MAC2313 Test 1 A

(5 pts) 1. For the curve given parametrically by $\mathbf{r}(\mathrm{t}) = \langle 1, \mathrm{t}, \mathrm{t}^2 \rangle$, the unit tangent vector to the curve at $t = 1$ is parallel to which of the following?

A. $\langle 0, 2, 4 \rangle$ B. $\langle 1, 0, 1 \rangle$ C. $\langle 1, 0, -1 \rangle$ D. $\langle 4, -2, 1 \rangle$ E. $\langle 0, 1, -1 \rangle$

(5 pts) 2. Which of the following is the equation of the trace generated by intersecting the surface $z = x^2 + y^2 - 4$ with the plane $y = -2$?

A. $z = 0$ B. $z = -x^2$ C. $z = x^2 - 8$ D. $z = x^2$ E. none of the above

(5 pts) 3. If $\mathbf{r}(\mathrm{t})$ is a smooth curve in R^3, then which of the following is true:

A. $\kappa = \frac{1}{|\mathbf{v}|} \left| \frac{d\mathbf{T}}{ds} \right|$

B. $\mathbf{B} = \mathbf{T} \times \mathbf{N}$

C. $\mathbf{T} = \frac{\mathbf{v}'}{|\mathbf{v}'|}$

D. $\mathbf{r} = \mathbf{a}''$

E. $|\mathbf{T}| > 1$

(5 pts) 4. Which of the following vectors is orthogonal to the plane containing the points $(2, 0, 0)$, $(0, -3, 0)$, and $(0, 0, 1)$?

A. $\langle 6, -4, -12 \rangle$ B. $\langle -6, -4, 12 \rangle$ C. $\langle -8, 4, -2 \rangle$ D. $\langle -3, 2, -6 \rangle$ E. $\langle 0, 1, 0 \rangle$

(5 pts) 5. If $\mathbf{u} = \langle 10, -3, 5\rangle$ and $\mathbf{v} = \langle 2, 0, 4\rangle$, then $\mathbf{u}_\perp$ is equal to:

A. $\langle 6, -3, 3\rangle$ B. $\langle 4, 0, 8\rangle$ C. $\langle -4, 0, -8\rangle$ D. $\langle 6, -3, -3\rangle$ E. $\langle 2, 1, 1\rangle$

(5 pts) 6. If $\mathbf{u}, \mathbf{v}$, and $\mathbf{w}$ are vectors in R^3 and λ is a scalar, then which of the following are true?

I. $(\mathbf{u} \times \mathbf{w}) + (\mathbf{w} \times \mathbf{v}) = (\mathbf{u} + \mathbf{v}) \times \mathbf{w}$

II. $\mathbf{w} \times \mathbf{w} = \mathbf{0}$

III. $(\mathbf{u} + \mathbf{v}) \times \mathbf{w} = \mathbf{u} \times (\mathbf{v} + \mathbf{w})$

IV. $\lambda\mathbf{u} \times \mathbf{v} = \mathbf{u} \times \lambda\mathbf{v}$

A. only I B. only III C. only II and IV D. only II and III E. only II, III, and IV

(5 pts) 7. The equation of the plane containing the origin and the vectors $\langle 1, 1, 2\rangle$ and $\langle -1, 0, 1\rangle$ is given by:

A. $-2x + 3y + z = 3$ B. $x - 3y + z = 0$ C. $x - 3y - z = 0$ D. $-2x + 3y + z = -3$

E. none of the above

(5 pts) 8. The vector equation of the line containing the points $(2, -1, 3)$ and $(-4, 6, 5)$ is given by:

A. $\mathbf{r}(\mathrm{t}) = \langle 2 - 6\mathrm{t}, -1 + 7\mathrm{t}, 3 + 2\mathrm{t}\rangle$ B. $\mathbf{r}(\mathrm{t}) = \langle -4 + 6\mathrm{t}, 6 - 7\mathrm{t}, 5 + 2\mathrm{t}\rangle$

C. $\mathbf{r}(\mathrm{t}) = \langle 2 + 4\mathrm{t}, -1 - 6\mathrm{t}, 3 - 5\mathrm{t}\rangle$ D. $\mathbf{r}(\mathrm{t}) = \langle -4 + 2\mathrm{t}, 6 - \mathrm{t}, 5 + 3\mathrm{t}\rangle$

E. $\mathbf{r}(\mathrm{t}) = \langle -4 - 2\mathrm{t}, 6 + \mathrm{t}, 5 - 3\mathrm{t}\rangle$

(5 pts) 9. Which of the following are true in R^3?

I.The magnitude of the zero vector is zero.

II. If $\mathbf{v}$ is a nonzero vector, then the projection of the zero vector onto $\mathbf{v}$ is the zero vector.

III. The zero vector is orthogonal to every vector.

IV. The zero vector is parallel to every vector.

A. only I B. only III C. only IV D. only I and III E. I, II, III, and IV

(5 pts) 10. Given $\mathbf{r}(\mathrm{t}) = \langle \tan \mathrm{t},\ \ln(1+\mathrm{t}^2), \mathrm{t}/(\mathrm{t}+1)\rangle$, which of the following is the equation of the tangent line to the curve at $t = 0$.

A. $x = t,\ y = 0,\ z = t$ B. $x = t,\ y = 0,\ z = 2t$ C. $x = 2t,\ y = 0,\ z = t$

D. $x = t,\ y = t,\ z = 2t$ E. $x = t,\ y = -t,\ z = t$

(5 pts) 11. The length of the curve $\mathbf{r}(\mathrm{t}) = \langle 3\mathrm{t}^2+1, 3\mathrm{t}^2-2, \mathrm{t}^3\rangle, \mathrm{t} \in [0,1]$ is:

A. 27 B. $27-16\sqrt{2}$ C. $27-8\sqrt{2}$ D. $27-4\sqrt{2}$ E. none of the above

(5 pts) 12. The position of a object in R^3 as a function of time is given by $\mathbf{r}(\mathrm{t}) = \langle \mathrm{e}^{2\mathrm{t}-2}, \cos \pi\mathrm{t}, 2\mathrm{t}\rangle$; what is the magnitude of the acceleration of the object when $t = 1$?

A. 4 B. $2e^2$ C. $\sqrt{2e^2+\pi^2}$ D. $\sqrt{4+\pi^4}$ E. $\sqrt{16+\pi^4}$

(5 pts) 13. Let $\mathbf{u}$ and $\mathbf{v}$ be differentiable vector-valued functions, $f(t)$ a differentiable real-valued function, and $\mathbf{c}$ a constant vector. Which of the following are true?

I. $\frac{d}{dt}\ \mathbf{u}(\mathrm{f(t)}) = \mathbf{u}(\mathrm{f(t)})\mathrm{f'(t)}$.

II. $\frac{d}{dt}\ (\mathbf{u}(\mathrm{t}) \cdot \mathbf{v}(\mathrm{t})) = \mathbf{u}'(\mathrm{t}) \cdot \mathbf{v}(\mathrm{t}) + \mathbf{u}(\mathrm{t}) \cdot \mathbf{v}'(\mathrm{t})$.

III. $\frac{d}{dt}\ (\mathbf{u}(\mathrm{t}) \times \mathbf{v}(\mathrm{t})) = \mathbf{u}'(\mathrm{t}) \times \mathbf{v}(\mathrm{t}) + \mathbf{v}(\mathrm{t}) \times \mathbf{u}'(\mathrm{t})$.

IV. The derivative of $\mathbf{c}$ with respect to t is equal to the scalar zero.

A. only I B. only II C. only II and III D. only II and IV E. only II, III, and IV

(5 pts) 14. Bonus. $[(\mathbf{i} - \mathbf{j}) \times (\mathbf{k} + 2\mathbf{j})] \cdot [2\mathbf{i} + \mathbf{k}]$ is equal to?

A. -2 B. -1 C. 0 D. 1 E. 2

MAC2313 Test 1A

Name: _____ UF-ID: _____ Section: _____

(7 pts) 1. If $\mathbf{r}(t) = \langle (t+1)^2, \ln t, e^{3t} \rangle$ is a position function of a object in R^3 as a function of time, what is $\mathbf{a}(1)$?

(7 pts) 2. Give the equation of a plane which contains the point $(2, -1, 0)$ and which is orthogonal to the plane $2x - y = 5$.

(7 pts) 3. Let $\vec{\mathbf{OP}} = \mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ and $\mathbf{F} = \langle 0, 10, 0 \rangle$; calculate the magnitude of the torque about O.

(7 pts) 4. Let $\mathbf{r}(\mathrm{t}) = \left\langle \sqrt{\mathrm{t} - 2}, \ln \mathrm{t}, \mathrm{e}^{-\mathrm{t}} \right\rangle$. Give the domains of each of the component functions of $\mathbf{r}(\mathrm{t})$ and then give the domain of $\mathbf{r}(\mathrm{t})$ itself.

(7 pts) 5. If $\mathbf{r}(t) = \langle \cos 3t, \sin 3t, 4t \rangle$, what is $\mathbf{N}(\pi)$?