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VCE Specialist Mathematics ½ Transformations I [4.2]

Test Solutions

24.5 Marks. 1 Minute Reading. 25 Minutes Writing

Results:

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Test Questions	/ 24.5	





Section A: Test Questions (24.5 Marks)

Question 1 (4.5 marks)

Tick whether the following statements are **true** or **false**.

	Statement	True	False
a.	A linear transformation is defined by a rule of the form $(x,y) \rightarrow (ax + by, cx + dy)$.	✓	
b.	You can find the first column of a linear transformation by finding the coordinates that $(1,0)$ maps to, and the second column by finding the coordinates that $(0,1)$ maps to.	✓	
c.	The point $(2,-1)$ under the transformation $(x,y) \rightarrow (2x-3y,-x+4y)$ has image $(1,-6)$.		✓
d.	If a triangle T has area k $units^2$, it then undergoes a transformation represented by matrix A , where $ \det(A) = c$, then the area of the transformation triangle T has an area $\frac{k}{c}$ $units^2$.		✓
e.	A dilation by a factor 2 from the <i>x</i> -axis is always the same as a dilation by a factor $\frac{1}{2}$ from the <i>y</i> -axis.		✓
f.	For a shear parallel to the x -axis, the points further away from the x -axis vertically shift further horizontally than the points closer to the x -axis.	✓	
g.	A projection of any point onto the <i>y</i> -axis will reduce the <i>y</i> -coordinate to 0.		✓
h.	In order for a transformation to be reversed, the determinant of the transformation matrix must not be 0 and there must be only one pre-image for the image.	✓	
i.	If there is a sequence of transformations T_1 , T_2 , T_3 applied in that order, then the resulting transformation will be given by $T_R = T_1 T_2 T_3$, where each T_i is a 2 × 2 matrix.		✓



Question 2 (6 marks)

For the following questions, state the composite transformation matrix and find the image of the point (1, -2).

a. Reflection in the y-axis and projection onto x-axis. (2 marks)

 $\begin{bmatrix} -1 & 0 \\ 0 & 0 \end{bmatrix}$ and (-1,0).

b. Shear of factor 4 parallel to the x-axis and reflection in the x-axis. (2 marks)

 $\begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}$ and (-7, 2).

c. Dilation of factor 2 from y-axis and shear of factor 3 parallel to the y-axis. (2 marks)

 $\begin{bmatrix} 2 & 0 \\ 6 & 1 \end{bmatrix}$ and (2,4).

Space for Personal Notes



Question 3 (9 marks)

$$A = \begin{bmatrix} 2 & -2 \\ -1 & 3 \end{bmatrix}$$

a. Find *det A*. (1 mark)

b. Find A^{-1} . (2 marks)

(a) Find det A. = ad - bc det A = 2(3) - (-1)(-2) = 6-2

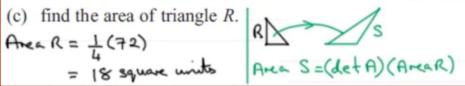
(b) Find
$$A^{-1}$$
.
$$A^{-1} = \frac{1}{\det A} \begin{pmatrix} \lambda & -b \\ -c & a \end{pmatrix}$$

$$= \frac{1}{4} \begin{pmatrix} 3 & 2 \\ 1 & 2 \end{pmatrix}$$

The triangle R is transformed into the triangle S by the matrix A.

c. Given that the area of triangle S is 72 square units, find the area of triangle R. (2 marks)

The triangle R is transformed to the triangle S by the matrix A. Given that the area of triangle S is 72 square units,





The triangle S has vertices at the points (0,4), (8,16) and (12,4).

d. Find the coordinates of the vertices of R. (4 marks)

The triangle S has vertices at the points (0,4), (8,16) and (12,4).

(d) Find the coordinates of the vertices of R.

:. vertices of R: (2,2), (14,10) and (11,5)

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Question 4 (5 marks)

Consider the transformation given by $A = \begin{bmatrix} -1 & 3 \\ 2 & 5 \end{bmatrix}$.

a. Find the image of (1,1) under the transformation A. (1 mark)

(2,7)

b. Find the inverse matrix A^{-1} . (2 marks)

 $\frac{1}{-11}\begin{bmatrix} 5 & -3 \\ -2 & -1 \end{bmatrix}$

It is known that (a, b) under the transformation A was (11, 33).

c. Find the values of a and b. (2 marks)

a = 4 and b = 5.

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