The coordonates are $v_1(4,1,0)$ $v_2(2,0,1)$
$v_3(0,2,4)$ and $v(1,4,2)$

$a_0 v_1 + a_1 v_2 + a_2 v_3 = v$, $\exists!\ a_0, a_1, a_2 \in \mathbb{R}$

$a_0(4,1,0) + a_1(2,0,1) + a_2(0,2,4) = (1,4,2)$

$$\begin{cases} 4a_0 + 2a_1 = 1 \\ a_0 + 2a_2 = 4 \Leftrightarrow a_0 = 4 - 2a_2 \\ a_1 + 4a_2 = 2 \Leftrightarrow a_1 = 2 - 4a_2 \end{cases}$$

$4(4-2a_2) + 2(2-4a_2) = 1$

$16 - 8a_2 + 4 - 8a_2 = 1$

$20 - 16a_2 = 1 \Leftrightarrow 16a_2 = 19 \Leftrightarrow a_2 = \frac{19}{16}$

$a_1 = 2 - 4\frac{19}{16} = 2 - \frac{19}{4} = \frac{8-19}{4} = \frac{-11}{4} = -2.75$

the second coord -2.75

$$\operatorname{Im} f = \{ f(v) \in \mathbb{R}^3 / v = (x,y,z) \in \mathbb{R}^3 \} =$$

$$= \{ (5x+3y,\ 3x+3z,\ 3y+5z) / x,y,z \in \mathbb{R} \} =$$

$$= \{ (5x,3x,0) + (3y,0,3y) + (0,3z,5z) / x,y,z \in \mathbb{R} \} =$$

$$= \{ x(5,3,0) + y(3,0,3) + z(0,3,5) / x,y,z \in \mathbb{R} \} =$$

$$= \langle (5,3,0), (3,0,3), (0,3,5) \rangle$$

$$\begin{vmatrix} 5 & 3 & 0 \\ 3 & 0 & 3 \\ 0 & 3 & 5 \end{vmatrix} = 0 + 0 + 0 - 0 - 45 - 45 = -90 \neq 0$$

$\Rightarrow$ lin indep

$$\Rightarrow \operatorname{Im} f = \langle (5,3,0), (3,0,3), (0,3,5) \rangle$$

$$\Rightarrow \dim \operatorname{Im} f = 3$$