(a) \( S = \{ [x_1] : x_1 - x_2 = 1 \} \)

- **Possible answer I:** \( \text{No} \) because \([8]\) is not in \( S \).
- **Possible answer II:** \( \text{Yes} \) \([0]\) is in \( S \) since \( x_1 - x_2 = 1 - 0 = 1 \),
  \( \text{but} \ 2[0] = [0] \) is not in \( S \) since \( 2 - 0 = 2 \neq 1 \).
  So \( S \) is not closed under scalar mult.
- **Possible answer III:** \( \text{No} \) \([6] + [0] = [6] \) is not in \( S \),
  So \( S \) is not closed under addition.

(b) \( S = \{ [x_2] : x_2 = 3x_1 \} \) all vectors of form \( [\frac{x}{3}] \).

- **Check (i):** \( [2x] = [\frac{2x}{3}] \). This is in \( S \) since 2nd coörd = 3 times 1st coörd.
  So \( S \) is closed under scalar mult.

- **Check (ii):** \( [\frac{x}{3}] + [\frac{y}{3}] = [\frac{x+y}{3}] \), which is in \( S \).
  So \( S \) is closed under addition.

\( S \) is closed under scalar mult. and under addition.

So \( S \) is a subspace of \( \mathbb{R}^2 \)

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2. Let \( \mathbf{v}_1 = [1], \mathbf{v}_2 = [-\frac{1}{2}], \mathbf{v}_3 = [\frac{3}{2}] \).

(a) Do \( \mathbf{v}_1, \mathbf{v}_2 \) span \( \mathbb{R}^3 \)? (Give reasoning / show work)

- **(3 pts)** \( \text{No} \) 2 vectors can't span the 3 dimensional space \( \mathbb{R}^3 \).
  (they only span some plane in \( \mathbb{R}^3 \))

(b) Do \( \mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3 \) span \( \mathbb{R}^3 \)? (Give reasoning / show work)

- **(3 pts)** \[
\begin{vmatrix}
1 & -1 & 3 \\
0 & 2 & -2 \\
1 & 0 & 2
\end{vmatrix} = \begin{vmatrix}
2 & -2 \\
-1 & 3 \\
2 & -2
\end{vmatrix} = 4 + (2 - 6) = 0
\]
  \( \text{No, they do not span } \mathbb{R}^3 \)