Score:

Name:_____

Section (circle one): 1041 2042
Team (circle one): a b c d e

SM221 – Sample Test #1– Spring 2006

Part 1: Multiple Choice (50%). For each question, circle the letter for he best answer.

1. Let *A, B, C, D*, and *E* be the vertices (in order) of a pentagon with each side of length 1. Then $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CD}$ equals:

(a) $\overrightarrow{AD}$ (b) 3 (c) $\overrightarrow{AB}-\overrightarrow{CD}$ (c) $\overrightarrow{DA}$ (d) $\overrightarrow{AE}$ (e) $\overrightarrow{AB}+\overrightarrow{CD}$

2. If $|y|=4$, $|z|=5$, and $y\cdot z=0$, $|y\times z|$ is:

(a) 0 (b) $\sqrt{10}$ (c) $\sqrt{20}$ (d) 10 (e) 20

3. The line through the two points (-1,2,1) and (1,1,2) also contains the point:

(a) (0,0,0) (b) (0,3,3) (c) (3,0,3) (d) (3,3,0) (e) (3,2,3)

4. The angle between the vectors $\langle 2,-2,1\rangle$ and $\langle 3,0,0\rangle$ is approximately:

(a) 0.383 rad (b) 0.841 rad (c) 0.931 rad (d) 6 rad (e) 48.2 rad

5. The plot for the equation $x^2+4y^2+9z^2=36$ is a:

(a) sphere (b) cylinder (c) ellipsoid (d) parabolic cylinder (e) plane

6. The equation of the line through the point (1,3,-1) perpendicular to the plane $2x-y+z=3$ is given by:

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

7. Which of these planes is <u>parallel</u> to the line $x=2-t,\ y=-2+\frac{1}{2}t,\ z=1+2t$?

(a) $x-\frac{1}{2}y-2z=2007$ (b) $2x-2y+z=2007$ (c) $x-2y-\frac{1}{2}z=2007$

(d) $-\frac{1}{2}x+\frac{1}{2}y-z=2007$ (e) $2x+z=2007$

8. Which of these planes is <u>perpendicular</u> to the line $x=2-t,\ y=-2+\frac{1}{2}t,\ z=1+2t$?

(a) $x-\frac{1}{2}y-2z=2007$ (b) $2x-2y+z=2007$ (c) $x-2y-\frac{1}{2}z=2007$

(d) $-\frac{1}{2}x+\frac{1}{2}y-z=2007$ (e) $2x+z=2007$

9. Suppose $\vec{u}$ and $\vec{w}$ are unit vectors, and the angle between them is $30°$. What is the magnitude of $\left|\vec{u}\times\vec{w}\right|$?

(a) 0 (b) 1 (c) $\sqrt{3}$ (d) $\frac{1}{2}$ (e) $\frac{\sqrt{3}}{2}$

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10. Suppose $\vec{v}$ and $\vec{w}$ are vectors. Which of the following expressions is a vector?

(a) $\vec{v}\cdot\vec{w}$ (b) $\left|\vec{v}\right|+\vec{w}$ (c) $\vec{v}/\vec{w}$ (d) $\left|\vec{v}\right|\vec{w}$ (e) $\left|\vec{v}+\vec{w}\right|$

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11. If $\vec{v}=\langle 0,2,-1\rangle$ and *P* is the point (0,2,-1), then $0(x-4)+2(y-1)-(z-2)=0$ is the equation of:

(a) a line parallel to $\vec{v}$ (b) a line through *P* (c) a plane parallel to $\vec{v}$

(d) a planed through *P* (e) a plane perpendicular to $\vec{v}$

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12. Which of the following is a unit vector?

(a) $\langle 2,1,-2\rangle$ (b) $\left\langle \frac{2}{3},\frac{1}{3},-\frac{2}{3}\right\rangle$ (c) $\langle 1,1,1\rangle$ (d) $\langle 3,3,3\rangle$ (e) $\left\langle \frac{1}{3},\frac{1}{3},\frac{1}{3}\right\rangle$

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13. The vertices of a rectangle are A, B, C, and D (in order). The vector $\overrightarrow{AB}-\overrightarrow{BC}$ is equal to:

(a) $\overrightarrow{AC}$ (b) $\overrightarrow{DB}$ (c) $\overrightarrow{AD}$ (d) $\overrightarrow{BC}$ (e) $\overrightarrow{CB}$

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14. A vector perpendicular to both $\langle 1,2,3\rangle$ and $\langle 2,1,-1\rangle$ is:

(a) $\langle -5,7,-3\rangle$ (b) $\langle -2,1,0\rangle$ (c) $\langle 0,-3,2\rangle$ (d) $\langle 3,3,3\rangle$ (e) $\langle 0,1,0\rangle$

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15. The point on the Cartesian coordinates *(x,y,z)=(2,2,0)* has the spherical coordinates (ρ,θ,ϕ)=

(a) $\left(\sqrt{8},\frac{\pi}{4},\frac{\pi}{2}\right)$ (b) $\left(8,\frac{\pi}{4},\frac{\pi}{2}\right)$ (c) $\left(\sqrt{8},\frac{\pi}{2},\frac{\pi}{4}\right)$ (d) $\left(8,\frac{\pi}{4},\frac{\pi}{2}\right)$ (e) $\left(8,\frac{\pi}{2},\frac{\pi}{2}\right)$

Part 2: Free Response (50 %). The remaining problems are not multiple choice. Answer them in the space below the problem. Show the details of your work and clearly indicate your answers.

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16. Given the vectors $\vec{u}=\langle 4,3,-12\rangle$ and $\vec{v}=\langle -2,1,2\rangle$ find

(a) $2\vec{u}-3\vec{v}$ (b) $\vec{u}\cdot 3\vec{v}$ (c) $2\vec{u}\times 3\vec{v}$

(d) a unit vector in the direction of $2\vec{u}-3\vec{v}$

(e) $comp_{\vec{v}}\vec{u}$

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17. (a) Find the parametric equations for the line through (1,-1,0) and (2,2,1).
(b) Find the equation of the plane through (1,2,3), (2,5,4), and (0,4,-1).
(c) Verify that your line and your plane are parallel.
(d) Find the distance between any point on your line and your plane.

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18. Consider the points *A=(5,0,0), B=(0,3,0),* and *C=(0,0,2)* which are the vertices of a triangle:
(a) Compute $\overrightarrow{CA} \cdot \overrightarrow{CB}$
(b) Determine angle *C* to the nearest degree.
(c) Find $proj_{\overrightarrow{CA}} \overrightarrow{CB}$
(d) Compute $\overrightarrow{CA} \times \overrightarrow{CB}$.
(e) Find the equation of the plane *E* that contains *A, B,* and *C*.
(f) Find the line through the origin perpendicular to the plane *E.*
(g) Find the area of the triangle formed by *A, B,* and *C*.

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19. Somewhere in the South Pacific: Your ship is traveling on a course 060 at a speed of 10 knots. There is a westerly ocean current with a direction of 270 and a speed of 4 knots. What is your true course and speed?

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20. Somewhere over the North Atlantic: Your F18 Hornet is flying on a course 045 at a speed of 400 knots in the jet stream whose direction is 090 and a speed of 100 knots. What is your true course and ground speed?
