GENERAL MATHEMATICS 2024

Unit 4
Key Topic Test 2 – Applications of Matrices

Recommended writing time*: 45 minutes
Total number of marks available: 25 marks

SOLUTIONS

SECTION A – Multiple Choice (1 mark per question)

Question 1
Answer: D

Team A has 3 wins and finishes first
Team D has 2 wins and finishes second

Question 2
Answer: B

$$\begin{bmatrix} a \\ c \end{bmatrix} = \begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}^{-1} \begin{bmatrix} 61 \\ 54.50 \end{bmatrix}$$
$$= \frac{1}{4} \begin{bmatrix} 3 & -2 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} 61 \\ 54.50 \end{bmatrix}$$

Question 3
Answer: A

$$\begin{bmatrix} 40 & 110 & 65 \end{bmatrix} \begin{bmatrix} 1.1 & 0 & 0 \\ 0 & 0.95 & 0 \\ 0 & 0 & 1.08 \end{bmatrix}$$

Question 4
Answer: A

$$\begin{bmatrix} 40 & 110 & 65 \end{bmatrix} \begin{bmatrix} 1.1 & 0 & 0 \\ 0 & 0.95 & 0 \\ 0 & 0 & 1.08 \end{bmatrix} = \begin{bmatrix} 44 & 104.5 & 70.2 \end{bmatrix}$$

$$\begin{bmatrix} 44 & 104.5 & 70.2 \end{bmatrix} \begin{bmatrix} 1 \\ 5 \\ 3 \end{bmatrix} = \begin{bmatrix} 777.1 \end{bmatrix}$$

Cost = $777.10

Question 5
Answer: A

$$\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$

SECTION B – Short Answer

Question 1

   a. 46

                1 mark

   b. $22 + 12 + 26 = 60$ noodles sold

                1 mark

   c.
$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 42 & 65 & 22 \\ 33 & 46 & 12 \\ 26 & 52 & 26 \end{bmatrix}^{-1} \begin{bmatrix} 509.20 \\ 356.90 \\ 416 \end{bmatrix}$$

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 4.50 \\ 3.20 \\ 5.10 \end{bmatrix}$$

Hotdogs $= \$3.20$

                2 marks

   d. $L = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$

                1 mark

   e.
$$D = \begin{bmatrix} 1.2 & 0 & 0 \\ 0 & 0.9 & 0 \\ 0 & 0 & 1.05 \end{bmatrix}$$

                2 marks

   f.
$$\begin{bmatrix} 1.2 & 0 & 0 \\ 0 & 0.9 & 0 \\ 0 & 0 & 1.05 \end{bmatrix} \begin{bmatrix} 4.50 \\ 3.20 \\ 5.10 \end{bmatrix} = \begin{bmatrix} 5.40 \\ 2.88 \\ 5.355 \end{bmatrix}$$

$$\begin{bmatrix} 42 & 65 & 22 \\ 33 & 46 & 12 \\ 26 & 52 & 26 \end{bmatrix} \begin{bmatrix} 5.40 \\ 2.88 \\ 5.355 \end{bmatrix} = \begin{bmatrix} 531.81 \\ 374.94 \\ 429.39 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 531.81 \\ 374.94 \\ 429.39 \end{bmatrix} = 1336.14$$

$1336.14 - 1282.10 = \$54.04$

                2 marks

Question 2

a. $D = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \end{bmatrix}$

2 marks

b. Third row is the sum of the wins from the teams that Kings Canyon beat.
   Sum $= 4$
   Uluru and Wycliffe Wells had a total of 4 wins.

1 mark

c. $D + D^2 = \begin{bmatrix} 0 & 1 & 1 & 0 & 1 \\ 2 & 0 & 2 & 1 & 1 \\ 2 & 2 & 0 & 1 & 1 \\ 2 & 2 & 2 & 0 & 2 \\ 2 & 1 & 1 & 1 & 0 \end{bmatrix} \begin{matrix} 3 \\ 6 \\ 6 \\ 8 \\ 5 \end{matrix}$

   Gunlom finished Fourth in the tournament.

2 marks

Question 3

a. $2 + 1 + 4 = 7$

1 mark

b. $2a + 2c = 73$
   $2a + s + c = 79$
   $a + s + 4c = 90.50$

2 marks

c. $\begin{bmatrix} 2 & 0 & 2 \\ 2 & 1 & 1 \\ 1 & 1 & 4 \end{bmatrix} \times \begin{bmatrix} a \\ s \\ c \end{bmatrix} = \begin{bmatrix} 73 \\ 79 \\ 90.50 \end{bmatrix}$

1 mark

d. $\begin{bmatrix} a \\ s \\ c \end{bmatrix} = \begin{bmatrix} 2 & 0 & 2 \\ 2 & 1 & 1 \\ 1 & 1 & 4 \end{bmatrix}^{-1} \begin{bmatrix} 73 \\ 79 \\ 90.50 \end{bmatrix}$

   $\begin{bmatrix} a \\ s \\ c \end{bmatrix} = \begin{bmatrix} 24.5 \\ 18 \\ 12 \end{bmatrix}$

   Adult $= \$24.50$, Student $= \$18$, Child $= \$12$

2 marks

END OF KEY TOPIC TEST SOLUTIONS