

001-1 / FRONT / QUESTION

RECOGNIZE

In a grid P, which address does p_{42} name?

Read the instruction before calculating.

001-2 / FRONT / QUESTION

RECOGNIZE

Let A be 2×3 , B be 3×2 , and $C = AB$. Its entry rule is $c_{ij} = \sum_{z=1}^3 a_{iz} b_{zj}$. While finding c_{21} , which symbols stay fixed and which one runs?

Read the instruction before calculating.

001-3 / FRONT / QUESTION

APPLY

Expand and evaluate $\sum_{k=1}^4 (k + 1)$.

Read the instruction before calculating.

001-4 / FRONT / QUESTION

APPLY

With $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, expand and calculate c_{12} in $C = AB$.

Read the instruction before calculating.

001-2 / BACK / REASON

RECOGNIZE

$i = 2$ and $j = 1$ stay fixed; z runs through 1, 2, and 3.

The destination c_{21} fixes row i at 2 and column j at 1. The bounds under and over Σ tell z to take the values 1, 2, and 3.

001-1 / BACK / REASON

RECOGNIZE

Row 4, column 2 of P .

P names the whole grid; lowercase p with subscripts names one entry. The first subscript 4 chooses the row. The second subscript 2 chooses the column.

001-4 / BACK / REASON

APPLY

$$c_{12} = 2 \times 2 + 1 \times 1 + 3 \times 4 = 4 + 1 + 12 = 17.$$

For c_{12} , fix $i = 1$ and $j = 2$; z still runs through 1, 2, and 3. A's first row is (2, 1, 3). B's second column is (2, 1, 4). Multiply corresponding positions and add: $4 + 1 + 12 = 17$.

001-3 / BACK / REASON

APPLY

$$(1 + 1) + (2 + 1) + (3 + 1) + (4 + 1) = 2 + 3 + 4 + 5 = 14.$$

The bounds include both endpoints, so there are four terms. Evaluate $(k + 1)$ at each value and add the four results.

001-5 / FRONT / QUESTION

TRANSFER

Expand and evaluate $\sum_{r=2}^4 3r$. Does changing the running letter from r to t change the value?

Read the instruction before calculating.

001-6 / FRONT / QUESTION

TRANSFER

A rule says $d_{ij} = \sum_{q=1}^5 x_{iq} y_{qj}$. How many products make one entry d_{ij} , and does the 5 say how many entries D has?

Read the instruction before calculating.

002-1 / FRONT / QUESTION

RECOGNIZE

In $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, find a_{23} and b_{32} . Say each address as row, column before reading its value.

Read the instruction before calculating.

002-2 / FRONT / QUESTION

RECOGNIZE

Let $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, and $C = AB$. For c_{12} , which row of A and column of B must meet? How many paired products make that one entry?

Read the instruction before calculating.

001-6 / BACK / REASON

TRANSFER

Five products make each chosen entry. The 5 does not say how many entries D has.

The running index q takes 1, 2, 3, 4, and 5, so the sum has five product terms. The size of D comes from its available row and column addresses, which this sum bound alone does not specify.

001-5 / BACK / REASON

TRANSFER

$3(2) + 3(3) + 3(4) = 6 + 9 + 12 = 27$. Renaming r to t does not change the value.

The lower bound starts the sum at 2; the upper bound ends it at 4, giving three terms. The running letter is a placeholder. The same three values and rule give the same result with another letter.

002-2 / BACK / REASON

RECOGNIZE

Use A row 1, (2, 1, 3), with B column 2, (2, 1, 4). That entry has three paired products.

The first subscript 1 selects A row 1; the second subscript 2 selects B column 2. Their positions match three times: 2 with 2, 1 with 1, and 3 with 4. The shape's shared 3 sets the count.

002-1 / BACK / REASON

RECOGNIZE

$a_{23} = 1$ and $b_{32} = 4$.

A's second row is (4, 2, 1); its third entry is 1. B's third row is (2, 4); its second entry is 4. An address names one entry, not the whole matrix.

002-3 / FRONT / QUESTION

APPLY

Let $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, and $C = AB$. Calculate c_{22} .
Write the chosen row and column before the arithmetic.

Read the instruction before calculating.

002-4 / FRONT / QUESTION

APPLY

Let $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$.
Is BA defined? If so, give its shape and top-left entry.

Read the instruction before calculating.

002-5 / FRONT / QUESTION

APPLY

Let $P = \begin{bmatrix} 1 & 0 \\ 2 & 3 \end{bmatrix}$ and $Q = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$.
Find PQ and its shape.

Read the instruction before calculating.

002-6 / FRONT / QUESTION

TRANSFER

A is 2×3 , B is 3×2 , and D is any 2×3 matrix. Which of AB , BA , AD , and DA are defined? Give each valid output shape.

Read the instruction before calculating.

002-4 / BACK / REASON

APPLY

BA has shape 3×3 . Its top-left entry is $1 \times 2 + 2 \times 4 = 10$.

The adjacent dimensions in $(3 \times 2)(2 \times 3)$ match at 2; the outside dimensions are 3 and 3. B row 1 is (1, 2), and A column 1 is (2, 4). Pair their positions and add $2 + 8 = 10$.

002-3 / BACK / REASON

APPLY

$$c_{22} = 4 \times 2 + 2 \times 1 + 1 \times 4 = 8 + 2 + 4 = 14.$$

Address 22 fixes row 2 of A and column 2 of B. The corresponding pairs are 4 with 2, 2 with 1, and 1 with 4. Their products add to 14. Place 14 at row 2, column 2 of C.

002-6 / BACK / REASON

TRANSFER

AB is defined and is 2×2 . BA is defined and is 3×3 . AD and DA are undefined.

AB has shapes $(2 \times 3)(3 \times 2)$: the adjacent 3s match, giving 2×2 . BA has shapes $(3 \times 2)(2 \times 3)$: the adjacent 2s match, giving 3×3 . AD and DA both have shapes $(2 \times 3)(2 \times 3)$. Their adjacent dimensions are 3 and 2, so neither product is defined.

002-5 / BACK / REASON

APPLY

$PQ = \begin{bmatrix} 4 \\ 23 \end{bmatrix}$, a 2×1 matrix.

The shapes $(2 \times 2)(2 \times 1)$ fit, and the outside dimensions give 2×1 . The first entry is $1 \times 4 + 0 \times 5 = 4$. The second is $2 \times 4 + 3 \times 5 = 8 + 15 = 23$. Put the two entries in one column: $\begin{bmatrix} 4 \\ 23 \end{bmatrix}$.

002-7 / FRONT / QUESTION

TRANSFER

Without calculating entries, describe $(4 \times 9)(9 \times 6)$: output shape, total output entries, and paired products per entry.

Read the instruction before calculating.

002-8 / FRONT / QUESTION

TRANSFER

Let $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, and $C = AB$. Someone tries nine every-to-every products for c_{21} . Which row and column should they choose, how should they pair positions instead, and what is c_{21} ?

Read the instruction before calculating.

003-1 / FRONT / QUESTION

RECOGNIZE

P and Q are matrices. Which expression asks for scalar multiplication: $5P$ or PQ ? What clue settles it?

Read the instruction before calculating.

003-2 / FRONT / QUESTION

RECOGNIZE

M has 2 rows and 3 columns, and s is a scalar. What is the shape of sM ? If the entry of M at row 2, column 3 is m_{23} , what is the entry at that address in sM ?

Read the instruction before calculating.

002-8 / BACK / REASON

TRANSFER

Make three corresponding products: $4 \times 1 + 2 \times 3 + 1 \times 2 = 12$.

For c_{21} , A row 2 is (4, 2, 1) and B column 1 is (1, 3, 2). Pair first with first, second with second, and third with third, giving 4, 6, and 2. Add those three products to get 12. The shared dimension is 3, so nine every-to-every products answer a different question.

002-7 / BACK / REASON

TRANSFER

The output is 4×6 , with 24 entries and 9 paired products in each entry.

The adjacent 9s match, so the product is defined. The outside dimensions 4 and 6 give its shape. A 4×6 matrix has $4 \times 6 = 24$ entries. The shared 9 means each entry adds nine corresponding products.

003-2 / BACK / REASON

RECOGNIZE

sM is 2×3 , and its row 2, column 3 entry is $s \times m_{23}$.

M has six addresses arranged in 2 rows and 3 columns; scaling leaves those addresses in place. At each address, multiply the existing entry by s . At (2, 3), that gives $s \times m_{23}$.

003-1 / BACK / REASON

RECOGNIZE

5P asks for scalar multiplication; PQ asks for matrix multiplication.

In 5P, 5 is one number, so it multiplies every entry of P . In PQ, both named objects are matrices. Its entries require the matrix-product rule, assuming their shapes are compatible.

003-3 / FRONT / QUESTION

APPLY

Calculate $-2 \times [[3, -1], [0, 4]]$.

Read the instruction before calculating.

003-4 / FRONT / QUESTION

APPLY

Calculate $(1/2) \times [[6, 0], [-4, 10]]$.

Read the instruction before calculating.

003-5 / FRONT / QUESTION

TRANSFER

Let $k(t) = 2t - 1$ and $P = [[1, 0], [2, -3]]$.
Find $k(2)P$. What would $k(t)P$ mean
before a value of t is chosen?

Read the instruction before calculating.

003-6 / FRONT / QUESTION

TRANSFER

In complex-number work, $i^2 = -1$.
Compare iP with p_{ij} , where $P = [p_{ij}]$.
What job does i do in each expression? If
 $P = [[1, 2]]$, what is iP ?

Read the instruction before calculating.

003-4 / BACK / REASON

APPLY

 $[[3, 0], [-2, 5]]$

At each address, multiply by $1/2$: $[[6/2, 0/2], [-4/2, 10/2]]$. Simplify without moving entries: $[[3, 0], [-2, 5]]$.

003-3 / BACK / REASON

APPLY

 $[[-6, 2], [0, -8]]$

Keep the two rows: $[-2 \times 3, -2 \times (-1)], [-2 \times 0, -2 \times 4]$. The products are $-6, 2, 0$, and -8 in their original positions, giving $[[-6, 2], [0, -8]]$.

003-6 / BACK / REASON

TRANSFER

In iP , i is the imaginary-unit scalar, so $iP = [[i, 2i]]$. In p_{ij} , i is the row index, not a multiplier.

The statement $i^2 = -1$ declares i to be the imaginary unit in this context. Placed before P , it scales each entry; this gives $[[i \times 1, i \times 2]] = [[i, 2i]]$. The output has complex entries. In p_{ij} , subscripts identify an entry at row i and column j . That i names a position. The same printed letter can have a different role in a different context.

003-5 / BACK / REASON

TRANSFER

$k(2)P = [[3, 0], [6, -9]]$. Before choosing t , $k(t)P = [[k(t), 0], [2k(t), -3k(t)]]$.

$k(2) = 2 \times 2 - 1 = 3$, so the instruction becomes $3P$. Multiply each entry of P by 3: $[[3 \times 1, 3 \times 0], [3 \times 2, 3 \times (-3)]] = [[3, 0], [6, -9]]$. With t unspecified, use the same factor $k(t)$ at every address: $[[k(t), 0], [2k(t), -3k(t)]]$.

004-1 / FRONT / QUESTION

RECOGNIZE

A square matrix gives $Av = v$ for a nonzero v . Is v an eigenvector? What is λ ?

Read the instruction before calculating.

004-2 / FRONT / QUESTION

RECOGNIZE

For $A = \begin{bmatrix} 3 & 0 \\ 0 & 2 \end{bmatrix}$, someone says $(1, 1)$ is an eigenvector because $A(1, 1) = (3, 2)$ still points generally up and right. Check the claim.

Read the instruction before calculating.

004-3 / FRONT / QUESTION

APPLY

Keep $A = \begin{bmatrix} 3 & 0 \\ 0 & 2 \end{bmatrix}$. Test $v = (0, -3)$. Give Av and the eigenvalue if v qualifies.

Read the instruction before calculating.

004-4 / FRONT / QUESTION

APPLY

Let $D = \begin{bmatrix} -2 & 0 \\ 0 & 1 \end{bmatrix}$ and $v = (3, 0)$. Find Dv , decide whether v is an eigenvector, and describe what the sign of λ does.

Read the instruction before calculating.

004-2 / BACK / REASON

RECOGNIZE

No. $(1, 1)$ is not an eigenvector of this A .

If $(3, 2) = \lambda(1, 1)$, the first coordinate demands $\lambda = 3$ while the second demands $\lambda = 2$. One scalar cannot be both. A nearby-looking direction does not satisfy $Av = \lambda v$.

004-1 / BACK / REASON

RECOGNIZE

Yes. $\lambda = 1$.

Because v is nonzero and A is square, the definition can apply. $Av = v = 1v$, so one common scalar works for every coordinate. The input is unchanged, not merely kept on the same line.

004-4 / BACK / REASON

APPLY

$Dv = (-6, 0) = -2v$. Yes: $\lambda = -2$, so the arrow reverses along the same line and doubles in length.

The first coordinate is $(-2) \times 3 + 0 \times 0 = -6$; the second is $0 \times 3 + 1 \times 0 = 0$. One scalar, -2 , scales both coordinates. Its negative sign reverses orientation; its absolute value 2 doubles length.

004-3 / BACK / REASON

APPLY

$Av = (0, -6) = 2v$, so v is an eigenvector with $\lambda = 2$.

The first output coordinate is $3 \times 0 + 0 \times (-3) = 0$. The second is $0 \times 0 + 2 \times (-3) = -6$. Because $(0, -6) = 2(0, -3)$, one common scalar works.

004-5 / FRONT / QUESTION

TRANSFER

Let $P = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$ and $v = (2, 0)$. P sends v to the origin. Does v count as an eigenvector? Would the zero vector itself count?

Read the instruction before calculating.

004-6 / FRONT / QUESTION

TRANSFER

$R = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ rotates every plane arrow 90° counterclockwise. Test $(1, 0)$, then decide whether any nonzero real vector can be an eigenvector of R .

Read the instruction before calculating.

005-1 / FRONT / QUESTION

RECOGNIZE

Suppose $Av = 3v$ for a nonzero vector v . Read A^4v aloud, then state its value as a multiple of v .

Read the instruction before calculating.

005-2 / FRONT / QUESTION

RECOGNIZE

A nonzero eigenvector v has $\lambda = -2$. List its positions at steps $k = 0, 1, 2, 3$ as multiples of v . Does its length grow or shrink with each application, and does it point to the same side of the origin?

Read the instruction before calculating.

004-6 / BACK / REASON

TRANSFER

$R(1, 0) = (0, 1)$, not a multiple of $(1, 0)$. No nonzero real vector is an eigenvector of this 90° rotation.

$R(1, 0) = (0 \times 1 + (-1) \times 0, 1 \times 1 + 0 \times 0) = (0, 1)$. The input lies on the horizontal line and the output on the vertical line. The same quarter-turn moves every nonzero real arrow off its line, while preserving nonzero length. Real scaling cannot make that turn, and $\lambda = 0$ cannot describe a nonzero output. Thus no real λ and nonzero real v satisfy $Rv = \lambda v$.

004-5 / BACK / REASON

TRANSFER

Yes: $Pv = (0, 0) = 0v$, so v is an eigenvector with $\lambda = 0$. The zero vector is not an eigenvector.

The input $(2, 0)$ is nonzero. Multiplication gives $(0 \times 2 + 0 \times 0, 0 \times 2 + 1 \times 0) = (0, 0)$. The scalar 0 works: $0(2, 0) = (0, 0)$. The output has no direction, but the eigenvector definition still holds. The zero input is excluded because it would satisfy $A0 = \lambda 0$ for every λ .

005-2 / BACK / REASON

RECOGNIZE

Its length doubles each step and its direction alternates: $v, -2v, 4v, -8v$.

The multipliers at steps 0 through 3 are 1, -2, 4, and -8. Their absolute values are 1, 2, 4, and 8, so the arrow grows. The signs alternate, so the arrow switches sides of the origin every step.

005-1 / BACK / REASON

RECOGNIZE

$$A^4v = 3^4v = 81v.$$

The equation $Av = 3v$ verifies that v is an eigenvector with eigenvalue 3. Each application multiplies this same vector direction by 3; four applications use four factors of 3. Read A^4v as 'apply A four times to v ,' so the result is $81v$.

005-3 / FRONT / QUESTION

APPLY

A nonzero eigenvector v has $\lambda = -1/2$.
Write its positions at steps $k = 0, 1, 2, 3$,
and 4 as multiples of v . Does any of these
steps land on zero?

Read the instruction before calculating.

005-4 / FRONT / QUESTION

APPLY

Let $A = \begin{bmatrix} 3 & 0 \\ 0 & -1 \end{bmatrix}$ and $v = (0, 2)$.
Verify $Av = \lambda v$, identify λ , and find A^2v .

Read the instruction before calculating.

005-5 / FRONT / QUESTION

TRANSFER

Let $A = \begin{bmatrix} 2 & 0 \\ 0 & 1/2 \end{bmatrix}$ and $w = (1, 1)$.
Compute Aw and A^2w . Why can you not
choose one λ and write $A^2w = \lambda^2w$ here?

Read the instruction before calculating.

005-6 / FRONT / QUESTION

TRANSFER

For $M = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, compare the true
matrix square M^2 with the array
obtained by squaring each entry. Are
they equal?

Read the instruction before calculating.

005-4 / BACK / REASON

APPLY

$Av = (0, -2) = -v$, so $\lambda = -1$ and $A^2v = v = (0, 2)$.

Matrix-vector multiplication gives $Av = (3 \cdot 0 + 0 \cdot 2, 0 \cdot 0 + (-1) \cdot 2) = (0, -2)$. Since $v = (0, 2)$, the output is -1 times v . The second application uses $(-1)^2 = 1$, so $A^2v = (0, 2)$.

005-3 / BACK / REASON

APPLY

$v, -v/2, v/4, -v/8, v/16$. None is zero.

Begin with coefficient 1 at $k = 0$. Successive multiplication by $-1/2$ gives $-1/2, 1/4, -1/8$, and $1/16$. Every listed coefficient is nonzero. Indeed, $(-1/2)^k$ remains nonzero for every finite whole-number k .

005-6 / BACK / REASON

TRANSFER

$M^2 = MM = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$, while entry-by-entry squaring gives $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$. They are different.

For MM , the top-right entry is $1 \cdot 1 + 1 \cdot 1 = 2$; the other entries are 1, 0, and 1. Squaring the four entries separately gives 1, 1, 0, and 1. A matrix power represents composition through matrix multiplication, which combines rows and columns.

005-5 / BACK / REASON

TRANSFER

$Aw = (2, 1/2)$ and $A^2w = (4, 1/4)$. The first coordinate doubles while the second halves, so w is not an eigenvector and has no single λ for this rule.

One application gives $Aw = (2 \cdot 1, (1/2) \cdot 1) = (2, 1/2)$. A second application gives $A(Aw) = (2 \cdot 2, (1/2) \cdot (1/2)) = (4, 1/4)$. If Aw were λw , both coordinates would equal the same λ . They are 2 and $1/2$, so the eigenvector shortcut does not apply to w .

006-1 / FRONT / QUESTION

RECOGNIZE

For $F(x) = 3x - 4$ on real numbers, test whether $x^* = 2$ is fixed. Is $x = 1$ fixed?

Read the instruction before calculating.

006-2 / FRONT / QUESTION

RECOGNIZE

Let $F(x) = 2 - x$. Starting at 5 gives $5 \rightarrow -3 \rightarrow 5$. Is 5 fixed or on a genuine two-step cycle? Find one fixed state of this F .

Read the instruction before calculating.

006-3 / FRONT / QUESTION

APPLY

Let $x_{k+1} = A x_k$: each new state is A times the current state. For $A = \begin{bmatrix} 1 & 0 \\ 0 & -1/2 \end{bmatrix}$ and $x_0 = (2, 4)$, find x_1, x_2, x_3 and the fixed state this path approaches. Does it ever reach that state in a finite number of steps?

Read the instruction before calculating.

006-4 / FRONT / QUESTION

APPLY

A nonzero vector v satisfies $Av = -v$. Classify the repeated path $v \rightarrow Av \rightarrow A^2v$ as fixed, a genuine two-step cycle, or neither.

Read the instruction before calculating.

006-2 / BACK / REASON

RECOGNIZE

5 is on a genuine two-step cycle, not fixed. The fixed state is $x^* = 1$.

$F(5) = 2 - 5 = -3$, so 5 changes after one step.
 $F(-3) = 2 - (-3) = 5$, so it returns after exactly two steps. Solving $F(x) = x$ gives $2 - x = x$, hence $x = 1$; indeed $F(1) = 1$.

006-1 / BACK / REASON

RECOGNIZE

2 is fixed because $F(2) = 2$. 1 is not fixed because $F(1) = -1$.

$F(2) = 3 \cdot 2 - 4 = 2$, so applying the rule leaves 2 unchanged. $F(1) = 3 \cdot 1 - 4 = -1$, which differs from 1. The fixed-point test asks for equality after one application, not just a nearby result.

006-4 / BACK / REASON

APPLY

It is a genuine two-step cycle: $v \rightarrow -v \rightarrow v$.

The first step is $Av = -v$, which differs from v because v is nonzero. The second is $A(-v) = -Av = -(-v) = v$. Returning after two steps, with a change after one, is precisely a period-two cycle.

006-3 / BACK / REASON

APPLY

$x_1 = (2, -2)$, $x_2 = (2, 1)$, $x_3 = (2, -1/2)$. They approach $(2, 0)$ but never reach it at any finite step.

The matrix leaves the first coordinate at 2 and multiplies the second by $-1/2$ each time. The second coordinates are 4, -2 , 1, $-1/2$, and in general $4(-1/2)^k$. Their magnitudes tend to zero, but $4(-1/2)^k$ is nonzero for every finite k . Also $A(2, 0) = (2, 0)$, so $(2, 0)$ is fixed.

006-5 / FRONT / QUESTION

TRANSFER

$A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ fixes $v = (1, 0)$.
Starting instead at $w = (1, 1)$, find Aw and A^2w . Does the fixed vector v prove that every state approaches a fixed state?

Read the instruction before calculating.

006-6 / FRONT / QUESTION

TRANSFER

Compare two rules with the same fixed state 7. Rule $P(x) = 7$; rule $Q(x) = 7 + (x - 7)/2$. Starting at $x_0 = 2$, which rule reaches 7 in a finite step, and which merely approaches it?

Read the instruction before calculating.

006-6 / BACK / REASON

TRANSFER

P reaches 7 after one step and stays there. Q approaches 7 but never reaches it from 2 in a finite number of steps.

Both have fixed state 7 because $P(7) = Q(7) = 7$. $P(2) = 7$, so its path is $2 \rightarrow 7 \rightarrow 7 \rightarrow \dots$. For Q, the initial error is $2 - 7 = -5$ and each step halves it: $x_k - 7 = -5/2^k$. This is nonzero for finite k but tends to zero.

006-5 / BACK / REASON

TRANSFER

$Aw = (1, 2)$, $A^2w = (1, 4)$. No: the vertical coordinate grows, so this starting state does not approach the fixed horizontal axis.

$Av = (1, 0)$ verifies v is fixed. But $Aw = (1, 2)$ and $A(Aw) = (1, 4)$; the second coordinate doubles each time. One fixed eigendirection describes what happens along that direction only. It cannot establish stability for all states.