

Matrix Operations, Determinants and Inverses

Grade 12 – Precalculus math · Test Answer Key · Standards: N-VM.C.6, N-VM.C.7, N-VM.C.8, N-VM.C.9, N-VM.C.10

Use the scoring notes to award partial credit. Most questions give a point for each correct row, entry or part, and one point for a correct setup. Fractions must be exact.

Standards: N-VM.C.6, N-VM.C.7, N-VM.C.8, N-VM.C.9, N-VM.C.10 · **Level:** Grade 12 Precalculus

Question 1 Combining Matrices (2 points)

$2A$ has rows $(6, -2)$ and $(0, 8)$. Subtracting B gives:

4	-7
3	7

Answer: **rows $(4, -7)$ and $(3, 7)$**

Scoring: 1 point for $2A$, 1 point for the subtraction.

Question 2 A 2×2 Product (2 points)

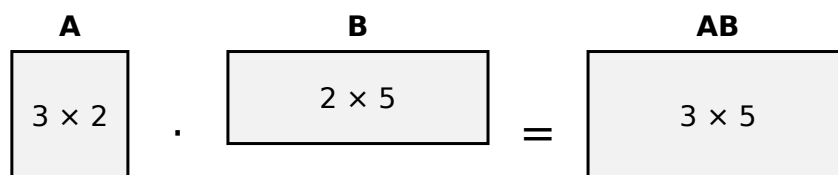
Row 1: $4(-1) + (-2)(2) = -8$ and $4(5) + (-2)(0) = 20$. Row 2: $1(-1) + 3(2) = 5$ and $1(5) + 3(0) = 5$.

-8	20
5	5

Answer: **rows $(-8, 20)$ and $(5, 5)$**

Scoring: 1 point for each row.

Question 3 Sizes of Products (2 points)



inner numbers must match

Sizes in the diagram: 3 by 2 and 2 by 5.

(a) A has 2 columns and B has 2 rows, so AB exists and measures 3×5 .

(b) BA fails because B has 5 columns but A has only 3 rows. $A + C$ fails because sizes 3×2 and 3×5 do not match.

Answer: **(a) 3×5 ; (b) neither BA nor $A + C$ can be formed**

Scoring: 1 point for each part.

Question 4 Determinants (2 points)

(a) $\det = (-3)(5) - (7)(2) = -15 - 14 = -29$.

(b) $\det = k^2 - 36$. Setting $k^2 - 36 = 0$ gives $k = 6$ or $k = -6$.

Answer: **(a) -29 ; (b) $k = 6$ or $k = -6$**

Scoring: 1 point for each part.

Question 5 An Inverse Matrix (3 points)

(a) $\det A = 2(5) - 4(3) = -2$.

(b) Swap and negate to get rows $(5, -4)$ and $(-3, 2)$, then divide by -2 :

$-\frac{5}{2}$	2
$\frac{3}{2}$	-1

(c) Row 1 of A times A^{-1} : $2(-\frac{5}{2}) + 4(\frac{3}{2}) = -5 + 6 = 1$ and $2(2) + 4(-1) = 0$. Row 2: $3(-\frac{5}{2}) + 5(\frac{3}{2}) = 0$ and $3(2) + 5(-1) = 1$. The product is I .

Answer: **$\det A = -2$; A^{-1} has rows $(-\frac{5}{2}, 2)$ and $(\frac{3}{2}, -1)$**

Scoring: 1 point for each part.

Question 6 A Row of a 3×3 Product (3 points)

Use row 2 of A , which is $(1, 3, -2)$, with each column of B .

Column 1: $1(1) + 3(0) + (-2)(3) = -5$. Column 2: $1(-1) + 3(2) + (-2)(1) = 3$. Column 3: $1(2) + 3(3) + (-2)(-1) = 13$.

Answer: **$(-5, 3, 13)$**

Scoring: 1 point for each entry.

Question 7 School Store Revenue (3 points)

(a) Sales matrix rows (120, 300, 80) and (150, 240, 100); price column (3.00, 1.25, 2.00).

(b) Fall: $120(3) + 300(1.25) + 80(2) = 360 + 375 + 160 = \$895$. Spring: $150(3) + 240(1.25) + 100(2) = 450 + 300 + 200 = \$950$.

(c) Spring earned $\$950 - \$895 = \$55$ more.

Answer: **\$895 in Fall and \$950 in Spring; Spring earned \$55 more**

Scoring: 1 point for each part.

Question 8 Products and Determinants (3 points)

(a) AB :

2	8
-5	7

(b) BA :

6	12
-3	3

The matrices are different, so $AB \neq BA$.

(c) $\det(AB) = 2(7) - 8(-5) = 54$. $\det A = 6$ and $\det B = 1 + 8 = 9$, and $6 \cdot 9 = 54$, so $\det(AB) = \det A \cdot \det B$.

Answer: **AB has rows (2, 8), (-5, 7); BA has rows (6, 12), (-3, 3); $\det(AB) = 54 = 6 \cdot 9$**

Scoring: 1 point for each part.