

MATH 261 Final Exam, Spring 2021

Simplify answers. No work, no credit		Name:	Score	
1.	Given a force $\mathbf{F} = 5\mathbf{i} - 3\mathbf{j}$ and a position vector $\mathbf{r} = 2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$, compute: a) The torque $\mathbf{r} \times \mathbf{F}$. Ans:_____	b) $ \mathbf{r} \times \mathbf{F} $. Ans:_____	1	11
			2	12
			3	13
			4	14
			5	15
			6	16
			7	17
			8	18
2.	Given the point $P(1, -1, 5)$ and the line $L : \mathbf{r}(t) = \langle 3 - t, 3 + 2t, 2 + 5t \rangle$, find: a) The direction vector of the line. Ans:_____	b) The line through P and \parallel to L . Ans:_____	9	19
			10	20
			Tot	
3.	Write parametric equations for: a) The hyperbola $x^2 - y^2 = 9$. Ans:_____	b) The cone $x^2 + y^2 - z^2 = 0$. Ans:_____		
4.	Given the surface $\mathcal{S} : z = xy - 12$ and the point $P(2, 2, -8)$ a) A normal to \mathcal{S} at P . Ans:_____	b) The equation of the tangent plane at P . Ans:_____		
5.	A particle moves along the path $\mathbf{r}(t) = \sqrt{2}t \mathbf{i} + e^t \mathbf{j} + e^{-t} \mathbf{k}$. Find the: a) Speed at $(0,1,1)$. Ans:_____	b) Acceleration. Ans:_____		
6.	c) Tangential acceleration at $(0,1,1)$. Ans:_____	d) Centripetal acceleration at $(0,1,1)$. Ans:_____		
Extra Space				

		Name:
7.	<p>Suppose $f(x, y) = \ln(x^2 + y^2)$.</p> <p>a) Compute ∇f.</p> <p style="text-align: right;">Ans: _____.</p>	<p>b) Compute df.</p> <p style="text-align: right;">Ans: _____.</p>
8.	<p>Let $f(x, y) = x^4y^3 - 3x^2 + y$ and \mathbf{u} point in the direction given by the angle $\theta = \pi/6$. Find</p> <p>a) The unit direction vector \mathbf{u}.</p> <p style="text-align: right;">Ans: _____.</p>	<p>b) $D_{\mathbf{u}}f(1, 1)$.</p> <p style="text-align: right;">Ans: _____.</p>
9.	<p>Let $z = f(x, y) = xy - x^2 - y^2 - 2x - 2y + 7$.</p> <p>a) Find the critical points.</p> <p style="text-align: right;">Ans: _____.</p>	<p>b) Classify the critical points.</p> <p style="text-align: right;">Ans: _____.</p>
10.	<p>Let $xe^z + y^2z^3 = 6$. Use implicit differentiation to find:</p> <p>a) z_x.</p> <p style="text-align: right;">Ans: _____.</p>	<p>b) z_y.</p> <p style="text-align: right;">Ans: _____.</p>
11.	<p>A plate of density $\rho = 5$ is bounded by $y = \sqrt{a^2 - x^2}$ and $y = 0$. Set up the integrals for</p> <p>a) $y_{c.m}$</p>	<p>b) I_z</p>
Extra space		

		Name:
12.	Setup and compute $\int \int dS$, where S is the part of the surface $z = xy + 4$, bounded by $x^2 + y^2 = 4$.	Ans:_____.
13.	Let $I = \int_0^3 \int_{y^2}^9 2ye^{x^2} dx dy$. a) Reverse the order of integration	b) Evaluate the integral Ans:_____.
14.	Find the volume bounded by $z = 49 - x^2 - y^2$, $z \geq 0$, and $x^2 + y^2 = 9$.	Ans:_____.
15.	Find the volume of spherical cap of the sphere $x^2 + y^2 + z^2 = 2$ above the plane $z=1$. Hint: the volume of a cone is $V_c = \frac{1}{3}\pi r^2 h$	Ans:_____.
16.	True or False? ___ a) If $\nabla \cdot \mathbf{F} = 0$, then \mathbf{F} is conservative. ___ b) If $\mathbf{F} = \nabla \times \mathbf{G}$, then \mathbf{F} is incompressible. ___ c) If $\int_C \mathbf{F} \cdot d\mathbf{r}$ is path independent, then $\nabla \times \mathbf{F} = 0$. ___ d) If $\nabla \times \mathbf{F} = 0$, then $\int_C \mathbf{F} \cdot d\mathbf{r} = 0$. ___ e) If $\text{bd}(S_1) = \text{bd}(S_2)$ then $\int \int_{S_1} \mathbf{F} \cdot d\mathbf{S} = \int \int_{S_2} \mathbf{F} \cdot d\mathbf{S}$	
	Extra Space	

		Name:
17.	Let $\mathbf{F} = (e^x \cos y + yz) \mathbf{i} + (xz - e^x \sin y) \mathbf{j} + (xy + z) \mathbf{k}$ and C is the line segment joining $(0,0,0)$ to $(-1, \pi/2, -2)$ a) Find f such that $\mathbf{F} = \nabla f$.	b) Compute $\int_C \mathbf{F} \cdot d\mathbf{r}$
	Ans: _____.	Ans: _____.
18.	Compute: $\oint_C -y^3 dx + x^3 dy$, where C is the circle $x^2 + y^2 = 36$	
		Ans: _____.
19.	Find $\iint (\nabla \times \mathbf{F}) \cdot d\mathbf{S}$, where $\mathbf{F} = \langle 6y + z^2, 2x - y^3, 5y^2z \rangle$ and $S: z = 36 - 4x^2 - 4y^2$ with $z \geq 0$.	
		Ans: _____.
20.	Find: $\int \int_{\Sigma} \mathbf{F} \cdot d\mathbf{S}$, where $\mathbf{F} = 3z^2x\mathbf{i} + y^3\mathbf{j} + 3x^2z\mathbf{k}$, and Σ is bounded by $x = \sqrt{16 - z^2 - y^2}$ and $x = 0$.	
		Ans: _____.
	Extra Space	
	Comments on this exam:	