SCHOOL: Your school name

SENIOR FOUR MATHEMATICS · UNIT 9 QUIZ

Vector space of real numbers · FREE SAMPLE

Academic year: 20..... – 20..... **Date:** ...../...../20.....

Name: ..... Class: .....

Duration: 1 hour 30 minutes **Total marks:** 24

INSTRUCTIONS

1. A full unit quiz has three sections and 50 marks.
2. This free sample is a short extract of each section.
3. Calculators may be used unless a question says otherwise.

SECTION A: OBJECTIVE QUESTIONS

Answer ALL questions. The marks are shown for each question.

1. Do $(1,2)$ and $(3,5)$ form a basis of $\mathbb{R}^2$? (1 mark)

A. Yes: the determinant is $-1 \neq 0$
B. No: the determinant is 0
C. Yes: both vectors are non-zero
D. No: a basis needs perpendicular vectors

2. Find the area of the parallelogram built on $(3,1)$ and $(1,2)$. (1 mark)

A. $\sqrt{50}$
B. 6
C. 7
D. 5

3. Find k so that $(k,3)$ and $(2,6)$ are linearly dependent. (1 mark)

A. $k=-1$
B. $k=1$
C. $k=4$
D. $k=9$

4. Find the coordinates of $(5,8)$ in the basis $\{(1,2),(3,5)\}$. (1 mark)

A. $(1,1)$
B. $(-1,2)$
C. $(5,8)$
D. $(2,-1)$

5. Matching. Match each item in column A with the correct answer in column B. Write the letter in the answer column. (4 marks)

Column A	Answer	Column B

1. $\|\mathbf{u}\|=3$, $\|\mathbf{v}\|=4$ and the angle between them is 60°. Find $\mathbf{u}\cdot\mathbf{v}$.		**a.** 45°
2. Find the angle between (1, 1) and (1, 0).		**b.** 3.4
3. Find the angle between (3, 4) and (4, 3).		**c.** about 16.3°
4. Find the scalar projection of $\mathbf{u}=(2, 3)$ on $\mathbf{v}=(4, 3)$.		**d.** 6

6. Fill in the blanks. Use the words in the box to complete the sentences. One word in the box is not needed. (3 marks)

k=6 · **k=–3/2** · **(–3/5, 4/5)** · **120°**

(i) Find the angle between (1, 0) and (–1, √3). → .....

(ii) Find k so that (k, 3) and (2, –4) are orthogonal. → .....

(iii) Find the unit vector in the direction of (–6, 8). → .....

SECTION B: SHORT ANSWER QUESTIONS

Answer ALL questions. Show your working.

7. Find the angle between $\vec{u}=\begin{pmatrix}1\\2\end{pmatrix}$ and $\vec{v}=\begin{pmatrix}3\\1\end{pmatrix}$. (4 marks)

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8. Are $\vec{u}=\begin{pmatrix}2\\3\end{pmatrix}$ and $\vec{v}=\begin{pmatrix}4\\6\end{pmatrix}$ linearly independent? (3 marks)

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9. Give a basis of $W=\{(x,y): x+4y=0\}$. (3 marks)

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10. Find $\vec{u}\cdot\vec{v}$ for $\vec{u}=(2,-3)$ and $\vec{v}=(4,1)$. (3 marks)

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SECTION C: STRUCTURED QUESTIONS

Answer ALL questions. Show all your working.

11. Vector space of real numbers **(7 marks)**

(a) Show that $W=\{(x,y): x+2y=0\}$ is a subspace of $\mathbb{R}^2$ and give a basis. (4 marks)

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(b) $\vec{u}=\begin{pmatrix}3\\-4\end{pmatrix}$. Find $|\vec{u}|$, the unit vector in its direction, and $2\vec{u}-\begin{pmatrix}1\\1\end{pmatrix}$. (3 marks)

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END