MAT 1341A Diagnostic test 2012

September 15, 2012. Duration: 80 minutes

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θ	$\sin\theta$	$\cos\theta$
0	0	1
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$
$\frac{\pi}{2}$	1	0

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total	

Family Name:_____

First Name:_____

Student number:_____

PLEASE READ THESE INSTRUCTIONS CAREFULLY.

1. You have 80 minutes to complete this exam.
2. This is a closed book exam, and no notes of any kind are allowed. The use of any calculator, text storage or communication device is not permitted.
3. Read each question carefully – you will save yourself time and unnecessary grief later on.
4. All questions are multiple choice, are worth 1 point each and no part marks will be given. Please record your answers in the spaces provided next to the question numbers above.
5. Where it is possible to check your work, do so.
6. Good luck! Bonne chance!

1. The distance from the point $(1,\ 0,\ -1)$ to the plane with equation $2x - y + z = 7$ is:

A. $\sqrt{6}$
B. $2\sqrt{6}$
C. $\dfrac{\sqrt{6}}{2}$
D. $\dfrac{1}{6}$
E. $\dfrac{1}{3}$
F. $-2\sqrt{6}$

2. Consider the following two lines given in scalar parametric form:

$$L_1 = \{(x, y, z) \mid x = -2s + 1,\ \ y = s + 2,\ \ \text{and } z = 4s + 1, \text{where } \ s \in \mathbf{R}\}$$

$$L_2 = \{(x, y, z) \mid x = t + 3,\ \ y = t + 1,\ \ \text{and } z = t - 3, \text{where } \ t \in \mathbf{R}\}$$

Which **one** of the following statements is correct?

A. L_1 and L_2 intersect at $(3,\ 1,\ -3)$.
B. L_1 and L_2 intersect at $(-3,\ 1,\ -3)$.
C. L_1 and L_2 intersect at $(3,\ -1,\ -3)$.
D. L_1 and L_2 are parallel.
E. L_1 and L_2 are perpendicular.
F. L_1 and L_2 are not coplanar.

3. The intersection of three (not necessarily distinct) planes in $\mathbf{R}^3$ is <u>always</u>

A. Empty

B. A line

C. A plane

D. A point

E. A point, or a line, or a plane

F. Empty, or a point, or a line, or a plane

4. The equation $5x - y + 6z = -3$ is the equation of ...

A. a line in $\mathbf{R}^3$ with direction vector $(5,\ -1,\ 6)$.

B. a plane passing through the points $(9,\ 0,\ -8)$, $(1\ ,1,\ 1)$ and $(0,\ 3,\ 0)$.

C. a plane with normal vector $(5,\ -1,\ 6)$ and passing through the point $(0,\ 3,\ 1)$.

D. a plane with normal vector $(5,\ -1,\ 6)$ and passing through the point $(9,\ 0,\ -8)$.

E. a line in $\mathbf{R}^3$ passing through the points $(0,\ 3,\ 0)$ and $(9,\ 0,\ -8)$

F. a plane, with normal vector $(0,\ 3,\ 0)$ and passing through the point $(5,\ -1,\ 6)$

5. The volume of the parallelepiped with edges given by the vectors $u = (1, -1, 0)$, $v = (0, 1, 2)$ and $w = (2, 0, 1)$ is:

A. 1

B. 2

C. 3

D. 4

E. 5

F. 0

6. Find the area of the triangle with vertices (2, 1, 0), (0, −1, 2) and (1, −2, 2).

A. $\sqrt{6}$

B. $2\sqrt{6}$

C. $\frac{\sqrt{6}}{2}$

D. $\frac{\sqrt{6}}{6}$

E. $\frac{\sqrt{6}}{3}$

F. $4\sqrt{6}$

7. A direction vector for the line of intersection of the planes with equations $x - 2y = 1$ and $x + y - z = 0$ is:

A. $(2, 1, 3)$

B. $(-2, 1, 3)$

C. $(-2, -1, 3)$

D. $(2, -3, -1)$

E. $(-2, 3, -1)$

F. $(2, 3, -1)$

8. Parametric equations of the line containing $(1, -1, 2)$ and which is parallel to the two planes with equations $x - y = 1$ and $x + y - 3z = 0$ are:

A. $x = 1 + 3t$, $y = -1 + 3t$, $z = 2 + 2t$, $t \in \mathbf{R}$

B. $x = 1 - 3t$, $y = -1 + 3t$, $z = 2 + 2t$, $t \in \mathbf{R}$

C. $x = 1 - 3t$, $y = 1 + 3t$, $z = 2 + 2t$, $t \in \mathbf{R}$

D. $x = 1$, $y = -1 + 3t$, $z = 2 + 2t$, $t \in \mathbf{R}$

E. $x = 1 + 3t$, $y = 1$, $z = 2 + 2t$, $t \in \mathbf{R}$

F. $x = 1 - 3t$, $y = -1$, $z = 2 + 2t$, $t \in \mathbf{R}$

9. Find a scalar equation for the plane

$$H = \{(1 + s + 2t, 2 + t, 1 + s) \mid s, t \in \mathbf{R}.\}$$

A. $x - 2y - z = 4$

B. $x + 5y - 2z = 9$

C. $-x + 2y + z = 4$

D. $x - 2y + z = -3$

E. $-x - 2y + z = -4$

F. $3x + 2y - z = -2$

10. If $u = (1,\ 1,\ 1)$ and $v = (2,\ 1,\ 3)$ find the orthogonal projection of u on v, that is, $\text{proj}_v u$.

A. $\frac{3}{7}(2,\ 1,\ 3)$

B. $\frac{4}{7}(2,\ 1,\ 3)$

C. $\frac{3\sqrt{14}}{7}(2,\ 1,\ 3)$

D. $(1,\ 1,\ 1)$

E. $\frac{3}{7}(3,\ 3,\ 3)$

F. $2\sqrt{3}\ (1,\ 1,\ 1)$

11. Evaluate $\mathrm{Im}(z)$ if

$$z = \frac{1-3i}{1+i}.$$

A. 2
B. -2
C. -1
D. 1
E. 3
F. -3

12. Find the polar form of:

$$\frac{1+i}{1-\sqrt{3}i}$$

A. $\frac{\sqrt{2}}{2}\Big(\cos(-\frac{7\pi}{12}) + i\sin(-\frac{7\pi}{12})\Big)$
B. $\frac{\sqrt{2}}{2}\Big(\cos(\frac{7\pi}{12}) + i\sin(\frac{7\pi}{12})\Big)$
C. $\sqrt{2}\Big(\cos(-\frac{\pi}{12}) + i\sin(-\frac{\pi}{12})\Big)$
D. $\sqrt{2}\Big(\cos(\frac{5\pi}{12}) + i\sin(\frac{5\pi}{12})\Big)$
E. $\sqrt{2}\Big(\cos(-\frac{5\pi}{12}) + i\sin(-\frac{5\pi}{12}\Big)$
F. $\frac{\sqrt{2}}{2}\Big(\cos(\frac{\pi}{12}) + i\sin(\frac{\pi}{12})\Big)$