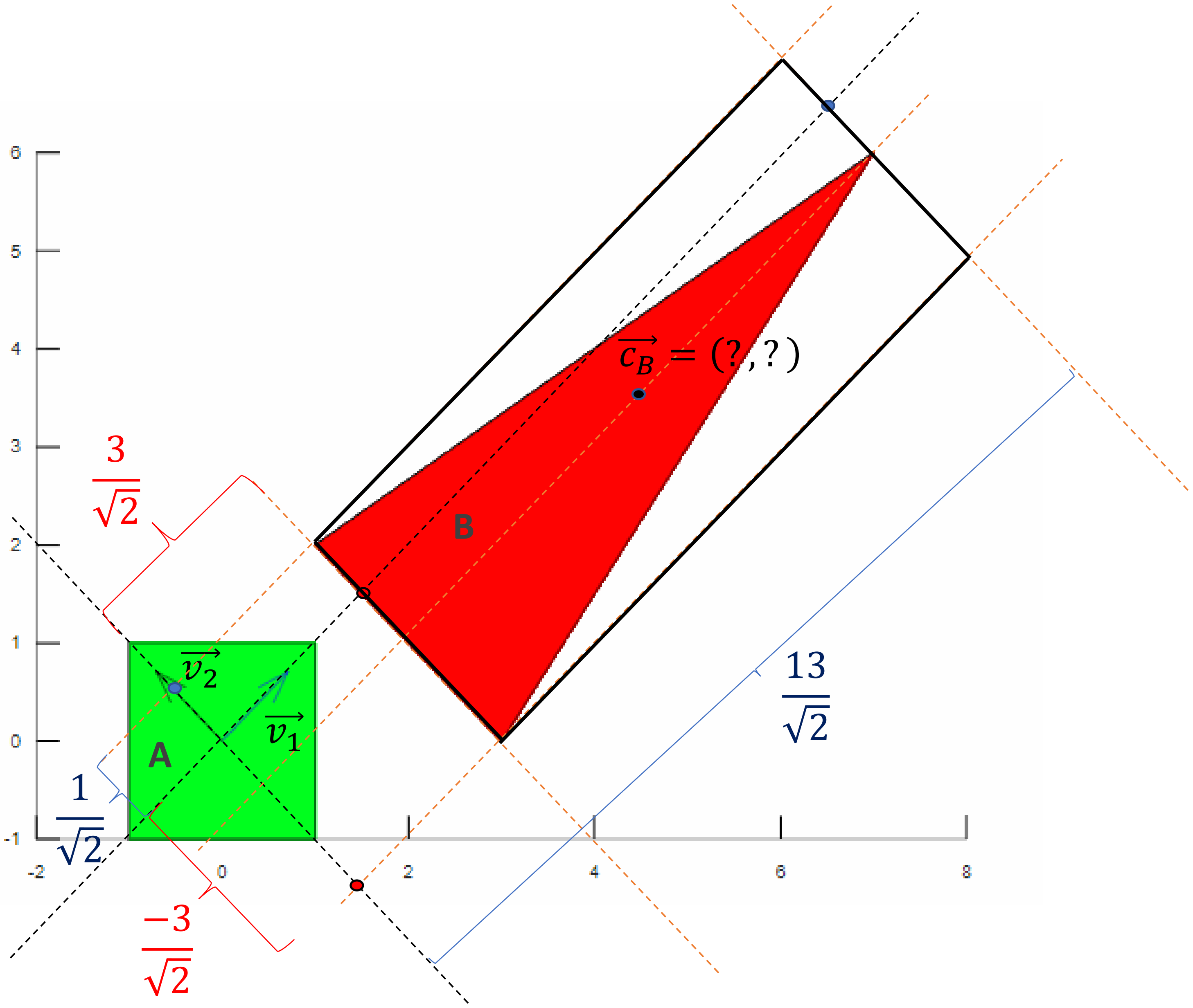
$$\overrightarrow{v_2}\cdot(7,6)=\left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)\cdot(7,6)=\frac{-1}{\sqrt{2}}$$

$$\overrightarrow{v_2}\cdot(3,0)=\left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)\cdot(3,0)=\frac{-3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

Separating Axis Theorem



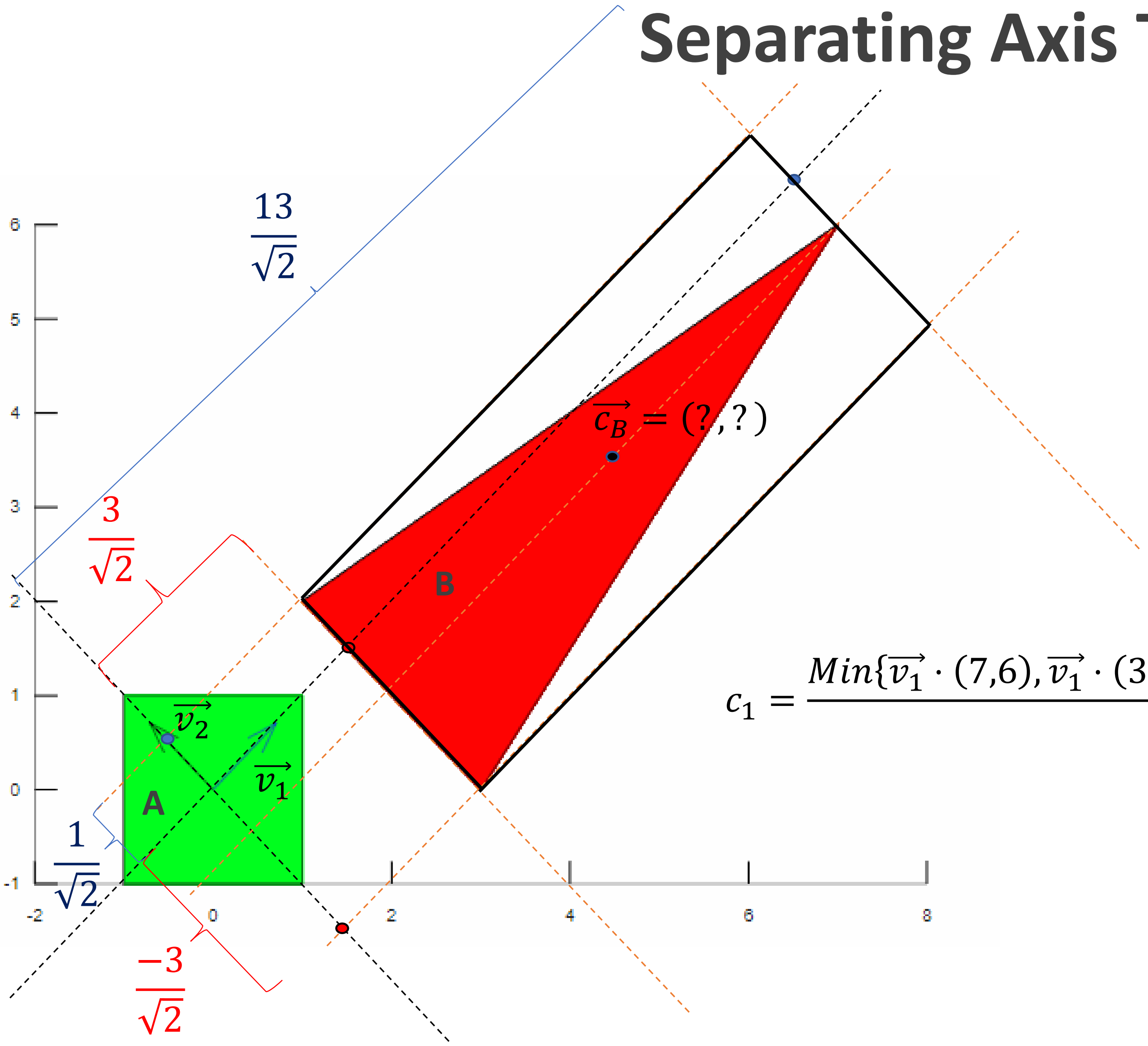
$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

Separating Axis Theorem



$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$

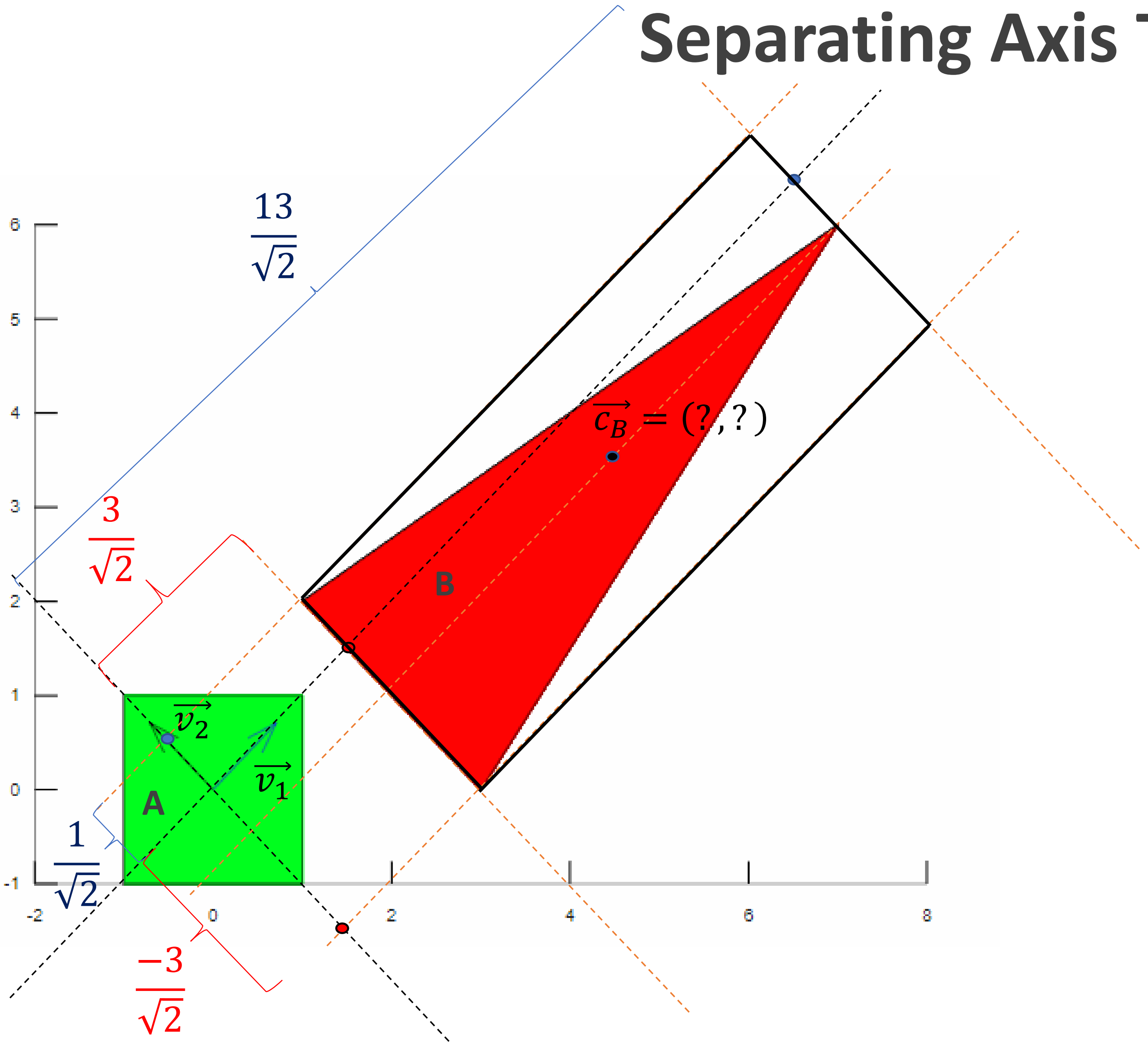
$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$

$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$

$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$

$$c_1 = \frac{Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\} + Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}}{2}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

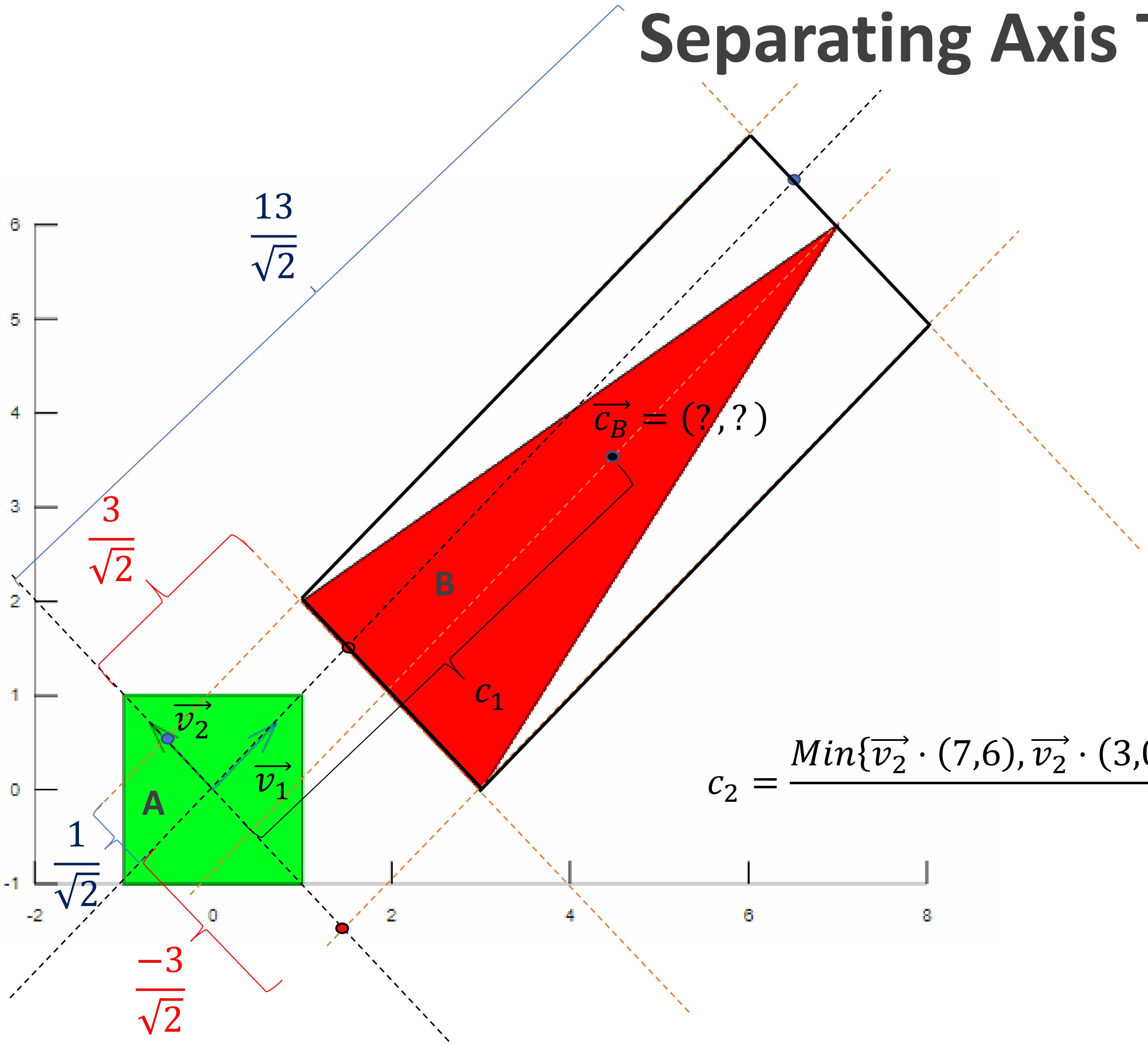
$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1 = \frac{\frac{3}{\sqrt{2}}+\frac{13}{\sqrt{2}}}{2} = \frac{16}{2\sqrt{2}} = \frac{8}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

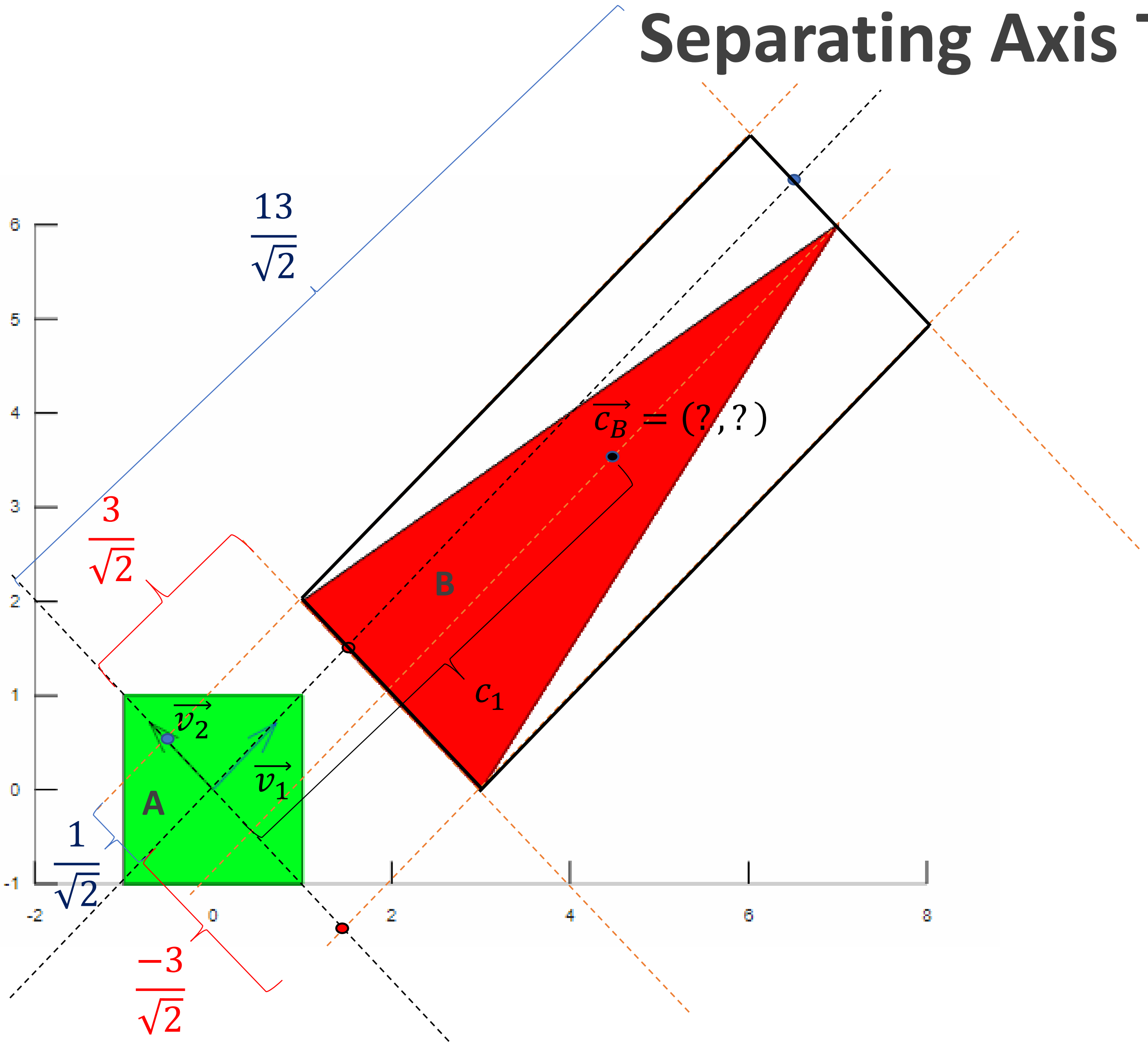
$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1=\frac{8}{\sqrt{2}}$$

$$c_2=\frac{Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}+Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}}{2}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

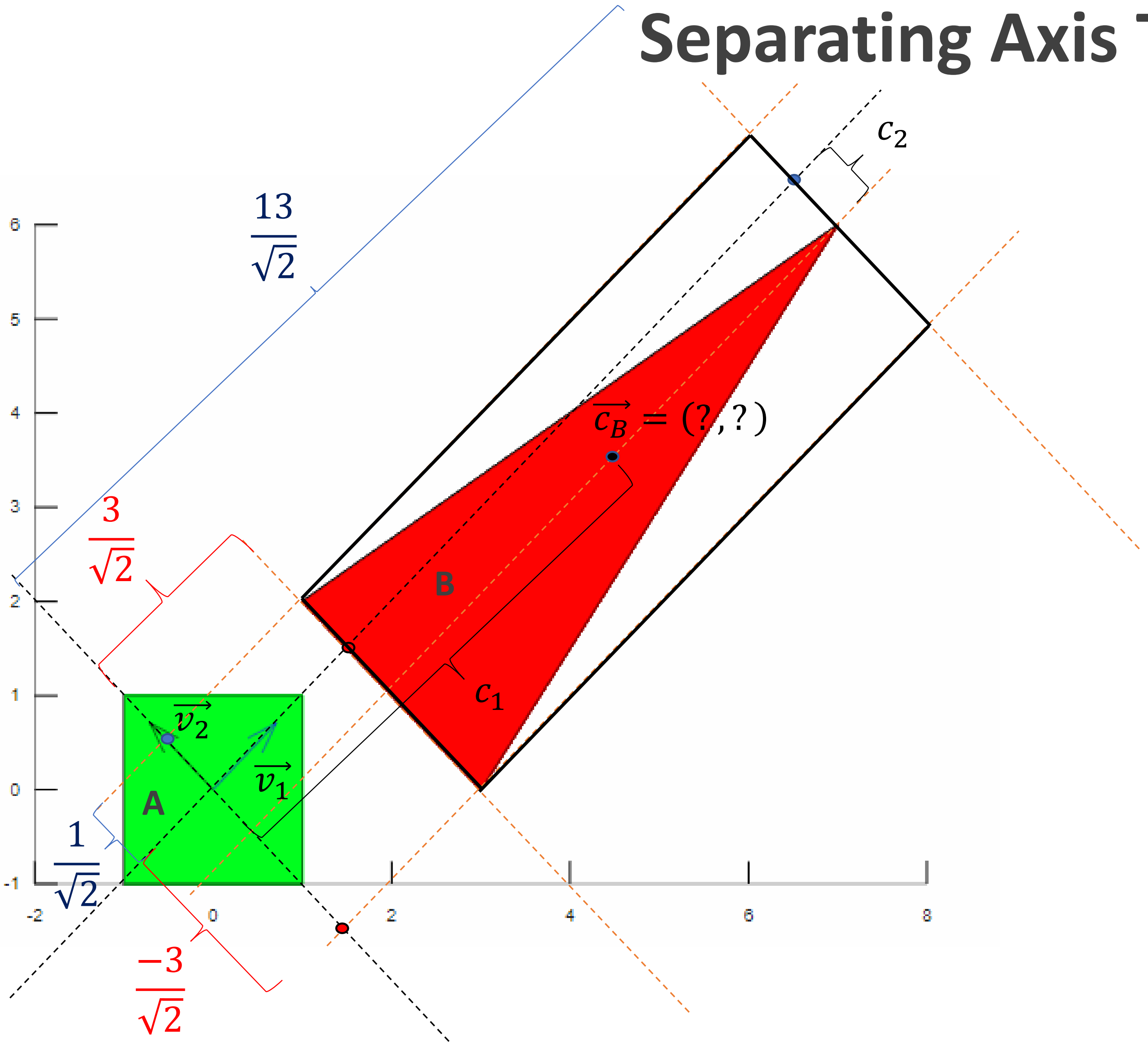
$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1 = \frac{8}{\sqrt{2}}$$

$$c_2 = \frac{\frac{-3}{\sqrt{2}}+\frac{1}{\sqrt{2}}}{2} = \frac{1-3}{2\sqrt{2}} = \frac{-2}{2\sqrt{2}} = \frac{-1}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

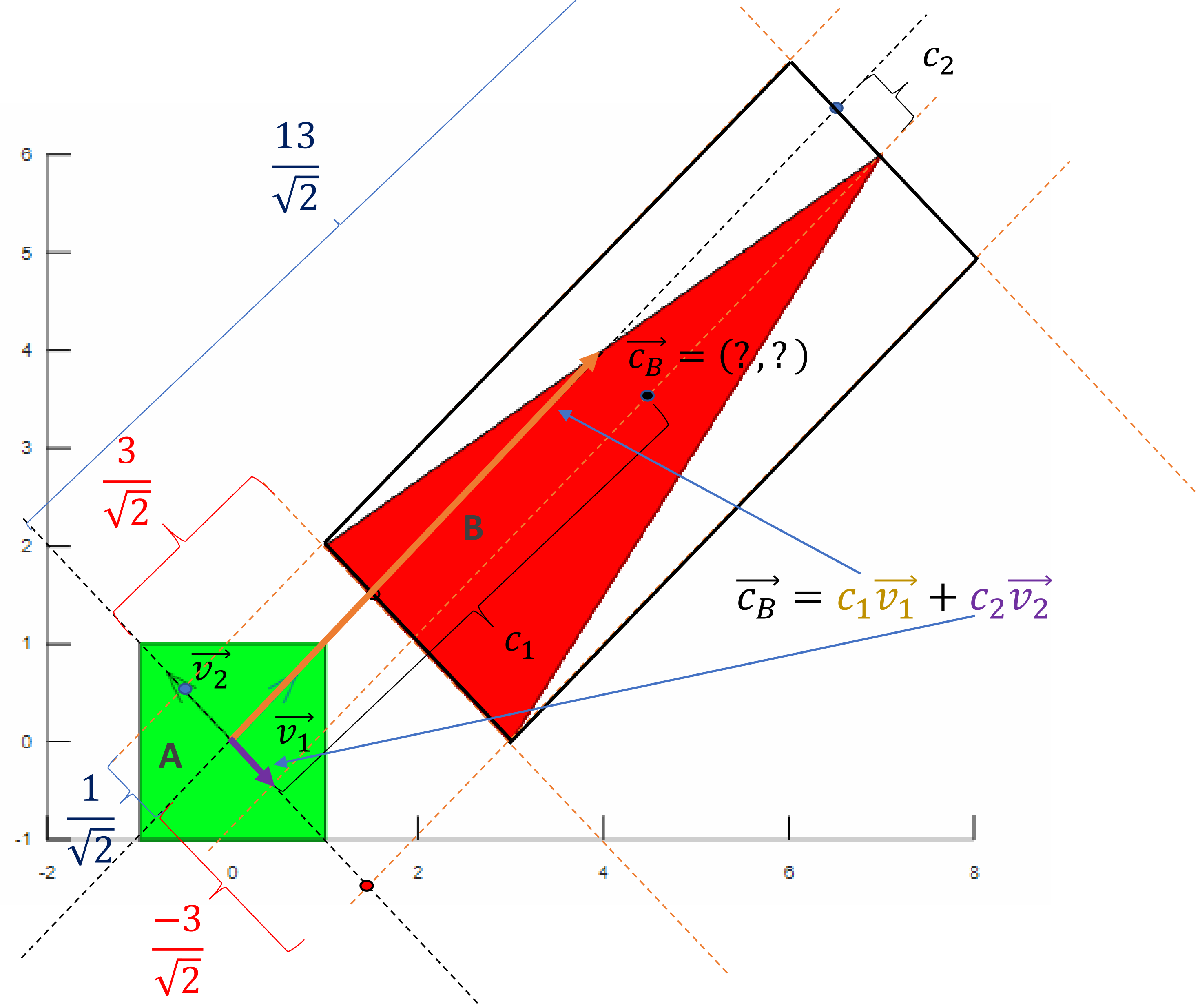
$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1 = \frac{8}{\sqrt{2}}$$

$$c_2 = \frac{-1}{\sqrt{2}}$$

$$\overrightarrow{c_B} = ?$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{3}{\sqrt{2}}$$

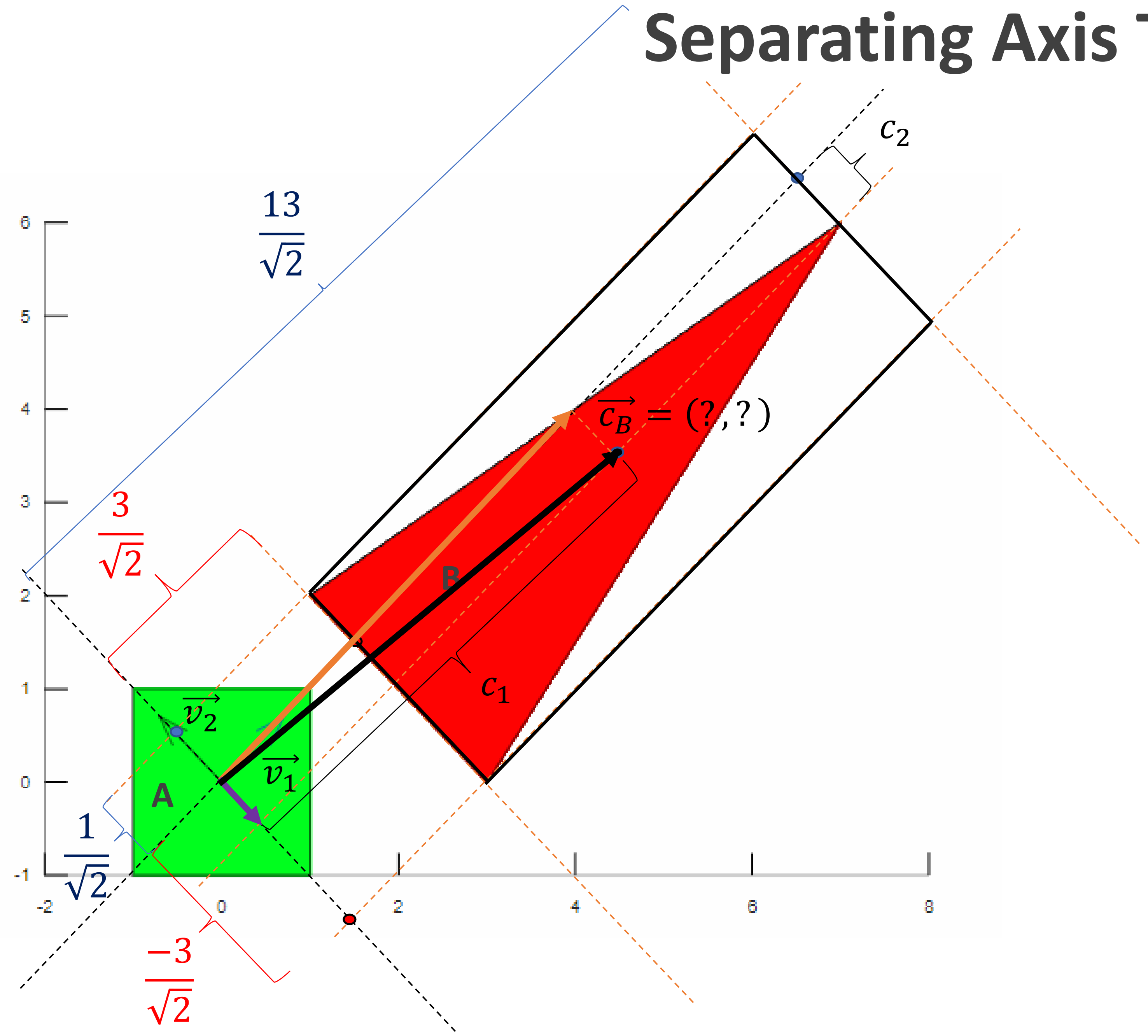
$$Max\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{-3}{\sqrt{2}}$$

$$c_1 = \frac{8}{\sqrt{2}}$$

$$c_2 = \frac{-1}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

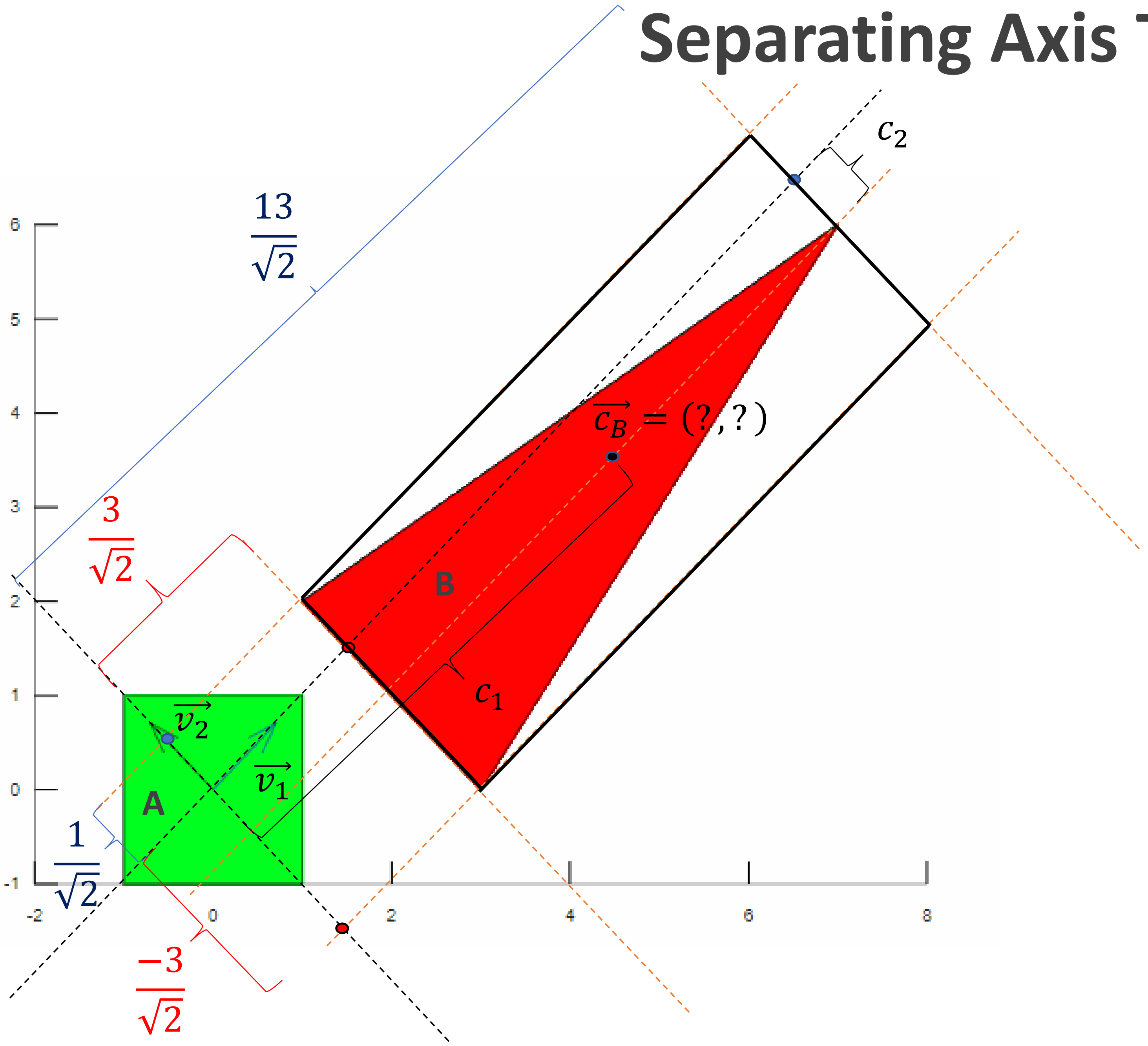
$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1 = \frac{8}{\sqrt{2}}$$

$$c_2 = \frac{-1}{\sqrt{2}}$$

$$\overrightarrow{c_B} = c_1\overrightarrow{v_1} + c_2\overrightarrow{v_2}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

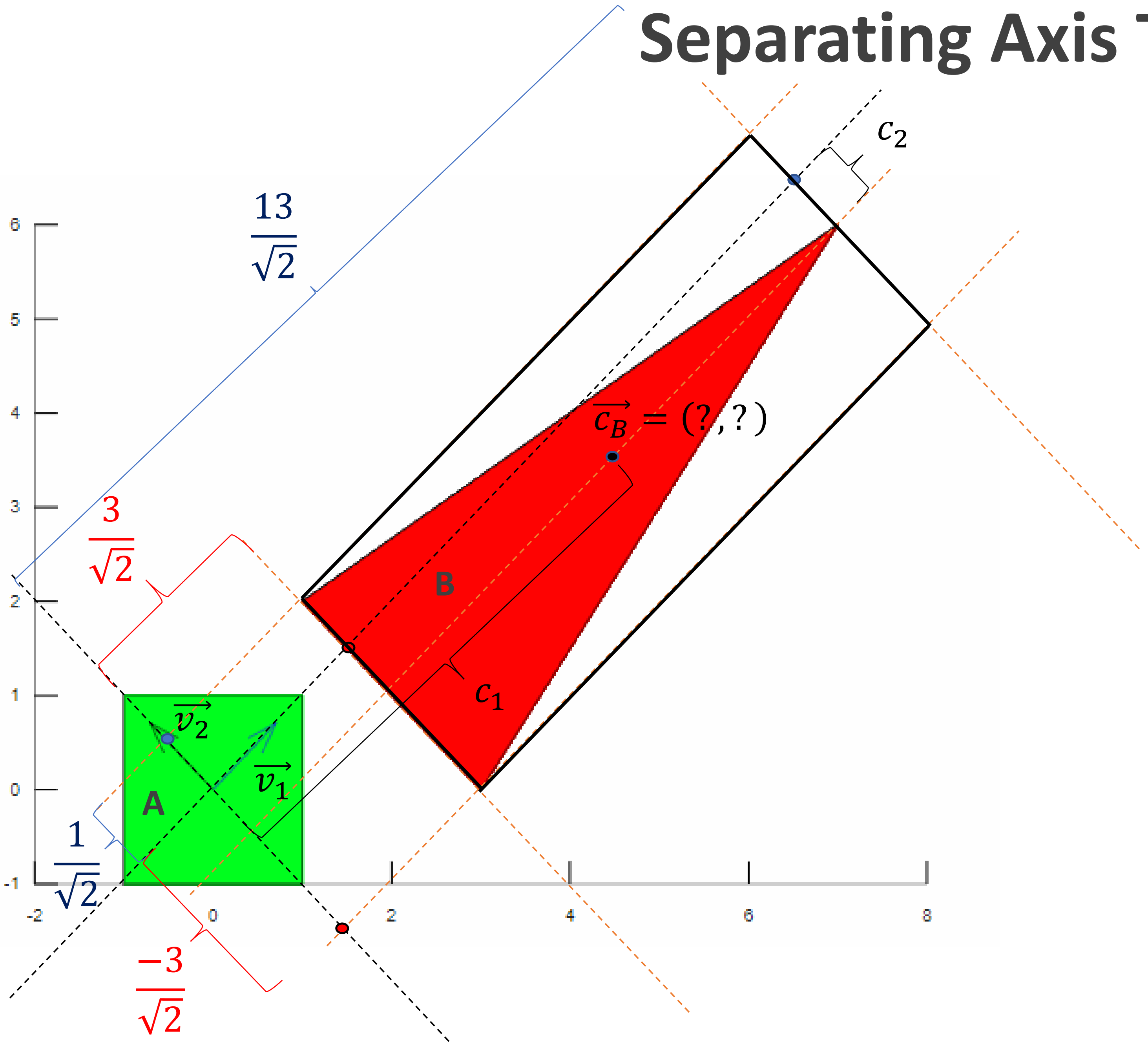
$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1 = \frac{8}{\sqrt{2}}$$

$$c_2 = \frac{-1}{\sqrt{2}}$$

$$\overrightarrow{c_B} = \frac{8}{\sqrt{2}}\left(\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right) + \frac{-1}{\sqrt{2}}\left(\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

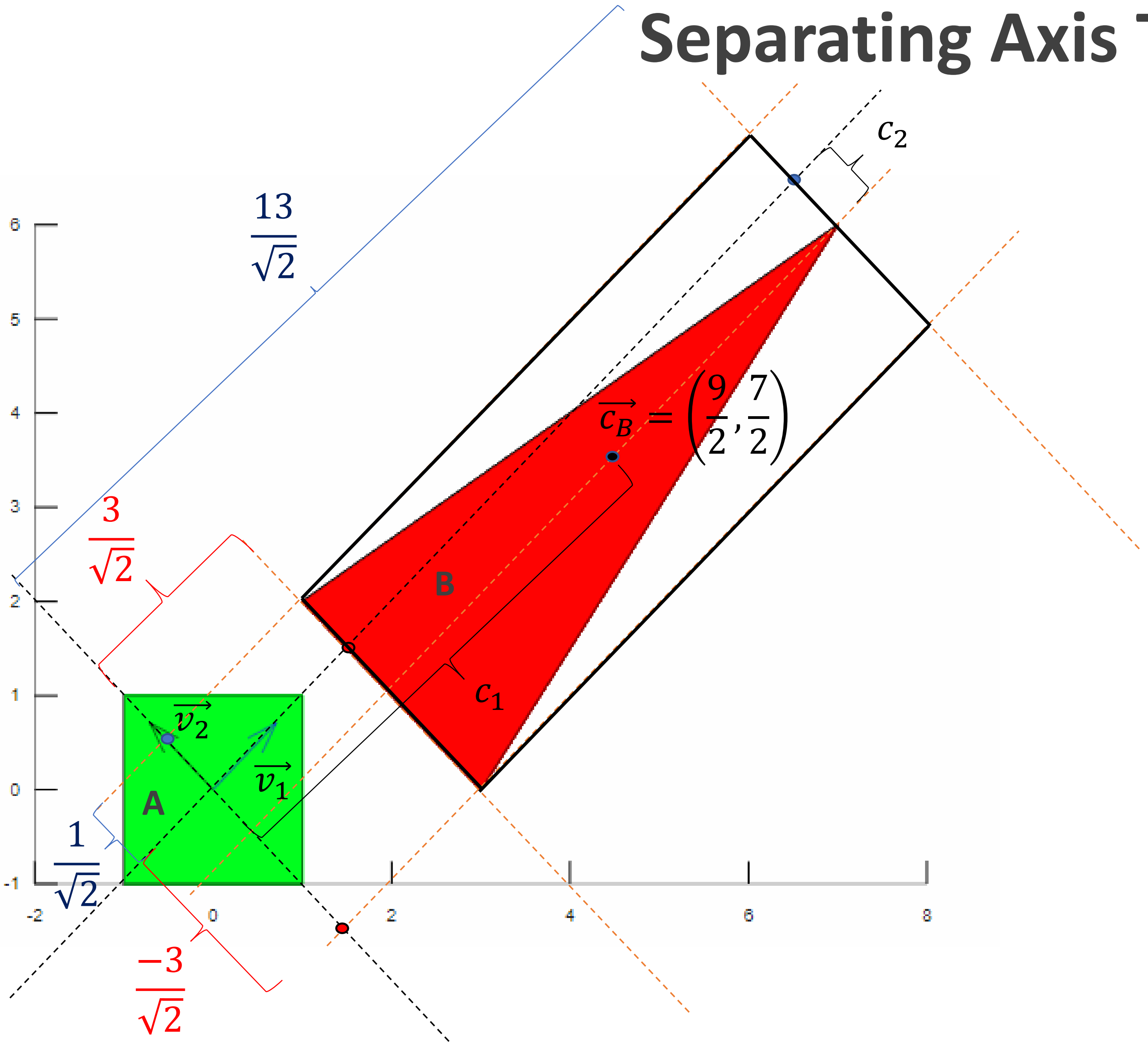
$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1 = \frac{8}{\sqrt{2}}$$

$$c_2 = \frac{-1}{\sqrt{2}}$$

$$\overrightarrow{c_B} = \left(\frac{8}{2},\frac{8}{2}\right) + \left(\frac{1}{2},\frac{-1}{2}\right)$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7{,}6),\overrightarrow{v_2}\cdot(3{,}0),\overrightarrow{v_2}\cdot(1{,}2)\}=\frac{1}{\sqrt{2}}$$

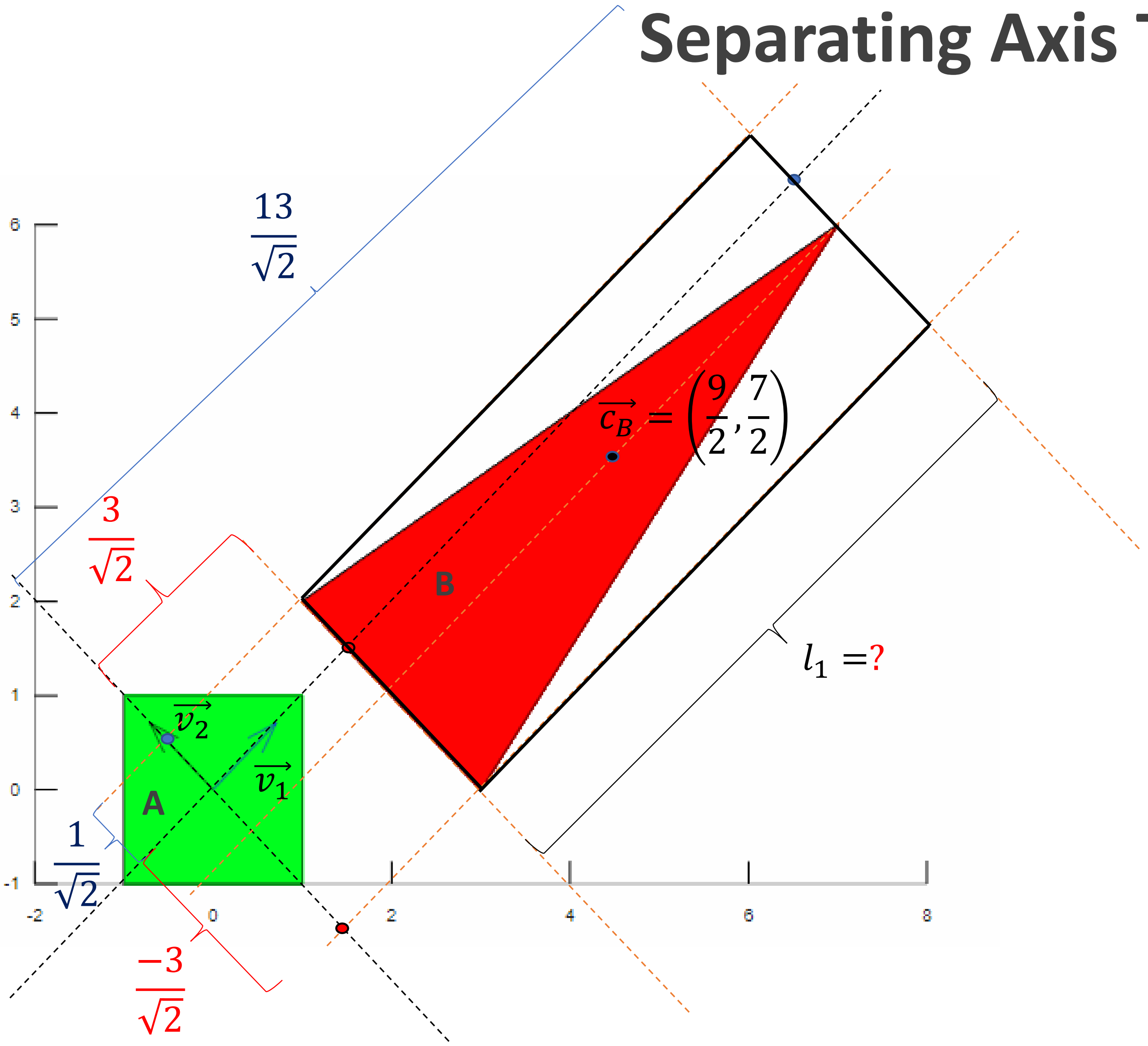
$$Min\{\overrightarrow{v_2}\cdot(7{,}6),\overrightarrow{v_2}\cdot(3{,}0),\overrightarrow{v_2}\cdot(1{,}2)\}=\frac{-3}{\sqrt{2}}$$

$$c_1=\frac{8}{\sqrt{2}}$$

$$c_2=\frac{-1}{\sqrt{2}}$$

$$\overrightarrow{c_B}=\left(\frac{9}{2},\frac{7}{2}\right)$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{13}{\sqrt{2}}$$

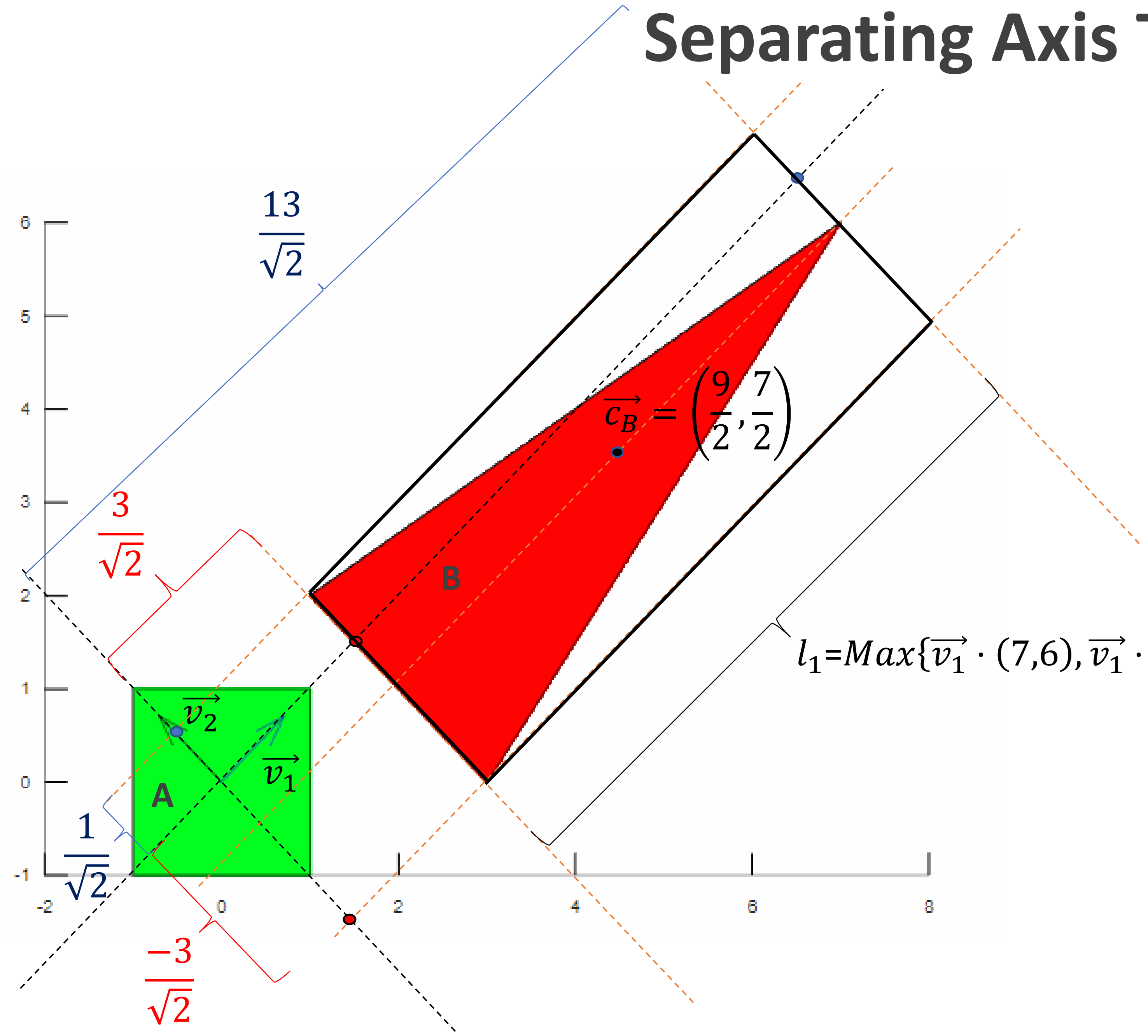
$$Min\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}=\frac{3}{\sqrt{2}}$$

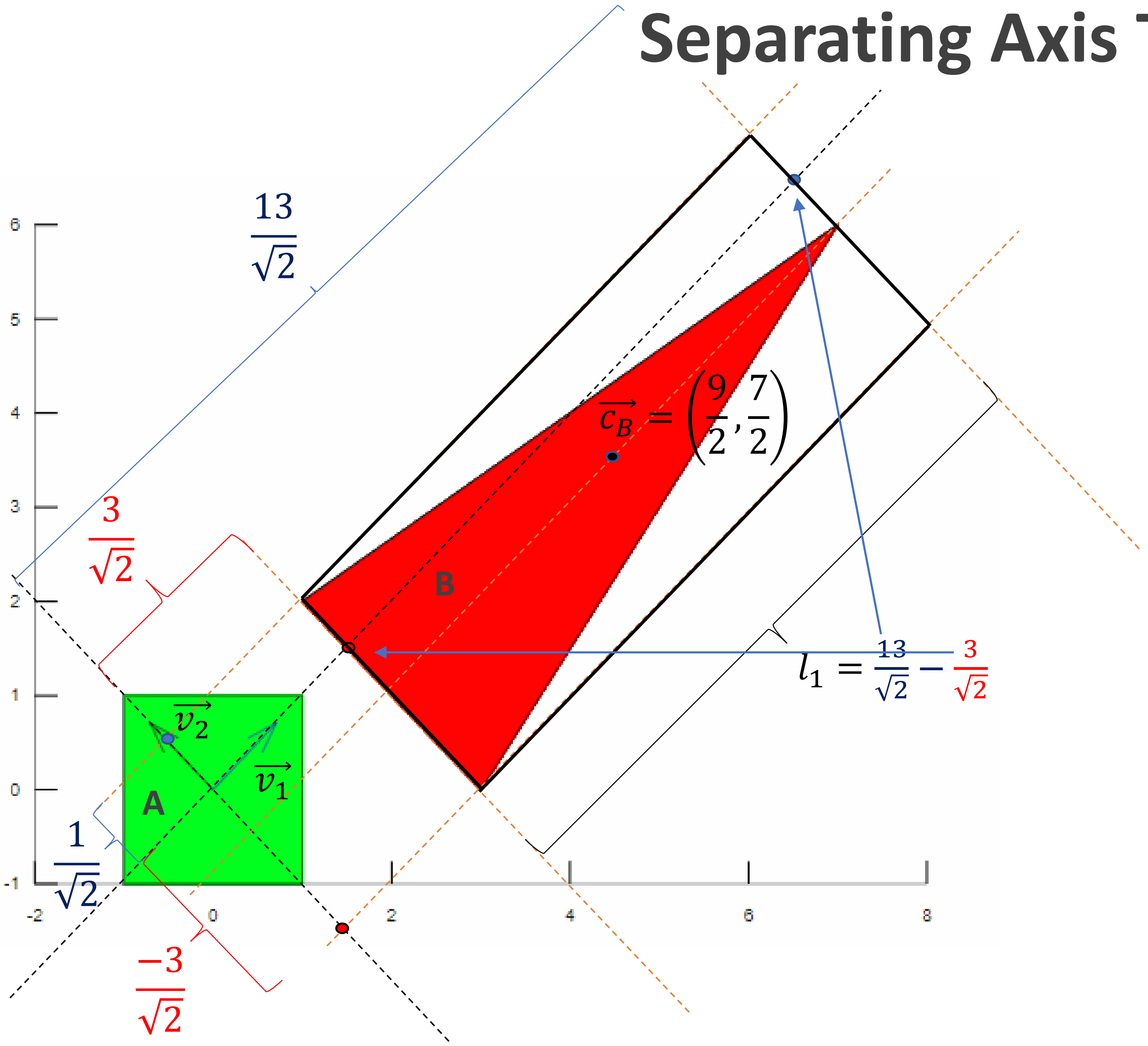
$$Max\{\overrightarrow{v_2}\cdot(7{,}6),\overrightarrow{v_2}\cdot(3{,}0),\overrightarrow{v_2}\cdot(1{,}2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7{,}6),\overrightarrow{v_2}\cdot(3{,}0),\overrightarrow{v_2}\cdot(1{,}2)\}=\frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B}=\left(\frac{9}{2},\frac{7}{2}\right)$$

$$l_1=Max\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}\text{-}Min\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{13}{\sqrt{2}}$$

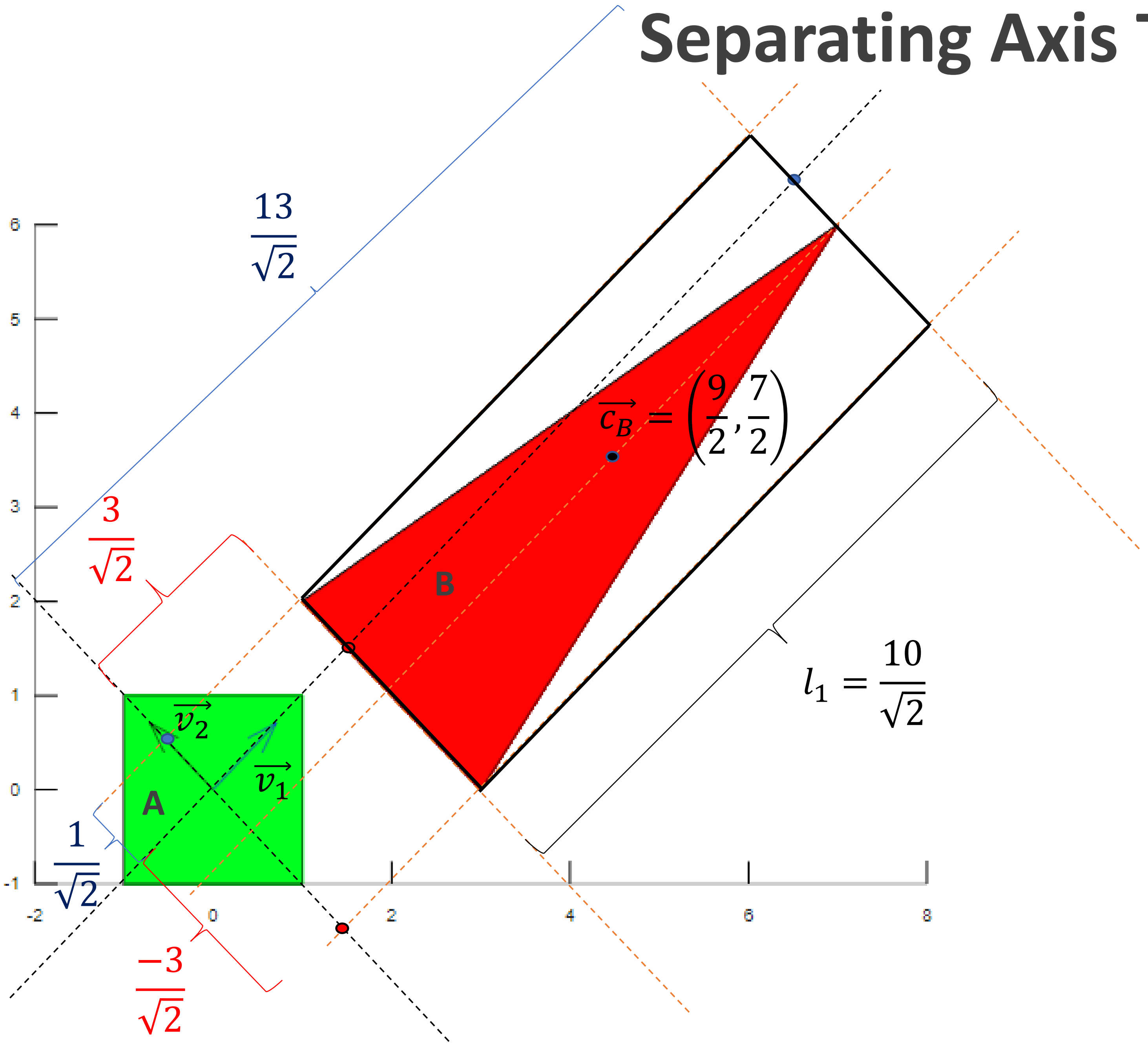
$$Min\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{13}{\sqrt{2}}$$

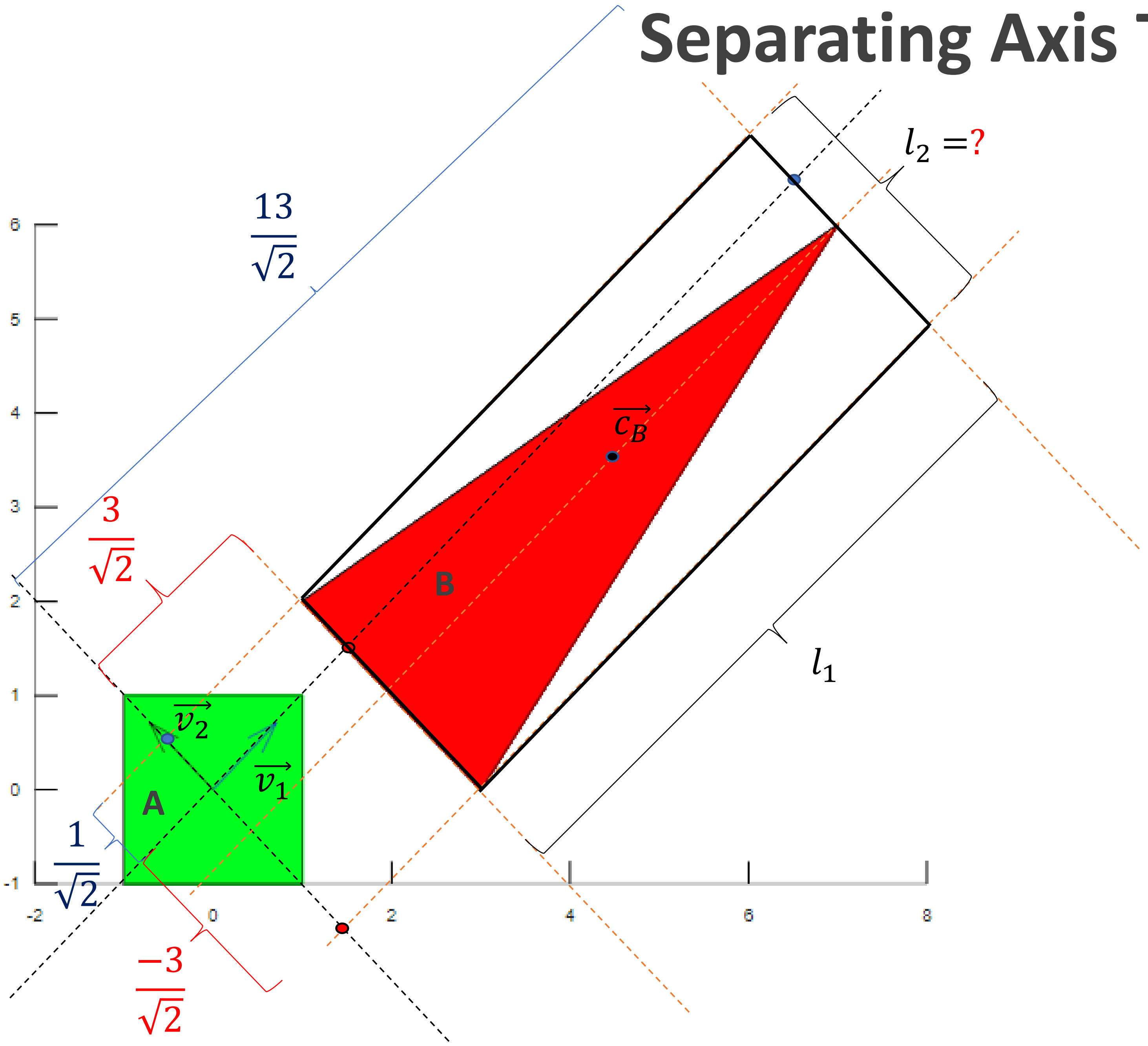
$$Min\{\overrightarrow{v_1}\cdot(7,6), \overrightarrow{v_1}\cdot(3,0), \overrightarrow{v_1}\cdot(1,2)\} = \frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6), \overrightarrow{v_2}\cdot(3,0), \overrightarrow{v_2}\cdot(1,2)\} = \frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7{,}6),\overrightarrow{v_1}\cdot(3{,}0),\overrightarrow{v_1}\cdot(1{,}2)\}=\frac{3}{\sqrt{2}}$$

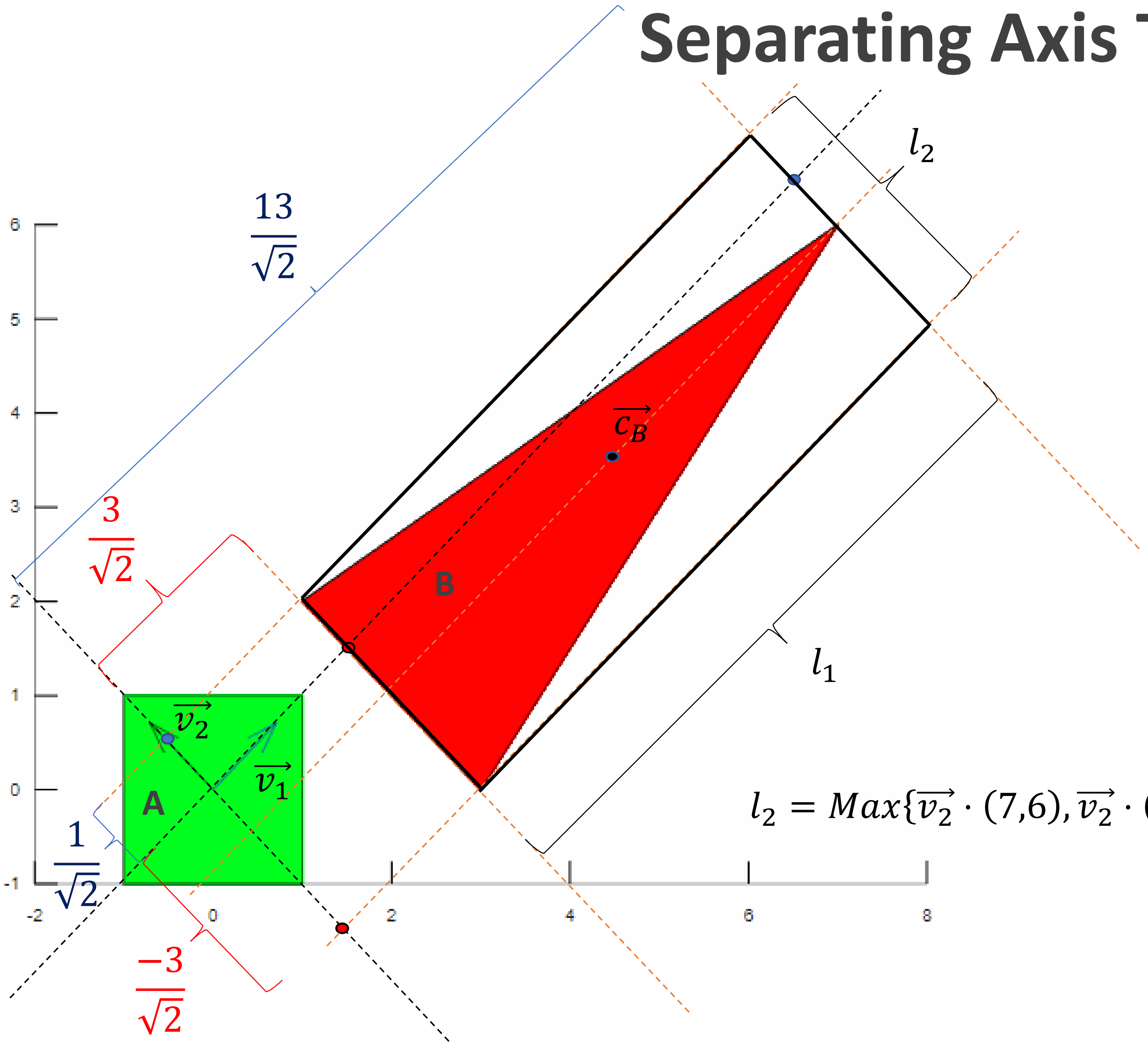
$$Max\{\overrightarrow{v_2}\cdot(7{,}6),\overrightarrow{v_2}\cdot(3{,}0),\overrightarrow{v_2}\cdot(1{,}2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7{,}6),\overrightarrow{v_2}\cdot(3{,}0),\overrightarrow{v_2}\cdot(1{,}2)\}=\frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B}=\left(\frac{9}{2},\frac{7}{2}\right)$$

$$l_1=\frac{10}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

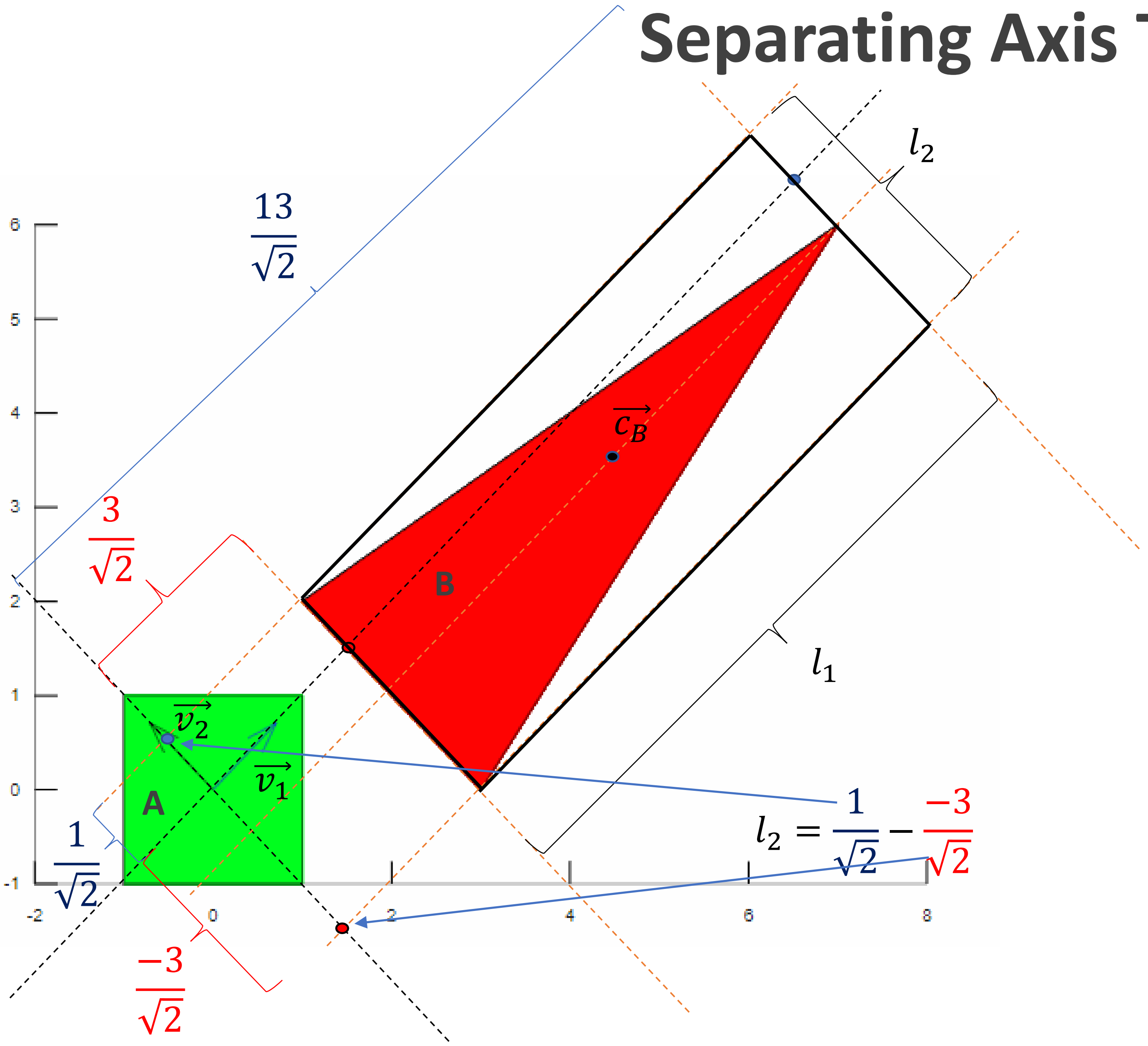
$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B}=\left(\frac{9}{2},\frac{7}{2}\right)$$

$$l_1=\frac{10}{\sqrt{2}}$$

$$l_2=Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}\text{-}\,Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

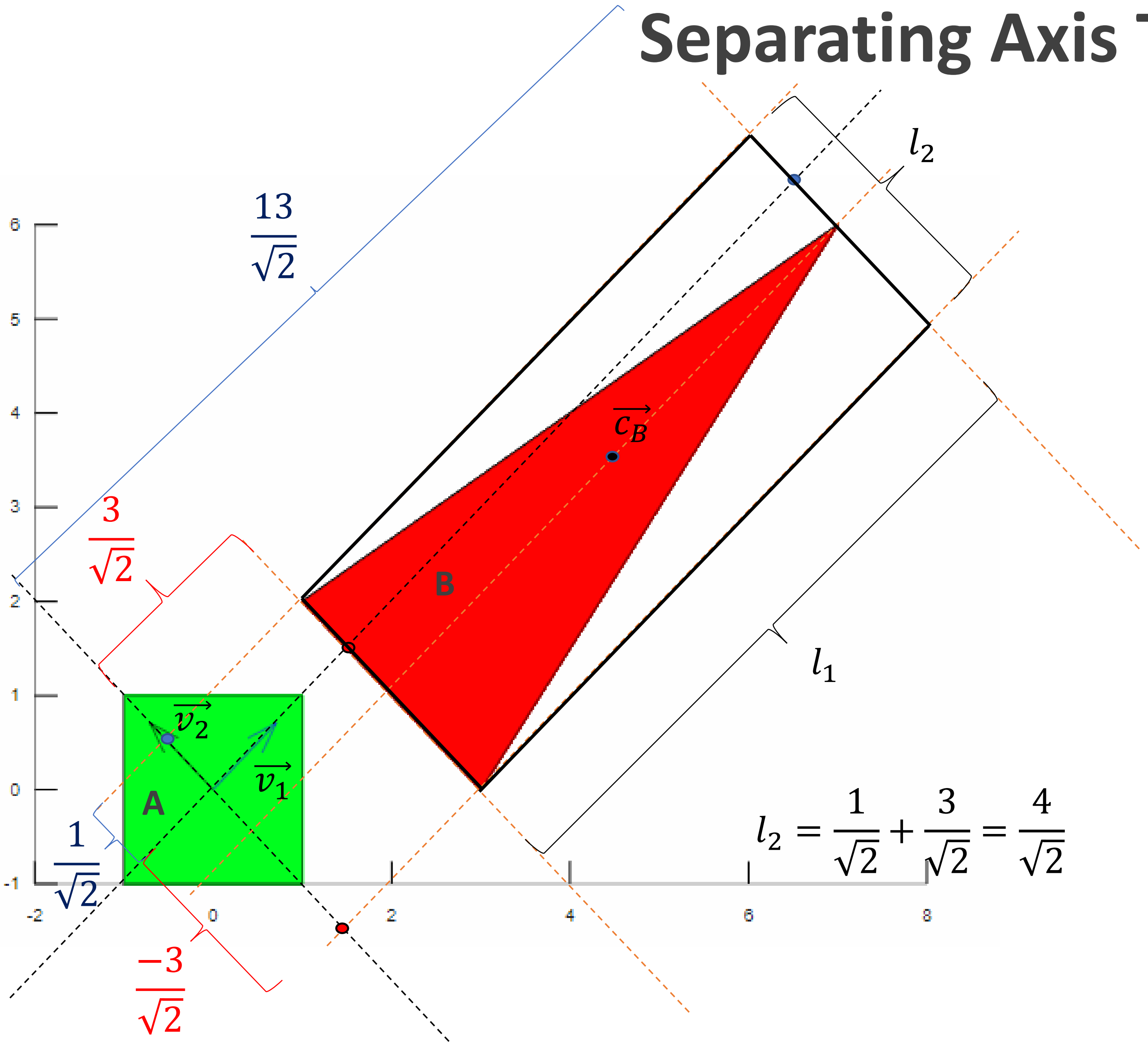
$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B} = \left(\frac{9}{2},\frac{7}{2}\right)$$

$$l_1 = \frac{10}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

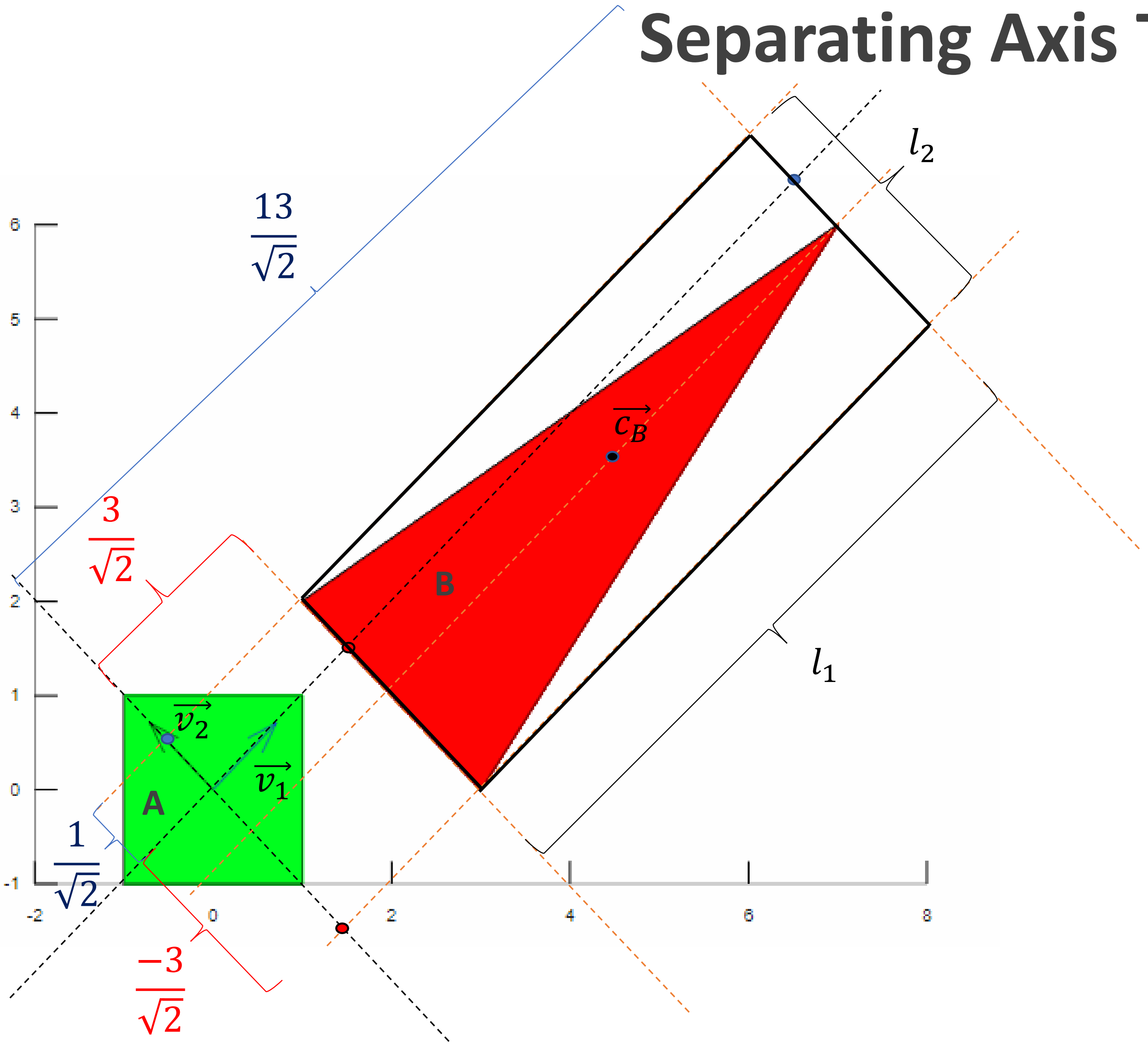
$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B} = \left(\frac{9}{2},\frac{7}{2}\right)$$

$$l_1 = \frac{10}{\sqrt{2}}$$

Separating Axis Theorem



$$Max\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{13}{\sqrt{2}}$$

$$Min\{\overrightarrow{v_1}\cdot(7,6),\overrightarrow{v_1}\cdot(3,0),\overrightarrow{v_1}\cdot(1,2)\}=\frac{3}{\sqrt{2}}$$

$$Max\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{1}{\sqrt{2}}$$

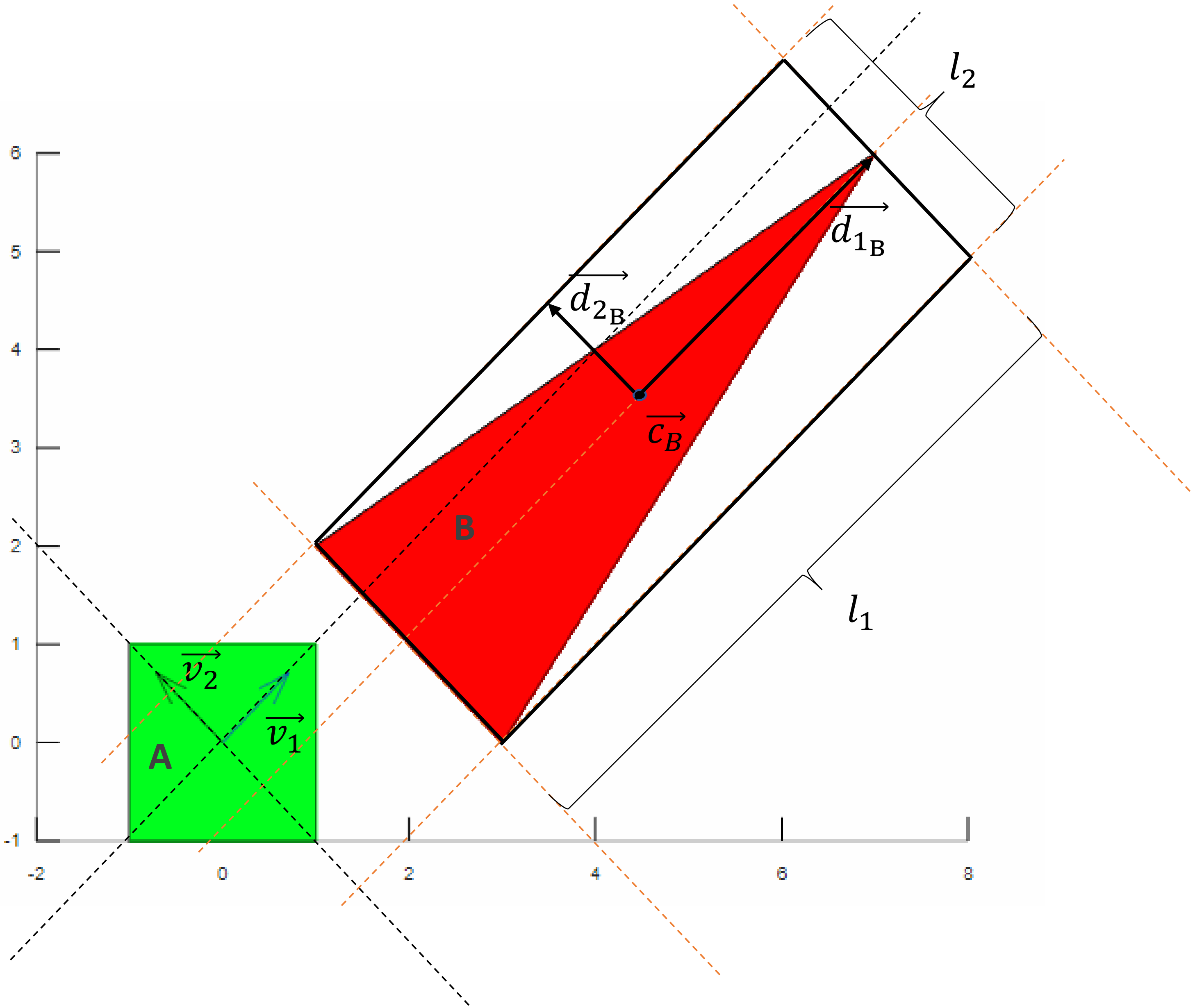
$$Min\{\overrightarrow{v_2}\cdot(7,6),\overrightarrow{v_2}\cdot(3,0),\overrightarrow{v_2}\cdot(1,2)\}=\frac{-3}{\sqrt{2}}$$

$$\overrightarrow{c_B}=\left(\frac{9}{2},\frac{7}{2}\right)$$

$$l_1=\frac{10}{\sqrt{2}}$$

$$l_2=\frac{4}{\sqrt{2}}$$

Separating Axis Theorem

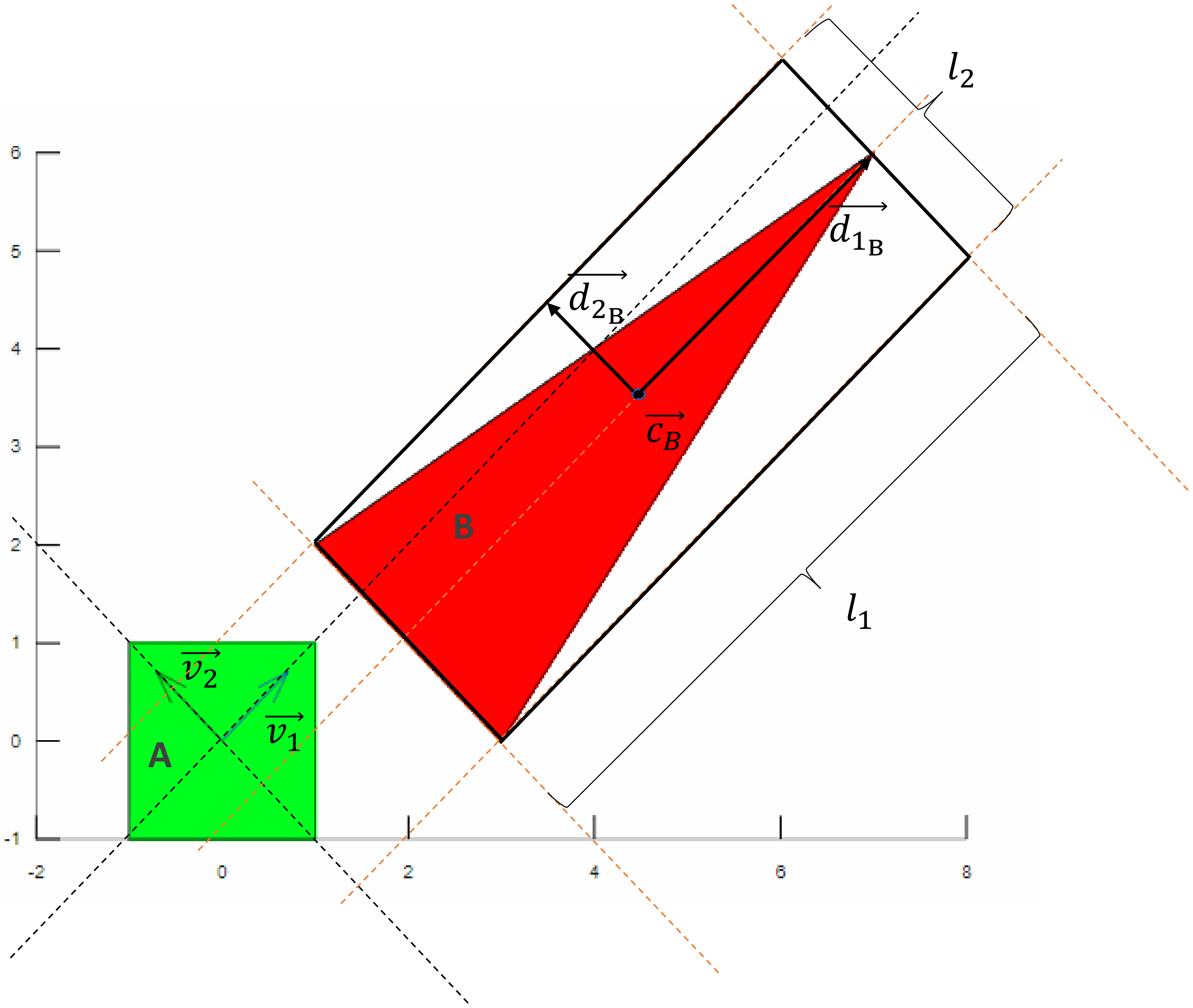


$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$l_1 = \frac{10}{\sqrt{2}}$$

$$l_2 = \frac{4}{\sqrt{2}}$$

Separating Axis Theorem



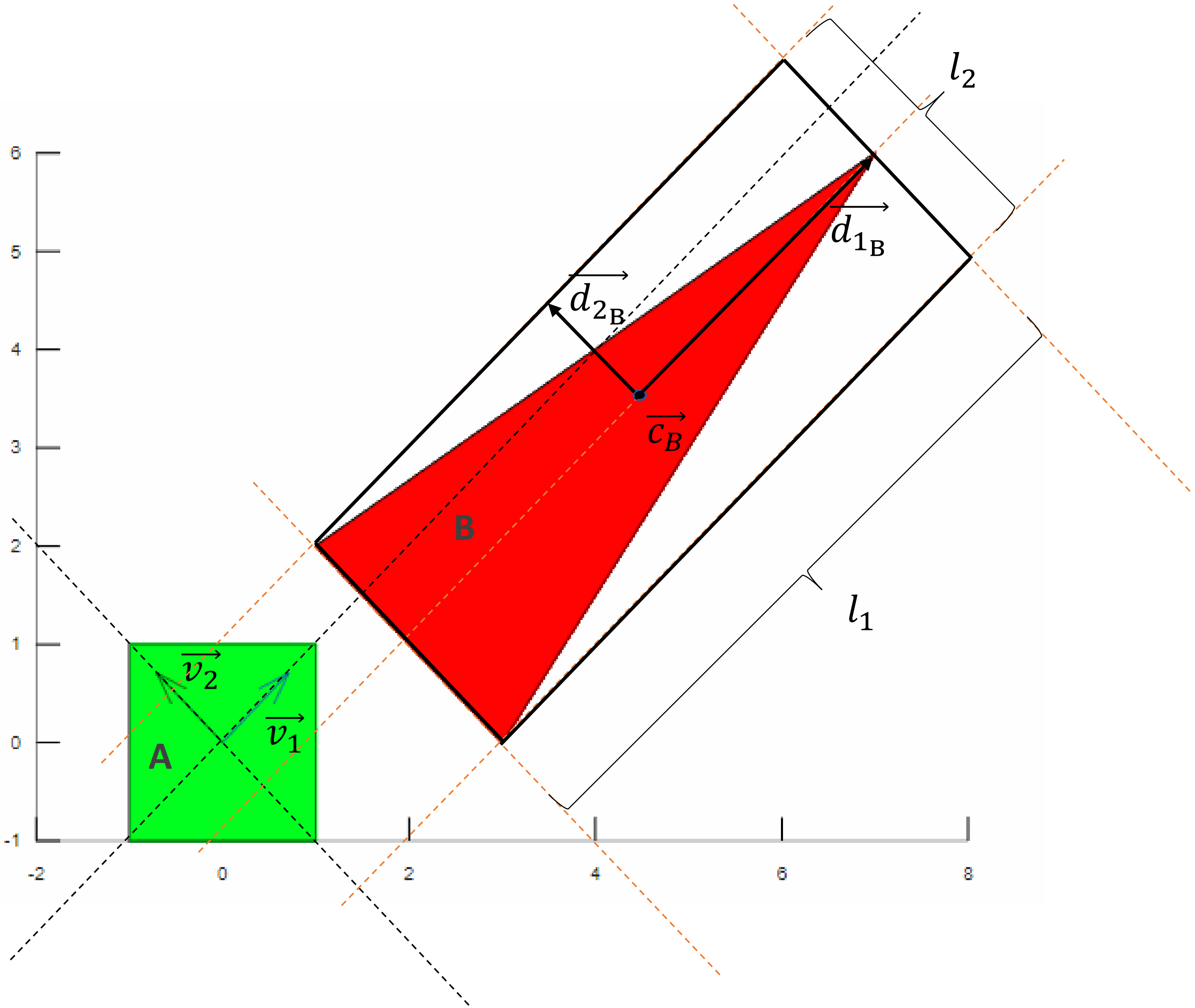
$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$l_1 = \frac{10}{\sqrt{2}}$$

$$l_2 = \frac{4}{\sqrt{2}}$$

$$\overrightarrow{d_{1_B}} = \frac{l_1}{2}\overrightarrow{v_1} = \frac{5}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$$

Separating Axis Theorem



$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

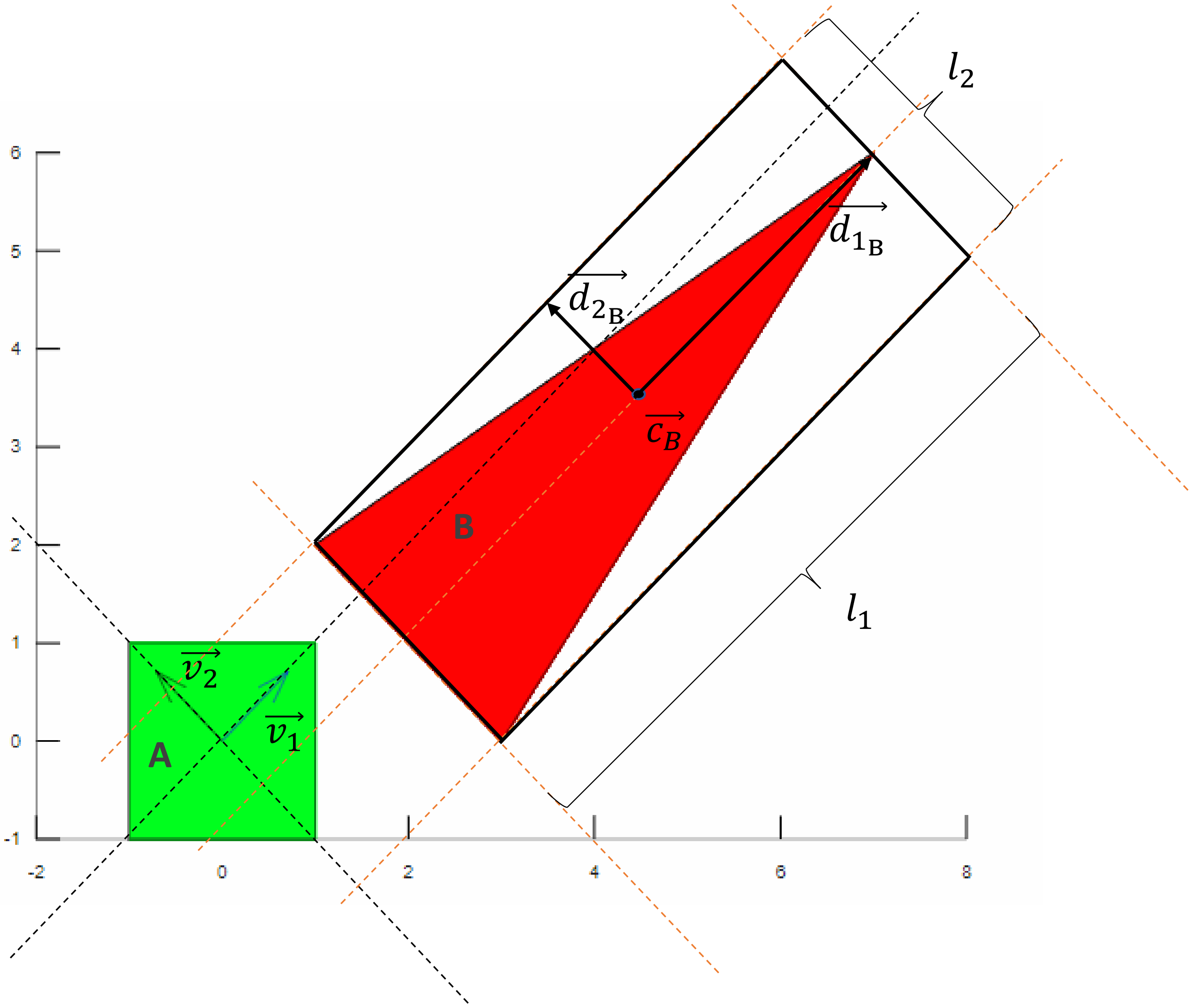
$$l_1 = \frac{10}{\sqrt{2}}$$

$$l_2 = \frac{4}{\sqrt{2}}$$

$$\overrightarrow{d_{1_B}} = \frac{l_1}{2}\overrightarrow{v_1} = \frac{5}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$$

$$\overrightarrow{d_{2_B}} = \frac{l_2}{2}\overrightarrow{v_2} = \frac{2}{\sqrt{2}}\left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$$

Separating Axis Theorem



$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

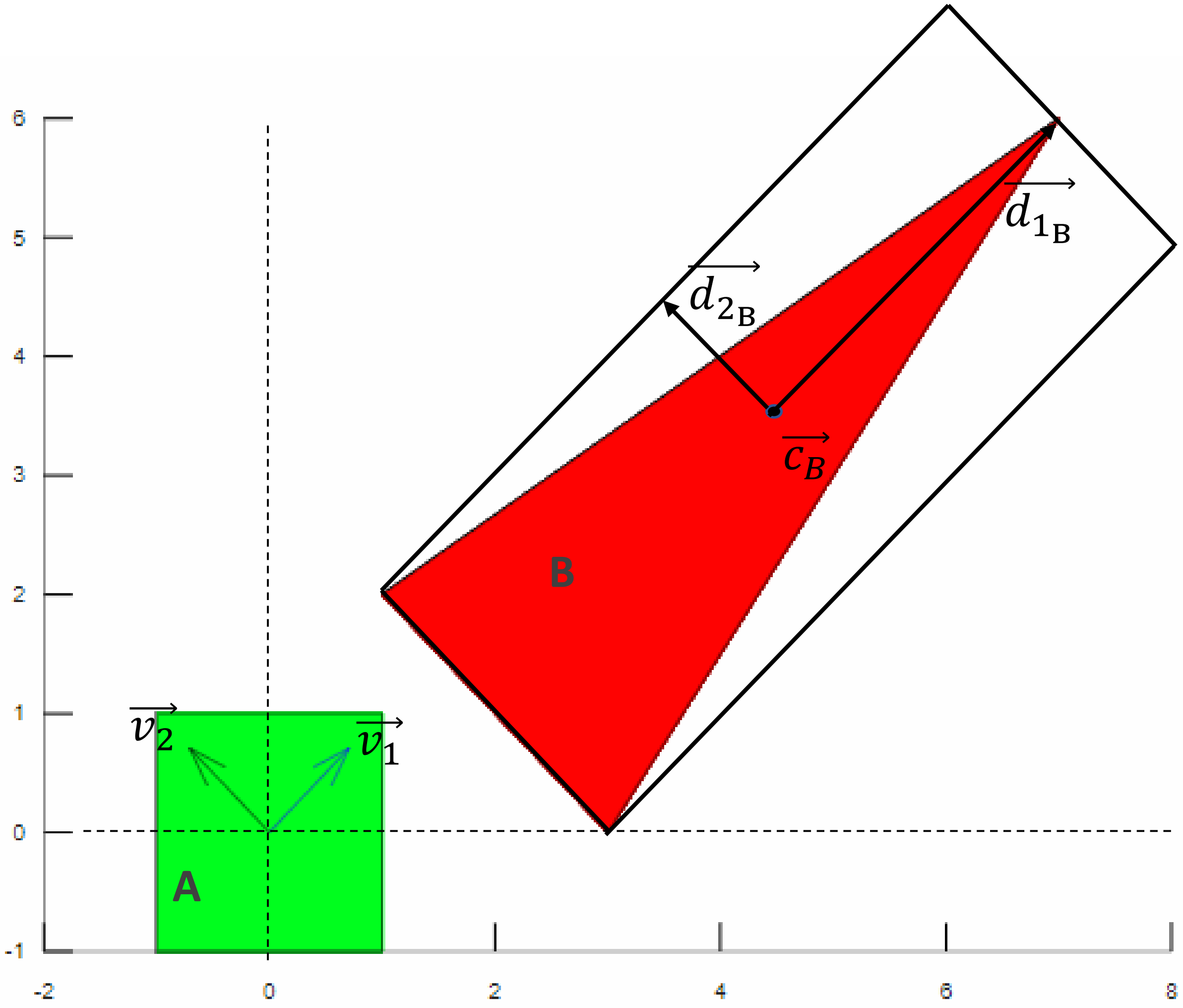
$$l_1 = \frac{10}{\sqrt{2}}$$

$$l_2 = \frac{4}{\sqrt{2}}$$

$$\overrightarrow{d_{1_B}} = \left(\frac{5}{2}, \frac{5}{2}\right)$$

$$\overrightarrow{d_{2_B}} = (-1,1)$$

Separating Axis Theorem



$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$\overrightarrow{d_{1_B}} = \left(\frac{5}{2}, \frac{5}{2}\right)$$

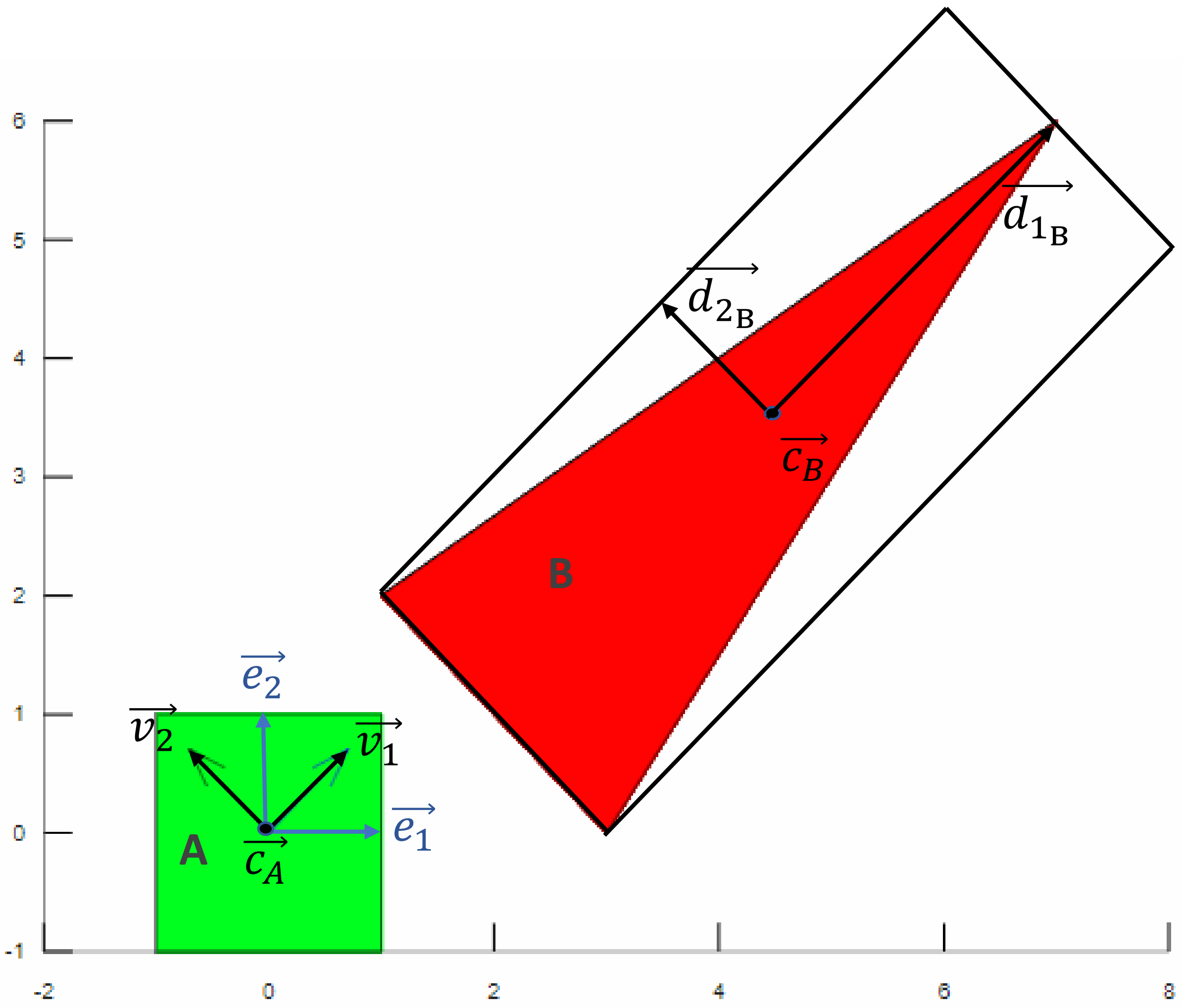
$$\overrightarrow{d_{2_B}} = (-1,1)$$

$$\overrightarrow{c_A} = ?$$

$$\overrightarrow{d_{1_A}} = ?$$

$$\overrightarrow{d_{2_A}} = ?$$

Separating Axis Theorem



$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$\overrightarrow{d_{1_B}} = \left(\frac{5}{2}, \frac{5}{2}\right)$$

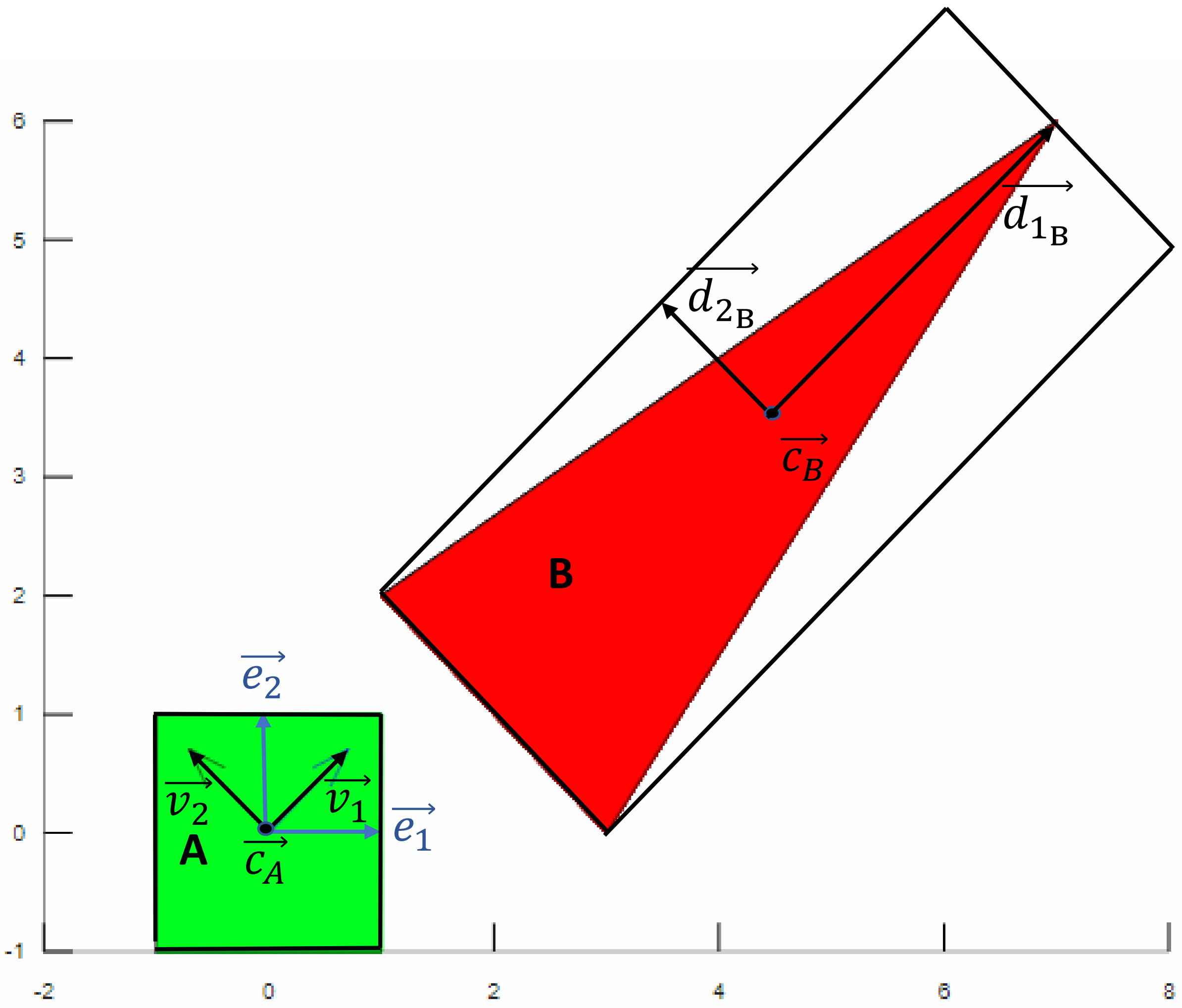
$$\overrightarrow{d_{2_B}} = (-1,1)$$

$$\overrightarrow{c_A} = ?$$

$$\overrightarrow{d_{1_A}} = ?$$

$$\overrightarrow{d_{2_A}} = ?$$

Separating Axis Theorem



$$\overrightarrow{c_B} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$\overrightarrow{d_{1_B}} = \left(\frac{5}{2}, \frac{5}{2}\right)$$

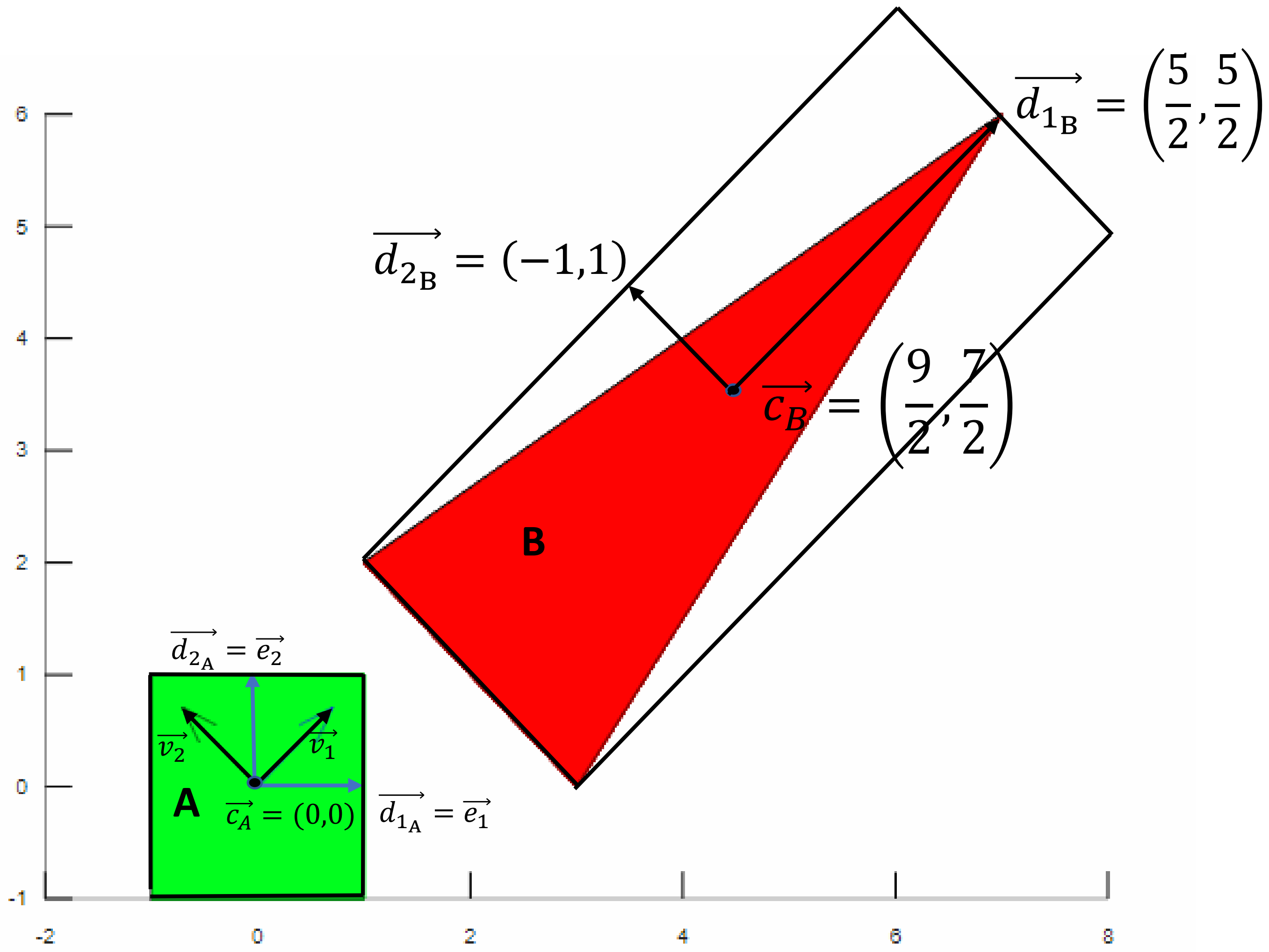
$$\overrightarrow{d_{2_B}} = (-1,1)$$

$$\overrightarrow{c_A} = (0,0)$$

$$\overrightarrow{d_{1_A}} = \overrightarrow{e_1}$$

$$\overrightarrow{d_{2_A}} = \overrightarrow{e_2}$$

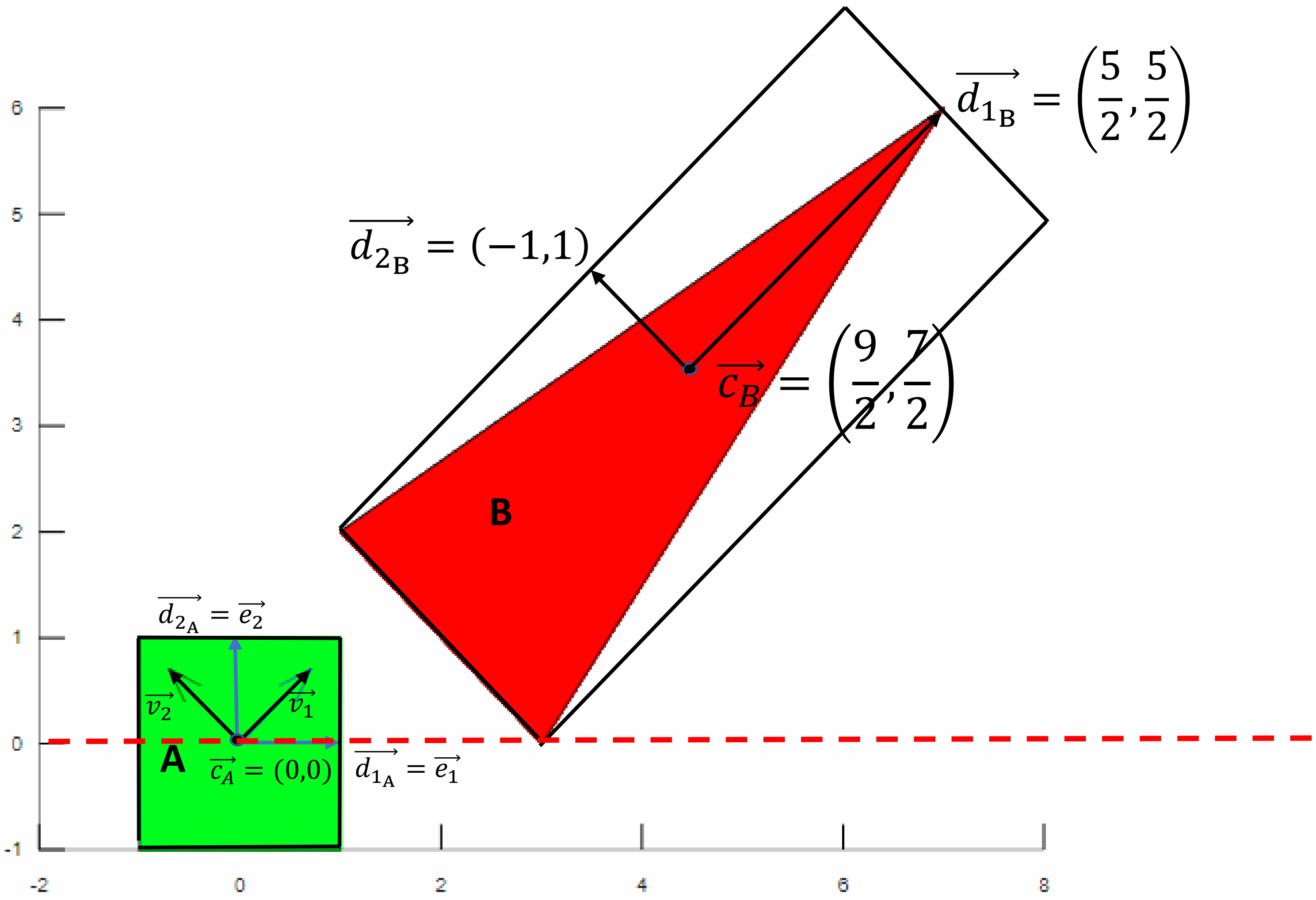
Separating Axis Theorem



Test:

Separating Axis Theorem

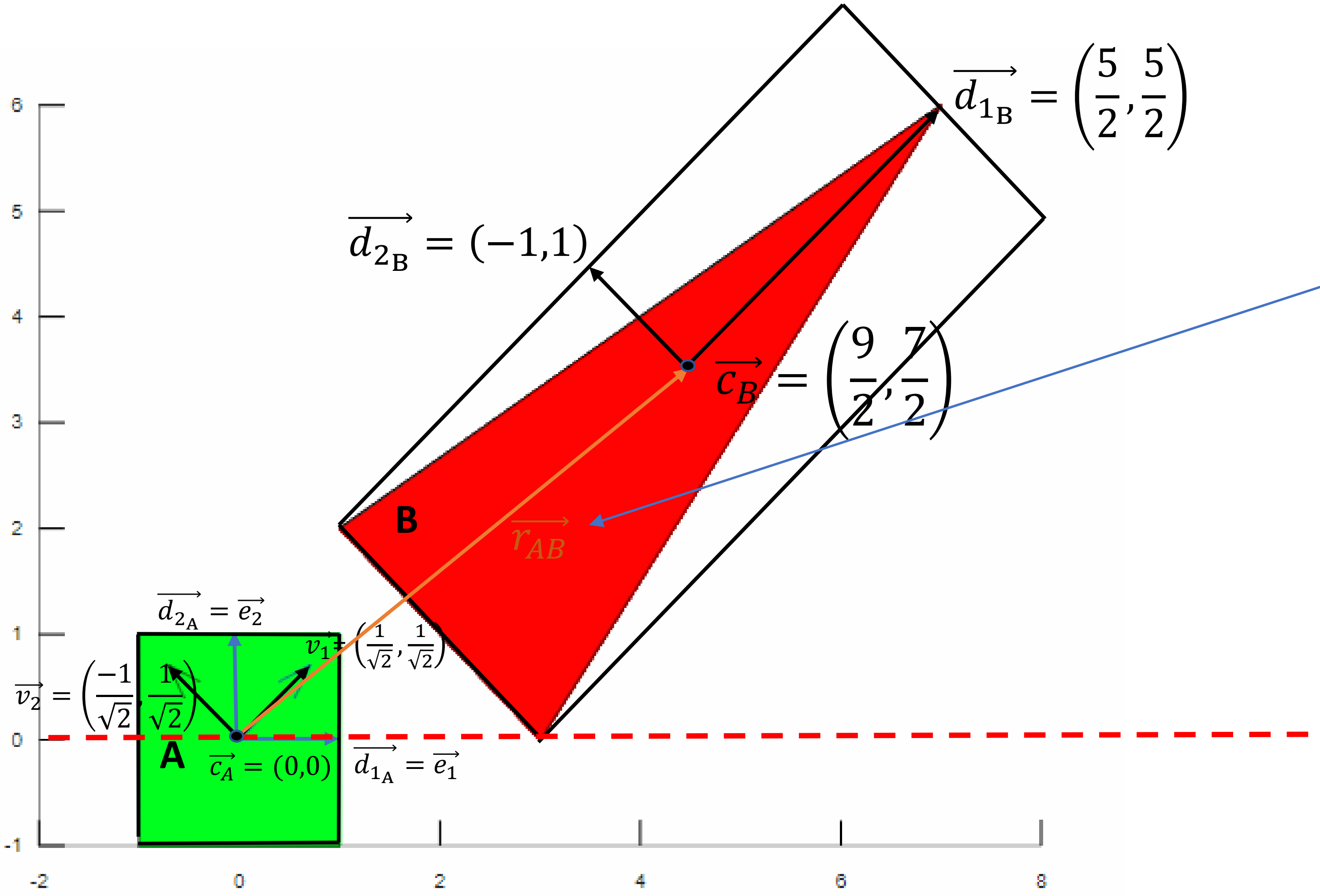
Test: $\vec{v} = \overrightarrow{e_1} = (1,0)$



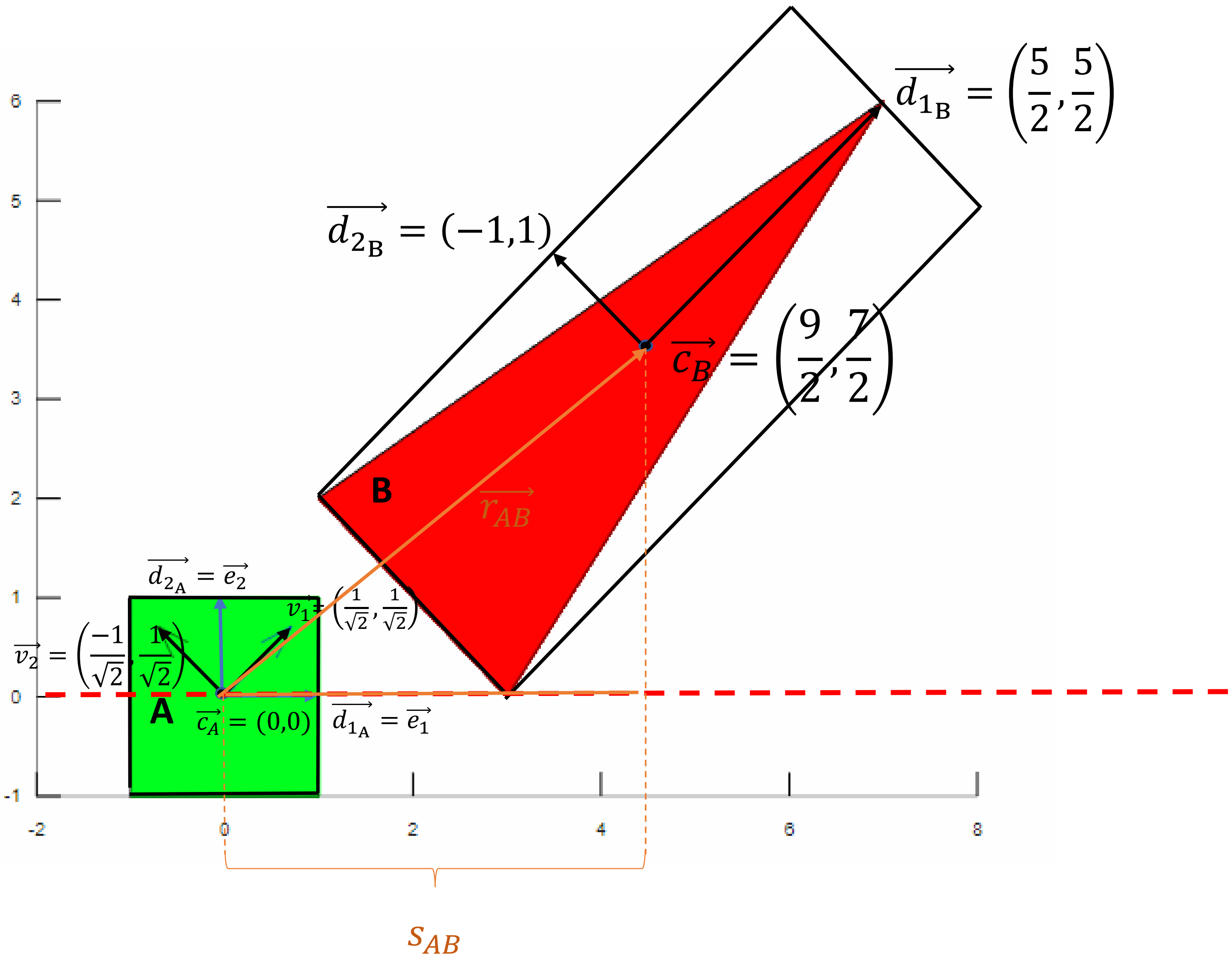
Separating Axis Theorem

Test: $\vec{v} = \vec{e_1} = (1,0)$

$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$



Separating Axis Theorem

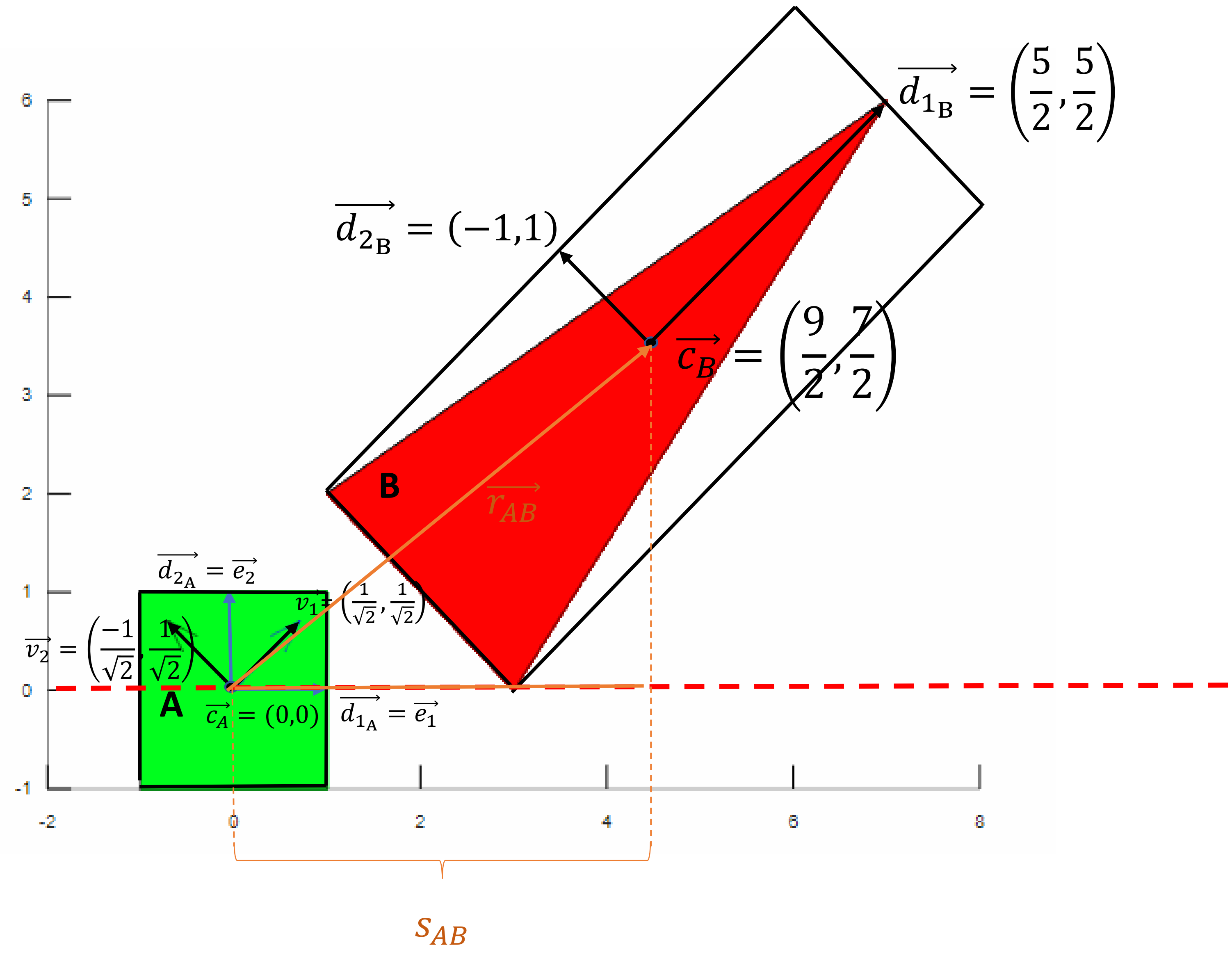


Test: $\vec{v} = \overrightarrow{e_1} = (1,0)$

$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = (1,0) \cdot \left(\frac{9}{2}, \frac{7}{2}\right) = \frac{9}{2}$$

Separating Axis Theorem



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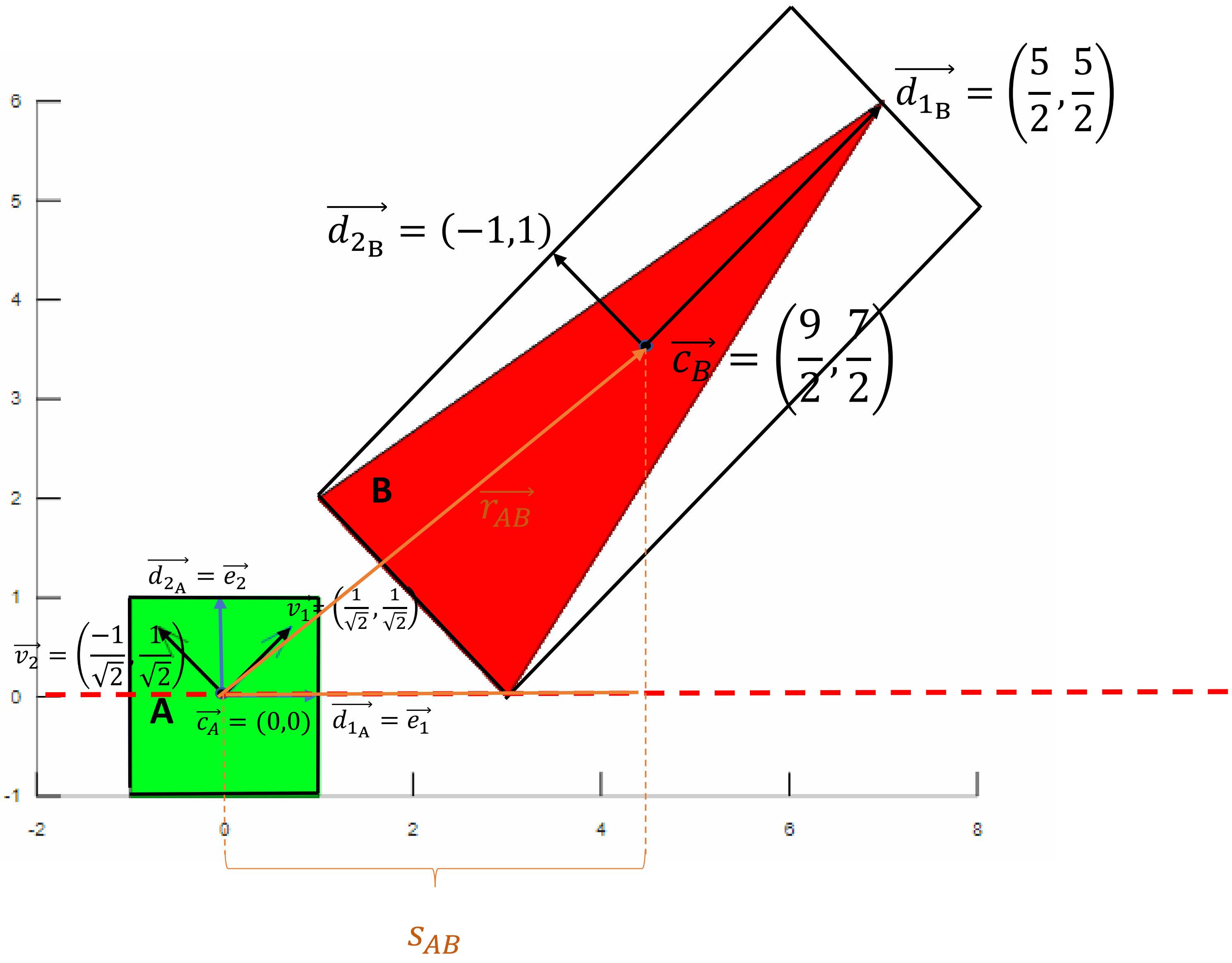
$$h_A = \left|\vec{v} \cdot \overrightarrow{d_{1_A}}\right| + \left|\vec{v} \cdot \overrightarrow{d_{2_A}}\right|$$

Separating Axis Theorem



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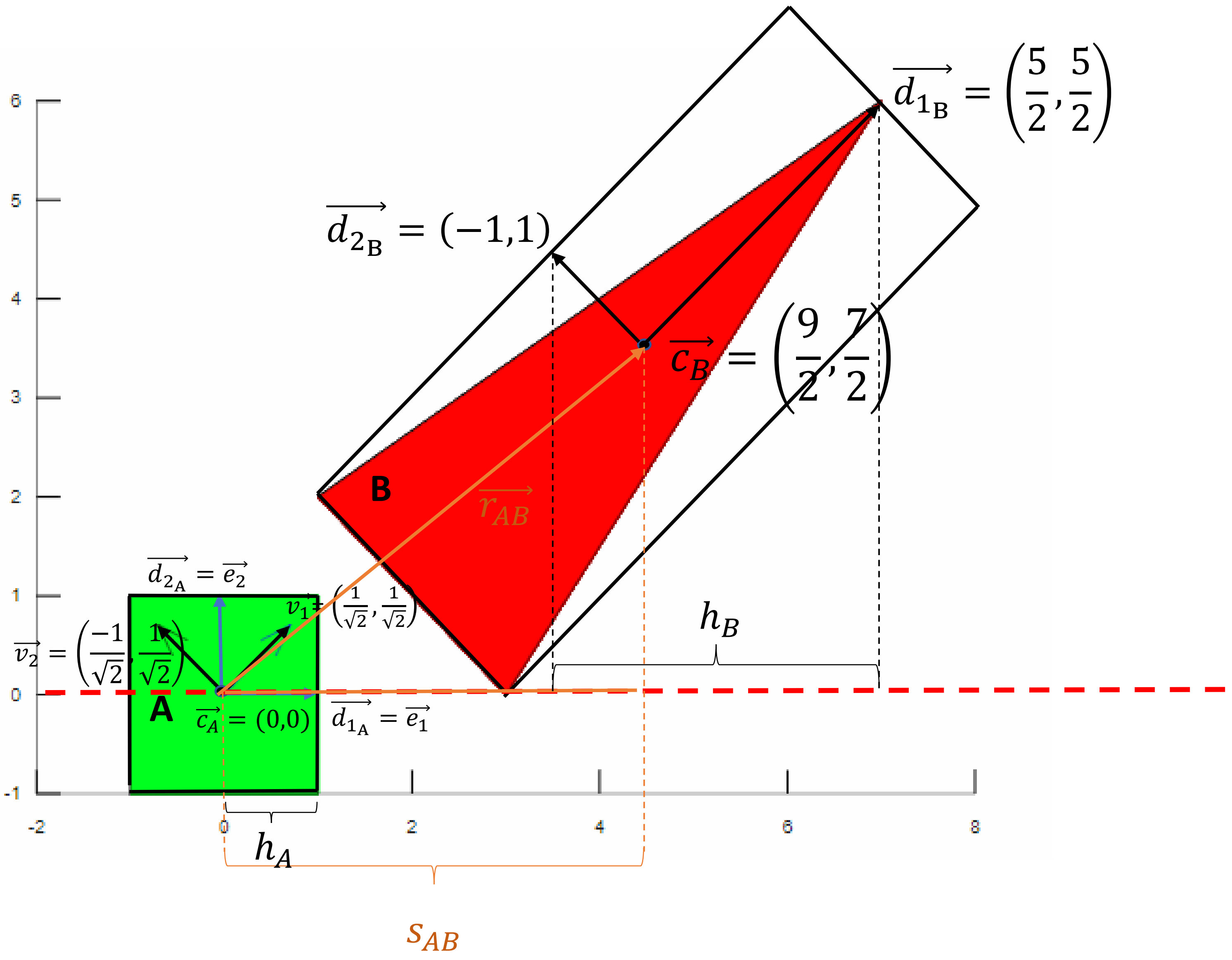
$$h_A = |(1,0) \cdot (1,0)| + |(1,0) \cdot (0,1)|$$

Separating Axis Theorem



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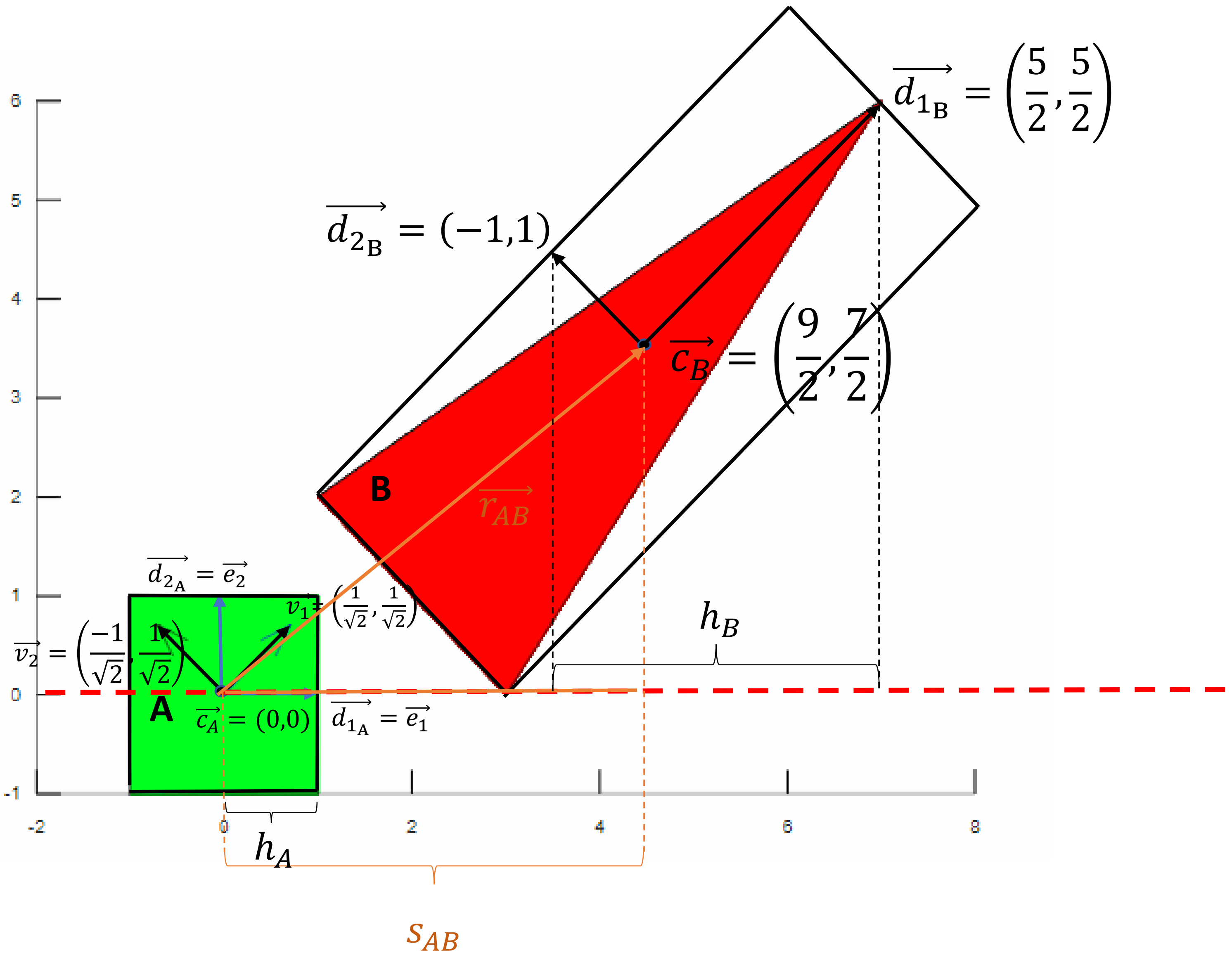
$$h_A = 1$$

$$h_B = |\vec{v} \cdot \overrightarrow{d_{1_B}}| + |\vec{v} \cdot \overrightarrow{d_{2_B}}|$$

Separating Axis Theorem



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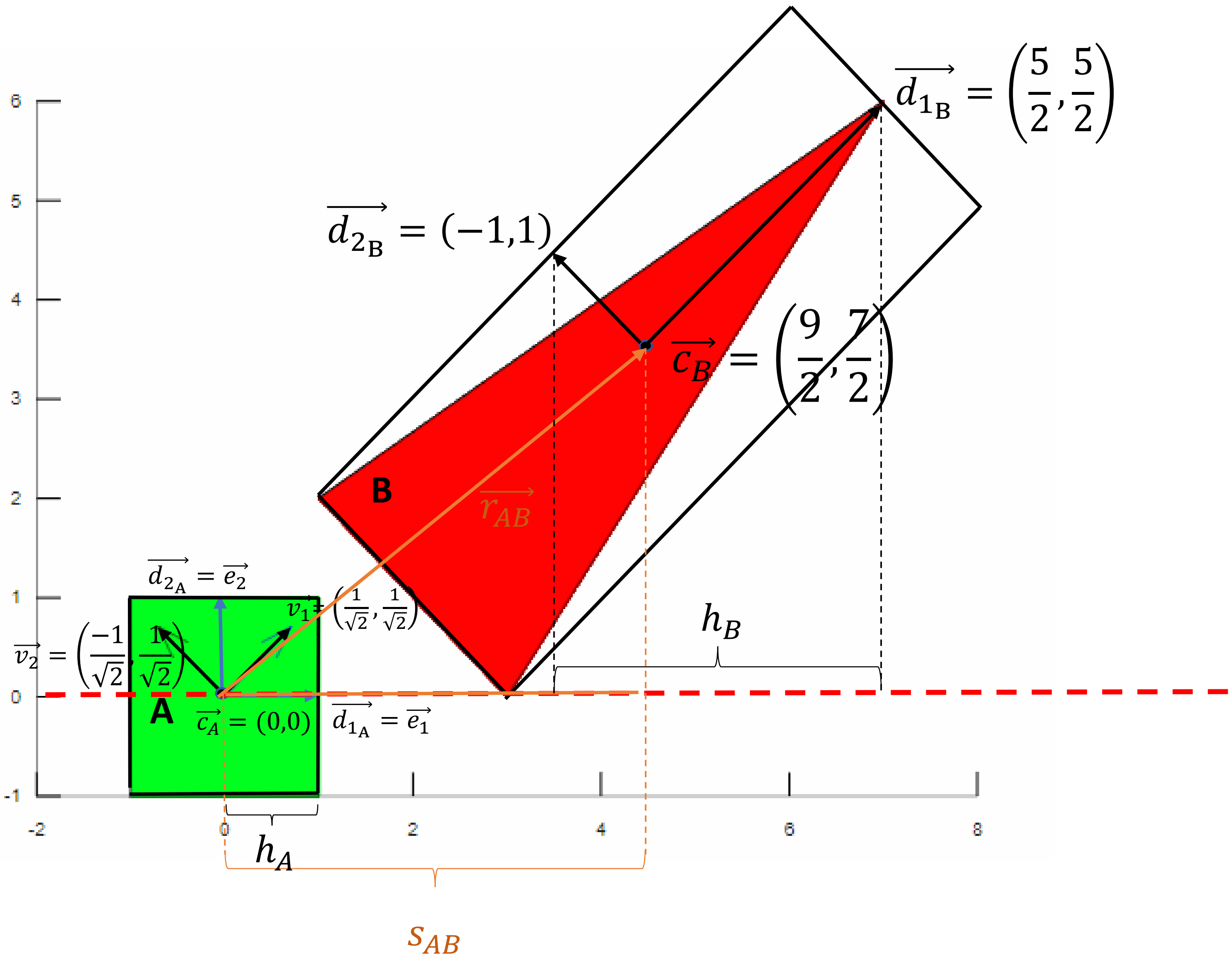
$$h_A = 1$$

$$h_B = \left|(1,0)\cdot\left(\frac{5}{2},\frac{5}{2}\right)\right| + |(1,0)\cdot(-1,1)|$$

Separating Axis Theorem



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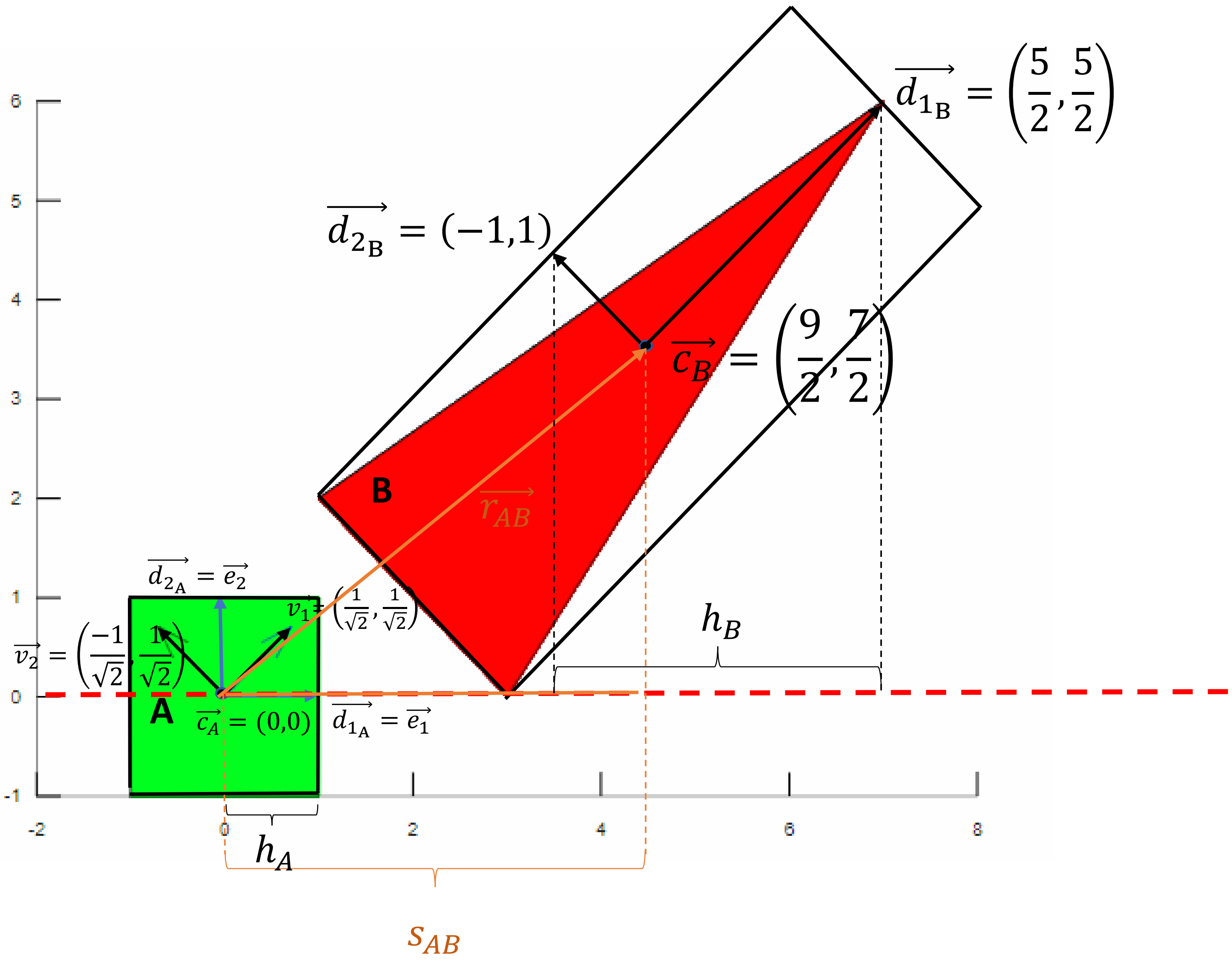
$$h_A = \frac{2}{2}$$

$$h_B = \frac{5}{2} + \frac{2}{2}$$

Separating Axis Theorem



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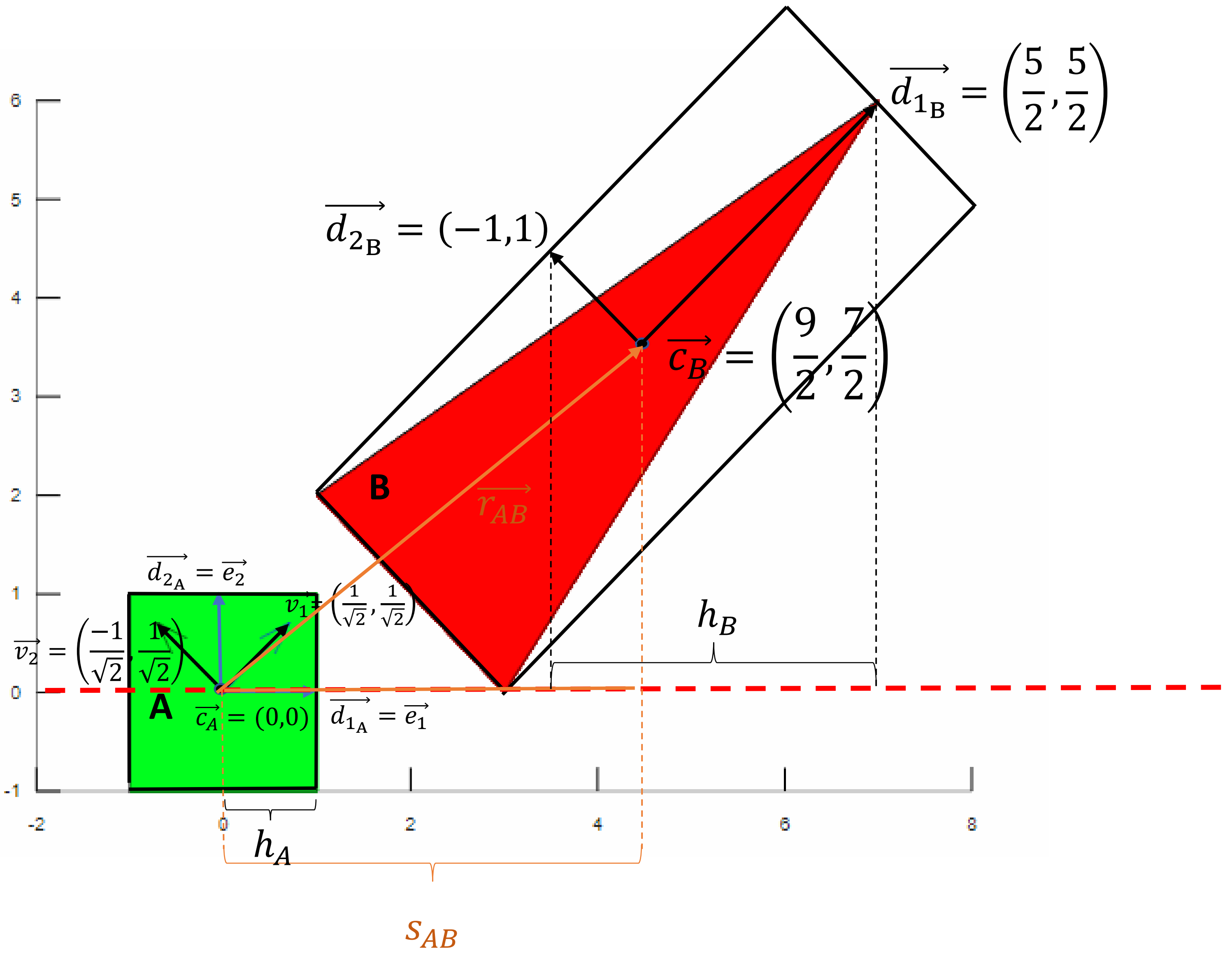
$$h_B = \frac{7}{2}$$

Separating Axis Theorem



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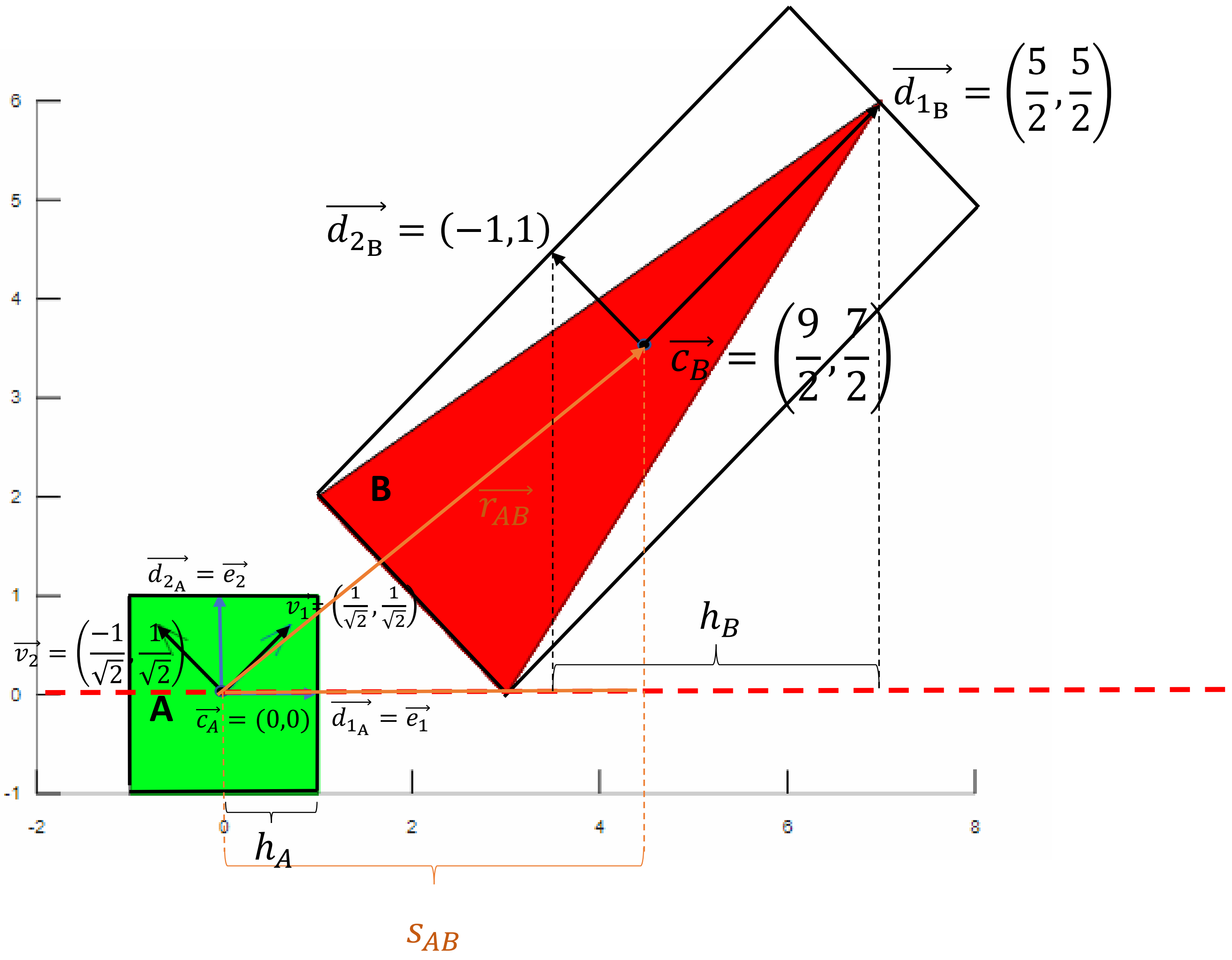
$$h_A + h_B = \frac{2+7}{2} = \frac{9}{2}$$

$$s_{AB} \overset{?}{>} h_A + h_B$$

Separating Axis Theorem



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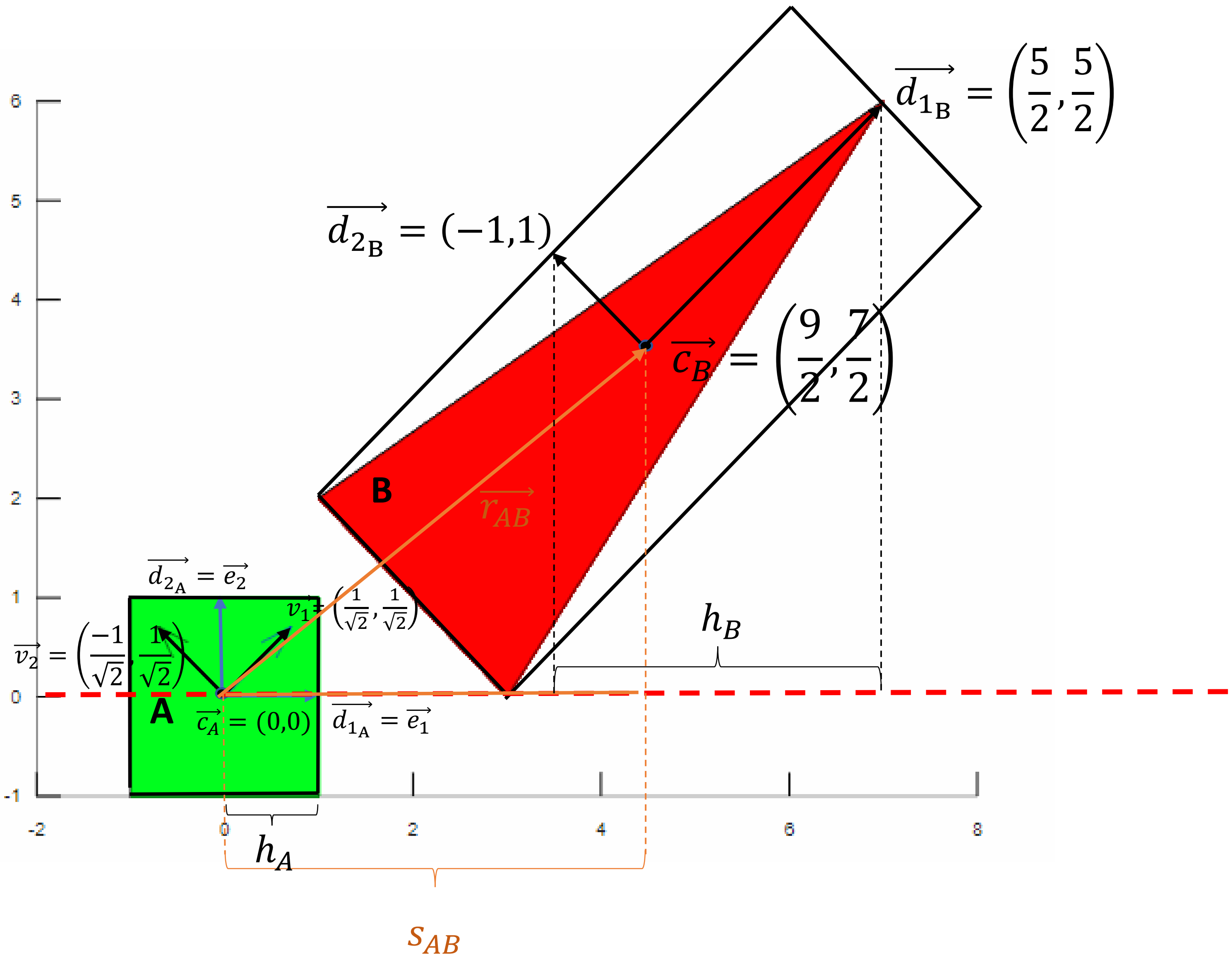
$$s_{AB} \overset{?}{>} h_A + h_B$$

$$\frac{9}{2} > \frac{9}{2}$$

Separating Axis Theorem



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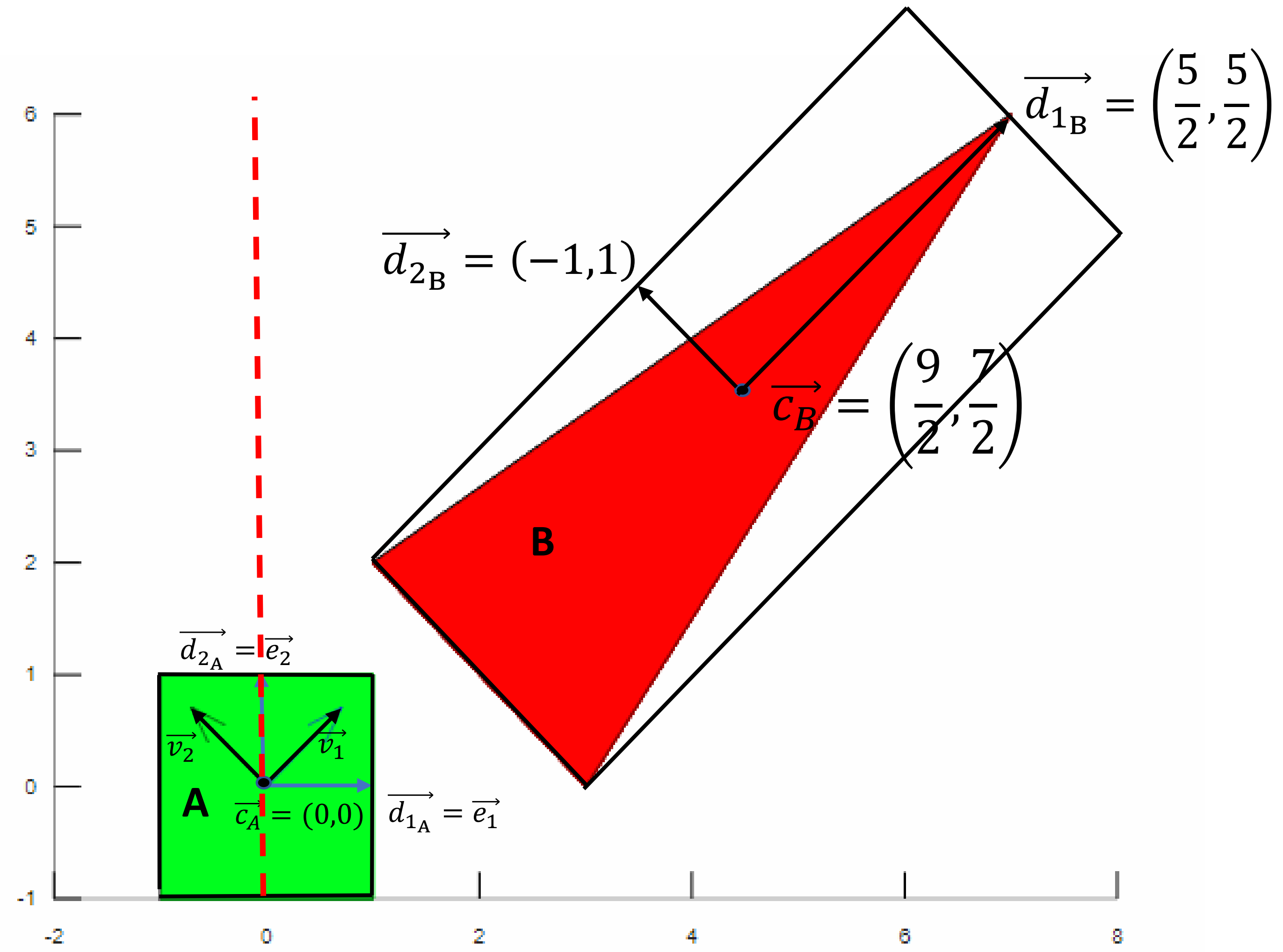
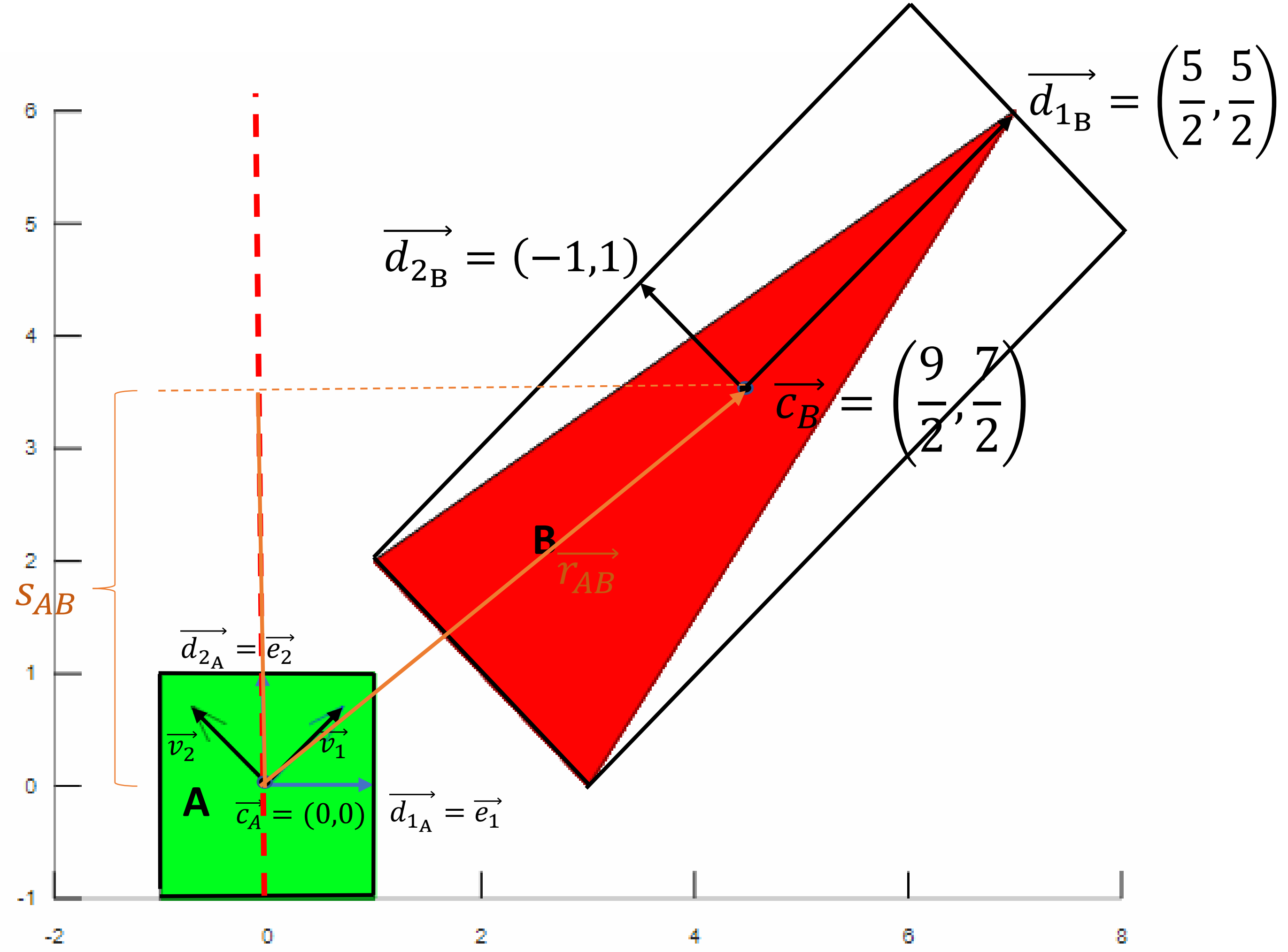
not true ⇒ can't say that they are not in a collision

Separating Axis Theorem



Test: $\vec{v} = \overrightarrow{e_2} = (0,1)$

Separating Axis Theorem

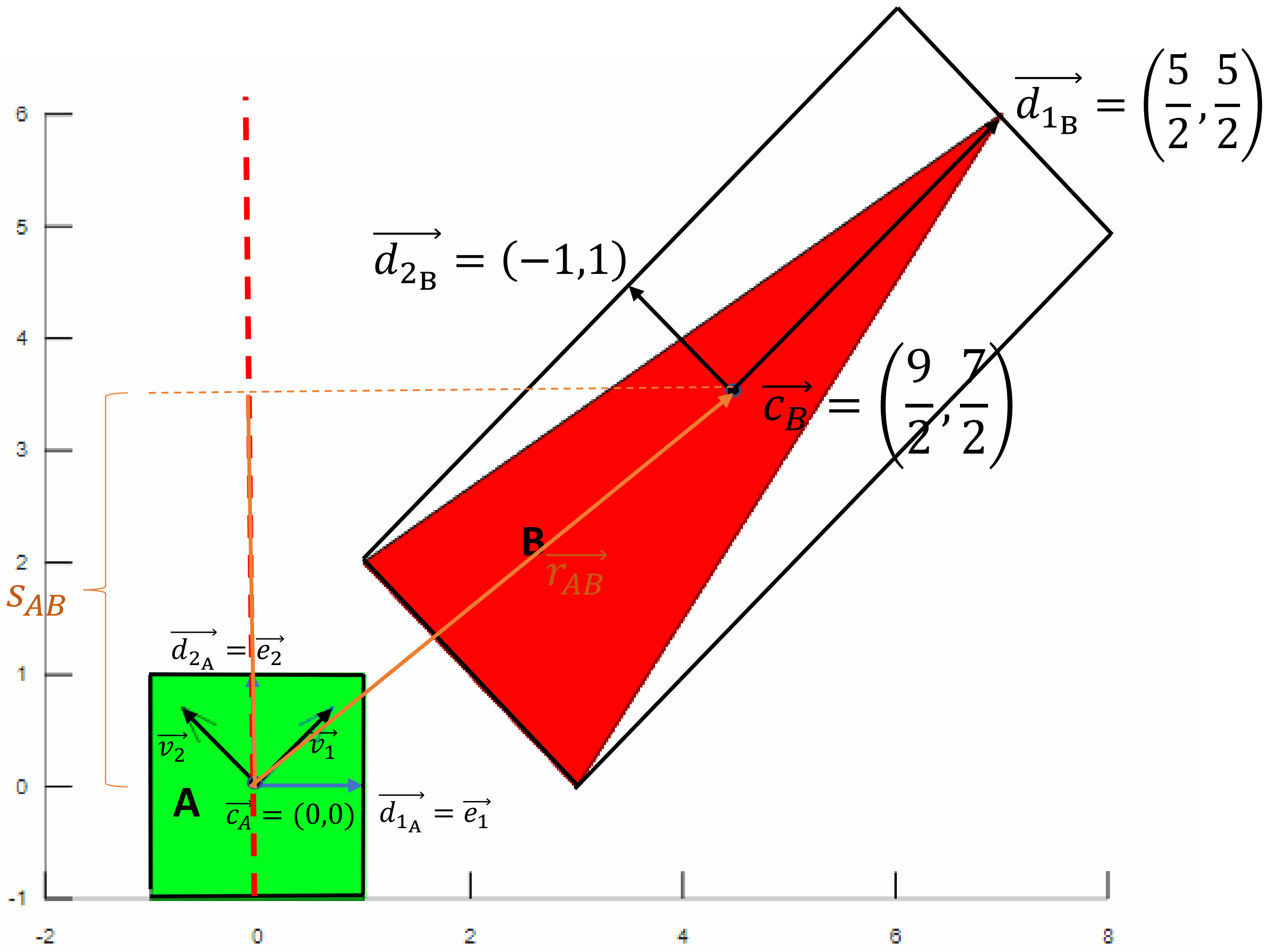


Test: $\vec{v} = \overrightarrow{e_2} = (0,1)$

$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2},\frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = (0,1) \cdot \left(\frac{9}{2},\frac{7}{2}\right) = \frac{7}{2}$$

Separating Axis Theorem



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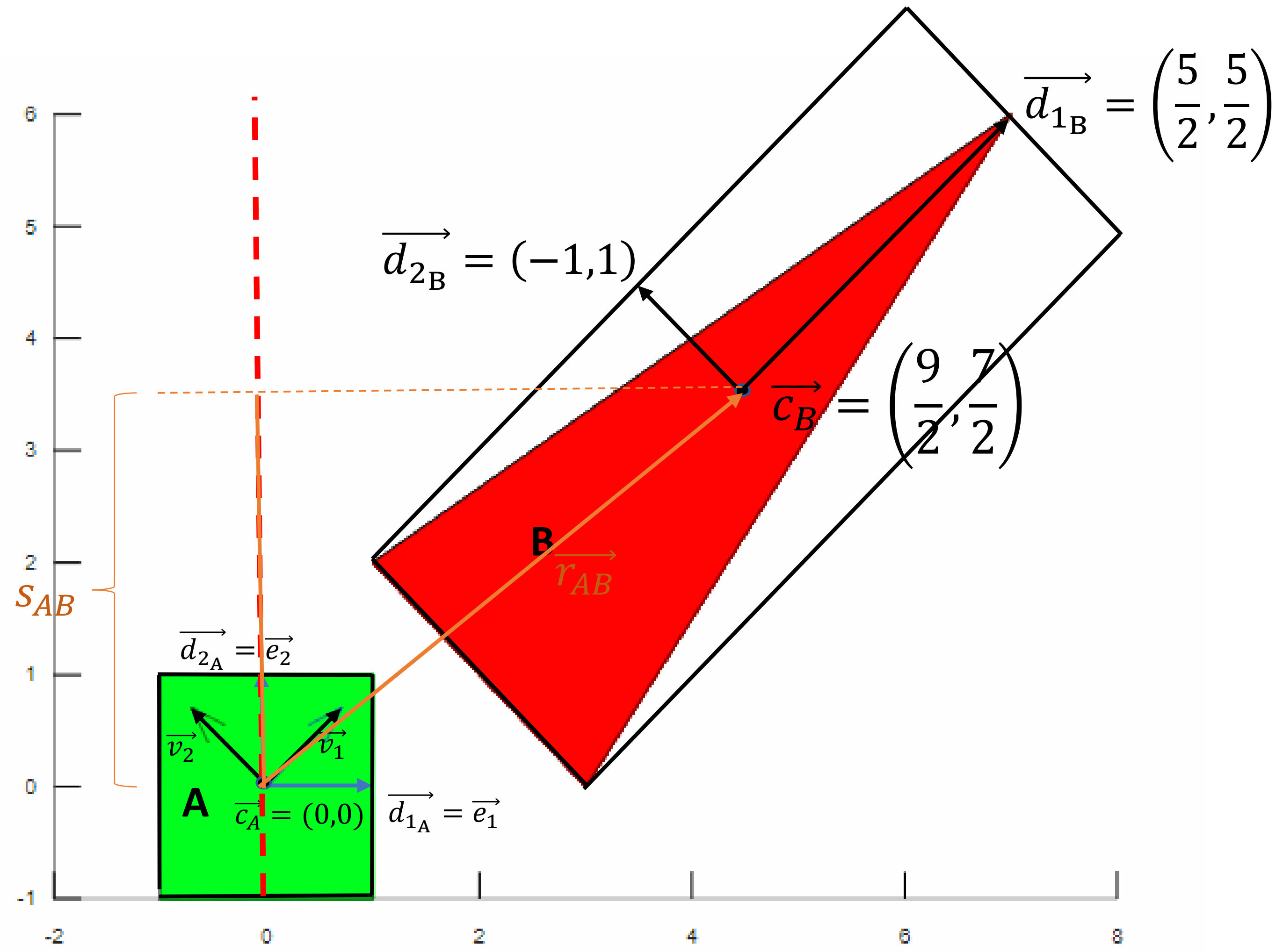
$$h_B = \left|\vec{v} \cdot \overrightarrow{d_{1_B}}\right| + \left|\vec{v} \cdot \overrightarrow{d_{2_B}}\right|$$

Separating Axis Theorem



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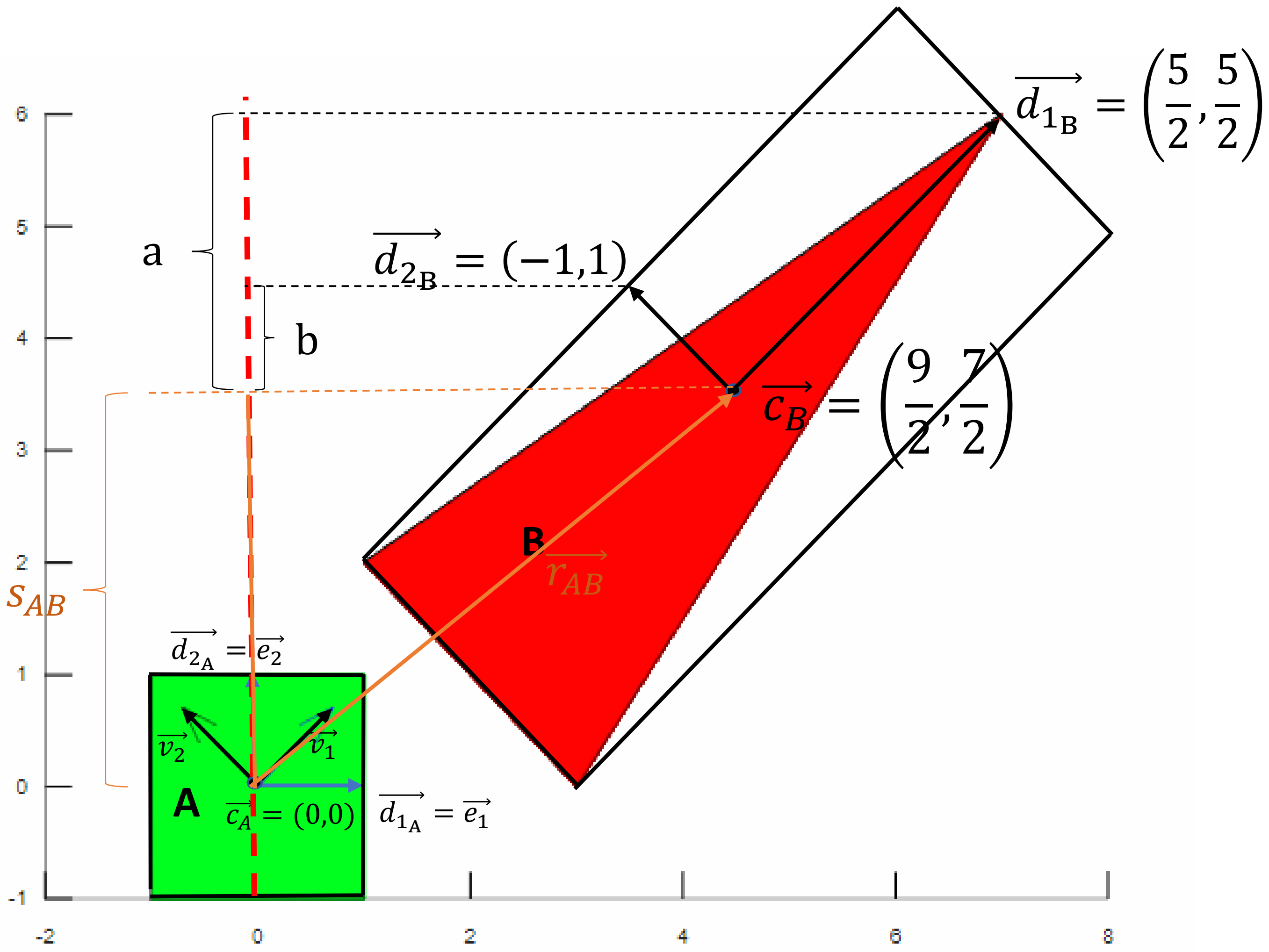
$$h_B = \left|\vec{v} \cdot \overrightarrow{d_{1_B}}\right| + \left|\vec{v} \cdot \overrightarrow{d_{2_B}}\right|$$

$$h_B = \left|(0,1) \cdot \overrightarrow{d_{1_B}}\right| + \left|(0,1) \cdot \overrightarrow{d_{2_B}}\right|$$

Separating Axis Theorem



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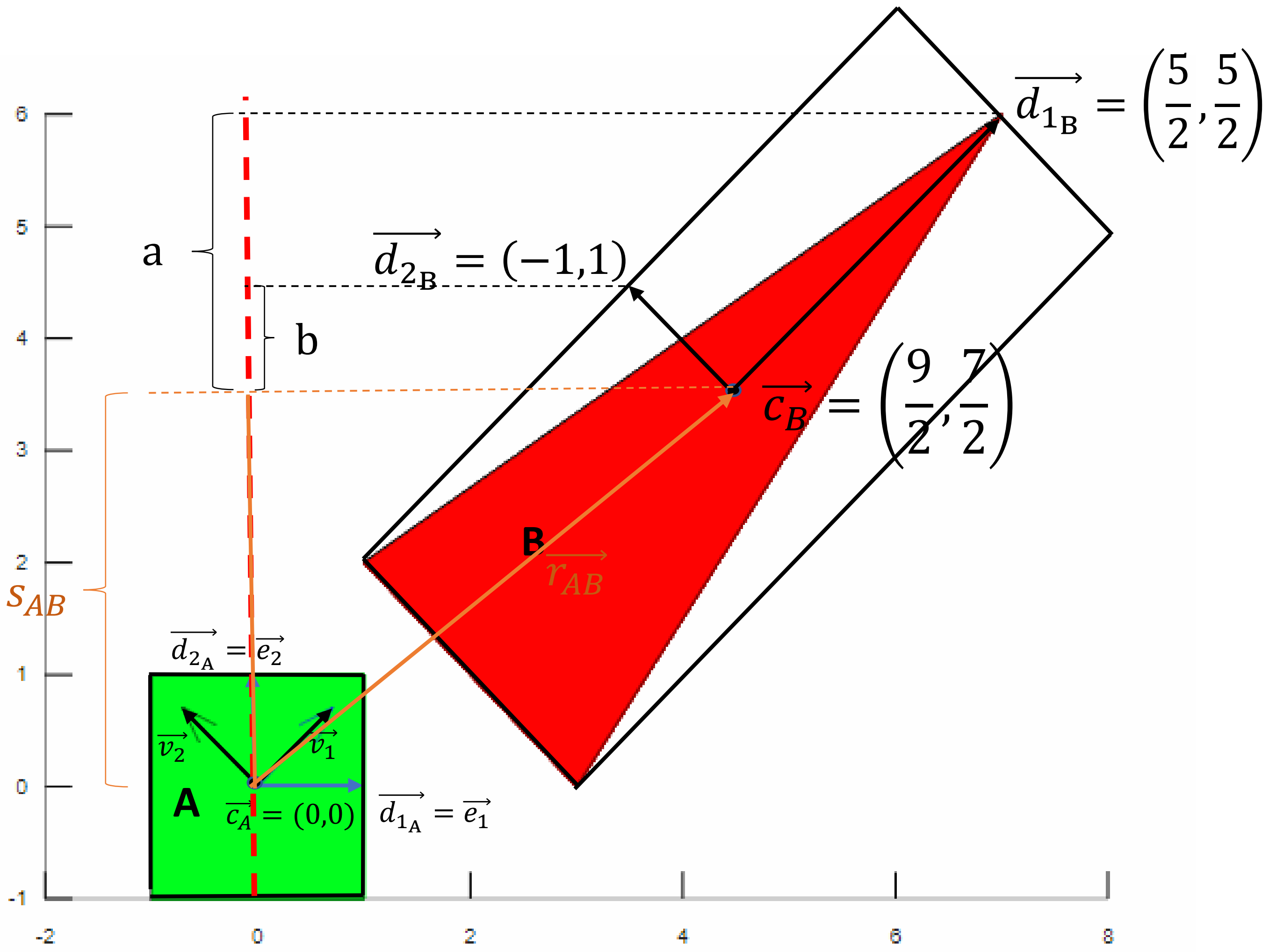
$$h_B = \left|(0,1) \cdot \overrightarrow{d_{1_B}}\right| + \left|(0,1) \cdot \overrightarrow{d_{2_B}}\right|$$

$$h_B = \underbrace{\left|(0,1) \cdot \left(\frac{5}{2}, \frac{5}{2}\right)\right|}_{a} + \underbrace{|(0,1) \cdot (-1,1)|}_{b}$$

Separating Axis Theorem



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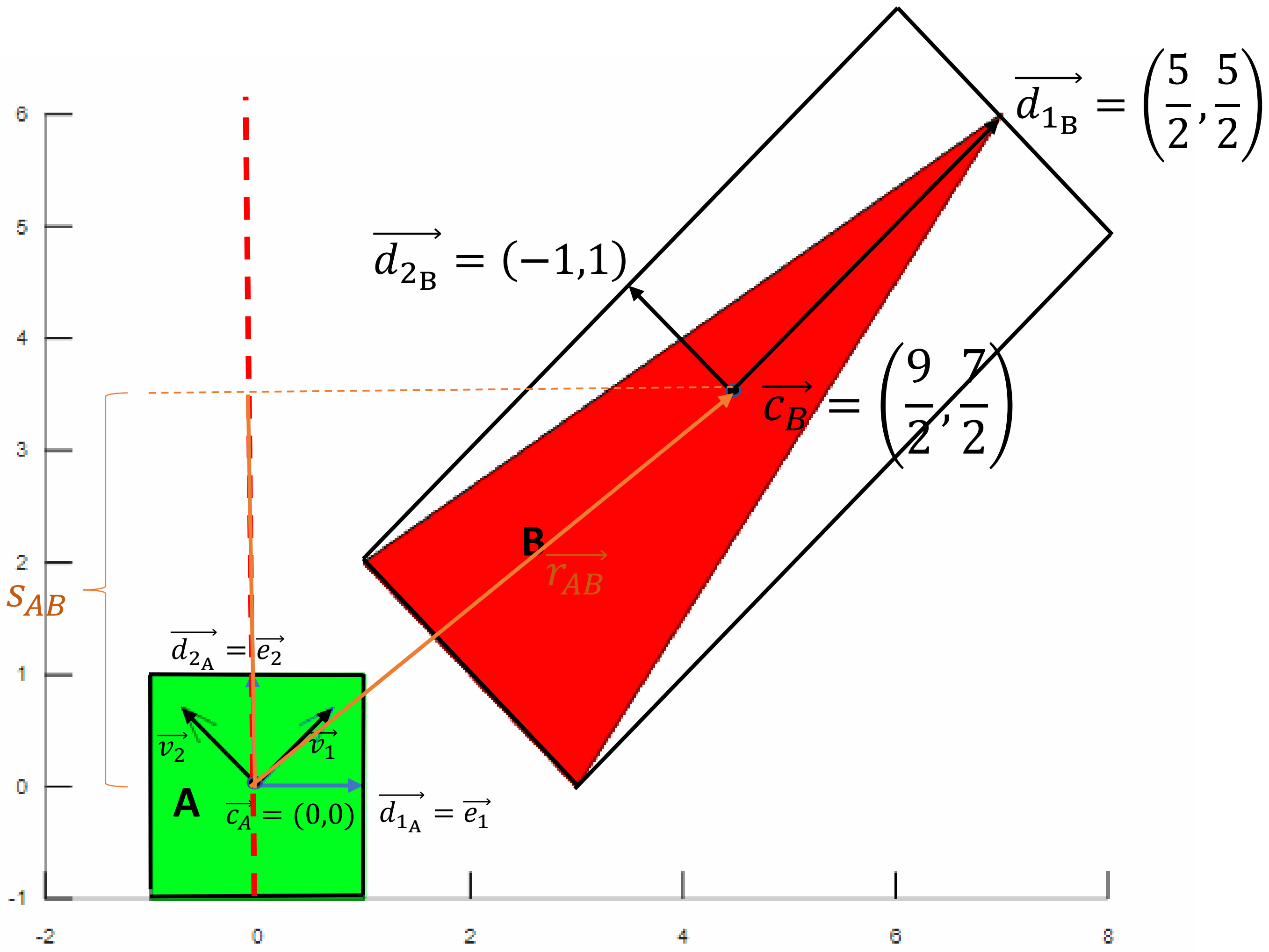
$$h_B = \frac{5}{2} + \frac{2}{2} = \frac{7}{2}$$

Separating Axis Theorem



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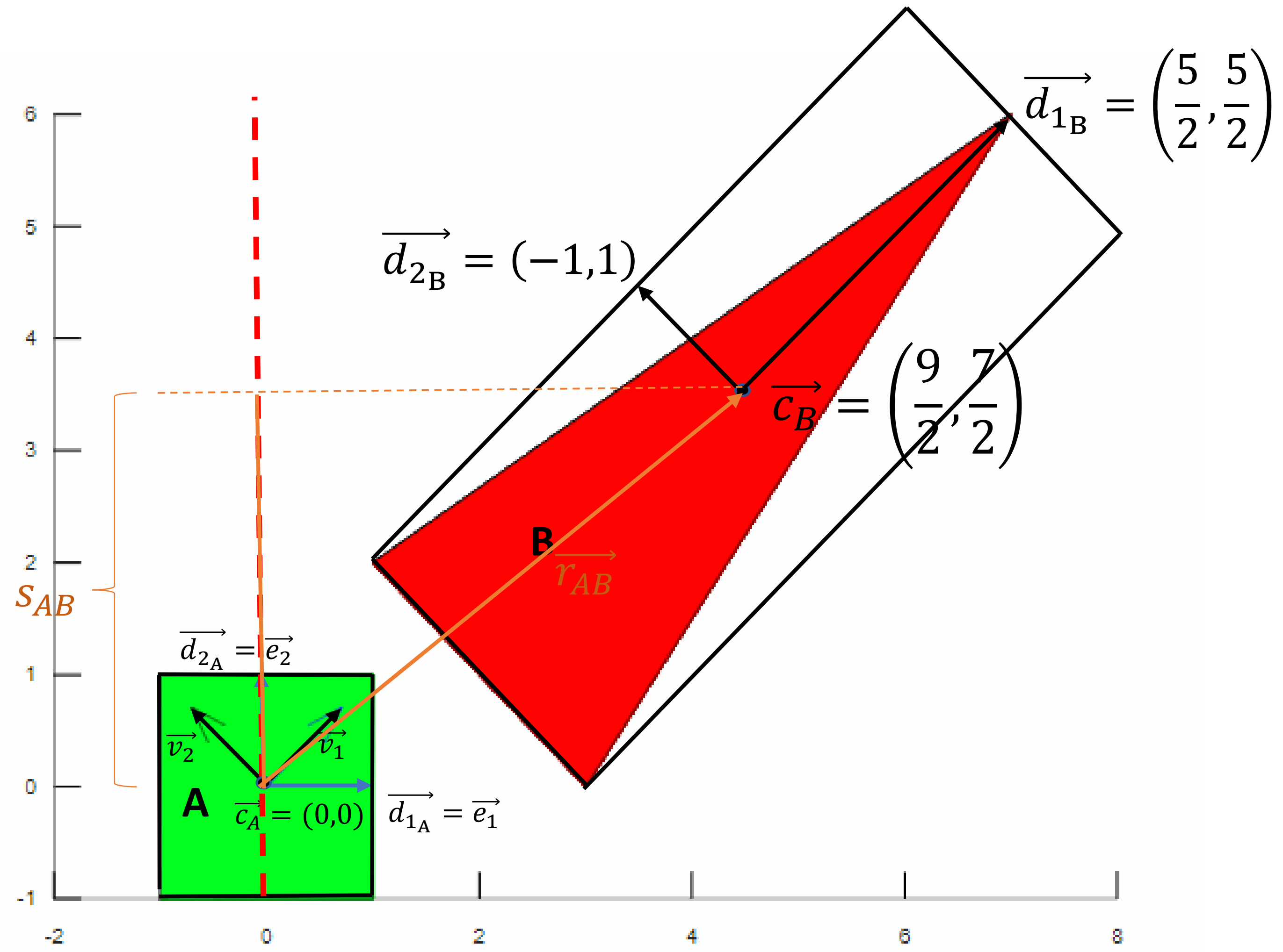
$$h_B = \frac{7}{2}$$

Separating Axis Theorem



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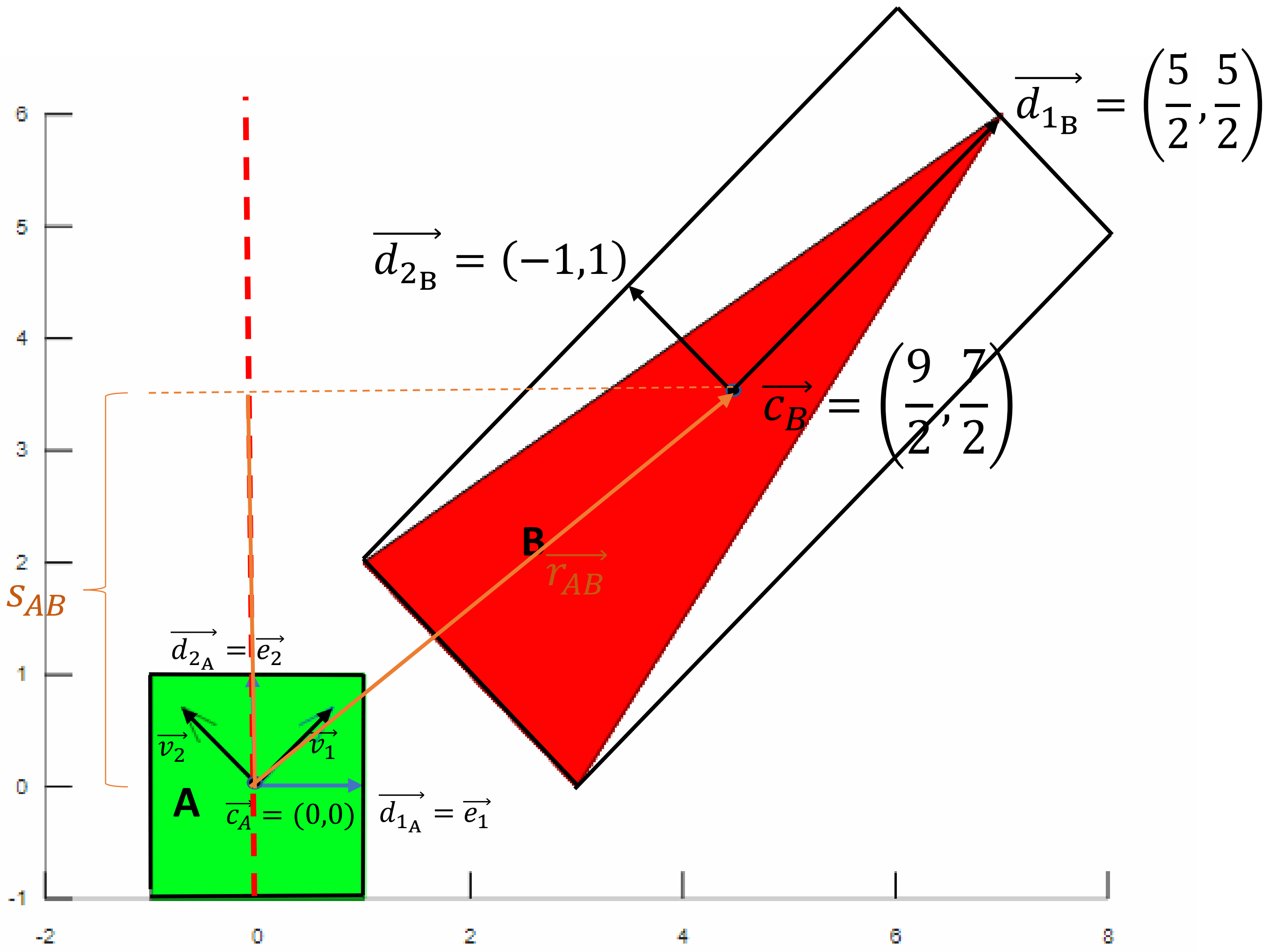
$$h_B = \frac{7}{2}$$

$$h_A = \left|\vec{v} \cdot \overrightarrow{d_{1_A}}\right| + \left|\vec{v} \cdot \overrightarrow{d_{2_A}}\right|$$

Separating Axis Theorem



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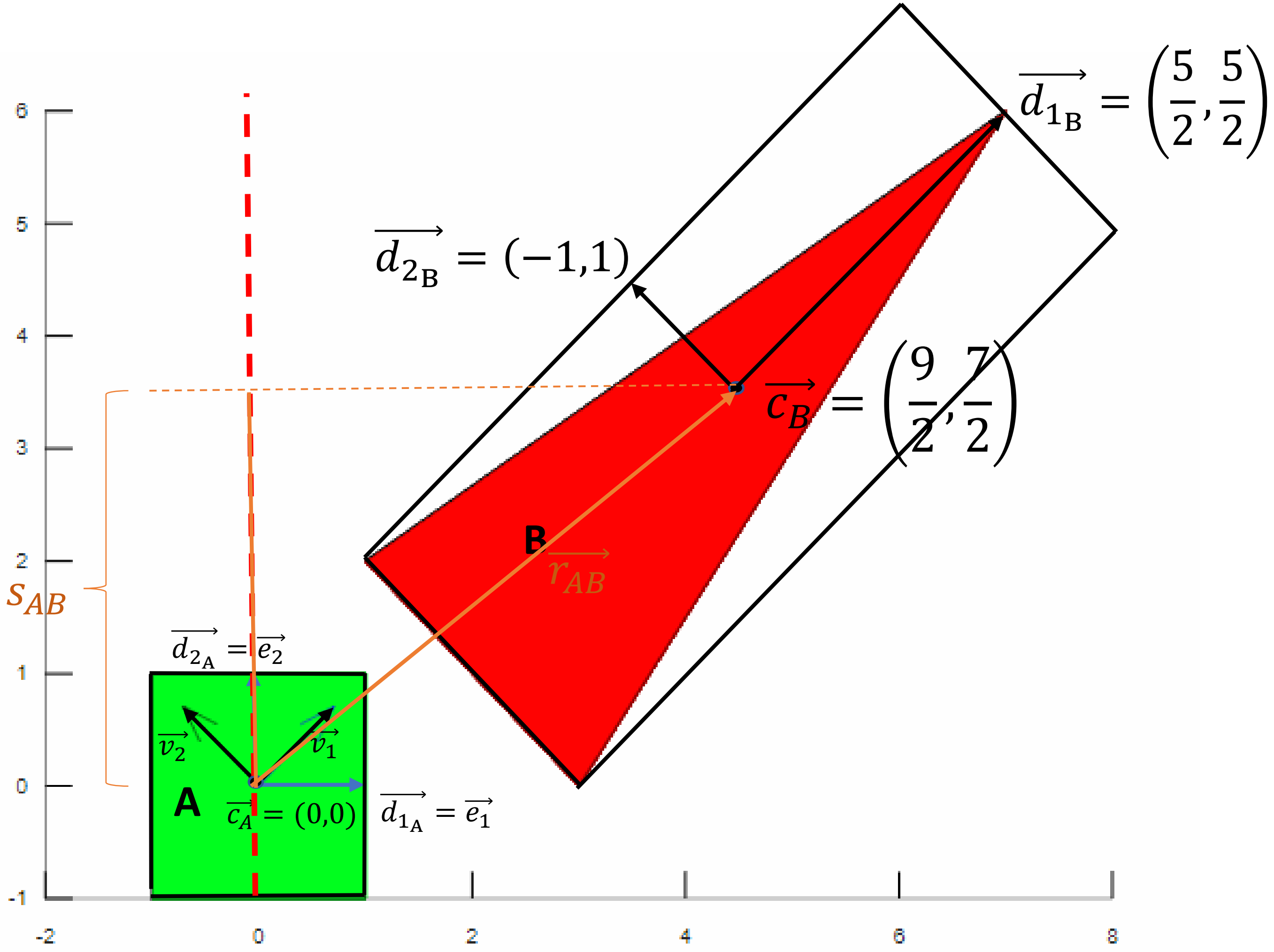
$$h_B = \frac{7}{2}$$

$$h_A = \left|\vec{v} \cdot \overrightarrow{d_{1_A}}\right| + \left|\vec{v} \cdot \overrightarrow{d_{2_A}}\right|$$

$$h_A = |(0,1) \cdot (1,0)| + |(0,1) \cdot (0,1)|$$

Separating Axis Theorem



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$$h_B = \frac{7}{2}$$

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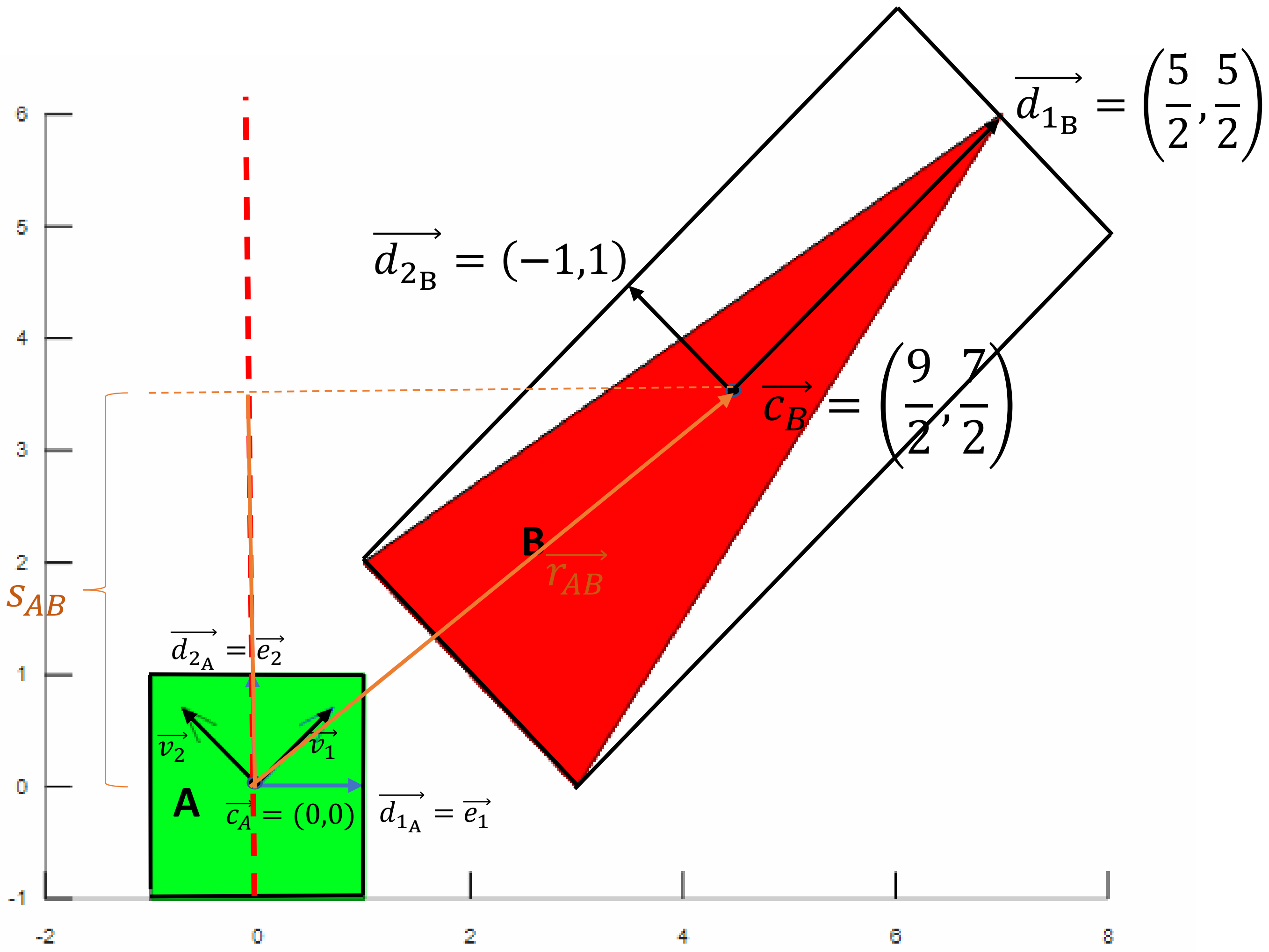
$$h_A = |(0,1) \cdot (1,0)| + |(0,1) \cdot (0,1)|$$

$$h_A = \frac{2}{2}$$

Separating Axis Theorem



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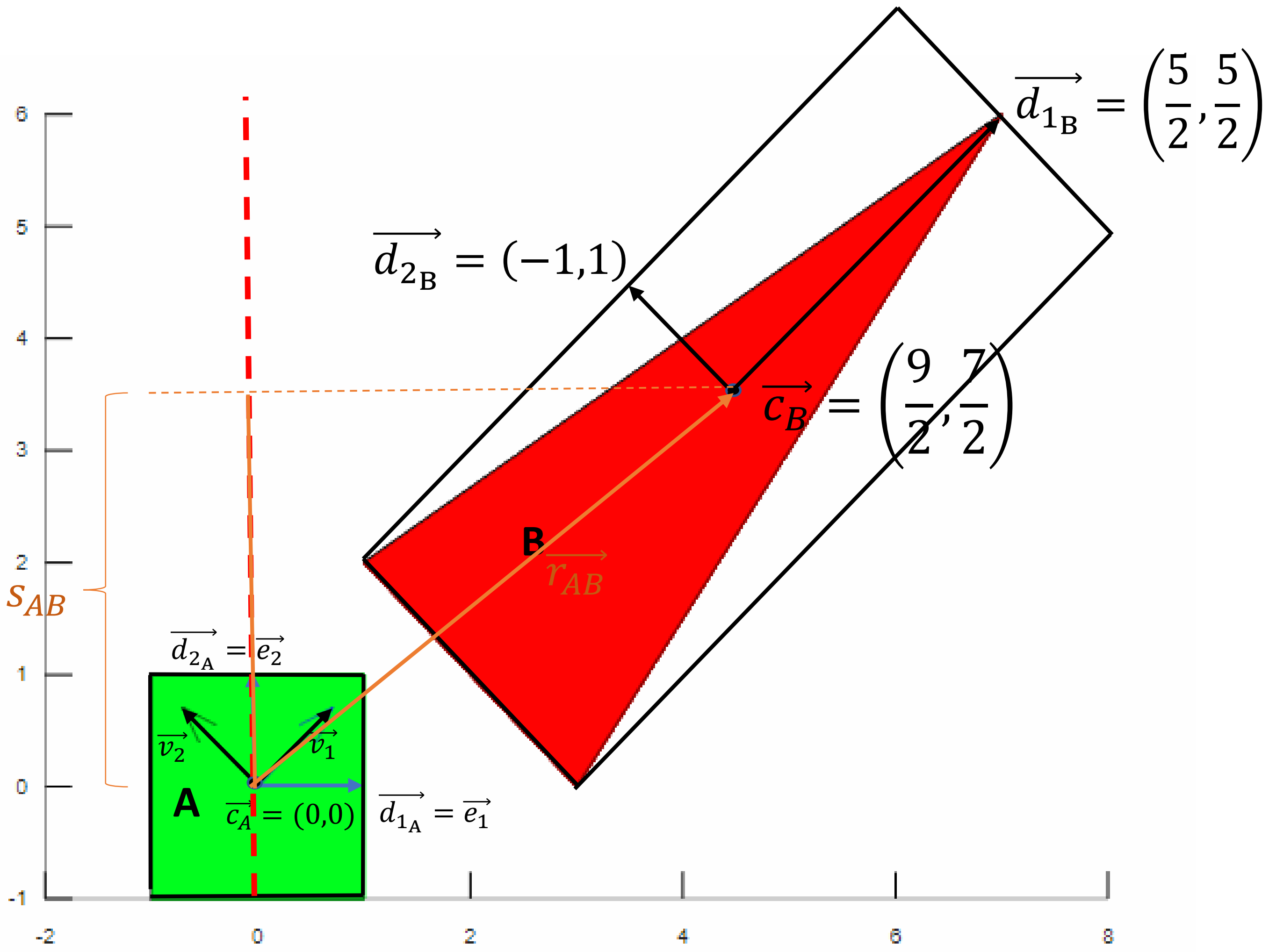
$$h_B = \frac{7}{2}$$

$$h_A = \frac{2}{2}$$

$$h_A + h_B = \frac{2+7}{2} = \frac{9}{2}$$

$$s_{AB} \overset{?}{>} h_A + h_B$$

Separating Axis Theorem



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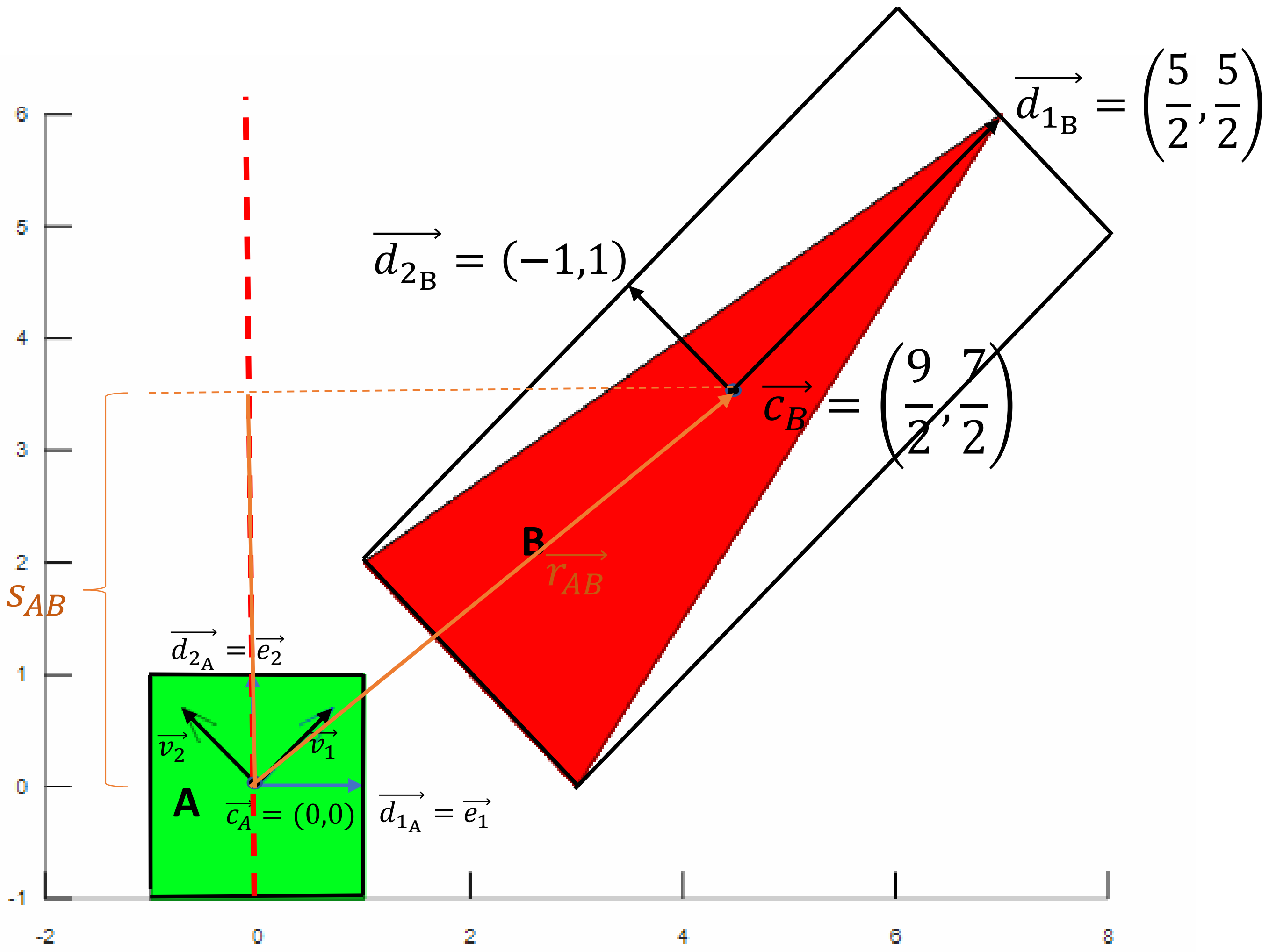
$$\frac{7}{2} > \frac{9}{2}$$

Separating Axis Theorem



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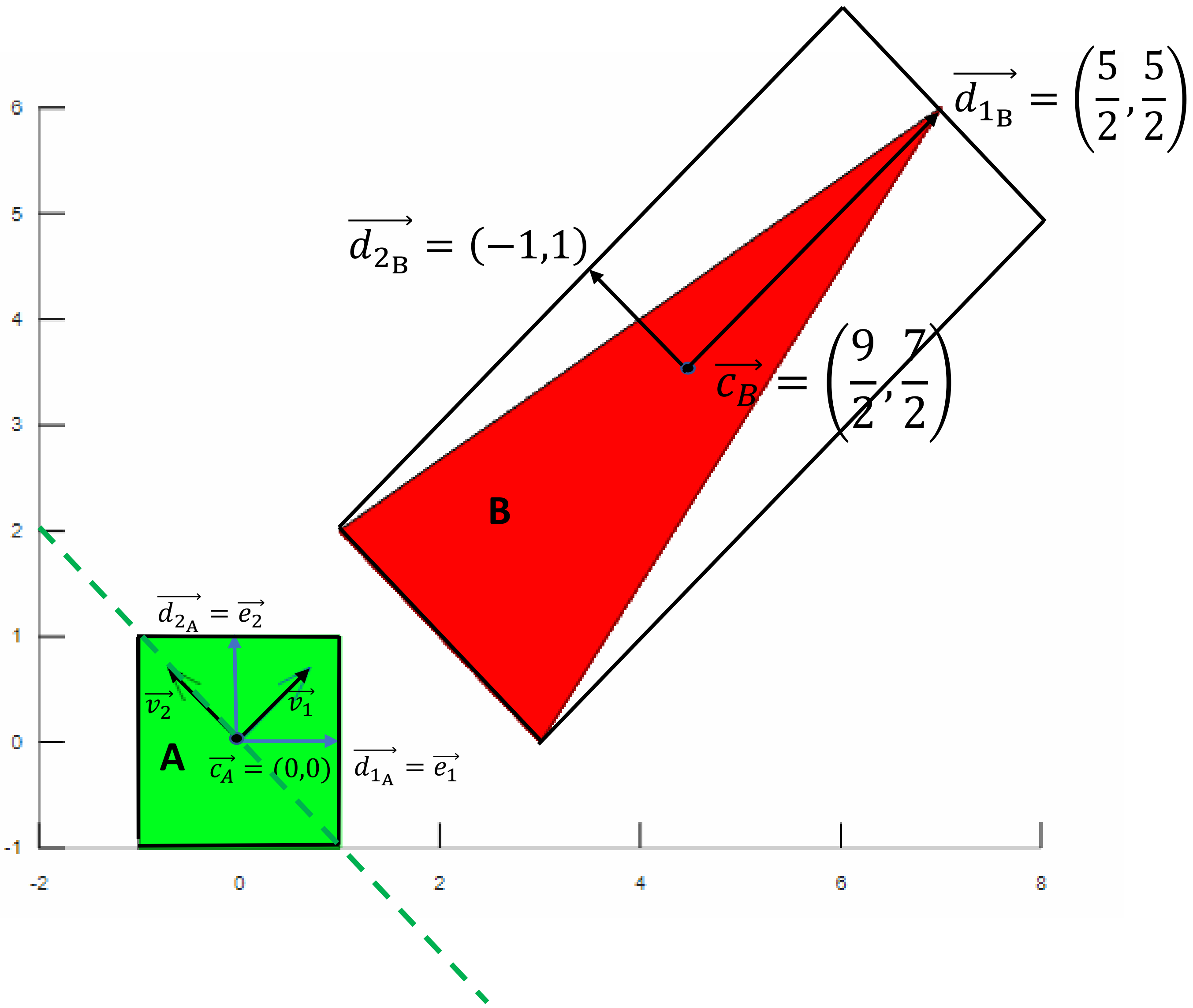
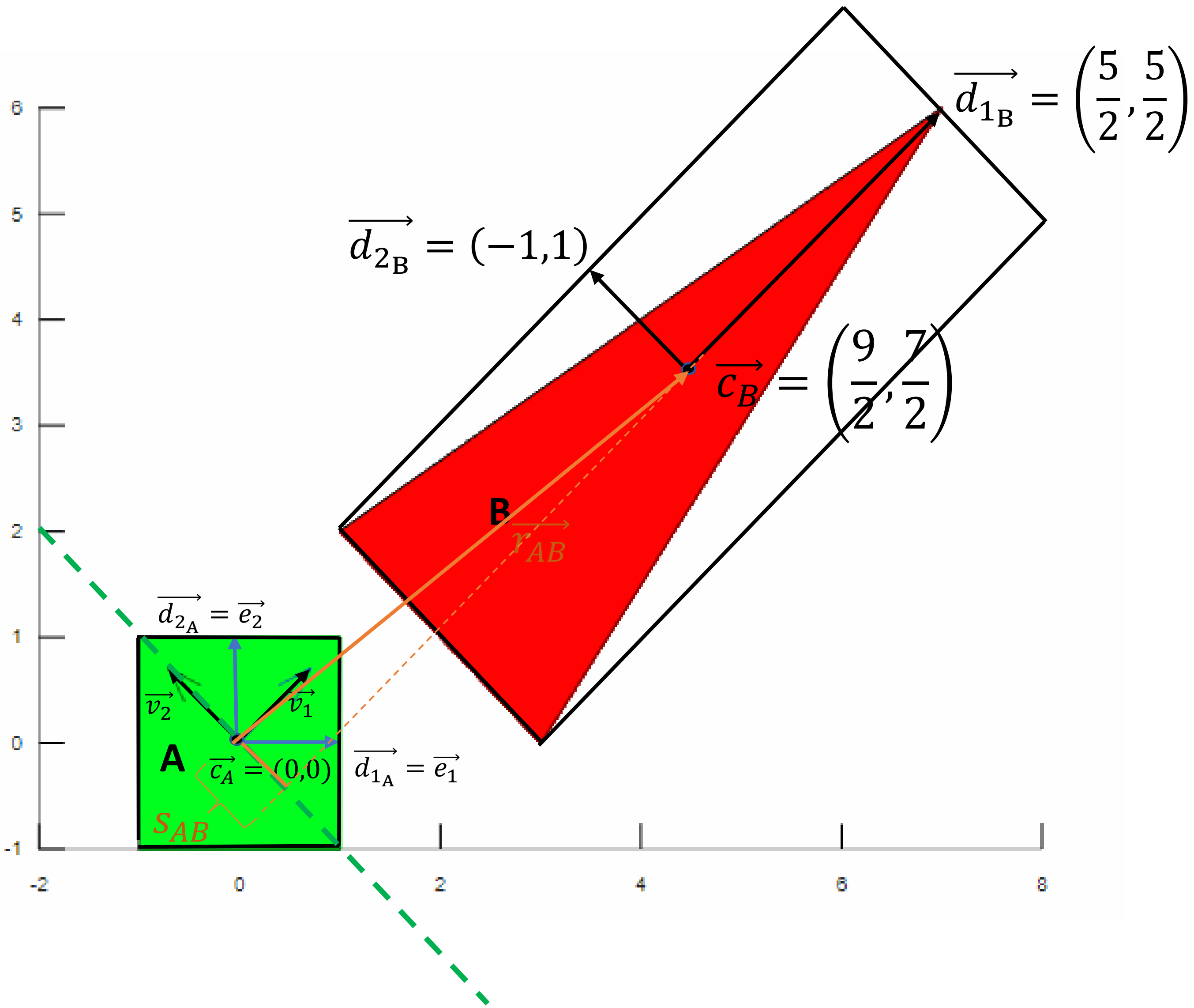
not true ⇒ can't say that they are not in a collision

Separating Axis Theorem



Test: $\vec{v} = \overrightarrow{v_2} = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

Separating Axis Theorem

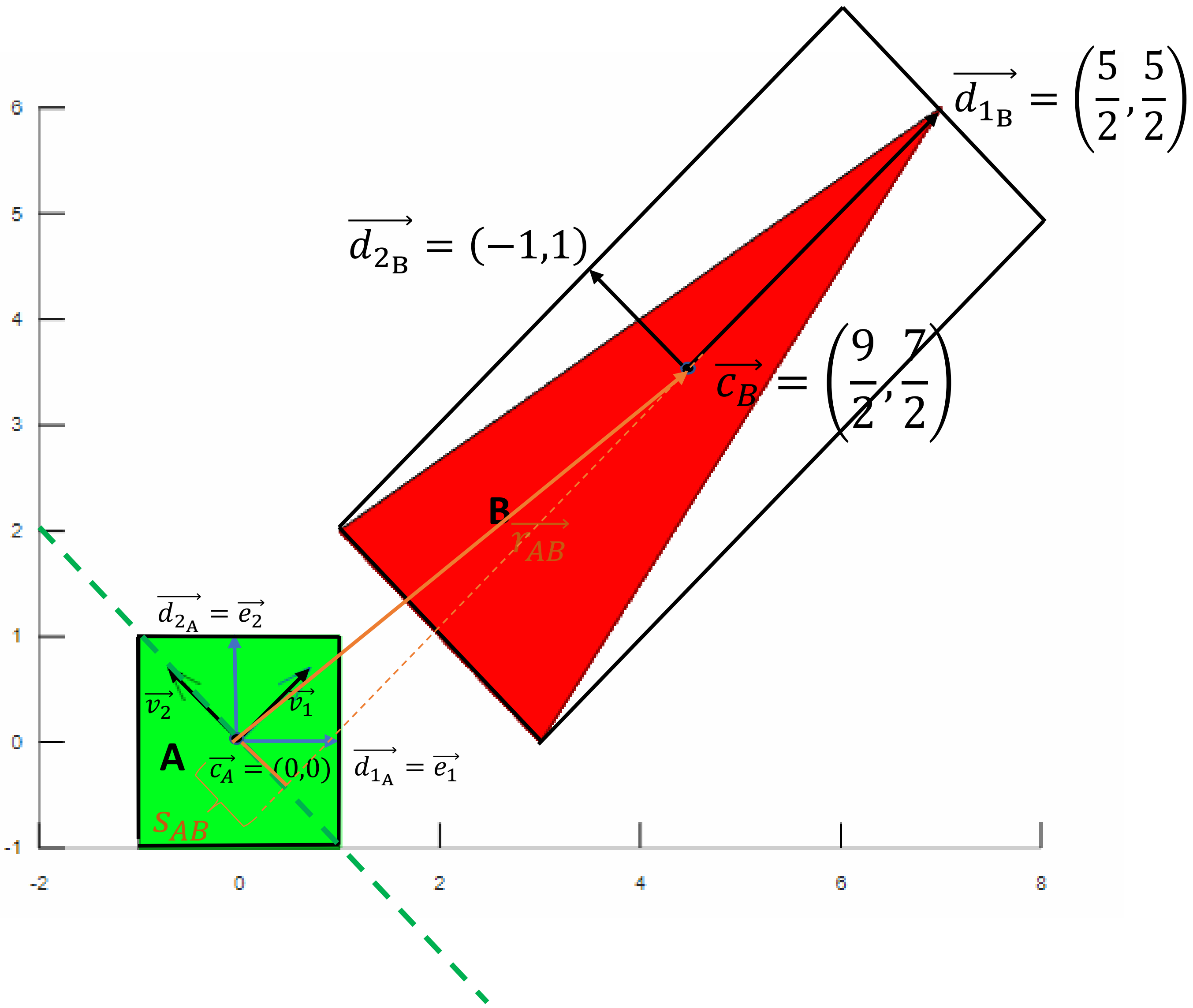


Test: $\vec{v} = \overrightarrow{v_2} = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \left|\left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot \left(\frac{9}{2}, \frac{7}{2}\right)\right| =$$
$$= \left|\frac{-9}{2\sqrt{2}} + \frac{7}{2\sqrt{2}}\right| = \left|\frac{-2}{2\sqrt{2}}\right| = \frac{1}{\sqrt{2}}$$

Separating Axis Theorem



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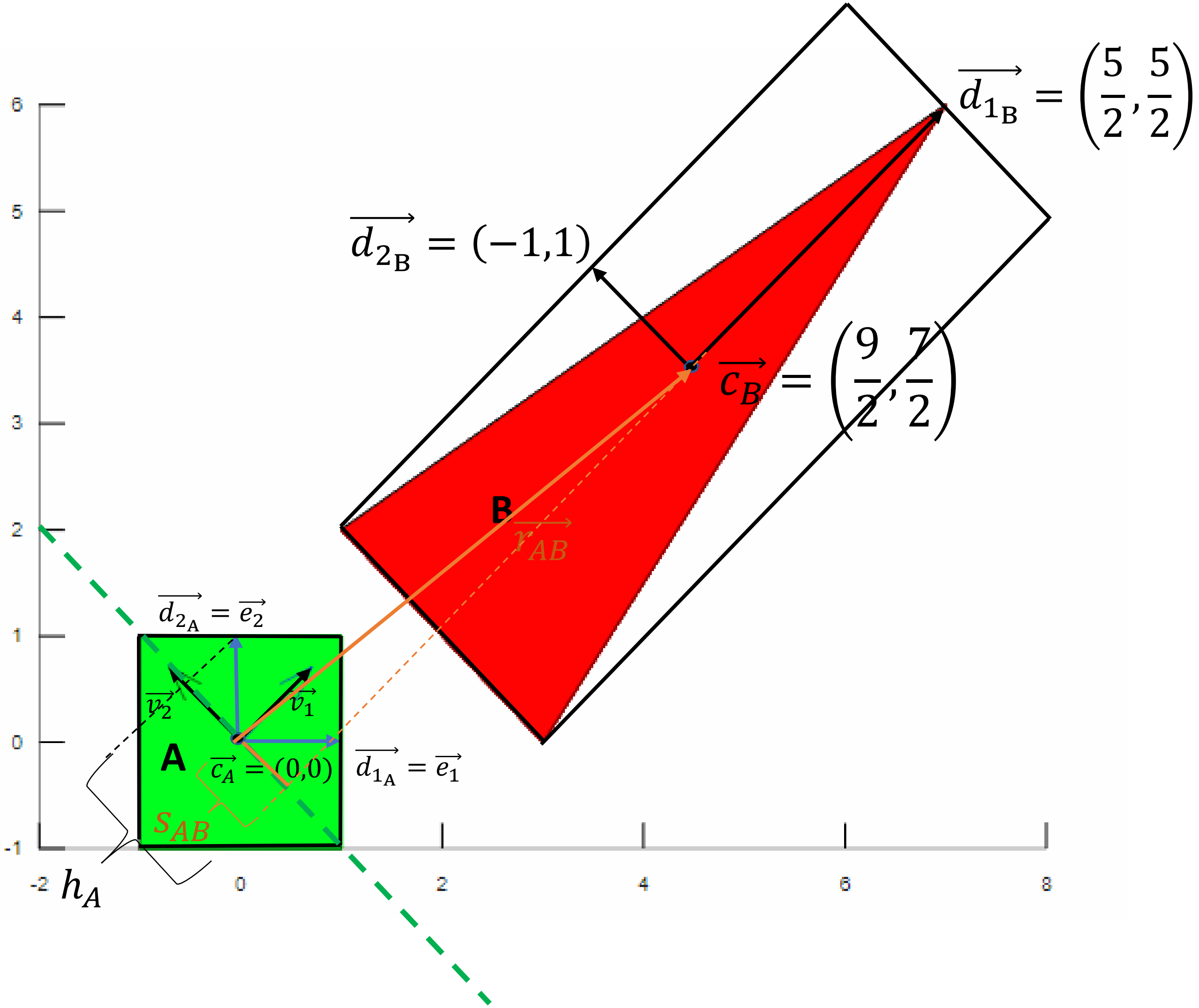
$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$$

$$h_A = \left|\vec{v} \cdot \overrightarrow{d_{1_A}}\right| + \left|\vec{v} \cdot \overrightarrow{d_{2_A}}\right|$$

Separating Axis Theorem



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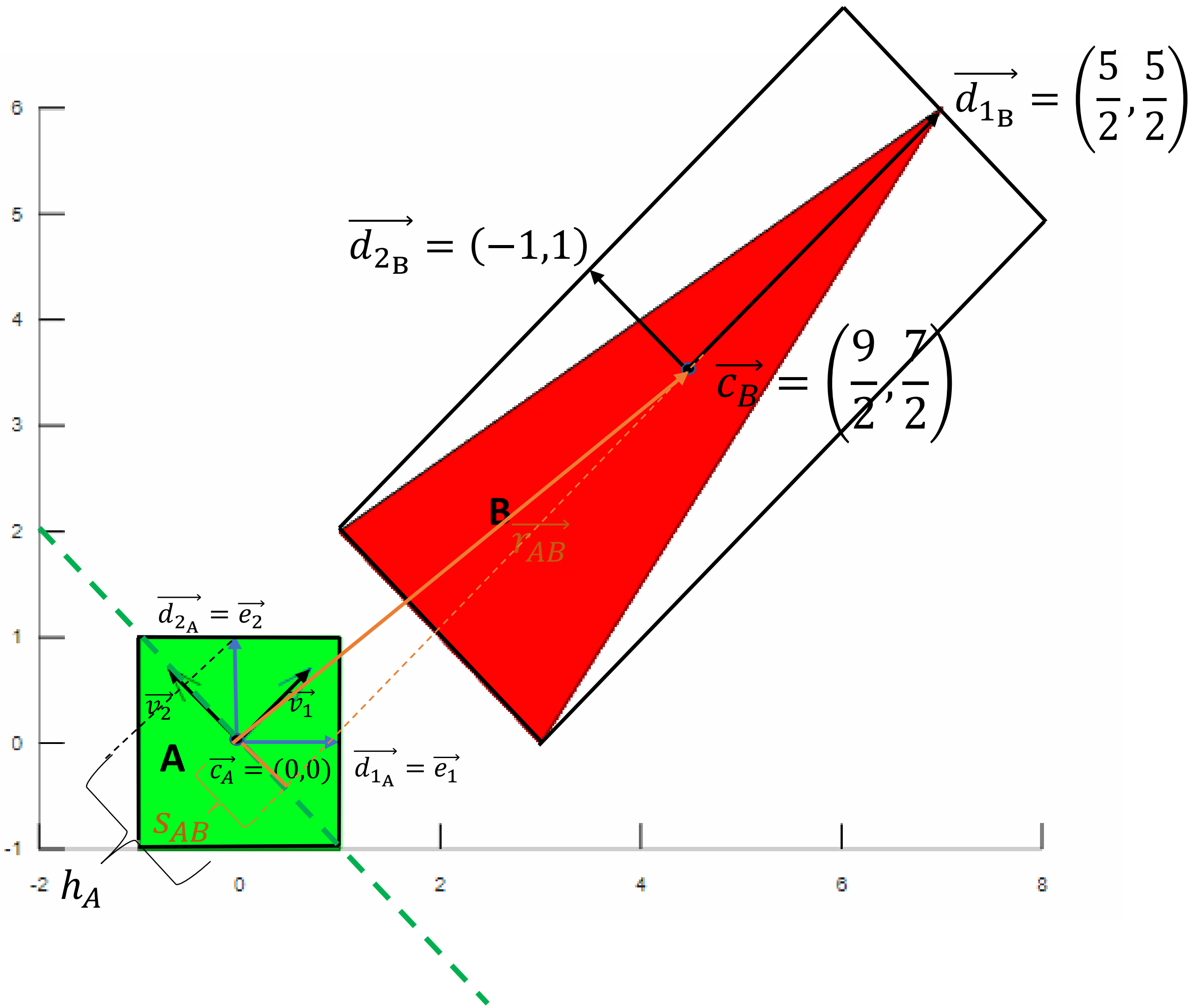
$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$$

$$h_A = \left|\left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,0)\right| + \left|\left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (0,1)\right|$$

Separating Axis Theorem



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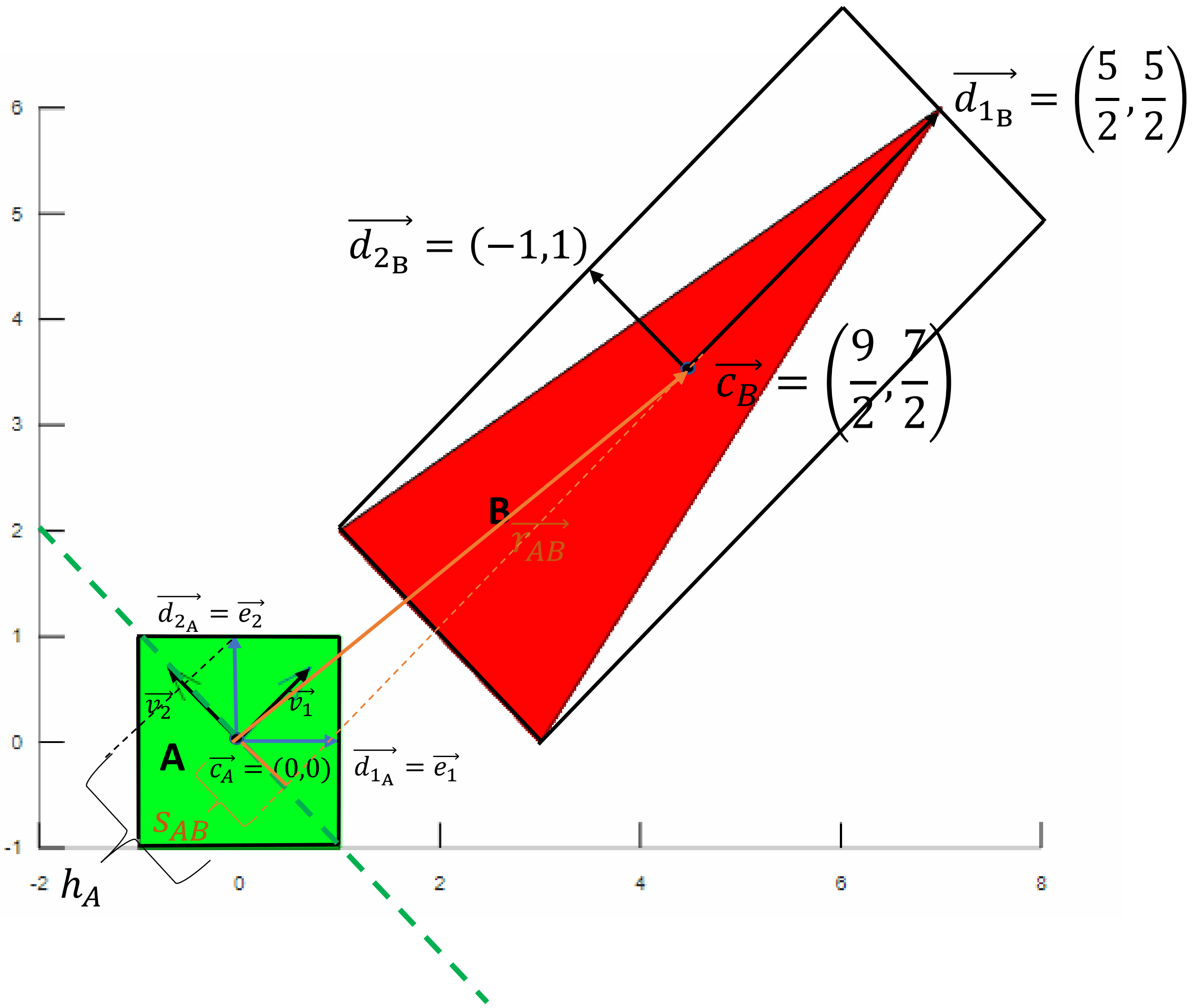
$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$$

$$h_A = \left|\frac{-1}{\sqrt{2}}\right| + \left|\frac{1}{\sqrt{2}}\right|$$

Separating Axis Theorem



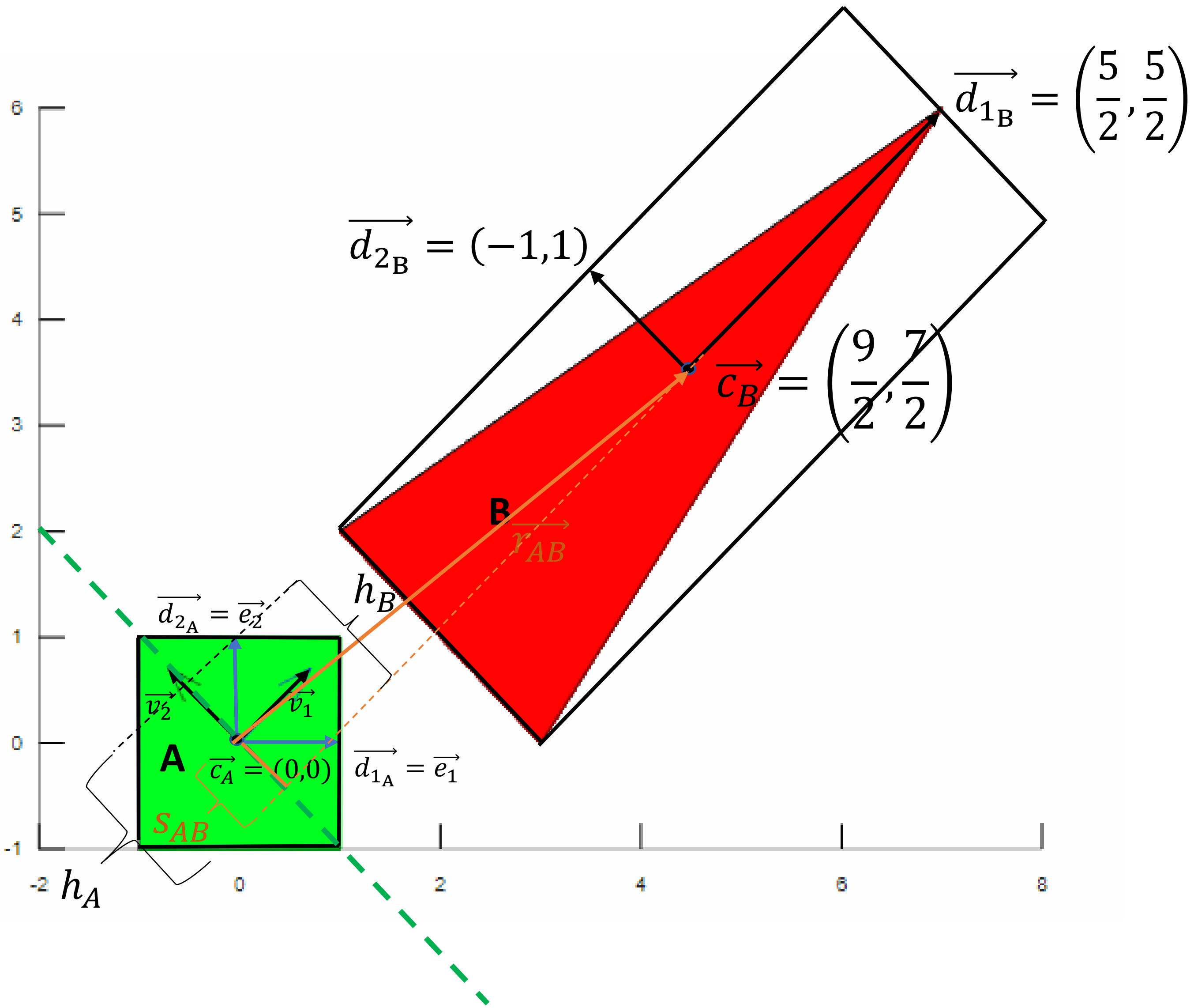
Test: $\vec{v} = \overrightarrow{v_2} = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$

$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$

$h_A = \frac{2}{\sqrt{2}}$

Separating Axis Theorem



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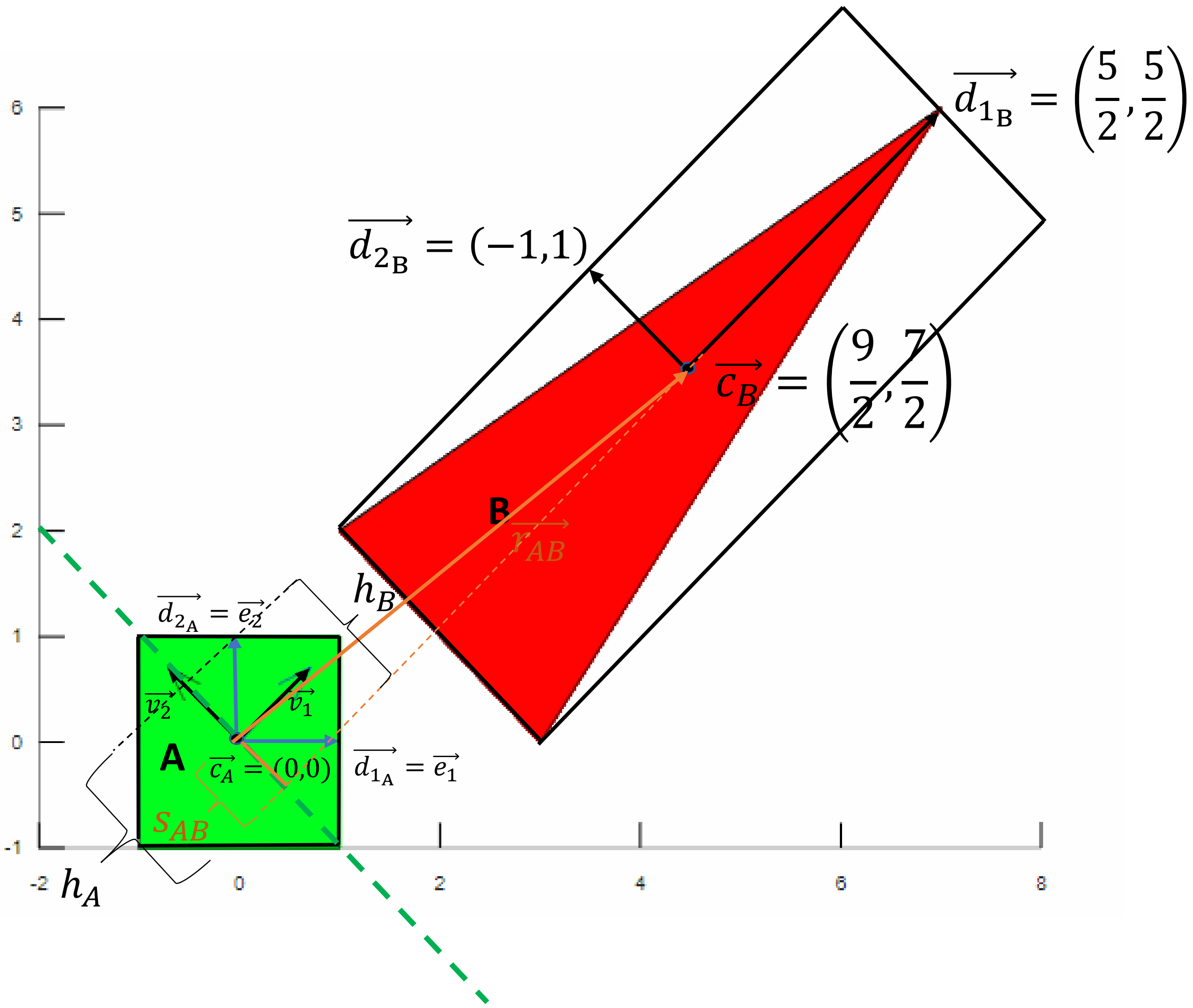
$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$$

$$h_A = \frac{2}{\sqrt{2}}$$

$$h_B = \left|\left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot \left(\frac{5}{2}, \frac{5}{2}\right)\right| + \left|\left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (-1,1)\right|$$

Separating Axis Theorem



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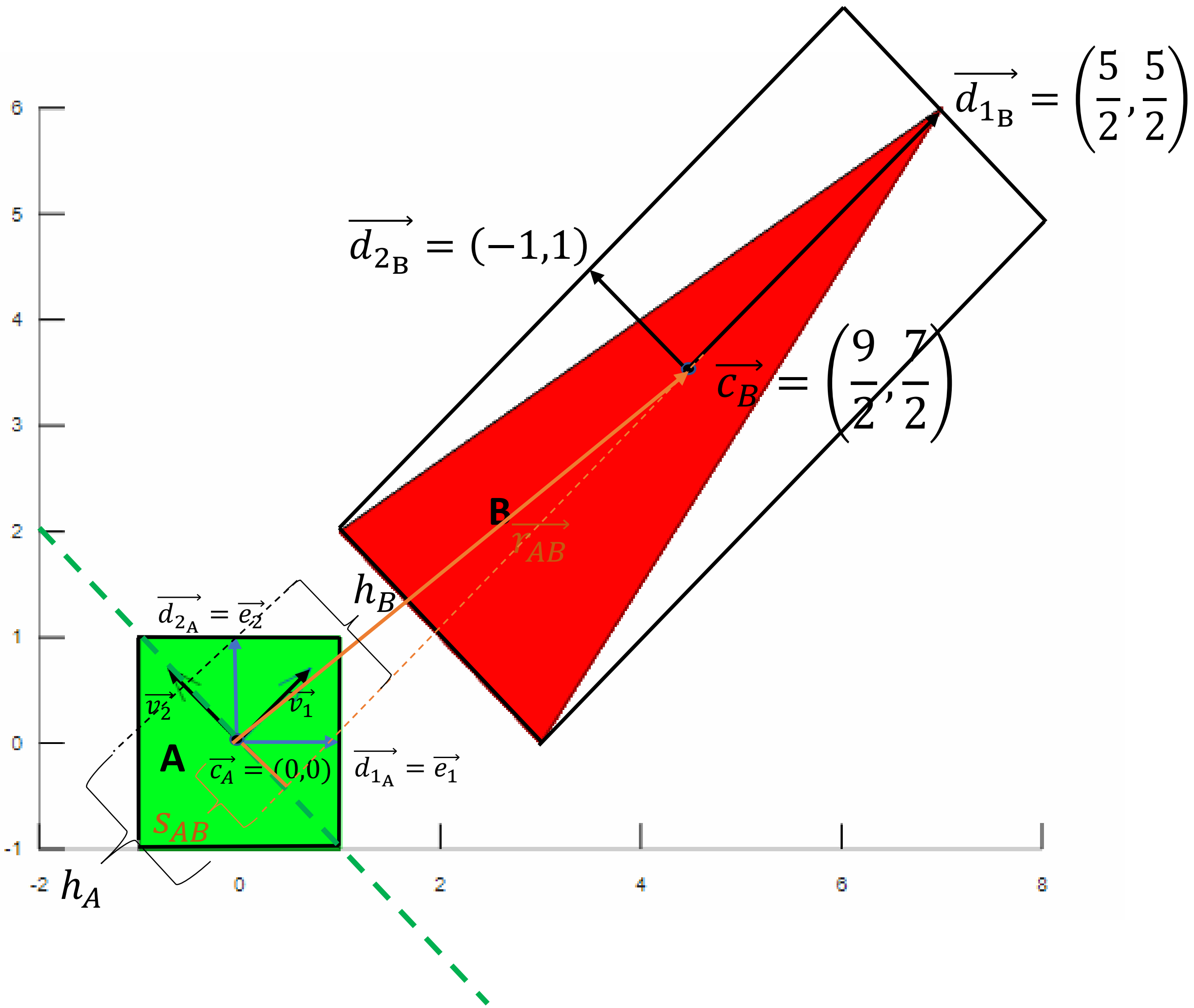
$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$

$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$

$h_A = \frac{2}{\sqrt{2}}$

$h_B = 0 + \frac{1+1}{\sqrt{2}}$

Separating Axis Theorem



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$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$

$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$

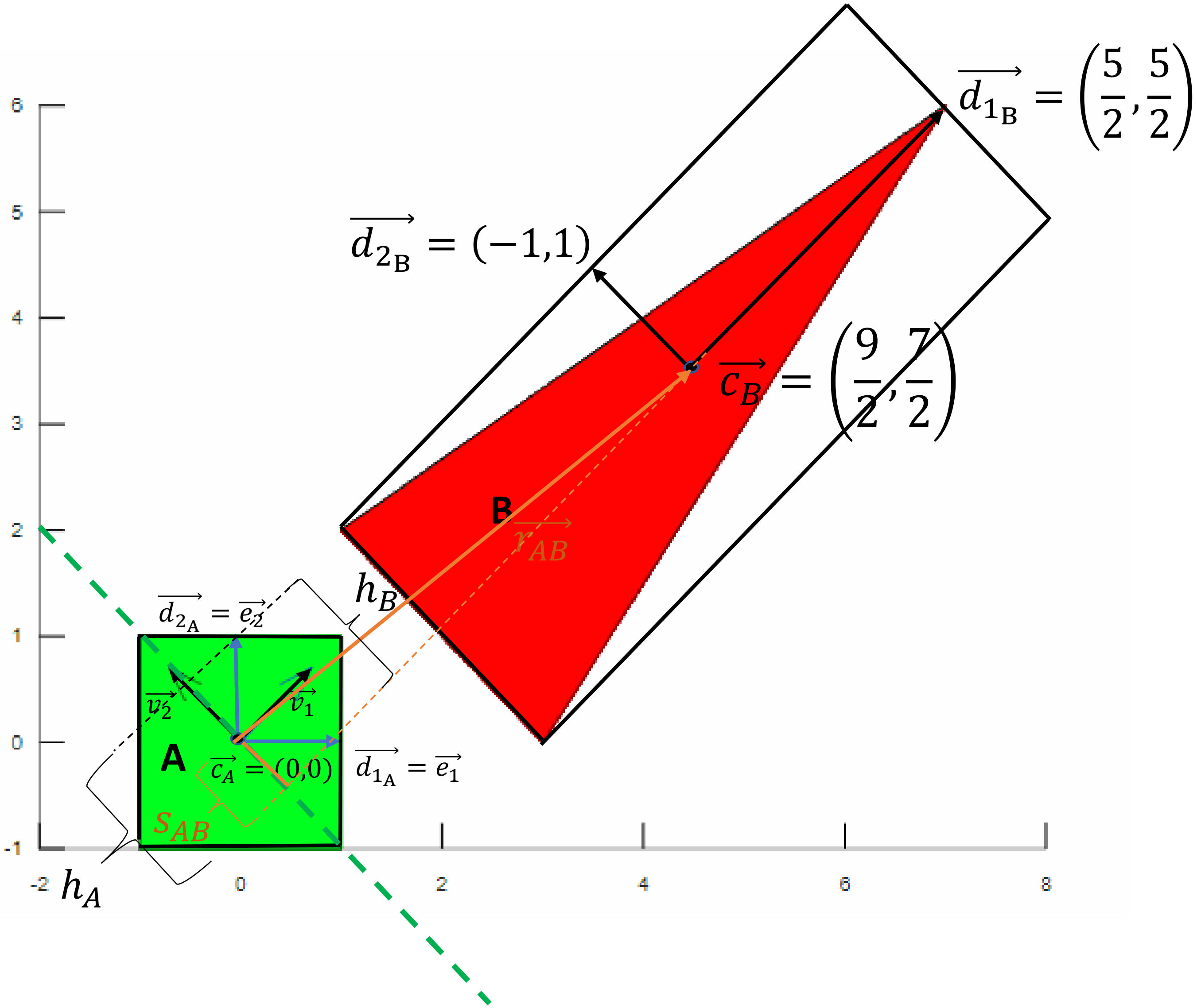
$h_A = \frac{2}{\sqrt{2}}$

$h_B = \frac{2}{\sqrt{2}}$

$h_A + h_B = \frac{2+2}{\sqrt{2}} = \frac{4}{\sqrt{2}}$

$s_{AB} \overset{?}{>} h_A + h_B$

Separating Axis Theorem



Test: $\vec{v} = \overrightarrow{v_2} = \left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{1}{\sqrt{2}}$$

$$h_A = \frac{2}{\sqrt{2}}$$

$$h_B = \frac{2}{\sqrt{2}}$$

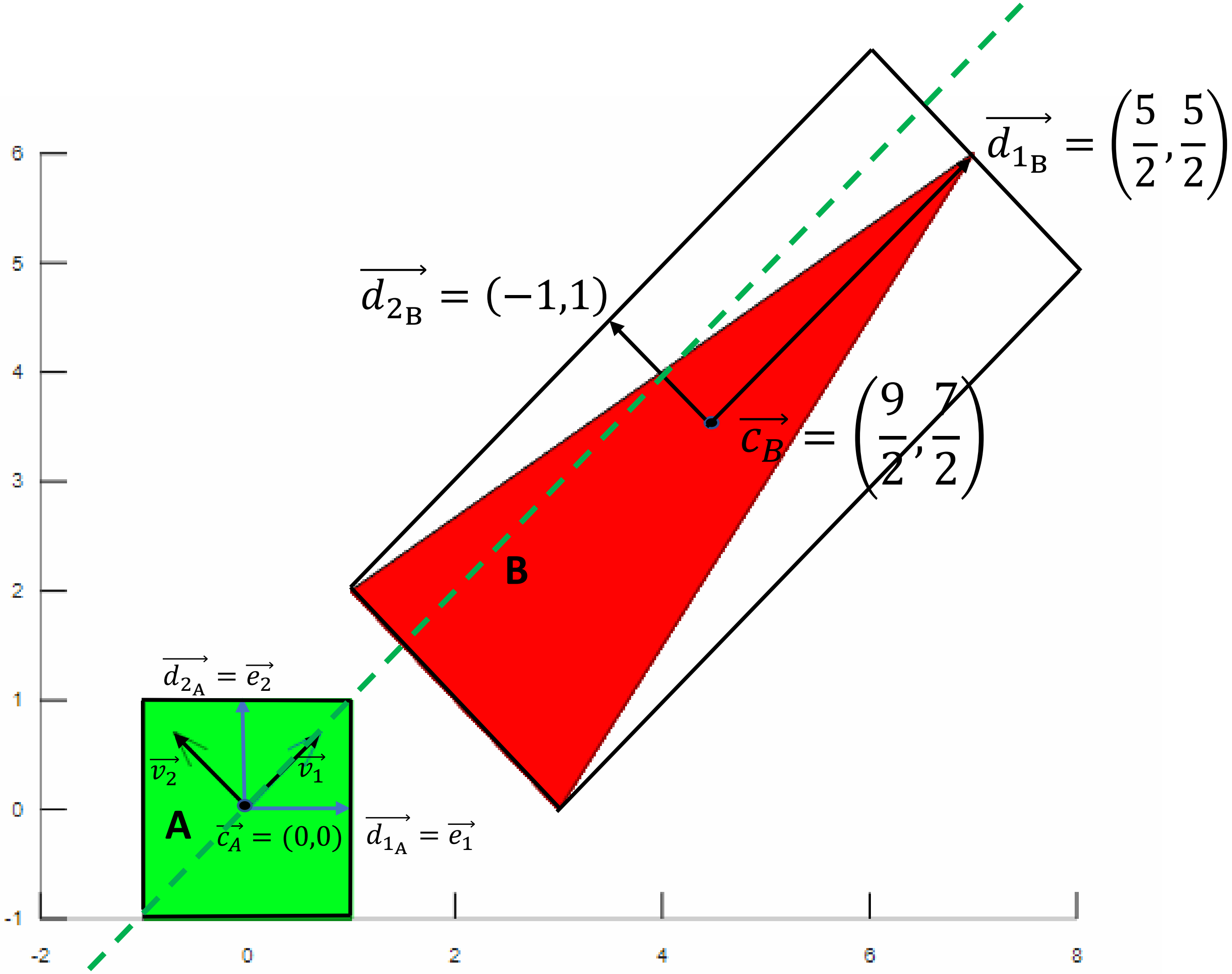
$$h_A + h_B = \frac{2+2}{\sqrt{2}} = \frac{4}{\sqrt{2}}$$

$$\frac{1}{\sqrt{2}} > \frac{4}{\sqrt{2}}$$

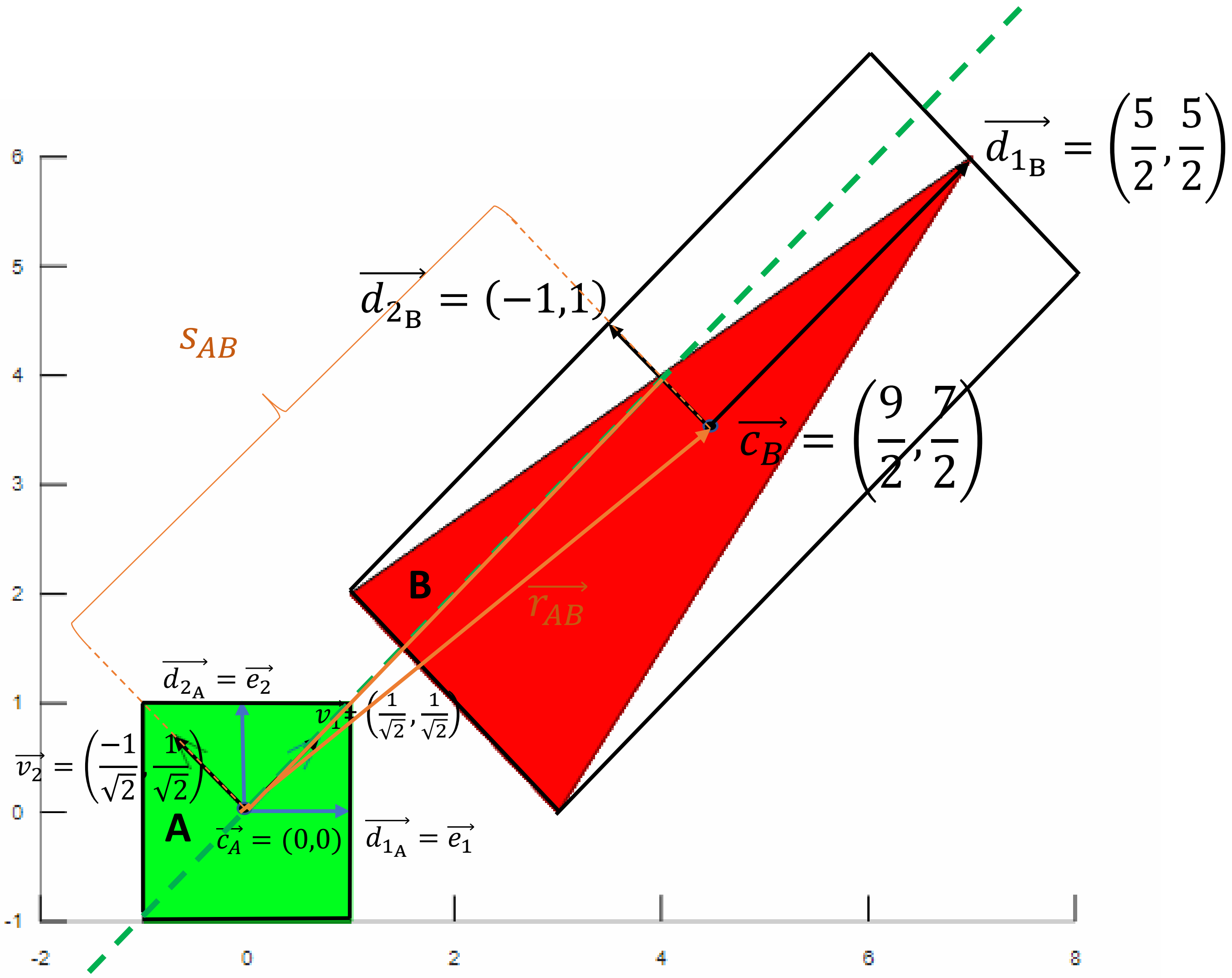
not true ⇒ can't say that they are not in a collision

Separating Axis Theorem

Test: $\vec{v} = \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$



Separating Axis Theorem



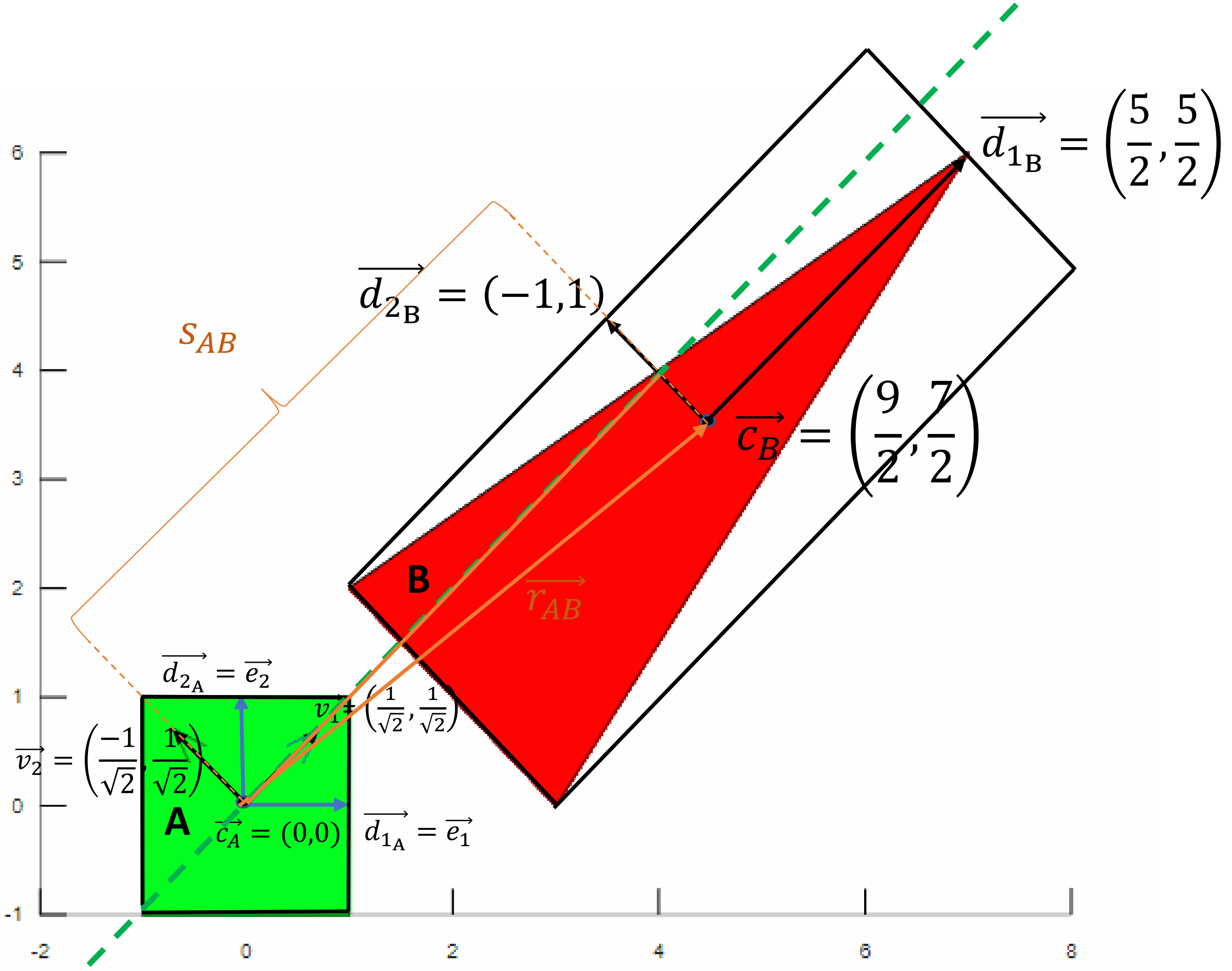
Test: $\vec{v} = \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$

$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \left|\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot \left(\frac{9}{2}, \frac{7}{2}\right)\right| =$

$= \left|\frac{9}{2\sqrt{2}} + \frac{7}{2\sqrt{2}}\right| = \frac{16}{2\sqrt{2}} = \frac{8}{\sqrt{2}}$

Separating Axis Theorem



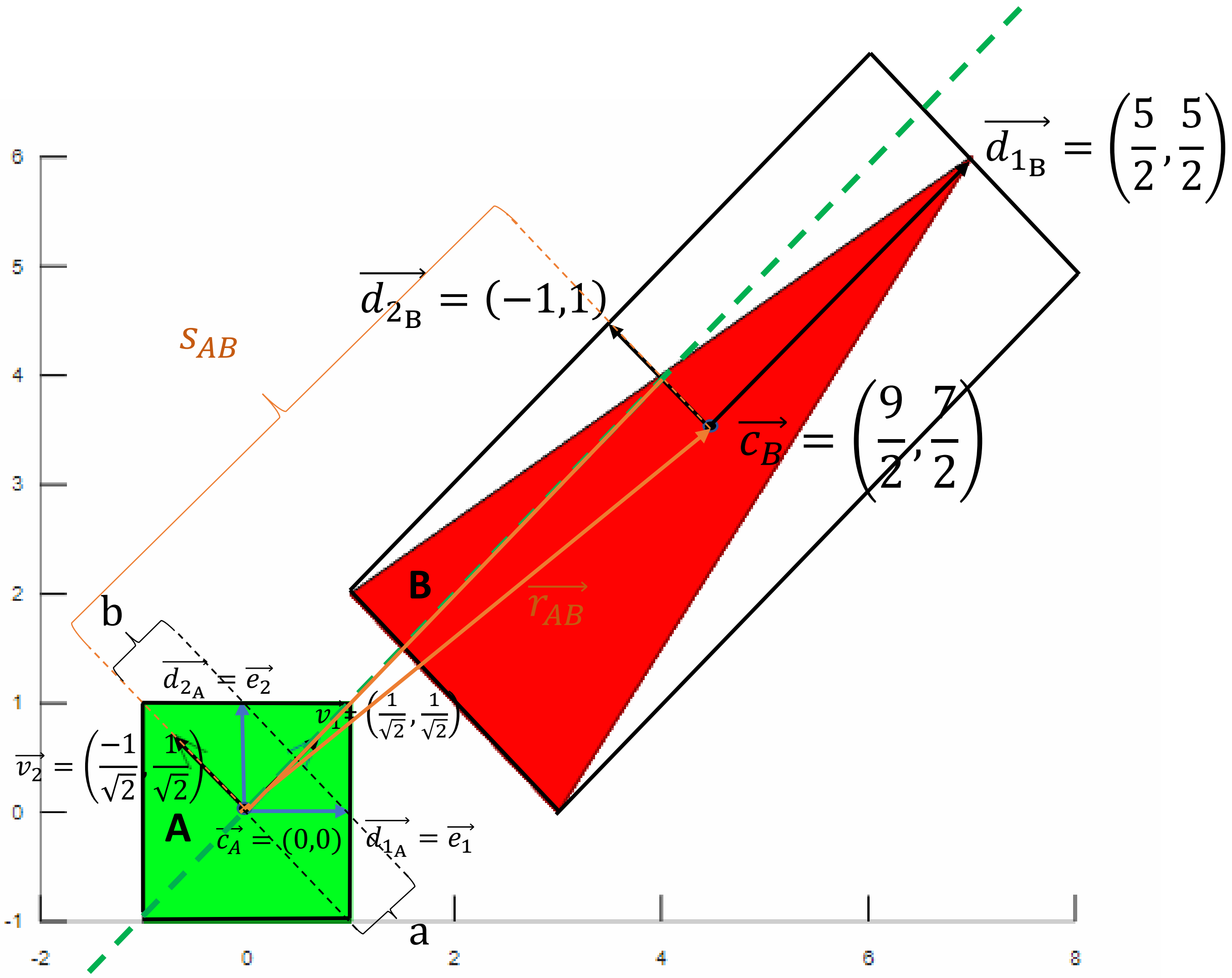
Test: $\vec{v} = \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$

$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$

$h_A = \left|\vec{v} \cdot \overrightarrow{d_{1_A}}\right| + \left|\vec{v} \cdot \overrightarrow{d_{2_A}}\right|$

Separating Axis Theorem



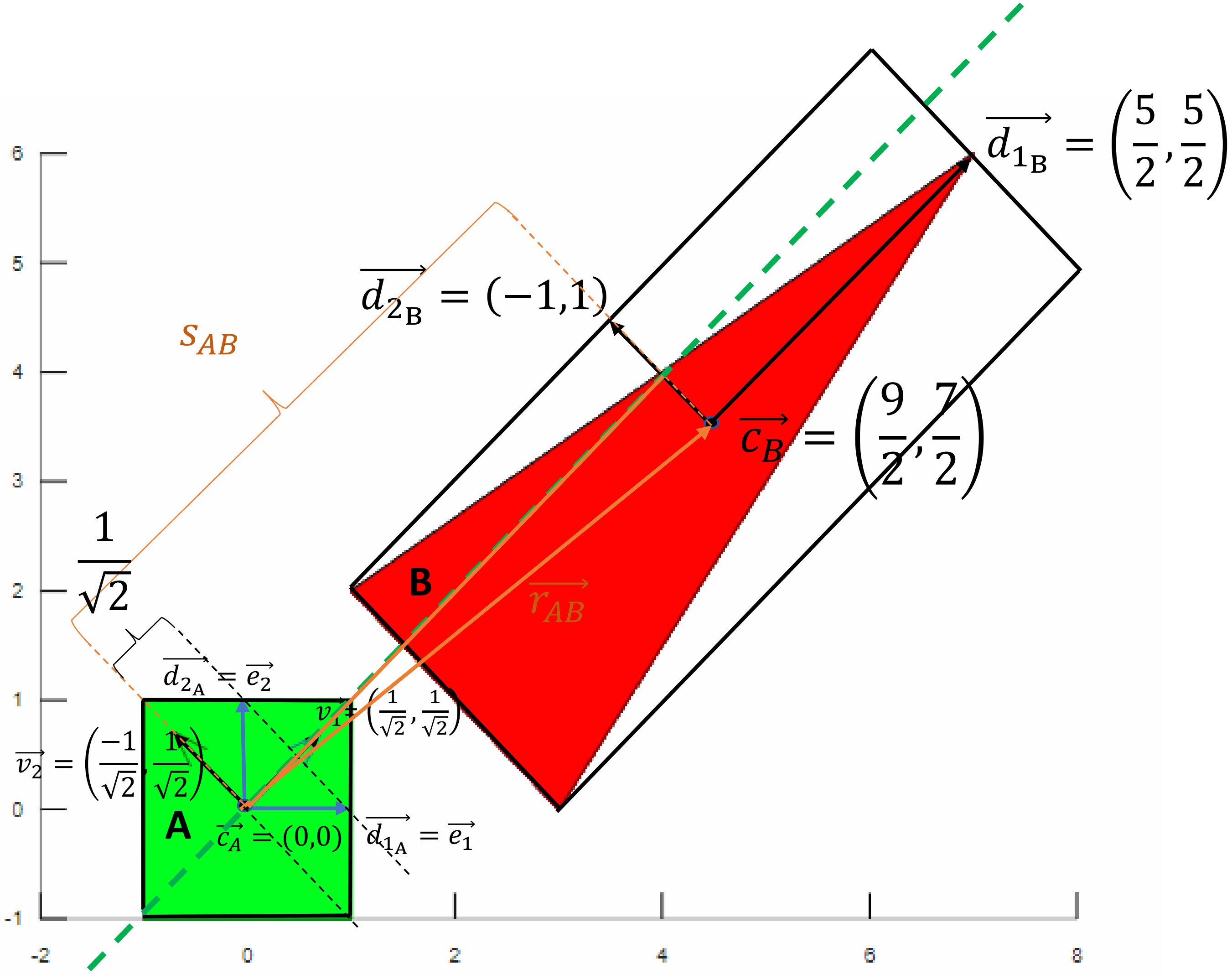
Test: $\vec{v} = \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$

$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$

$$h_A = \underbrace{\left|\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (1,0)\right|}_{a} + \underbrace{\left|\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (0,1)\right|}_{b}$$

Separating Axis Theorem



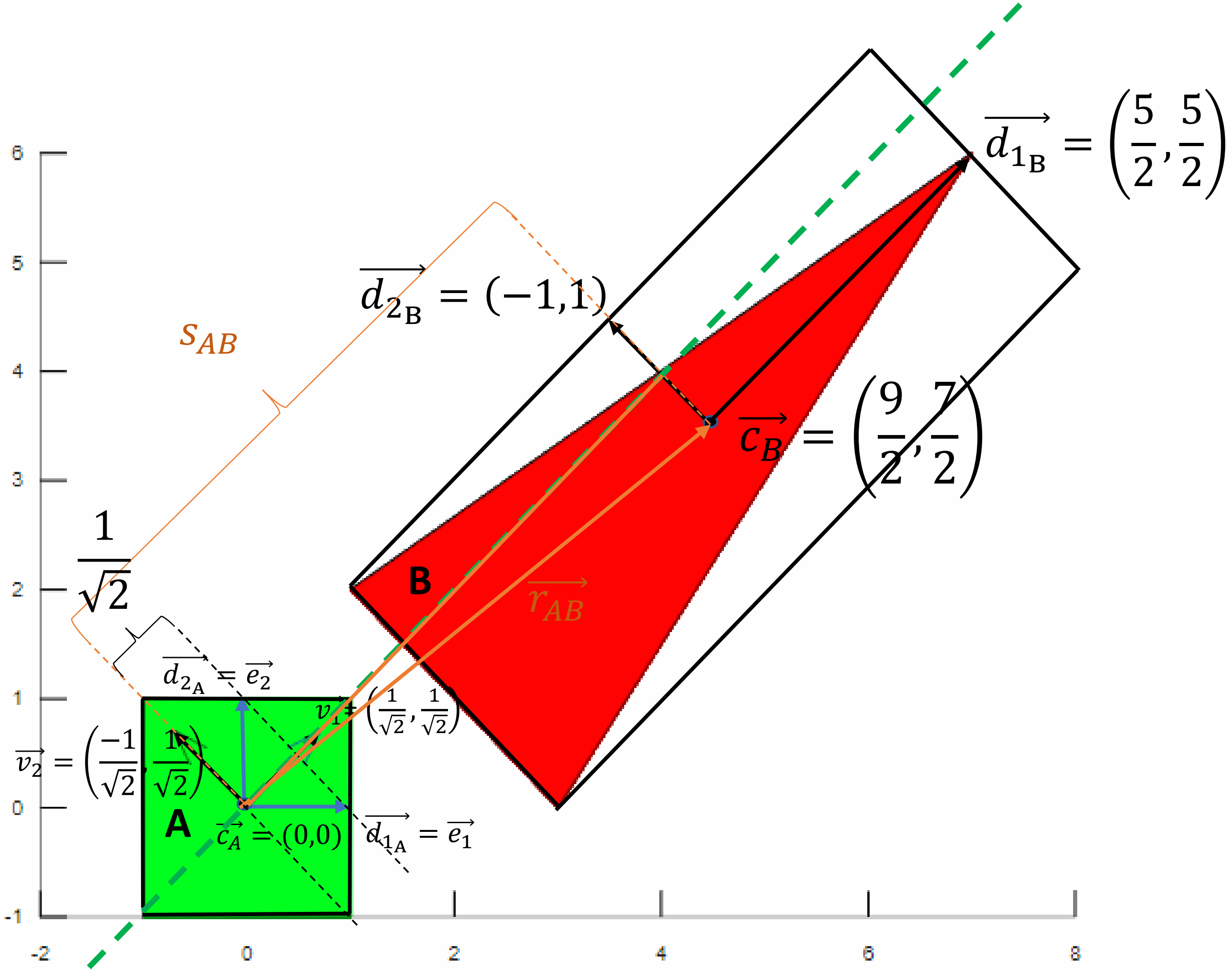
Test: $\vec{v} = \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$

$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$

$h_A = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}$

Separating Axis Theorem



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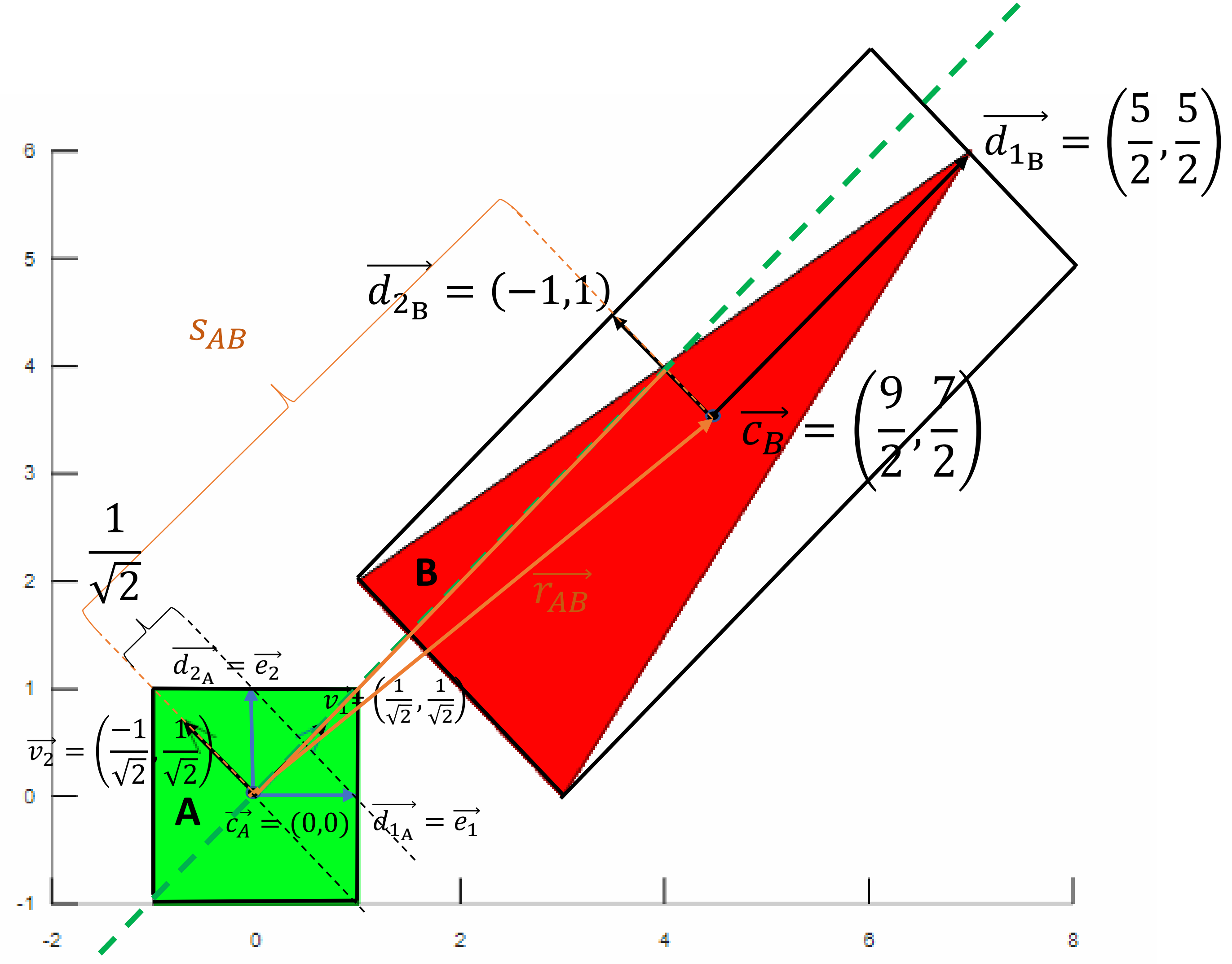
$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$

$h_A = \frac{2}{\sqrt{2}}$

Separating Axis Theorem



Test: $\vec{v} = \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

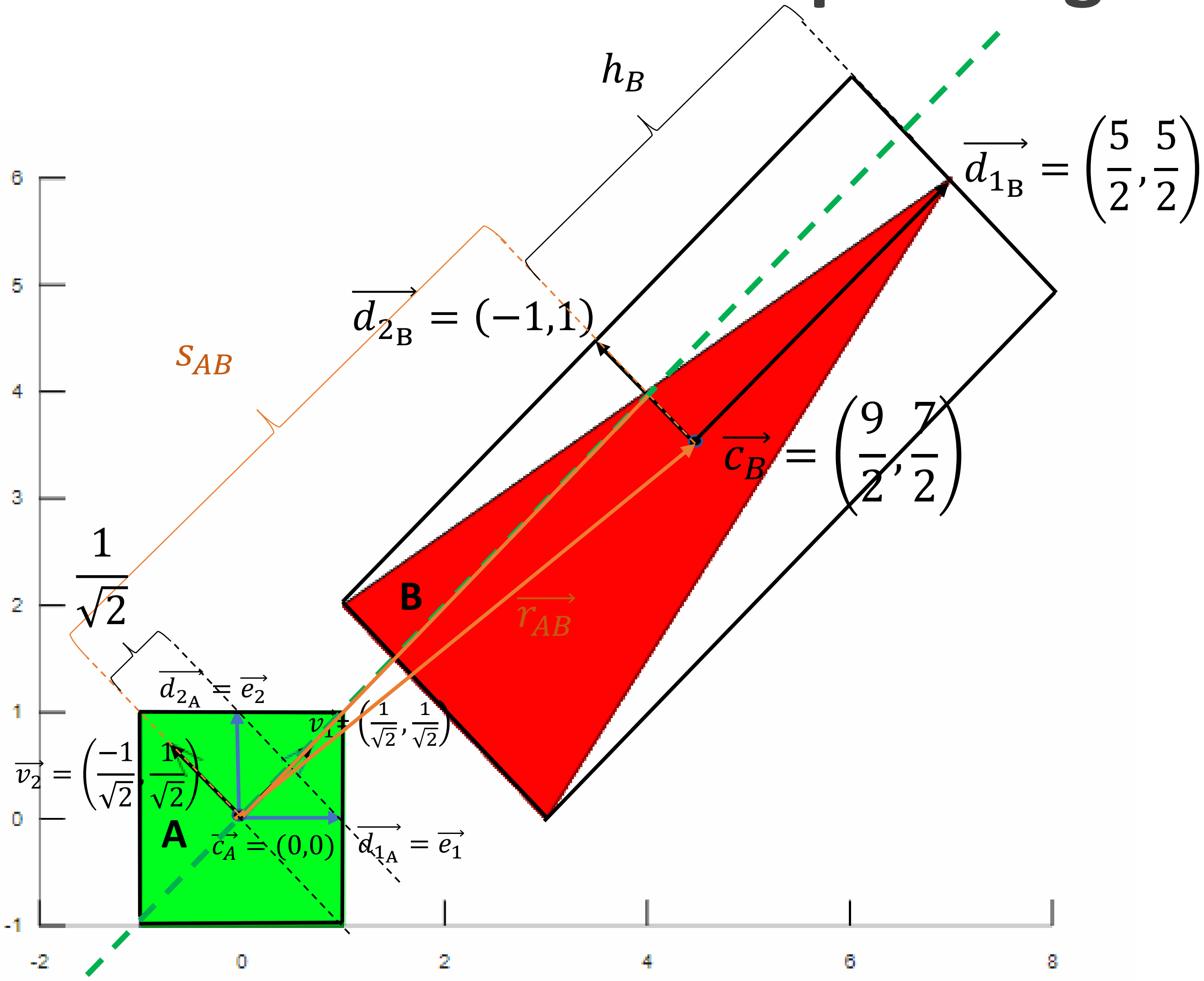
$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$$

$$h_A = \frac{2}{\sqrt{2}}$$

$$h_B = \left|\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot \left(\frac{5}{2}, \frac{5}{2}\right)\right| + \left|\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \cdot (-1,1)\right|$$

Separating Axis Theorem



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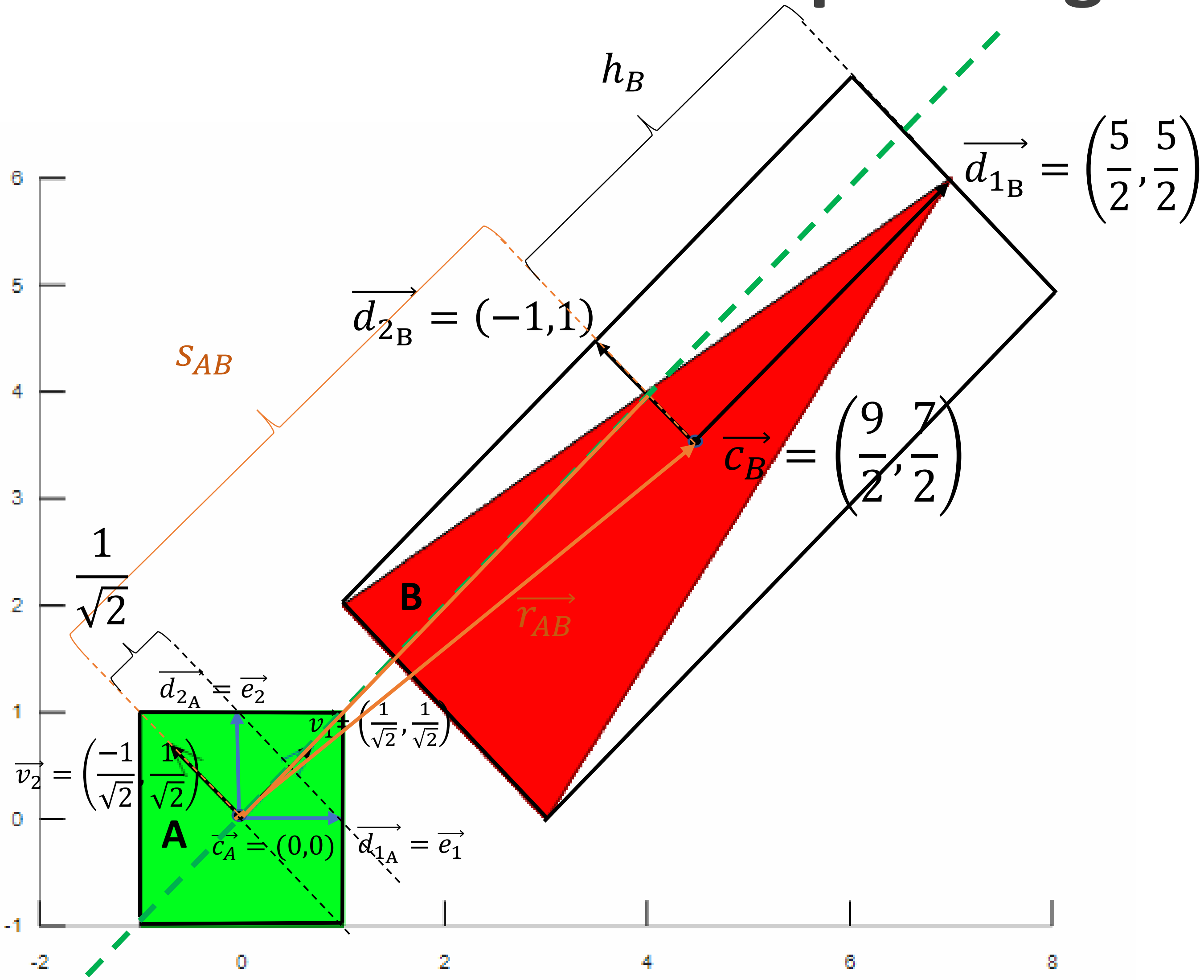
$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$$

$$h_A = \frac{2}{\sqrt{2}}$$

$$h_B = \frac{5}{2\sqrt{2}} + \frac{5}{2\sqrt{2}} = \frac{5}{\sqrt{2}}$$

Separating Axis Theorem



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$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$$

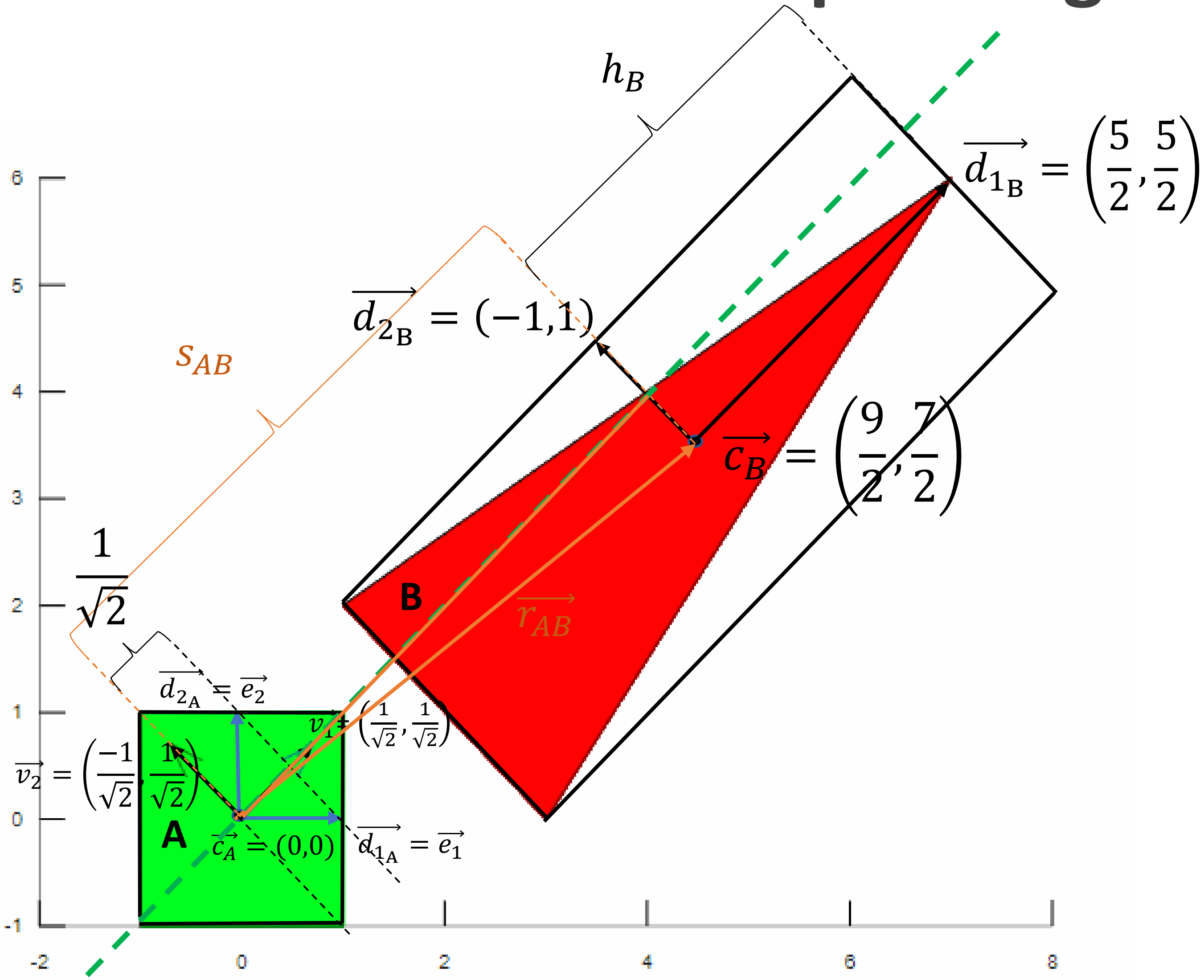
$$h_A = \frac{2}{\sqrt{2}}$$

$$h_B = \frac{5}{2\sqrt{2}} + \frac{5}{2\sqrt{2}} = \frac{5}{\sqrt{2}}$$

$$h_A + h_B = \frac{2+5}{\sqrt{2}} = \frac{7}{\sqrt{2}}$$

$$s_{AB} \overset{?}{>} h_A + h_B$$

Separating Axis Theorem



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$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$$

$$h_A = \frac{2}{\sqrt{2}}$$

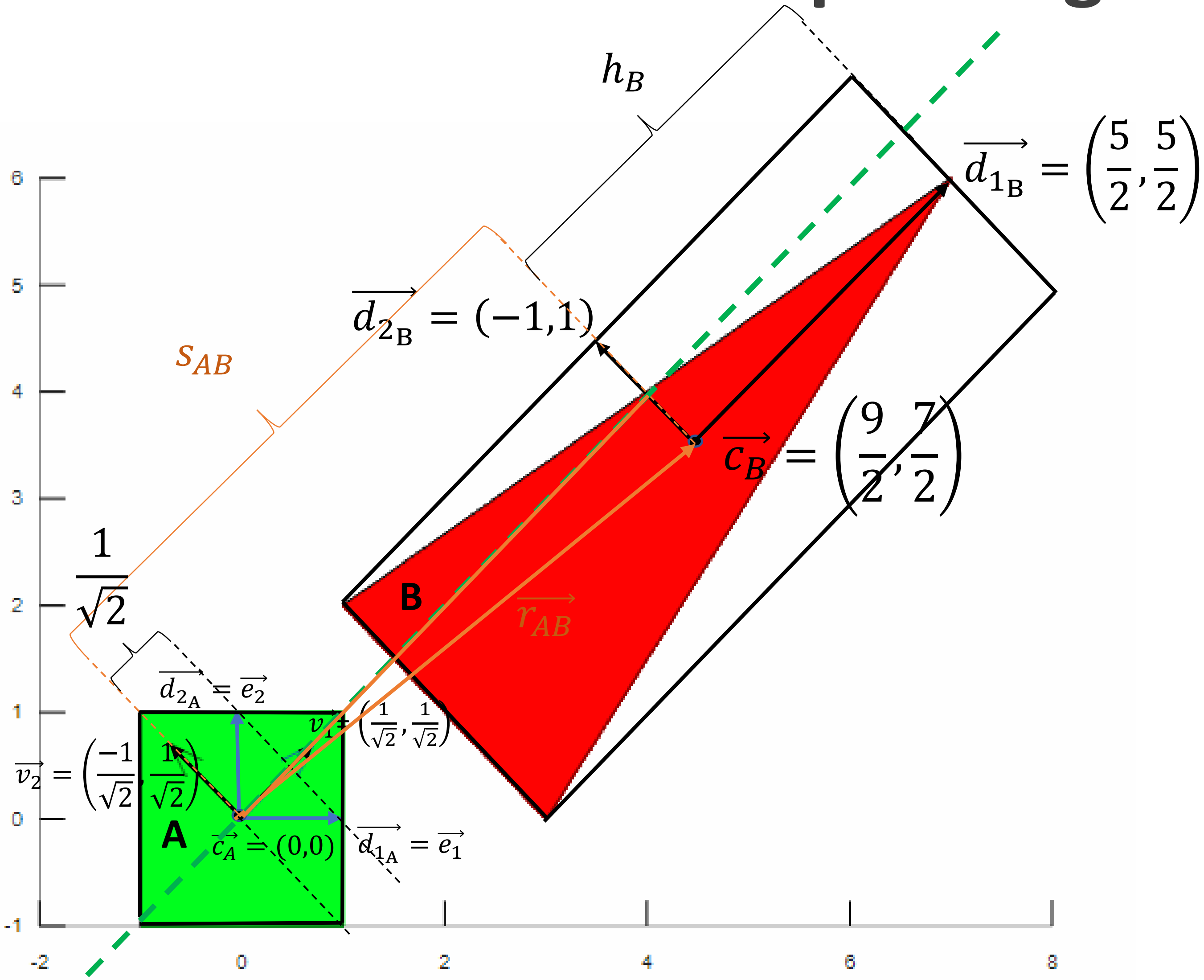
$$h_B = \frac{5}{2\sqrt{2}} + \frac{5}{2\sqrt{2}} = \frac{5}{\sqrt{2}}$$

$$h_A + h_B = \frac{2+5}{\sqrt{2}} = \frac{7}{\sqrt{2}}$$

$$s_{AB} \overset{?}{>} h_A + h_B$$

$$\frac{8}{\sqrt{2}} > \frac{7}{\sqrt{2}}$$

Separating Axis Theorem



Test: $\vec{v} = \overrightarrow{v_1} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$$\overrightarrow{r_{AB}} = \overrightarrow{c_B} - \overrightarrow{c_A} = \left(\frac{9}{2}, \frac{7}{2}\right)$$

$$s_{AB} = |\vec{v} \cdot \overrightarrow{r_{AB}}| = \frac{8}{\sqrt{2}}$$

$$h_A = \frac{2}{\sqrt{2}}$$

$$h_B = \frac{5}{2\sqrt{2}} + \frac{5}{2\sqrt{2}} = \frac{5}{\sqrt{2}}$$

$$h_A + h_B = \frac{2+5}{\sqrt{2}} = \frac{7}{\sqrt{2}}$$

$$\frac{8}{\sqrt{2}} > \frac{7}{\sqrt{2}}$$

true ⇒ they are not in a collision