Math 1B03 Term 2/1ZC3

1st Sample Test #2

Name:____
(Last Name) (First Name)

Student Number:____________________ **Tutorial Number:**____________________

This test consists of 20 multiple choice questions worth 1 mark each (no part marks), and 1 question worth 1 mark (no part marks) on proper computer card filling. All questions must be answered on the COMPUTER CARD with an HB PENCIL. Marks will not be deducted for wrong answers (i.e., there is no penalty for guessing). You are responsible for ensuring that your copy of the test is complete. Bring any discrepancy to the attention of the invigilator. Calculators are NOT allowed.

1. Suppose that a matrix A (not given) has eigenvalues $\lambda = 1, -2, 3$ with eigenvectors $\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$, $\begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$, and $\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$, respectively. Find P and D so that $P^{-1}AP = D$.

(a) $P = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

(b) $P = \begin{bmatrix} 0 & 1 & -1 \\ 0 & 2 & 0 \\ 1 & 1 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{bmatrix}$

(c) $P = \begin{bmatrix} -1 & 1 & 0 \\ 0 & 2 & 0 \\ 1 & 1 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & -2 \end{bmatrix}$

(d) $P = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 3 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(e) $P = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

2. Suppose $p(\lambda) = (\lambda - 1)^3$ for some diagonalizable 3×3 matrix A (not given). Calculate A^{25}.

(a) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ **(b)** $\begin{bmatrix} -25 & 0 & 0 \\ 0 & -25 & 0 \\ 0 & 0 & -25 \end{bmatrix}$ **(c)** $\begin{bmatrix} 25 & 0 & 0 \\ 0 & 25 & 0 \\ 0 & 0 & 25 \end{bmatrix}$

(d) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ **(e)** $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

3. Determine which of the following matrices is a regular stochastic matrix, and then find the steady-state vector for the associated Markov Chain.

$$A = \begin{bmatrix} \frac{1}{5} & 0 \\ \frac{4}{5} & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & \frac{2}{3} \\ 0 & \frac{1}{3} \end{bmatrix}, \quad C = \begin{bmatrix} \frac{1}{2} & 1 \\ \frac{1}{2} & 0 \end{bmatrix}.$$

(a) $\begin{bmatrix} \frac{2}{3} \\ \frac{1}{3} \end{bmatrix}$ **(b)** $\begin{bmatrix} \frac{3}{4} \\ \frac{1}{4} \end{bmatrix}$ **(c)** $\begin{bmatrix} \frac{3}{5} \\ \frac{2}{5} \end{bmatrix}$ **(d)** $\begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \end{bmatrix}$ **(e)** $\begin{bmatrix} \frac{1}{4} \\ \frac{3}{4} \end{bmatrix}$

4. After exposure to certain live pathogens, the body develops long-term immunity. The evolution over time of the associated disease can be modeled as a dynamical system whose state vector at time t consists of the number of people who have not been exposed and are therefore susceptible, the number who are currently sick with the disease, and the number who have recovered and are now immune. Suppose that the associated 3×3 yearly transition matrix A has eigenvalues $\lambda = 1, \frac{1}{2}, 0$, and that the eigenvectors corresponding to the first two eigenvalues are $\mathbf{x}_1 = (60, 20, 30)$ and $\mathbf{x}_2 = (-60, -30, 90)$, respectively. The initial state vector for the population is given by

$$\mathbf{v}_0 = 500\mathbf{x}_1 + 200\mathbf{x}_2 + 100\mathbf{x}_3$$

where the third eigenvector $\mathbf{x}_3$ is not given here. How many people will be sick with the disease 2 years later?

(a) 15450 **(b)** 27000 **(c)** 8500 **(d)** 9700 **(e)** 4000

5. Find the equation of the plane passing through $A(2, 1, 3)$, $B(3, -1, 5)$, and $C(1, 2, -3)$.

(a) $4x - 2z - 2 = 0$ **(b)** $10x + 4y - z - 21 = 0$

(c) $6x - 3z - 3 = 0$ **(d)** $8x + y - 3z - 8 = 0$

(e) $6x - 2y - 5z + 5 = 0$

6. Find the parametric equations of the line passing through the points $P(3,-1,4)$ and $Q(3,-1,5)$.

(a) $x = 3t$	**(b)** $x = 3$	**(c)** $x = 3+t$	**(d)** $x = t$	**(e)** $x = 0$
$y = -t$	$y = -1$	$y = -1+t$	$y = t$	$y = 0$
$z = 1{+}4t$	$z = 4+t$	$z = 4+t$	$z = 1+4t$	$z = t$

7. Find the volume of the parallelepiped determined by **w**, **u**, and **v** when:
$\mathbf{w} = (2,1,1)$, $\mathbf{v} = (1,0,2)$, and $\mathbf{u} = (2,1,-1)$.
(a) 1 **(b)** 2 **(c)** 3 **(d)** 4 **(e)** 5

8. Find the shortest distance between the following pairs of parallel lines.
$(x,y,z) = (2,-1,3) + t(1,-1,4)$
$(x,y,z) = (1,0,1) + t(1,-1,4)$
(a) $\frac{5}{9}$ **(b)** $\frac{2}{9}$ **(c)** 1 **(d)** $\frac{2}{3}$ **(e)** $\frac{1}{\sqrt{2}}$

9. A parallelogram has sides $AB, BC, CD,$ and DA. Given $A(1,-1,2), C(2,1,0)$, and the midpoint $M(2,0,-3)$ of AB, find $\overrightarrow{BD}$.
(a) $(3,1,-8)$ **(b)** $(-1,0,8)$ **(c)** $(2,2,-10)$ **(d)** $(-3,-2,18)$ **(e)** $(1,-1,2)$

10. Consider the following statements regarding vectors in R^3.
(i) If $\|\mathbf{u}\| = \|\mathbf{v}\|$ then $\mathbf{u}+\mathbf{v}$ is orthogonal to $\mathbf{u}-\mathbf{v}$
(ii) If **v** is orthogonal to $\mathbf{w}_1$ and $\mathbf{w}_2$, then **v** is orthogonal to $\mathbf{u} = k_1\mathbf{w}_1 + k_2\mathbf{w}_2$ for all scalars k_1 and k_2.
(iii) $\|\mathbf{u}+\mathbf{v}\| = \|\mathbf{u}-\mathbf{v}\|$

Which of the above statements are always true?
(a) (i) only
(b) (ii) only
(c) (i) and (ii) only
(d) (iii) only
(e) (ii) and (iii) only

11. Assume **u** and **v** are nonzero vectors that are not parallel. Let $\mathbf{w} = \|\mathbf{u}\|\mathbf{v} + \|\mathbf{v}\|\mathbf{u}$. Find a simplified expression for the cosine of the angle between **u** and **w**.
(a) $\frac{\|\mathbf{u}\|[(\mathbf{u}\cdot\mathbf{v})+\|\mathbf{v}\|]}{\|\mathbf{w}\|}$ **(b)** $\frac{(\mathbf{u}\cdot\mathbf{v})+\|\mathbf{v}\|\|\mathbf{u}\|^2}{\|\mathbf{w}\|}$ **(c)** $\frac{2(\mathbf{u}\cdot\mathbf{v})}{\|\mathbf{w}\|}$ **(d)** $\frac{(\mathbf{u}\cdot\mathbf{v})+\|\mathbf{v}\|\|\mathbf{u}\|}{\|\mathbf{w}\|}$ **(e)** $\frac{\|\mathbf{v}\|\|\mathbf{u}\|}{\|\mathbf{w}\|}$

12. Let V be the set of all ordered pairs of real numbers $\mathbf{u} = (u_1, u_2)$ with $u_1 > 0$, with the usual scalar multiplication, and consider the following operation on $\mathbf{u} = (u_1, u_2)$ and $\mathbf{v} = (v_1, v_2)$.

$$\mathbf{u} + \mathbf{v} = (u_1 v_1, u_2 + v_2)$$

If this set satisfies Axiom 4 of a vector space (the existence of a zero vector), what would be the zero vector?
(a) $(1, 0)$ **(b)** $(0, 0)$ **(c)** $(0, 1)$ **(d)** $(1, 1)$ **(e)** $(0, -1)$

13. Let V be the set of all ordered pairs of real numbers $\mathbf{u} = (u_1, u_2)$ with $u_1 > 0$, with the usual scalar multiplication, and consider the following operation on $\mathbf{u} = (u_1, u_2)$ and $\mathbf{v} = (v_1, v_2)$.

$$\mathbf{u} + \mathbf{v} = (u_1 v_1, u_2 + v_2)$$

If this set satisfies Axiom 5 of a vector space (the existence of the negative of a vector), what would be the value of $-\mathbf{u}$?
(a) $(\frac{1}{u_2}, -u_1)$ **(b)** $(-u_1, -u_2)$ **(c)** $(u_1, -u_2)$ **(d)** $(-u_1, u_2)$ **(e)** $(\frac{1}{u_1}, -u_2)$

For Questions 14-16, determine which of the following answers is correct for the given subset W of $\mathbb{R}^3$.
(a) W is a subspace
(b) W is closed under addition, but not closed under scalar multiplication
(c) W is closed under scalar multiplication, but not closed under addition
(d) W is not closed under scalar multiplication, and not closed under addition

14. $W =$ all vectors of the form $(a, b, 1)$
(a) **(b)** **(c)** **(d)**

15. $W =$ all vectors of the form (a, b, c) where $a - 2c = 0$
(a) **(b)** **(c)** **(d)**

16. $W =$ all vectors of the form (a, b, c) where $c \geq 0$
(a) **(b)** **(c)** **(d)**

17. Find the reduced row echelon form of the following matrix.

$$\begin{bmatrix} -1 & -i & 1 \\ -i & 1 & i \\ 1 & i & -1 \end{bmatrix}$$

(a) $\begin{bmatrix} 1 & i & -1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ **(b)** $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & i \\ 0 & 0 & 0 \end{bmatrix}$ **(c)** $\begin{bmatrix} 1 & i & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ **(d)** $\begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$
(e) $\begin{bmatrix} 1 & 0 & -i \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

18. Find $(\frac{1}{2} + \frac{\sqrt{3}}{2}i)^{60}$.
(a) 1 **(b)** -1 **(c)** $\frac{\sqrt{3}}{2} + \frac{1}{2}i$ **(d)** $\frac{\sqrt{3}}{2} - \frac{1}{2}i$ **(e)** $-\frac{\sqrt{3}}{2} + \frac{1}{2}i$

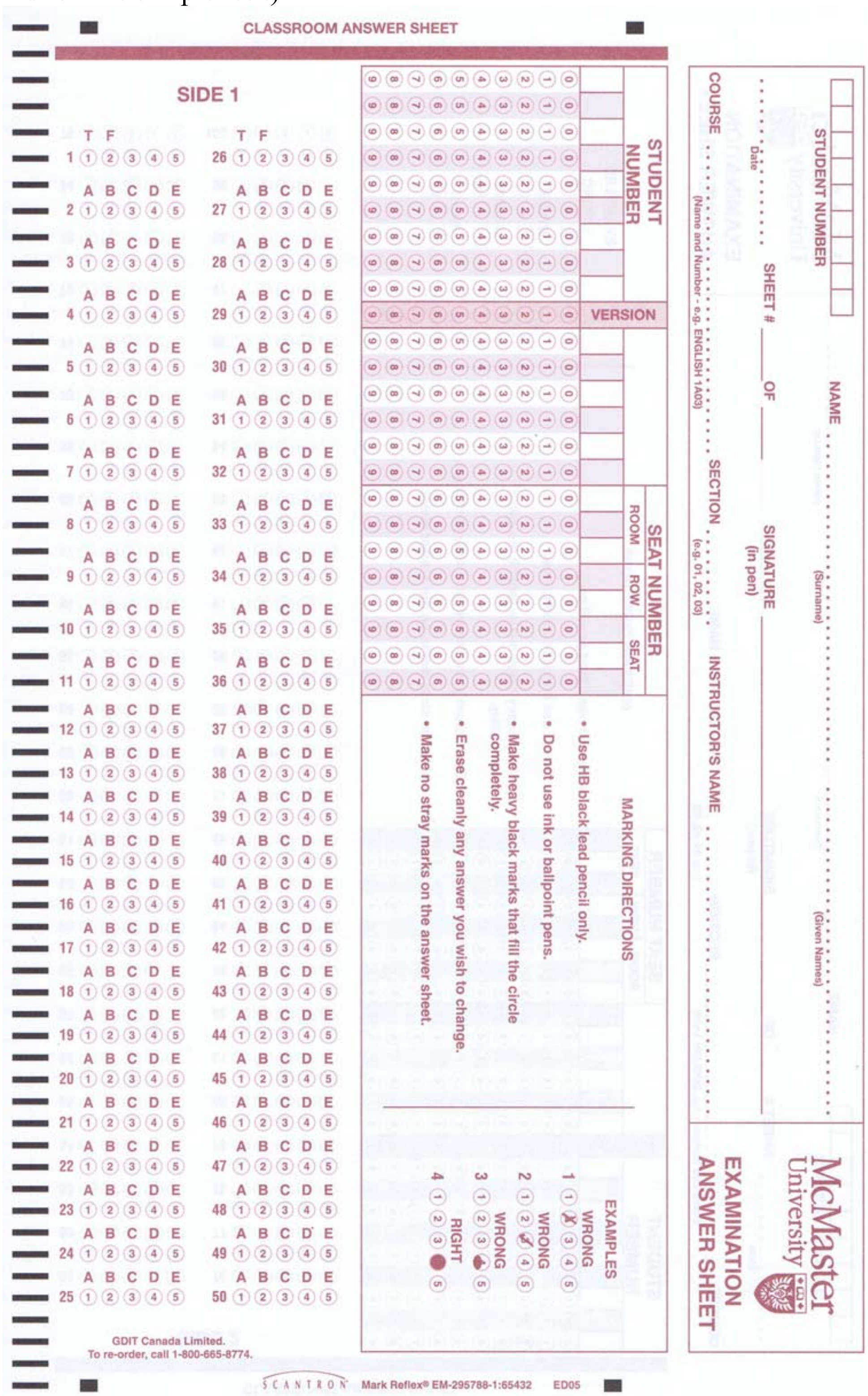
19. Recall that $\mathrm{Re}(z)$ and $\mathrm{Im}(z)$ denote, respectively, the real and imaginary parts of the complex number z. Consider the following statements.
(i) $\mathrm{Re}(iz) = \mathrm{Im}(z)$
(ii) $z - \overline{z} = 2i\,\mathrm{Re}(z)$
Which of the above statements is always true?
(a) (i) only **(b)** (ii) only **(c)** (i) and (ii) **(d)** neither

20. In Matlab, what command could be used to produce the following matrix?

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

(a) `>>diag(1,1,3,2)` **(b)** `>>block(eye(2),3,2)` **(c)** `>>ones(3,2)`
(d) `>>repmat(eye(2),3,2)` **(e)** `>>eye(3,2)`

21. Correctly fill out the bubbles corresponding to all 9 digits of your student number, as well as the version number of your test in the correct places on the computer card. (Use the below computer card for this sample test.)



Math 1B03 Term 2/1ZC3

2nd Sample Test #2

Name:____

(Last Name) (First Name)

Student Number:____________________ **Tutorial Number:**____________________

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1. Find a matrix P such that $P^{-1}AP$ is diagonal. $A = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 3 & 2 \\ 0 & -1 & 0 \end{bmatrix}$

(a) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -2 \\ 0 & 1 & 1 \end{bmatrix}$ **(b)** $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 2 \\ 0 & 1 & 1 \end{bmatrix}$ **(c)** $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & -2 \\ 0 & 1 & 1 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 0 & 0 \\ -1 & -1 & -2 \\ 0 & 1 & 1 \end{bmatrix}$ **(e)** $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & -2 \\ 1 & 1 & 1 \end{bmatrix}$

2. Consider the following statements.

(i) If $P^{-1}AP$ is diagonal, and $P^{-1}BP$ is diagonal, then AB diagonalizable.

(ii) If A is diagonalizable then $\det(A) = \lambda_1\lambda_2\cdots\lambda_n$, where $\lambda_1, \lambda_2, \ldots, \lambda_n$ are the (not necessarily distinct) eigenvalues of A.

(iii) If A is diagonalizable then A must be invertible.

Which of the above statements are always true?

(a) (ii) only

(b) (ii) and (iii) only

(c) all of them

(d) (i) and (iii) only

(e) (i) and (ii) only

3. A fox hunts in three territories A, B, and C. He never hunts in the same territory on two successive days. If he hunts in A on one day, then he hunts in C the next day. If he hunts in B or C on one day, then he is twice as likely to hunt in A the next day as in the other territory. In the long run, what proportion of the time does he spend in C?

(a) $\frac{7}{20}$ **(b)** $\frac{1}{5}$ **(c)** $\frac{9}{20}$ **(d)** $\frac{3}{20}$ **(e)** $\frac{2}{5}$

4. A fox hunts in three territories A, B, and C. He never hunts in the same territory on two successive days. If he hunts in A on one day, then he hunts in C the next day. If he hunts in B or C on one day, then he is twice as likely to hunt in A the next day as in the other territory. If he hunts in A on Monday, what is the probability that he will hunt in B on Wednesday?

(a) $\frac{2}{5}$ **(b)** $\frac{1}{3}$ **(c)** $\frac{1}{4}$ **(d)** $\frac{2}{3}$ **(e)** $\frac{1}{5}$

5. Let $\mathbf{u} = (1, 1, 2), \mathbf{v} = (0, 1, 2), \mathbf{w} = (1, 0, -1)$, and $\mathbf{x} = (2, -1, 6)$. Find the number c such that $\mathbf{x} = a\mathbf{u} + b\mathbf{v} + c\mathbf{w}$

(a) -8 **(b)** 8 **(c)** -9 **(d)** 9 **(e)** 10

6. Find the equation of the plane containing the lines $(x, y, z) = (1, -1, 2) + t(1, 1, 1)$ and $(x, y, z) = (0, 0, 2) + t(1, -1, 0)$.

(a) $x + y + z = 2$ **(b)** $x + y - 3z = -6$ **(c)** $x + y + 4z = 8$
(d) $x + y - 2z = -4$ **(e)** $x + y - z = -2$

7. Find the parametric equations of the line passing through $P(1, 0, -3)$ and parallel to the line with parametric equations $x = -1 + 2t$, $y = 2 - t$, and $z = 3 + 3t$.

(a) $x = 1 - t$, $y = t$, $z = -3 + t$
(b) $x = 1 + 2t$, $y = -t$, $z = -3 + 3t$
(c) $x = 1 - t$, $y = 2t$, $z = -3 + 3t$
(d) $x = 1$, $y = 2t$, $z = -3$
(e) $x = 1 - 2t$, $y = 2t$, $z = -3 + 6t$

8. Compute the projection of $\mathbf{u}$ onto $\mathbf{v}$. $\mathbf{u} = (5, 7, 1), \mathbf{v} = (1, -1, 3)$

(a) $(\frac{54}{11}, 8, \frac{7}{11})$ **(b)** $\frac{1}{11}(1, -1, 3)$ **(c)** $\frac{1}{75}(5, 7, 1)$ **(d)** $\frac{1}{\sqrt{75}\sqrt{11}}$ **(e)** $(\frac{71}{75}, -\frac{82}{75}, \frac{224}{75})$

9. Let $P_1 = P_1(2, 1, -2)$ and $P_2 = P_2(1, -2, 0)$. Find the coordinates of the point P which is $\frac{1}{5}$ of the way from P_1 to P_2.
(a) $(\frac{3}{5}, -\frac{1}{5}, -\frac{2}{5})$ **(b)** $(-\frac{1}{5}, -\frac{3}{5}, \frac{2}{5})$ **(c)** $(\frac{6}{5}, -\frac{7}{5}, -\frac{2}{5})$
(d) $(-\frac{4}{5}, -\frac{12}{5}, \frac{8}{5})$ **(e)** $(\frac{9}{5}, \frac{2}{5}, -\frac{8}{5})$

10. Find the area of the triangle with vertices $A(1, 1, -1), B(2, 0, 1)$, and $C(1, -1, 3)$.
(a) $2\sqrt{5}$ **(b)** $\sqrt{5}$ **(c)** $\sqrt{3}$ **(d)** $2\sqrt{3}$ **(e)** $\sqrt{7}$

11. Find the point on the plane $3x - y + 4z = 1$ closest to the point $P(2, 1, -3)$.
(a) $(\frac{8}{5}, \frac{11}{13}, \frac{7}{8})$ **(b)** $(\frac{7}{3}, -\frac{2}{3}, \frac{5}{3})$ **(c)** $(\frac{25}{11}, -\frac{23}{11}, \frac{9}{11})$
(d) $(-\frac{38}{13}, \frac{11}{13}, \frac{23}{13})$ **(e)** $(\frac{38}{13}, \frac{9}{13}, -\frac{23}{13})$

12. Let $\mathbf{u}$ and $\mathbf{v}$ be vectors in $\mathbb{R}^3$, and consider the following statements.
(i) $\mathbf{u} \cdot \mathbf{v} = \frac{1}{2}\|\mathbf{u} + \mathbf{v}\|^2 - \frac{1}{2}\|\mathbf{u} - \mathbf{v}\|^2$
(ii) $\mathbf{v} - \mathbf{w}$ and $(\mathbf{u} \times \mathbf{v}) + (\mathbf{v} \times \mathbf{w}) + (\mathbf{u} \times \mathbf{w})$ are orthogonal.
(iii) If $\mathbf{u}$ is any vector then the projection of $\mathbf{u}$ on $\mathbf{v}$ equals the projection of $\mathbf{u} - \mathbf{v}$ on $\mathbf{v}$.

Which of the above statements are always true?
(a) (i) and (ii) only
(b) (i) and (iii) only
(c) (ii) and (iii) only
(d) (ii) only
(e) none of them

13. Let V be the set of all ordered pairs of real numbers, and consider the following addition and scalar multiplication operations on $\mathbf{u} = (u_1, u_2)$ and $\mathbf{v} = (v_1, v_2)$.

$$\mathbf{u} + \mathbf{v} = (u_1 + v_1, u_2 + v_2)$$

and

$$k\mathbf{u} = (ku_1 + 1, ku_2).$$

Recall axioms 7-9 of a vector space:
7. $k(\mathbf{u} + \mathbf{v}) = k\mathbf{u} + k\mathbf{v}$
8. $(k + m)\mathbf{u} = k\mathbf{u} + m\mathbf{u}$
9. $k(m\mathbf{u}) = (km)\mathbf{u}$

Which of these axioms are true?
(a) all of them **(b)** **7.** only **(c)** none of them **(d)** **7.** and **8.** only **(e)** **9.** only

For Questions 14-16, determine which of the following answers is correct for the given subset W of $\mathbb{R}^3$.
(a) W is a subspace
(b) W is closed under addition, but not closed under scalar multiplication
(c) W is closed under scalar multiplication, but not closed under addition
(d) W is not closed under scalar multiplication, and not closed under addition

14. $W =$ all vectors of the form (a, b, c) where $a - 2c - 1 = 0$
(a) **(b)** **(c)** **(d)**

15. $W =$ all vectors of the form (a, b, c) where the product $ab \geq 0$.
(a) **(b)** **(c)** **(d)**

16. Let **y** be a given vector. Let $W =$ all vectors **x** such that $\mathbf{y} \cdot \mathbf{x} = 0$.
(a) **(b)** **(c)** **(d)**

17. Solve the following equation for the complex number z. $z(1+i) = \overline{z} + (3+2i)$
(a) $-3+5i$ **(b)** $8-3i$ **(c)** $3+5i$ **(d)** $5-3i$ **(e)** $3+8i$

18. Express the following complex number in polar form. $z = -\sqrt{3} + i$.
(a) $2(\cos\frac{5\pi}{6} + i\sin\frac{5\pi}{6})$ **(b)** $2(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6})$ **(c)** $2(\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3})$
(d) $2(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3})$ **(e)** $2(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3})$

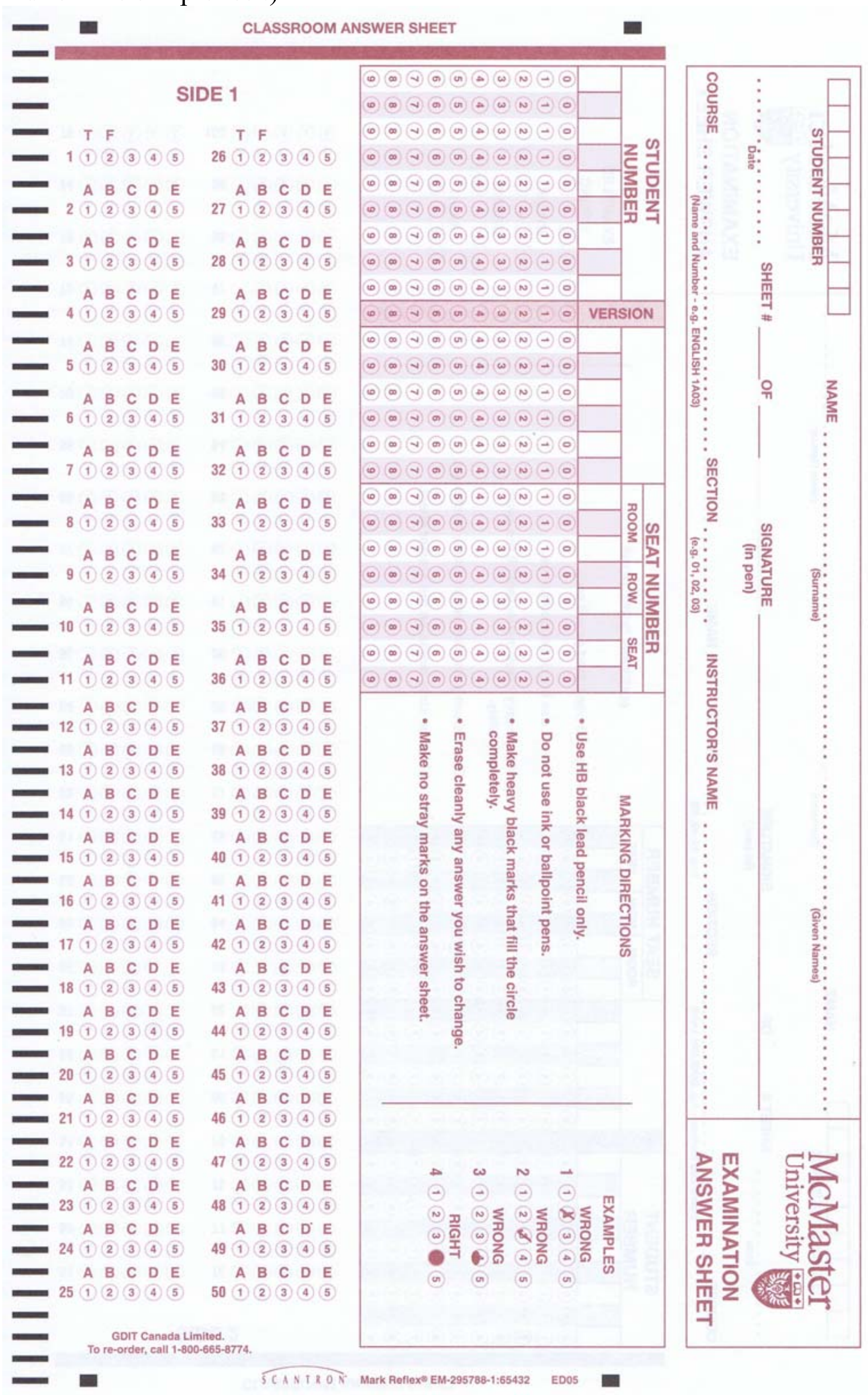
19. Find all complex numbers z such that

$$z^3 = -\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$$

(a) $\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}i$, $e^{i(5\pi/12)}$, $e^{i(7\pi/12)}$
(b) $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$, $e^{i(11\pi/12)}$, $e^{i(19\pi/12)}$
(c) $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$, $-\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$, $\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}i$
(d) $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$, $e^{i(4\pi/5)}$, $e^{i(7\pi/5)}$
(e) $\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}i$, $e^{i(4\pi/5)}$, $e^{i(7\pi/5)}$

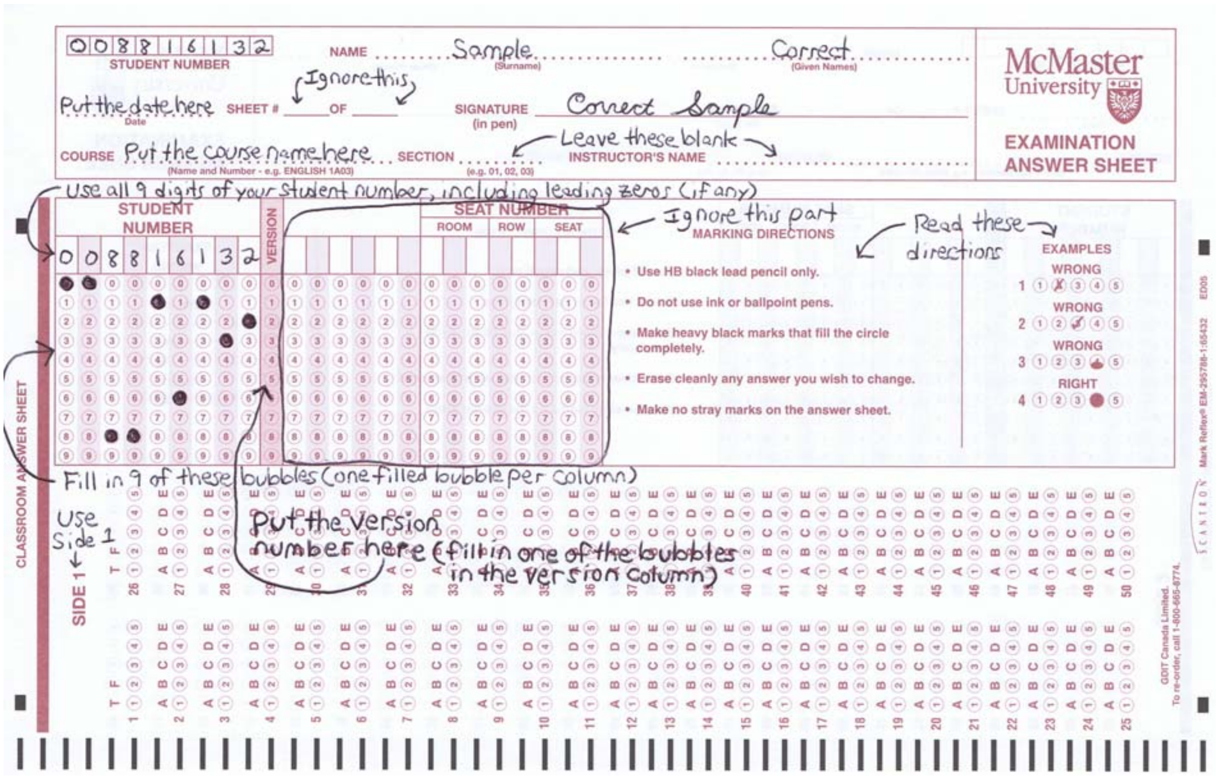
20. In Matlab, what command could be used to find the modulus of the complex number z?
(a) `>>mod(z)` **(b)** `>>modulus(z)` **(c)** `>>abs(z)`
(d) `>>length(z)` **(e)** `>>z*z'`

21. Correctly fill out the bubbles corresponding to all 9 digits of your student number, as well as the version number of your test in the correct places on the computer card. (Use the below computer card for this sample test.)



Answers for 1st Sample Test #2

1. b **2.** e **3.** a **4.** c **5.** b **6.** b **7.** b **8.** d **9.** d **10.** c
11. d **12.** a **13.** e **14.** d **15.** a **16.** b **17.** a **18.** a **19.** d **20.** d
21.



NOTE: On the sample tests, a version number is not given. On the actual tests, it will say "Version X" at the top, where X is the version number that you will have to fill in on the computer card. The sample above assumes that your student number is 008816132. On the actual test, you will have to fill in the bubbles corresponding to YOUR student number (not 008816132).

Answers for 2nd Sample Test #2

1. c **2.** e **3.** c **4.** b **5.** a **6.** d **7.** b **8.** b **9.** e **10.** b
11. e **12.** e **13.** c **14.** d **15.** c **16.** a **17.** b **18.** a **19.** b **20.** c
21. see the answer to #21 on the first sample test above.