UNIVERSITÉ D'OTTAWA • UNIVERSITY OF OTTAWA

Sciences • Science

Mathématiques et statistique
Mathematics and Statistics

# MAT 1341A Diagnostic Fall 2006

September 14, 2006. Duration: 80 minutes

Instructor: Barry Jessup

| $\theta$ | $\sin\theta$ | $\cos\theta$ |
|---|---|---|
| 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 |

Family Name:_____

First Name:_____

Student number:_____

| Question | Response |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| (bonus) 13 | |
| Total | |

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 calculators, cell phones, pagers or any 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 opposite the question numbers in the table above.**
5. Where it is possible to check your work, do so.
6. Good luck! Bonne chance!

**1.** An equation for the plane which contains the two lines with parametric equations $x + 1 = t,\ y - 6 = -t,\ z + 4 = 3t$ and $x + 3 = -4s,\ y - 6 = 2s,\ z - 7 = 5s,$ is:

A. $7x - 11y + 2z = 47$
B. $11x - 2y + 9z = 23$
C. $16x - 12y + z = 11$
D. $11x + 17y + 2z = 83$
E. $8x + 9y - 13z = 46$
F. $22x + 19y + 4z = 42$

**2.** An equation for the plane passing through the points (0, 0, -3) and (-1, 2, 1), and which is parallel to the x-axis is:

A. $-3x + 7y - 2z = 3$
B. $2x - z = 5$
C. $x + y - z = 4$
D. $x - y = 1$
E. $2y - z = 3$
F. $x + y + z = 2$

**3.** Find an equation of the plane which passes through the point $(1,\ -7,\ 8)$ and which is perpendicular to the line whose parametric equations are:

$$x = -6 + 4t,\ y = 12 - 8t,\ z = -73 + 2t;\ t \in \mathbf{R}.$$

A. $2x - 4y + z = -38$
B. $2x - 4y + z = 38$
C. $2x + 7y - 3z = -71$
D. $2x - 4y + z = -28$
E. $-4x + 2y + z = -10$
F. $-4x + 2y + z = 10$

**4.** Parametric equations for the line containing $(3,\ -1,\ 4)$ and $(-1,\ 5,\ 1)$ are:

A. Such a line does not exist.
B. $x = 3 + 4t,\ y = 3 + 6t,\ z = 4 + 3t;\ t \in \mathbf{R}$.
C. $x = 1 - t,\ y = -1 - 6t,\ z = 4 + 3t;\ t \in \mathbf{R}$.
D. $x = 3 + 4t,\ y = -1 - 6t,\ z = 6 + t;\ t \in \mathbf{R}$.
E. $x = 3 + 4t,\ y = -1 - 6t,\ z = 4 + 3t;\ t \in \mathbf{R}$.
F. $x = 1 - t,\ y = 3 + 6t,\ z = 6 + t;\ t \in \mathbf{R}$.

**5.** An equation of the plane containing the points $(6,\ -1,\ 5)$, $(7,\ 2,\ -4)$ and $(1,\ 1,\ 5)$ is:

A. $12x + 15y + 8z - 46 = 0$
B. $12x + 15y - 8z + 23 = 0$
C. $18x - 45y + 17z + 148 = 0$
D. $18x + 45y + 17z = 148$
E. $6x + 15y + 5z - 46 = 0$
F. $6x + 15y + 5z = -46$

**6.** Find all vectors in $\mathbf{R}^3$ which are perpendicular to both $(-1, 1, 5)$ and $(2, 1, 2)$.

A. $\{(2,\ -8,\ 2)\}$
B. $\{(t+1,\ -8,\ t+1) |\ t \in \mathbf{R}\}$
C. $\{(t,\ -4t,\ t) |\ t \in \mathbf{R}\}$
D. $\{(-t,\ 0,\ t) |\ t \in \mathbf{R}\}$
E. $\{(0,\ 0,\ 0)\}$
F. $\{(3,\ -12,\ 3)\}$

**7.** A triangle has vertices $A = (1,\ 1,\ 1)$, $B = (2,\ 3,\ 1)$ and $C = (1,\ 2,\ 3)$. Find the cosine of the interior angle at $A$.

A. 0
B. 1/5
C. 2/5
D. 3/5
E. 4/5
F. 1

**8.** Find the angle between the vectors $(0,\ 3,\ 4)$ and $(5\sqrt{2},\ -7,\ -1)$.

A. $\pi/3$
B. $\pi/6$
C. $2\pi/3$
D. $3\pi/4$
E. $5\pi/6$
F. $\pi$

**9.** If $u = (3,\ 3,\ 6)$ and $v = (2,\ -1,\ 1)$ then the length of the projection of $u$ along $v$ is:

A. $(3\sqrt{6})/2$
B. $(3\sqrt{2})/2$
C. 0
D. $\sqrt{6}/2$
E. $(2\sqrt{6})/3$
F. $(2\sqrt{2})/3$

**10.** Find the area of the triangle whose vertices are the points $P = (3,\ -1,\ 2)$, $Q = (1,\ 1,\ 0)$ and $R = (1,\ 2,\ -1)$.

A. 4
B. $2\sqrt{2}$
C. $\sqrt{2}$
D. 0
E. $4\sqrt{2}$
F. 2

**11.** Write the complex number

$$\frac{(16+13i)(1+2i)}{10+5i}$$

in the form a + $i$ b.

A. $1+4i$
B. 3
C. $1-4i$
D. $4i$
E. $(1/5)+(4/5)i$
F. $-(1/5)+(4/5)i$

**12.** What is the polar form of $3\sqrt{3}-3i$?

A. $36(\cos(\pi/6)+i\sin(\pi/6))$
B. $6(\cos(-\pi/6)+i\sin(-\pi/6))$
C. $36(\cos(-\pi/6)+i\sin(-\pi/6))$
D. $6(\cos(\pi/6)+i\sin(\pi/6))$
E. $36(\cos(-\pi/3)+i\sin(-\pi/3))$
F. $6(\cos(\pi/3)+i\sin(\pi/3))$

**13 (bonus).** Suppose $A = (2,\ 4,\ 1)$, $B = (3,\ 0,\ 9)$, $C = (1,\ 4,\ 0)$ and $D = (2,\ 6,\ 2)$. Find the cosine of the angle between the line $\overleftrightarrow{AD}$ and the plane containing $A$, $B$ and $C$.

A. $1/\sqrt{5}$
B. $8/\sqrt{5}$
C. $6/\sqrt{5}$
D. $3/\sqrt{5}$
E. $4/\sqrt{5}$
F. $2/\sqrt{5}$

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