

This print-out should have 5 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

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**001 10.0 points**

Find a matrix  $A$  so that  $\text{Nul}(A)$  is the set of all vectors

$$H = \left\{ \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} : \begin{array}{l} a + 2b = 4c, \\ a = c - 3d, \end{array} \right\}$$

in  $\mathbb{R}^4$ .

1.  $A = \begin{bmatrix} 1 & 2 & -4 & 0 \\ 1 & 0 & -1 & 3 \end{bmatrix}$

2.  $A = \begin{bmatrix} 1 & -2 & 4 & 0 \\ 1 & 0 & 1 & -3 \end{bmatrix}$

3.  $A = \begin{bmatrix} 1 & -2 & -4 & 0 \\ 1 & 0 & 1 & -3 \end{bmatrix}$

4.  $A = \begin{bmatrix} 1 & 2 & 4 & 0 \\ 1 & 0 & 1 & -3 \end{bmatrix}$

5.  $A = \begin{bmatrix} 1 & 2 & -4 & 0 \\ 1 & 0 & -1 & -3 \end{bmatrix}$

6.  $A = \begin{bmatrix} 1 & -2 & 4 & 0 \\ 1 & 0 & -1 & 3 \end{bmatrix}$

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**002 10.0 points**

When  $A$  is a  $5 \times 7$  matrix, then  $\text{Row}A$  is a subspace of  $\mathbb{R}^p$  and  $\text{Col}A$  is a subspace of  $\mathbb{R}^q$  for which values of  $p$  and  $q$ .

1.  $p = 5, \quad q = 7$

2.  $p = 5, \quad q = 5$

3.  $p = 7, \quad q = 7$

4.  $p = 7, \quad q = 5$

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**003 10.0 points**

Let  $H$  be the set of all vectors

$$\begin{bmatrix} a - 2b \\ ab + 3a \\ b \end{bmatrix}$$

where  $a$  and  $b$  are real. Determine if  $H$  is a subspace of  $\mathbb{R}^3$ , and then check the correct answer below.

1.  $H$  is not a subspace of  $\mathbb{R}^3$  because it is not closed under vector addition.

2.  $H$  is not a subspace of  $\mathbb{R}^3$  because it does not contain  $\mathbf{0}$ .

3.  $H$  is a subspace of  $\mathbb{R}^3$  because it can be written as  $\text{Span}\{\mathbf{v}_1, \mathbf{v}_2\}$  with  $\mathbf{v}_1, \mathbf{v}_2$  in  $\mathbb{R}^3$ .

4.  $H$  is a subspace of  $\mathbb{R}^3$  because it can be written as  $\text{Nul}(A)$  for some matrix  $A$ .

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**004 10.0 points**

Determine the rank of the matrix

$$A = \begin{bmatrix} 3 & 6 & -3 \\ -3 & -3 & -6 \\ 2 & 1 & 10 \end{bmatrix}.$$

1.  $\text{rank}(A) = 4$

2.  $\text{rank}(A) = 5$

3.  $\text{rank}(A) = 1$

4.  $\text{rank}(A) = 2$

5.  $\text{rank}(A) = 3$

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**005 10.0 points**

Determine the rank of the matrix

$$A = \begin{bmatrix} 3 & -3 & 3 & -3 \\ -3 & 5 & -9 & 1 \\ -1 & -2 & 8 & 4 \end{bmatrix}.$$

1.  $\text{rank}(A) = 1$

**2.**  $\text{rank}(A) = 5$

**3.**  $\text{rank}(A) = 4$

**4.**  $\text{rank}(A) = 3$

**5.**  $\text{rank}(A) = 2$