

Student Text *UNIT 39 Matrices*

Answers

39.1 Matrices: Addition and Subtraction

1. (a) 2×2 (b) 3×1 (c) 2×3 (d) 1×2 (e) 3×3

2. (a) $\begin{pmatrix} 5 & 0 \\ 2 & -4 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$ (c) $\begin{pmatrix} -2 & 0 \\ 2 & -9 \end{pmatrix}$ (d) $\begin{pmatrix} 2 & 0 \\ -2 & 9 \end{pmatrix}$

(Note that $C - A - B$ means $C - (A + B)$.)

3. (a) Not possible (b) $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$ (c) $\begin{pmatrix} 4 & -1 & -3 \end{pmatrix}$ (d) Not possible

(e) $\begin{pmatrix} 6 & 1 & -1 \end{pmatrix}$ (f) Not possible (g) $\begin{pmatrix} -4 & 3 & 3 \end{pmatrix}$

4. $a = -4$, $b = 1$, $c = 5$, $d = 2$

5. $a = 6$, $b = -5$, $c = -2$, $d = 4$, $e = 4$, $f = 4$

39.2 Matrices: Multiplication

1. (a) $\begin{pmatrix} 6 & 0 \\ 12 & -18 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 0 \\ 2 & -3 \end{pmatrix}$ (c) $\begin{pmatrix} 2 \\ -2 \end{pmatrix}$

2. $k = 3$, $x = -1$

3. $a = 3$, $b = -3.5$, $c = -1$, $d = 2$

4. $a = 5$, $b = 5$, $c = -2$, $d = 2$

5. (a) 1×2 (b) 3×3 (c) 1×2

(d) 2×2 (e) 2×3 (f) 3×2

6. (a) $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$ (b) $\begin{pmatrix} -2 & 1 \\ -4 & 7 \end{pmatrix}$

7. (a) $\begin{pmatrix} -3 & -2 & -1 \\ 3 & 3 & 0 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & -4 \\ 0 & 9 \end{pmatrix}$

8. (a) Not possible (b) $\begin{pmatrix} -6 & -4 \\ -3 & -2 \end{pmatrix}$ (c) Not possible (d) $\begin{pmatrix} 7 \\ 0 \end{pmatrix}$

(e) $\begin{pmatrix} -8 \end{pmatrix}$ (f) $\begin{pmatrix} -7 & -7 \end{pmatrix}$

9. $\begin{pmatrix} 2 & 6-a & 2a \\ 1 & 4 & -2 \end{pmatrix}$

10. $\begin{pmatrix} 3x+2 & 0 \\ 0 & 3x+2 \end{pmatrix}$

11. (a) $\begin{pmatrix} 1 & 4 \\ 0 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 6 \\ 0 & 1 \end{pmatrix}$

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39.3 Inverse Matrices: Solving Linear Equations

1. (a) Non-singular. Inverse $= \begin{pmatrix} 1 & 0.5 \\ 2 & 1.5 \end{pmatrix}$ (b) Singular (c) Singular
 (d) Non-singular. Inverse $= \begin{pmatrix} -5 & 2 \\ 3 & -1 \end{pmatrix}$ (e) Singular
 (f) Non-singular. Inverse $= \begin{pmatrix} -0.2 & 0.3 \\ 0.6 & -0.4 \end{pmatrix}$
2. (a) -3 (b) -5 (c) $\frac{1}{4}$
3. (a) $B = A^{-1}C$ (b) $\begin{pmatrix} 1 & 4 \\ -1 & 2 \end{pmatrix}$
4. (a) $x = 0.5, y = 3$ (b) $x = 2, y = -3$ (c) $x = -1, y = 4$
5. $x = 2, y = 1.5$
6. (a) $x = 1, y = 1$
 (b) Equations are equivalent, so solution is of the form $x = \lambda, y = 2 - \lambda$ for all values λ .
 (c) No solution as equations are inconsistent.
7. (a) $Q = \frac{1}{6} \begin{pmatrix} 5 & -1 \\ -4 & 2 \end{pmatrix}$ (b) $x = 1, y = -3$

39.4 Geometrical Transformations

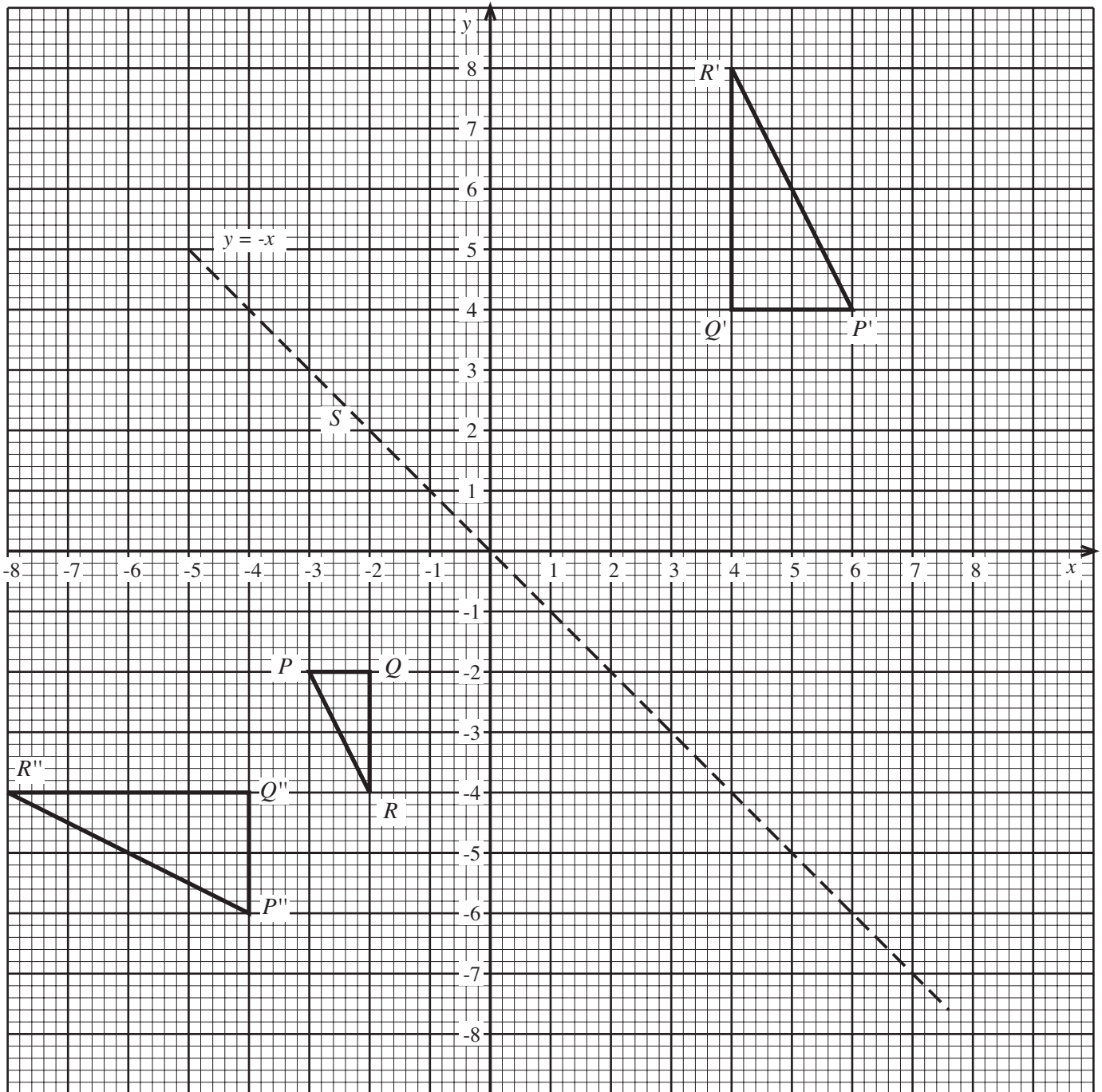
1. (a) $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ (c) $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$
 (d) $P' (6, -11), P'' (3, 16)$
2. (a) $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$ (b) Enlargement, centre O , of scale factor 3 (c) $1 : 9$
3. (a) Diagram on next page
 (b) Rotation of 180° about the origin, followed by enlargement, about O , of scale factor 2
 (c) Diagram on next page

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3. (a) and (c)



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$$3. \quad (d) \quad (i) \quad G = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$$

$$(ii) \quad M = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$$

$$(iii) \quad \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix} = \begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$$

4. (a) Rotation 90° , about O , anticlockwise

$$(b) \quad R^{-1} = \frac{1}{\det R} \operatorname{adj} R = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$$

(c) Rotation 90° about O , clockwise

5. (a) Enlargement, scale factor 2, followed by rotation of 90° clockwise

$$6. \quad (a) \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (b) \quad \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \quad (c) \quad \text{Rotation about } O, \text{ of } 180^\circ$$

$$7. \quad (a) \quad \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \quad (b) \quad \text{Rotation about } O, \text{ of } 90^\circ, \text{ clockwise}$$

(c) Rotation about O , of 45° , clockwise