# Singular matrices

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

**1.** Is $\begin{pmatrix} 2 & 6 \\ 1 & 3 \end{pmatrix}$ singular? [2 marks]

The determinant is $6 - 6 = 0$.

**Answer:** Yes.

**2.** Find $k$ so that $\begin{pmatrix} 2 & k \\ 4 & 6 \end{pmatrix}$ is singular. [2 marks]

Set $12 - 4k = 0$.

**Answer:** $k = 3$.

**3.** Solve $x + y = 4$, $2x + 2y = 8$ using a parameter. [2 marks]

The second equation repeats the first.

Choose $y = t$ and obtain $x = 4 - t$.

**Answer:** $(x, y) = (4 - t, t)$ for any real t.

**4.** Explain why $x + y = 4$, $2x + 2y = 9$ is inconsistent. [2 marks]

No pair can satisfy both statements.

**Answer:** Doubling the first equation gives 8, not 9.

**5.** Find a non-zero vector sent to zero by $\begin{pmatrix} 1 & -2 \\ 2 & -4 \end{pmatrix}$. [2 marks]

$2 - 2(1) = 0$ and $2(2) - 4(1) = 0$.

**Answer:** For example $(2, 1)$.

**6.** The matrix $\begin{pmatrix} 3 & 0 \\ 0 & 0 \end{pmatrix}$ acts on the plane. Describe all its possible outputs. [2 marks]

The output is $(3x, 0)$.

Every real x-coordinate is possible, but the y-coordinate is always zero.

**Answer:** All points on the x-axis.