
# MAT 1341A Diagnostic test 2013

September 14, 2013. 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 |

| | |
|---|---|
| 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.** If $u = (3,\ 0,\ 3),\ v = (-5,\ 1,\ -8)$ and $w = (1,\ 4,\ 2)$, then $\|(2u + v) \times w\|$ is:

A. $10\sqrt{5}$
B. $25$
C. $2\sqrt{10}$
D. $2\sqrt{5}$
E. $5\sqrt{5}$
F. $5\sqrt{2}$

**2.** Parametric equations of the line passing through $(1,\ 1,\ -1)$ and which is perpendicular to the plane $-2x - y + 3z = 6$ are:

A. $x = 1 - 2t,\ y = 1 + t,\ z = -1 + 3t,\ t \in \mathbf{R}$
B. $x = 1 + t,\ y = 1 + t,\ z = -1 - 3t,\ t \in \mathbf{R}$
C. $x = 1 + 2t,\ y = 1 - t,\ z = -1 + 3t,\ t \in \mathbf{R}$
D. $x = 1 - t,\ y = 1 + t,\ z = -1 - 6t,\ t \in \mathbf{R}$
E. $x = 1 - 2t,\ y = 1 - t,\ z = -1 + 3t,\ t \in \mathbf{R}$
F. $x = 1 - 4t,\ y = 1 - t,\ z = -1 - 3t,\ t \in \mathbf{R}$

**3.** Which of the vectors below is perpendicular (orthogonal) to both $(2,\ 1,\ -1)$ and $(1,\ 1,\ 5)$?

A. (-4, 0, 3)
B. (3, 0, 2)
C. (1, 0, 1)
D. (2, -5, -1)
E. (1, -2, 0)
F. None of the above

**4.** Find the volume of the parallelepiped determined by the vectors $u = (1,\ 1,\ -1)$, $v = (3,\ 1,\ 0)$ and $w = (1,\ -1,\ 3)$.

A. 6
B. -6
C. 16
D. -2
E. 4
F. 2

**5.** An equation for the plane passing through the points (1, 2, -1) and (2, 3, 1), and parallel to the $y$-axis is:

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

**6.** Find an equation of the plane which passes through the point (1, 2, 3) and which is perpendicular to the line whose parametric equations are:

$$x = 2 + 2t,\ y = 7 - 4t,\ z = -3 + t;\ t \in \mathbf{R}.$$

A. $2x - 4y + z = -3$
B. $2x + 7y - 3z = 7$
C. $2x - 4y + z = -5$
D. $-4x + 2y + z = 3$
E. $2x - 4y + z = 0$
F. $-4x + 2y + z = 4$

**7.** If $u = (3,\ 3,\ 3)$ and $v = (4,\ 2,\ 6)$ then $\text{proj}_v u =$

A. $\frac{9}{7}(3,\ 3,\ 3)$
B. $\frac{12}{7}(3,\ 3,\ 3)$
C. $\frac{11}{7}(3,\ 3,\ 3)$
D. $\frac{9}{7}(2,\ 1,\ 3)$
E. $\frac{12}{7}(2,\ 1,\ 3)$
F. $\frac{11}{7}(2,\ 1,\ 3)$

**8.** If $A = (2,\ 4,\ 1),\ B = (3,\ 0,\ 9)$ and $C = (1,\ 4,\ 0)$, find the angle $\angle BAC$.

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

**9.** Express the following complex numbers in the form $a + b\,i$ with $a$ and $b$ real.

$$z_1 = \frac{1}{1-i}$$

$$z_2 = (2+i)(1+i)$$

A. $z_1 = (1/2) - (1/2)i \ ; \ z_2 = 1 - 3i$
B. $z_1 = (1/2) + (1/2)i \ ; \ z_2 = 1 + 3i$
C. $z_1 = 2 - (1/4)i \ ; \ z_2 = 6 - 2i$
D. $z_1 = 1 - i \ ; \ z_2 = 4$
E. $z_1 = 1 - i \ ; \ z_2 = 4 + 4i$
F. $z_1 = -1 + i \ ; \ z_2 = 2 + 4i$

**10.** The point of intersection of the line passing through $(1,\ 1,\ 0)$ and $(0,\ 1,\ 0)$ with the plane with equation $x + y - z = 1$ is:

A. $(1/2,\ 1/2,\ 0)$
B. $(0,\ 1/2,\ -1/2)$
C. $(0,\ 1,\ 0)$
D. $(1/2,\ 0,\ -1/2)$
E. $(-1,\ 0,\ -1)$
F. $(1,\ 0,\ 0)$

**11.** Find the polar form of

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

A. $\sqrt{2}(\cos(-\pi/12)+i\sin(-\pi/12))$
B. $\sqrt{2}(\cos(\pi/12)+i\sin(\pi/12))$
C. $\sqrt{2}(\cos(-5\pi/12)+i\sin(-5\pi/12))$
D. $\sqrt{2}(\cos(11\pi/12)+i\sin(11\pi/12))$
E. $\sqrt{2}(\cos(-7\pi/12)+i\sin(-7\pi/12))$
F. $\sqrt{2}(\cos(5\pi/12)+i\sin(5\pi/12))$

**12.** What is the area of the triangle with vertices $(4,\ 1,\ -1), (6,\ 3,\ 0)$ and $(6,\ 10,\ 1)$?

A. 13
B. 15
C. 13/2
D. 15/2
E. 11
F. 17/2