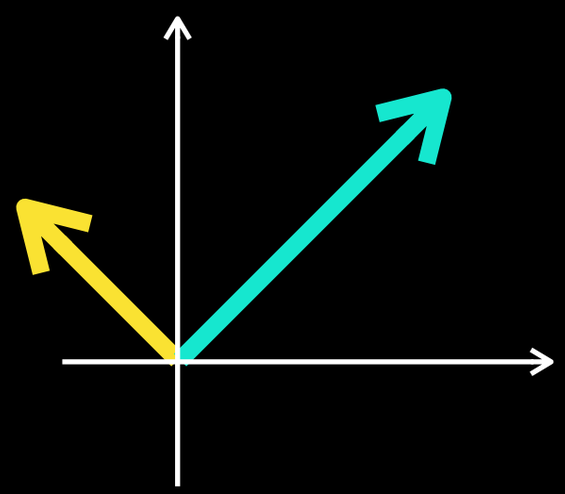
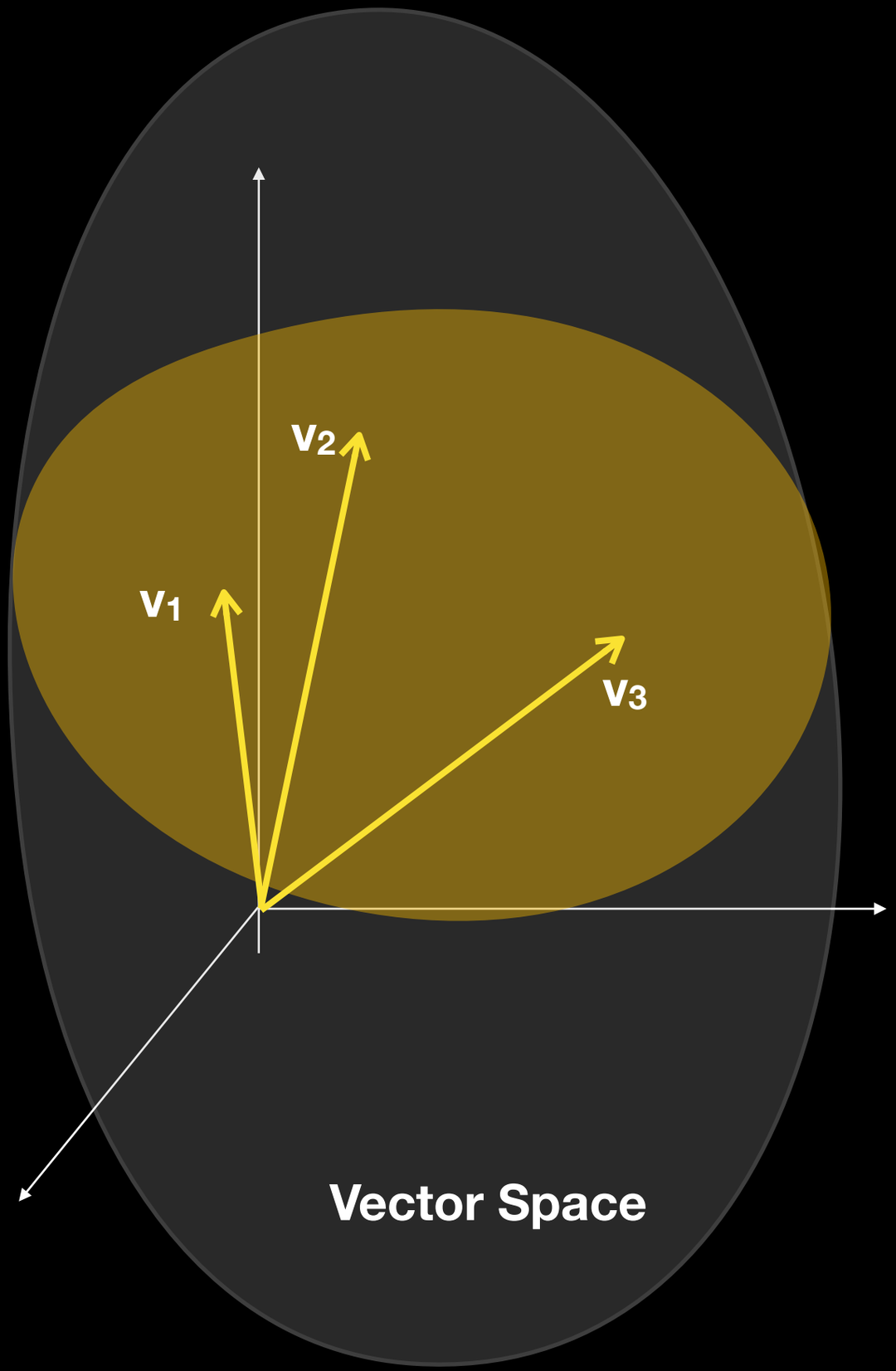
Plane equation

Linear Algebra Essentials



Given: $\mathbf{v_1}$, $\mathbf{v_2}$, $\mathbf{v_3} \in$ plane

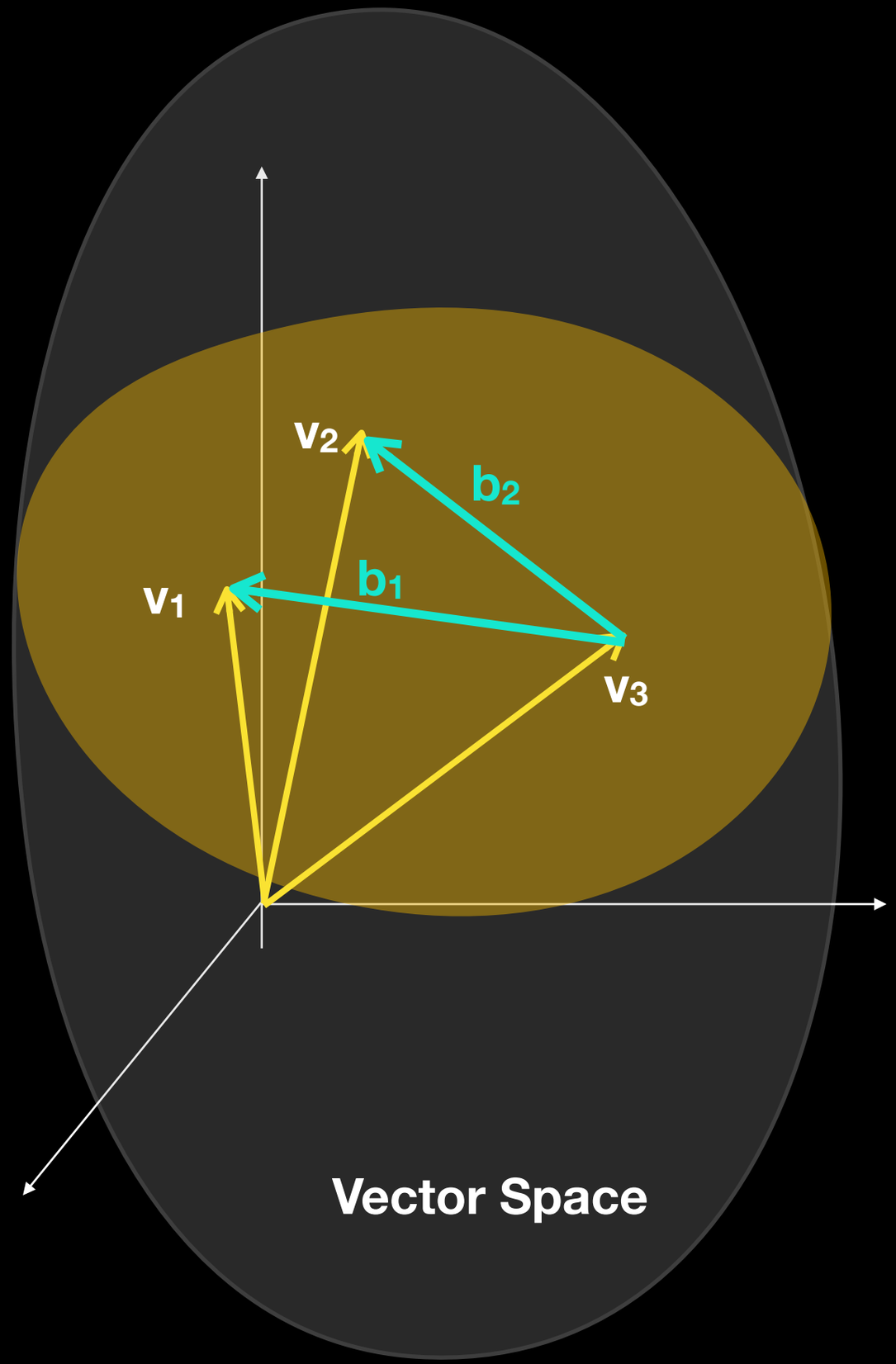
Find: all vectors of the plane



Given: $\mathbf{v_1}$, $\mathbf{v_2}$, $\mathbf{v_3} \in$ plane

Find: all vectors of the plane

1. $b_1 = (v_1 - v_3)$, $b_2 = (v_2 - v_3)$



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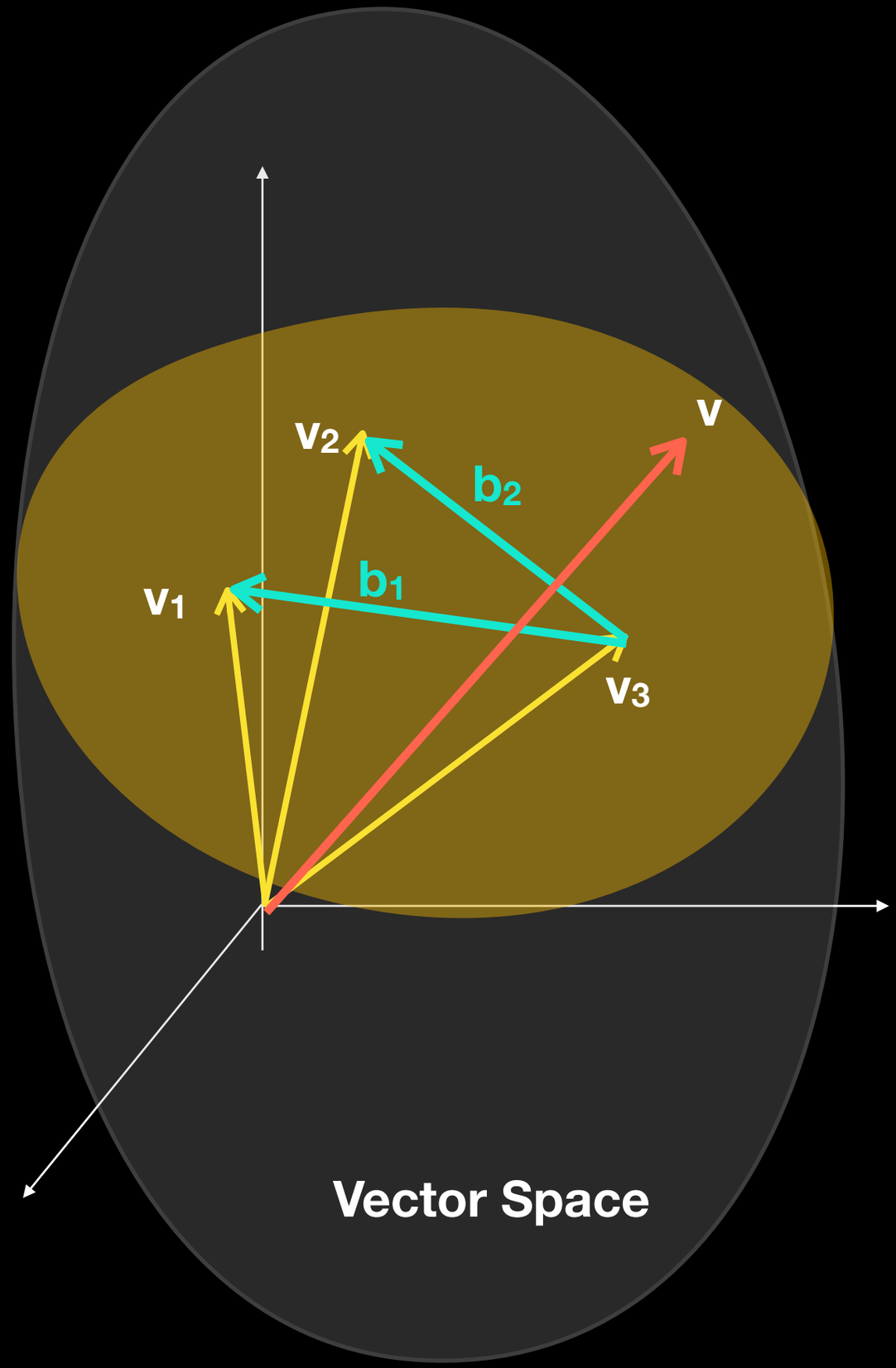
Find: all vectors of the plane

$b_1 = (v_1 - v_3)$, $b_2 = (v_2 - v_3)$

$v = v_3 + (v - v3)$



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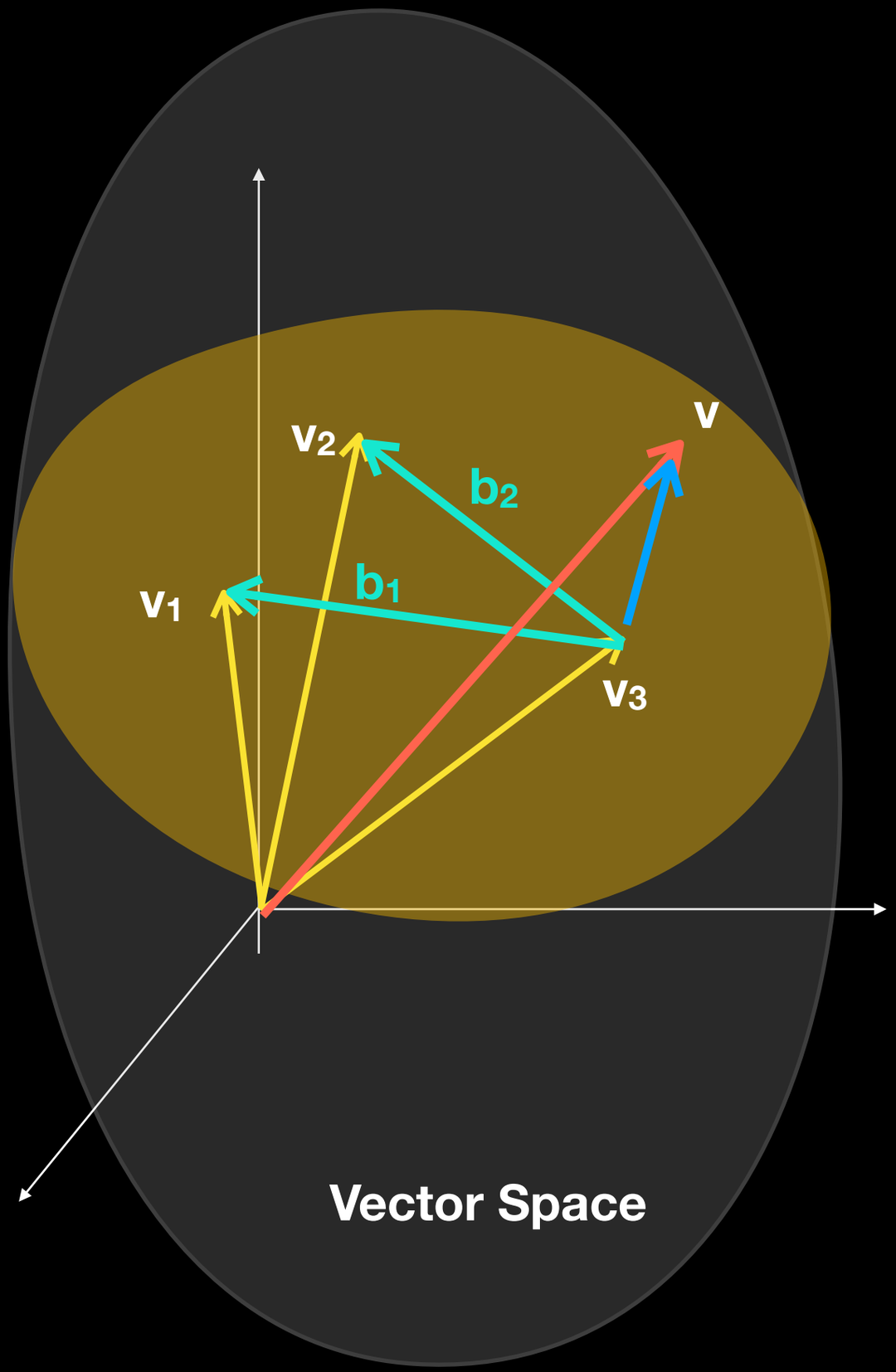

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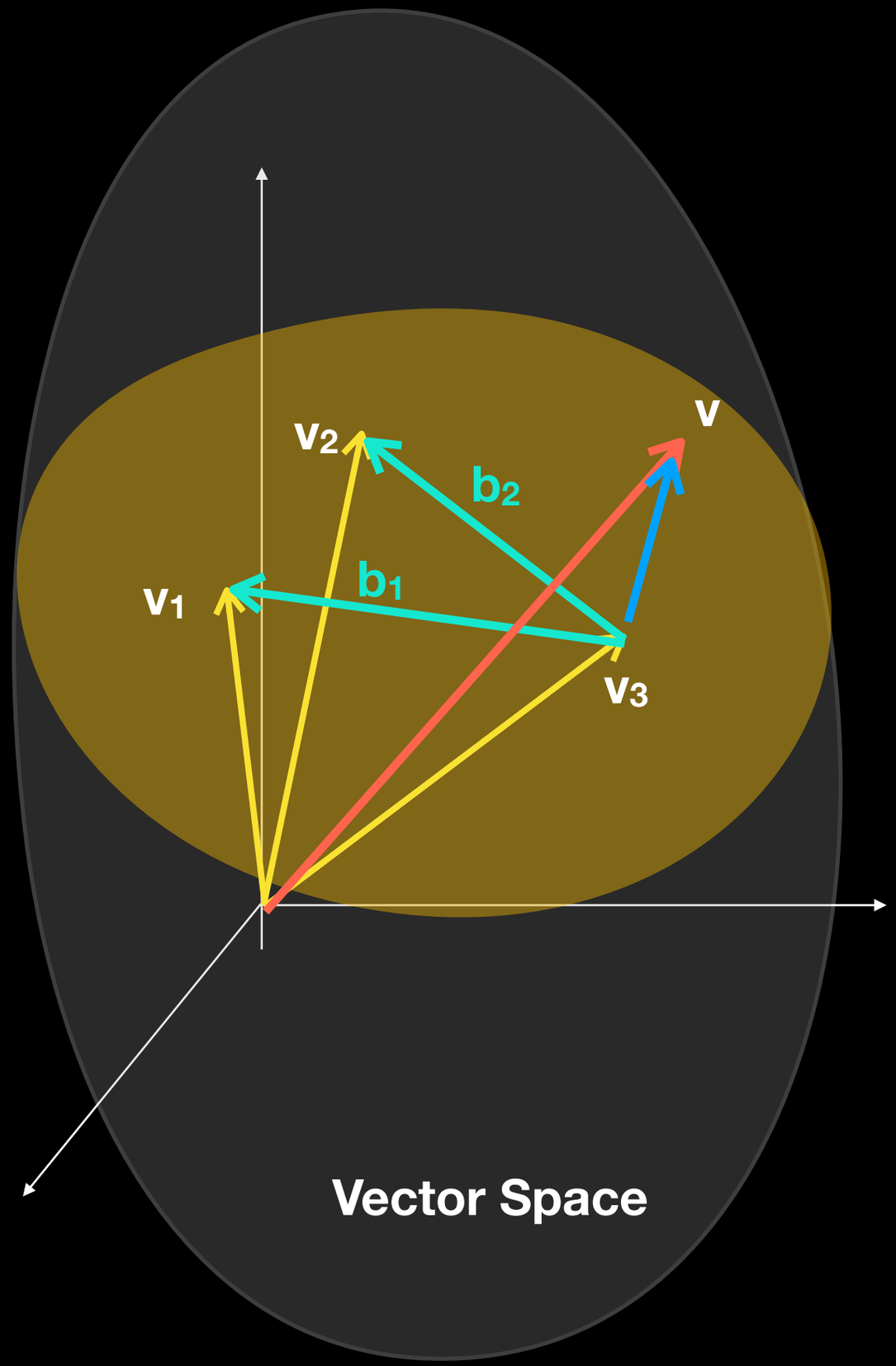
Find: all vectors of the plane

$b_1 = (v_1 - v_3)$, $b_2 = (v_2 - v_3)$

$v = v_3 + (v - v_3)$

$v = v_3 + t_1\, b_1 + t_2\, b_2$



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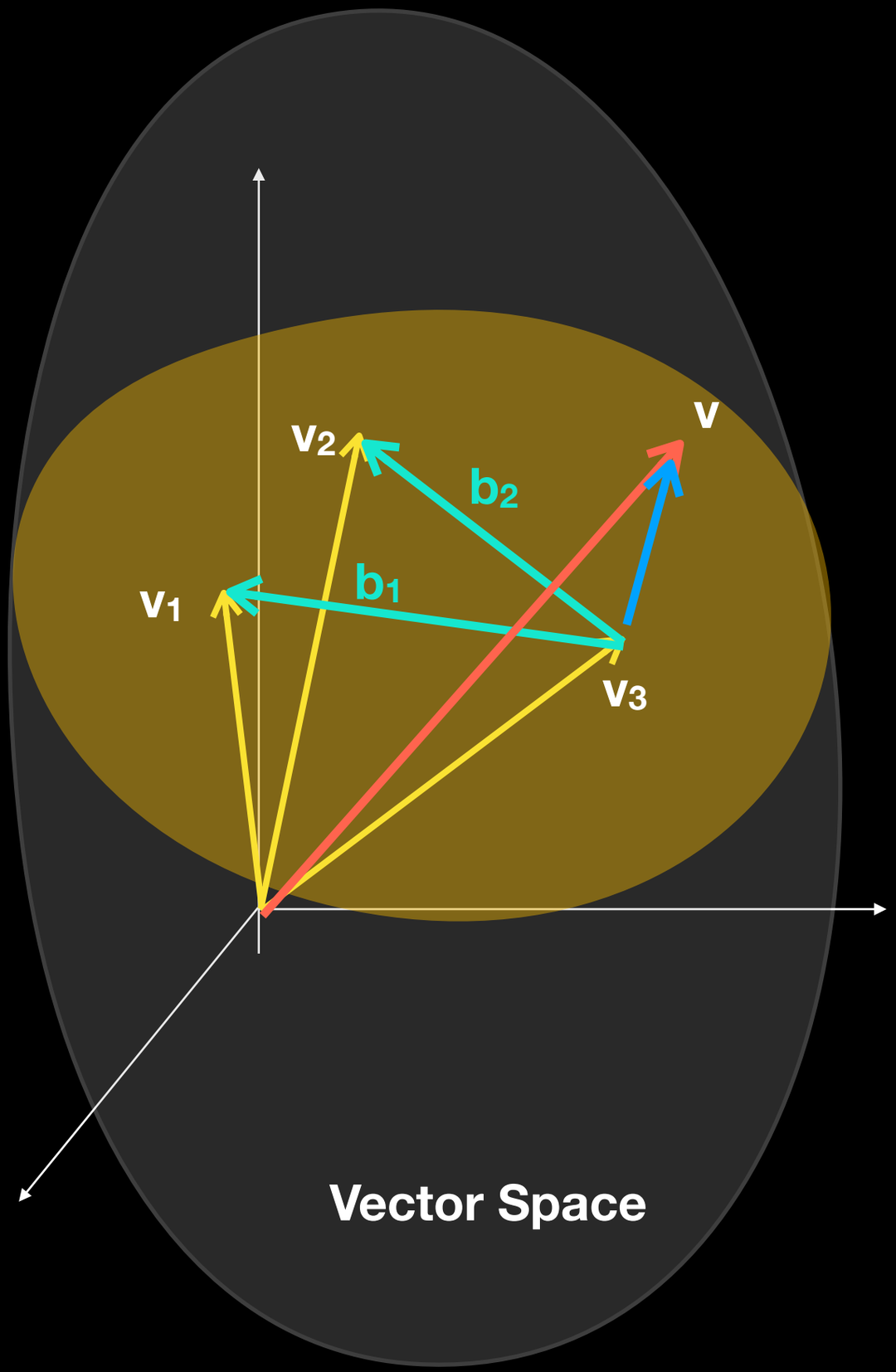
$v = v_3 + (v - v_3)$

$v = v_3 + t_1\, b_1 + t_2\, b_2$

$= v_3 + t_1\, (v_1 - v_3) + t_2 (v_2 - v_3)$



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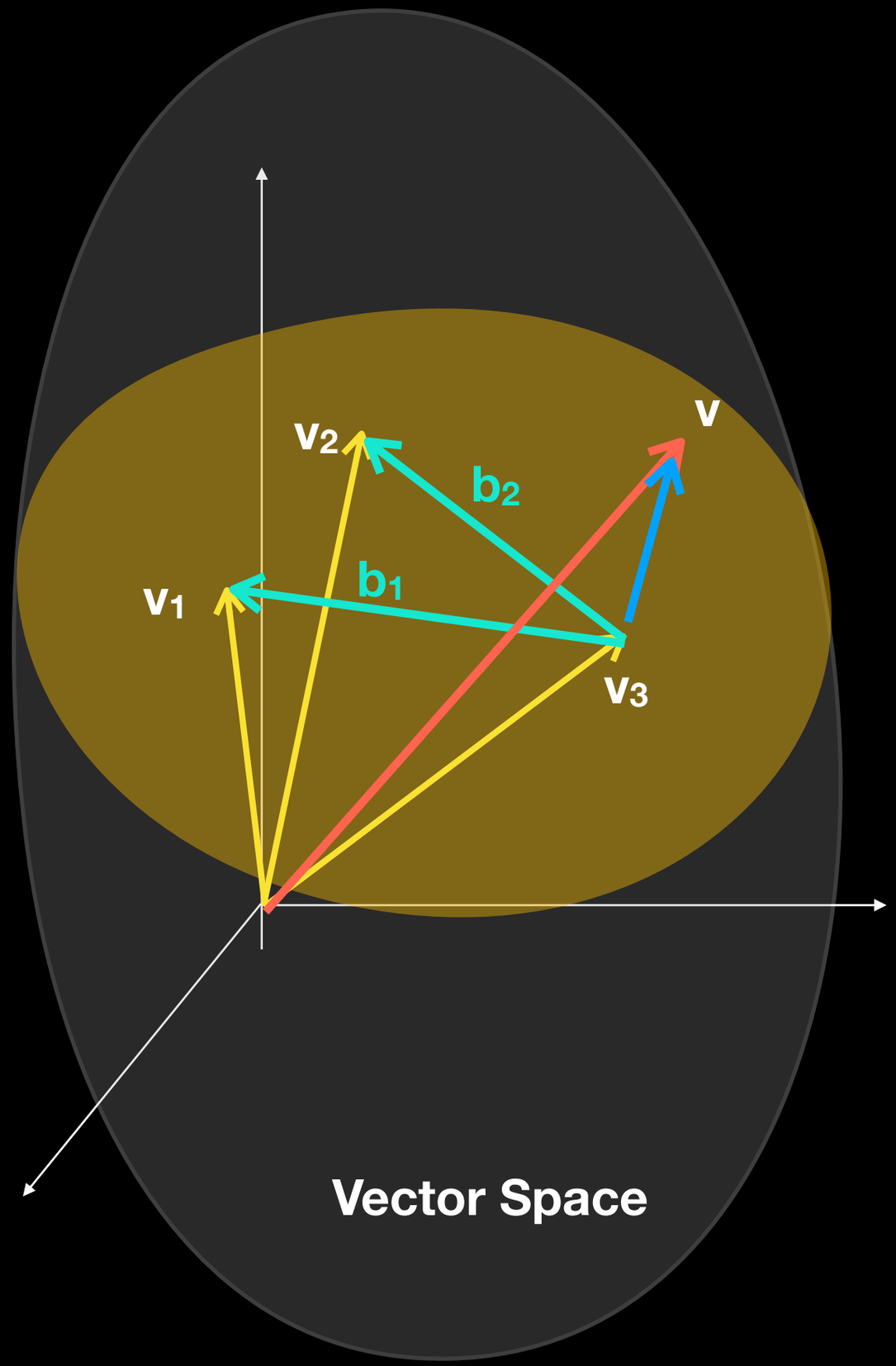
Find: all vectors of the plane

$b_1 = (v_1 - v_3)$, $b_2 = (v_2 - v_3)$

$v = v_3 + (v - v_3)$

$$
\begin{aligned}
v &= v_3 + t_1\, b_1 + t_2\, b_2 \\
&= v_3 + t_1\, (v_1 - v_3) + t_2 (v_2 - v_3) \\
&= t_1\, v_1 + t_2\, v_2 + (1 - t_1 - t_2)\, v_3
\end{aligned}
$$



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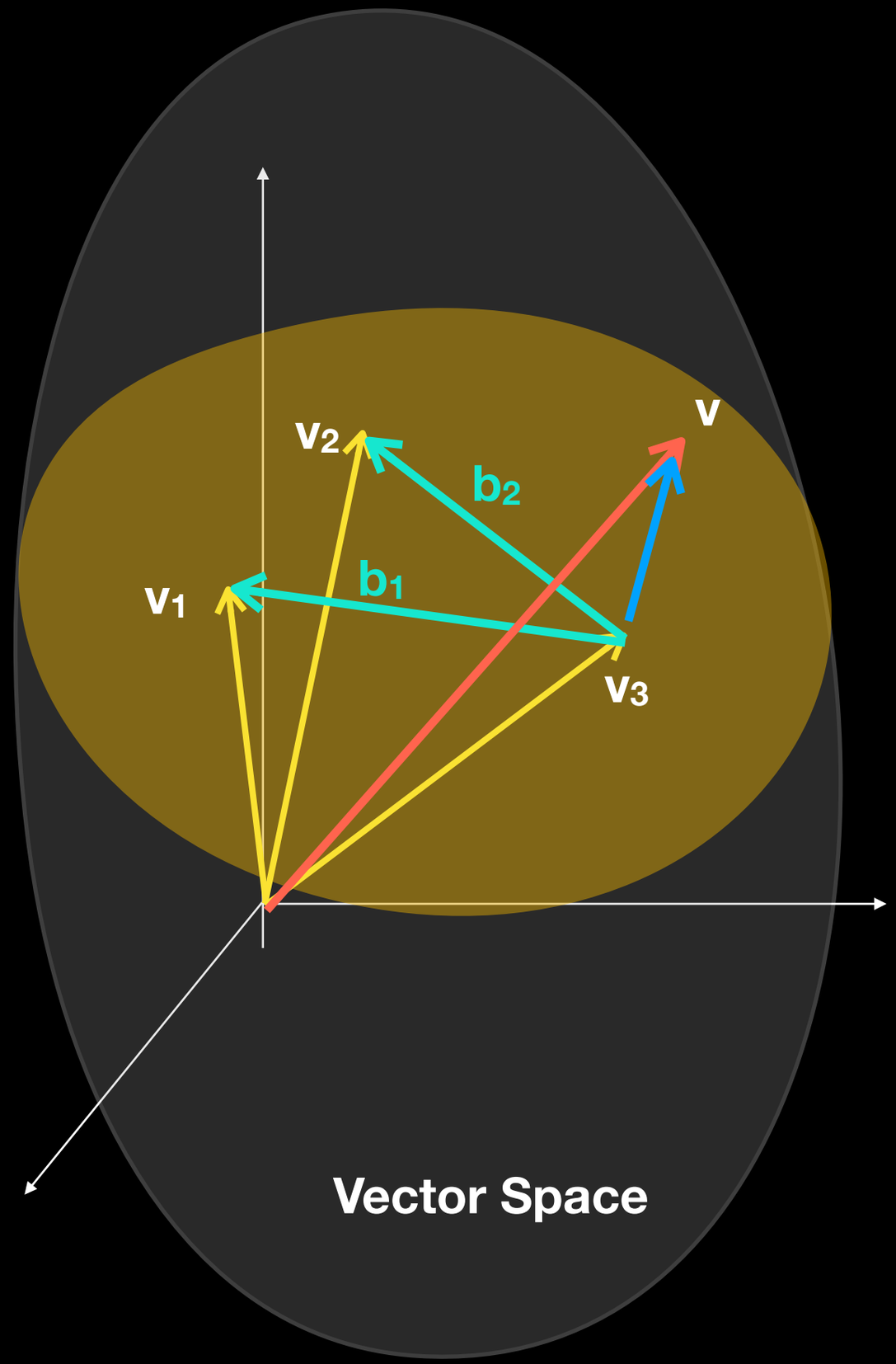
\begin{aligned}
v &= v_3 + t_1\, b_1 + t_2\, b_2 \\
&= v_3 + t_1\, (v_1 - v_3) + t_2 (v_2 - v_3) \\
&= t_1\, v_1 + t_2\, v_2 + \underbrace{(1 - t_1 - t_2)}_{= t_3}\, v_3
\end{aligned}
$$

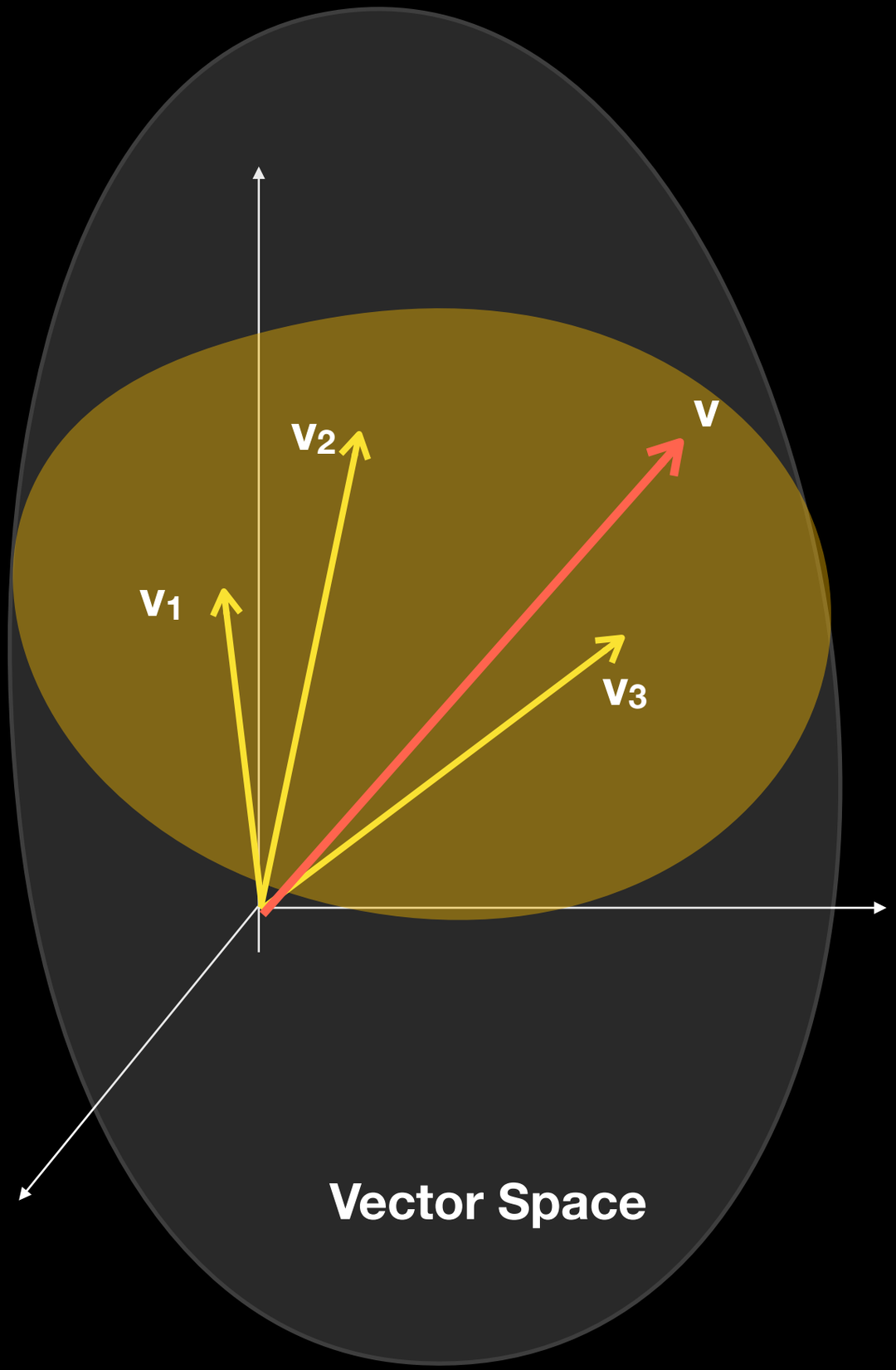


Given: $\mathbf{v_1}$, $\mathbf{v_2}$, $\mathbf{v_3} \in$ plane

Find: all vectors of the plane

$$\mathbf{v} = t_1 \mathbf{v_1} + t_2 \mathbf{v_2} + t_3 \mathbf{v_3},$$

$$t_1 + t_2 + t_3 = 1$$



Line equation

$$\mathbf{v} = (1\text{-}t)\ \mathbf{v}_1 + t\ \mathbf{v}_2$$

$$\mathbf{v} = t_1\ \mathbf{v}_1 + t_2\ \mathbf{v}_2$$

$$t_1 + t_2 = 1$$