

Determinates

Write two paragraphs...

1. Explain how to find the determinate of a 3×3 using minors

2. Explain how to find the determinate of a 3×3 using diagonals

For Exercises	See Examples
12–14, 35–36	1
15–17, 33, 34	3
18–20	4
21–23, 35, 37	5
24	2
26–32, 38–41	1–5

Extra Practice
See page 835.

15. $\begin{bmatrix} 0 & 1.5 & -2.5 \\ 2 & -1.5 & 0 \end{bmatrix}$

22. $D'(4, -2)$,
 $E'(4, -5)$, $F'(1, -4)$,
 $G'(1, -1)$

26. $\begin{bmatrix} 2 & 4 & 2 & -3 \\ 3 & -3 & -5 & -2 \\ \cdot (-1) = & & & \\ [-2 & -4 & -2 & 3] \\ [-3 & 3 & 5 & 2] \end{bmatrix}$

and 2 units up.

12. Write the translation matrix. $\begin{bmatrix} -4 & -4 & -4 \\ 2 & 2 & 2 \end{bmatrix}$
13. Find the coordinates of $\triangle D'E'F'$. $D'(-3, 6)$, $E'(-2, -3)$, $F'(-10, -4)$

14. Graph the preimage and the image. See margin.

- For Exercises 15–17, use the following information.
The vertices of $\triangle ABC$ are $A(0, 2)$, $B(1.5, -1.5)$, and $C(-2.5, 0)$. The triangle is dilated so that its perimeter is three times the original perimeter.
15. Write the coordinates for $\triangle ABC$ in a vertex matrix.
16. Find the coordinates of the image $\triangle A'B'C'$. $A'(0, 6)$, $B'(4.5, -4.5)$, $C'(-7.5, 0)$

17. Graph $\triangle ABC$ and $\triangle A'B'C'$. See margin.

- For Exercises 18–20, use the following information.
The vertices of $\triangle XYZ$ are $X(1, -1)$, $Y(2, -4)$, and $Z(7, -1)$. The triangle is reflected over the line $y = x$.

18. Write the coordinates of $\triangle XYZ$ in a vertex matrix. $\begin{bmatrix} 1 & 2 & 7 \\ -1 & -4 & -1 \end{bmatrix}$
19. Find the coordinates of $\triangle X'Y'Z'$. $X'(-1, 1)$, $Y'(-4, 2)$, $Z'(-1, 7)$

20. Graph $\triangle XYZ$ and $\triangle X'Y'Z'$. See margin.

- For Exercises 21–23, use the following information.
Parallelogram $DEFG$ with $D(2, 4)$, $E(5, 4)$, $F(4, 1)$, and $G(1, 1)$ is rotated 270° counterclockwise about the origin.

21. Write the coordinates of the parallelogram in a vertex matrix. $\begin{bmatrix} 2 & 5 & 4 & 1 \\ 4 & 4 & 1 & 1 \end{bmatrix}$
22. Find the coordinates of parallelogram $D'E'F'G'$.

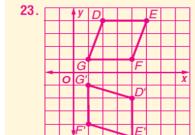
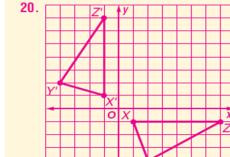
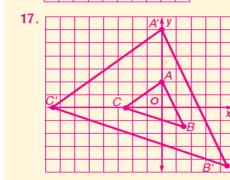
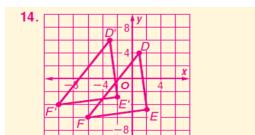
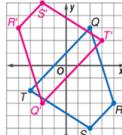
23. Graph the preimage and the image. See margin.

- * 24. Triangle DEF with vertices $D(-2, 2)$, $E(3, 5)$, and $F(5, -2)$ is translated so that D' is at $(1, -5)$. Find the coordinates of E' and F' . $E'(6, -2)$, $F'(8, -9)$

- * 25. A triangle is rotated 90° counterclockwise about the origin. The coordinates of the vertices are $J'(-3, -5)$, $K'(-2, 7)$, and $L'(1, 4)$. What were the coordinates of the triangle in its original position? $J(-5, 3)$, $K(7, 2)$, $L(4, -1)$

- For Exercises 26–28, use quadrilateral $QRST$ shown at the right.

26. Write the vertex matrix. Multiply the vertex matrix by -1 .
27. Graph the preimage and image. See right.
28. What type of transformation does the graph represent? 180° rotation

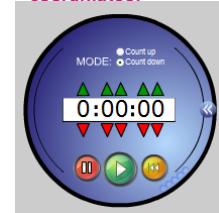


29. $\begin{bmatrix} 4 & -4 & -4 & 4 \\ -4 & -4 & 4 & 4 \end{bmatrix}$

30. $\begin{bmatrix} 4 & -4 & -4 & 4 \\ -4 & -4 & 4 & 4 \end{bmatrix}$

31. $\begin{bmatrix} 4 & 4 & -4 & -4 \\ -4 & 4 & 4 & -4 \end{bmatrix}$

32. The figures in Exercise 29 and Exercise 30 have the same coordinates, but the figure in Exercise 31 has different coordinates.



Notes 4.5

determinate: a number associated with a square matrix.

 2×2

$$\boxed{6}$$

 3×3

$$\boxed{-4.5}$$

 4×4

$$\boxed{0}$$

 2×3

No determinate

 15×2

No determinate

 2×2 Determinants.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

$$\left| \begin{array}{cc} a & b \\ c & d \end{array} \right| = ad - cb$$

Straight lines mean determinate

How to find
a 2×2 determinant

Example 1: Find the determinate

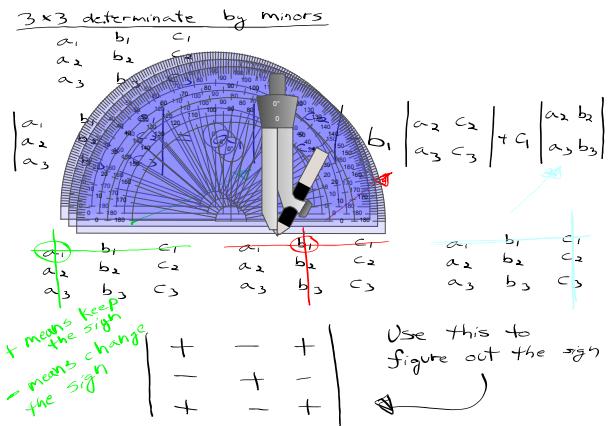
a) $\begin{vmatrix} -2 & 5 \\ 6 & 8 \end{vmatrix} = ad - bc$

$$\begin{aligned} &= -2 \cdot 8 - 6 \cdot 5 \\ &= -16 - 30 \\ &= \boxed{-46} \end{aligned}$$

The \rightarrow determinate

b) $\begin{vmatrix} 7 & 4 \\ -3 & 2 \end{vmatrix}$

$$\begin{aligned} &= 7 \cdot 2 - (-3 \cdot 4) \\ &= 14 - -12 \\ &= \boxed{26} \end{aligned}$$



Example 2. Find the determinate by minors:

$$\begin{vmatrix} 2 & 7 & -3 \\ -1 & 5 & -4 \\ 6 & 9 & 0 \end{vmatrix} \quad * \text{Expansion of the first row}$$

$$2 \begin{vmatrix} 5 & -4 \\ 9 & 0 \end{vmatrix} - 7 \begin{vmatrix} -1 & -4 \\ 6 & 0 \end{vmatrix} - 3 \begin{vmatrix} -1 & 5 \\ 6 & 9 \end{vmatrix}$$

$$2(5 \cdot 0 - (-4) \cdot 9) - 7(-1 \cdot 0 - 6 \cdot (-4)) - 3(-1 \cdot 9 - 6 \cdot 5)$$

$$2(36) - 7(24) - 3(-39)$$

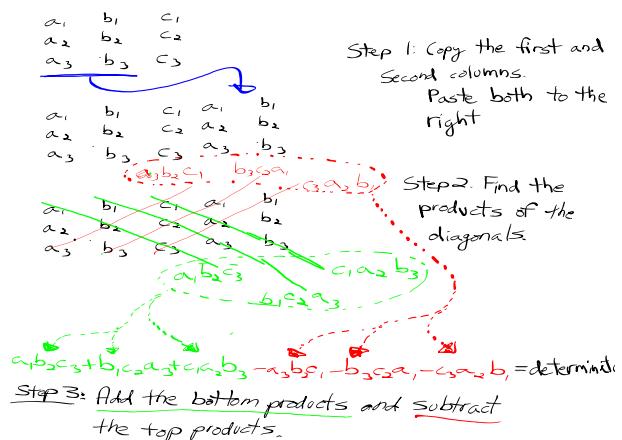
$$72 - 168 + 117$$

$$\boxed{21}$$

Example 3. Find the determinate using minors

$$\begin{vmatrix} 1 & 0 & -1 \\ 2 & -1 & 3 \\ 4 & -2 & -3 \end{vmatrix} = \boxed{9} \quad \boxed{\text{Yellow}}$$

3×3 determinate by diagonal



Example 4. Find the determinate using diagonals

$$\begin{vmatrix} -1 & 3 & -3 \\ 4 & -2 & -1 \\ 0 & -5 & 2 \end{vmatrix}$$

$$\begin{array}{ccccccc} -1 & 3 & -3 & -1 & 3 & 24 \\ 4 & -2 & -1 & 4 & -2 & -5 \\ 0 & -5 & 2 & 0 & -5 & 60 \end{array}$$

Step 1: Copy the first and second columns to the right

$$4 + 0 + 60 - 0 - (-5) - 24$$

$$\boxed{45}$$

Example # 5 : Find the determinate by diagonals

$$\begin{vmatrix} 3 & -2 & -1 \\ 2 & -1 & 0 \\ 1 & 2 & -3 \end{vmatrix} = \boxed{-8}$$

homework

pg 186-187

Due Wednesday

15, 25, 27, 32, 33, 38

39, 40

$$\begin{array}{l} 2 \left(-\frac{3}{2}x + \frac{3}{2}y - \frac{5}{2}z = -2 \right) \\ 3 \left(-\frac{4}{3}x - \frac{1}{3}y - \frac{1}{3}z = -\frac{19}{3} \right) \\ -2x + 3y + z = 11 \end{array} \Rightarrow \begin{array}{l} -3x + 3y - 5z = -4 \\ -4x - y - z = -19 \\ -2x + 3y + z = 11 \end{array}$$

$$\begin{array}{l} \frac{3}{4}r + \frac{5}{4}s + \frac{1}{2}t = -1 \\ \frac{2}{3}r - 2s + \frac{4}{3}t = -\frac{4}{3} \\ \frac{3}{2}r + 3s - \frac{1}{2}t = \frac{7}{2} \end{array}$$