Name: _____

MAT 397
Fall 2020
Quiz 1: Due 08/28

"I have no idea what I'm doing but I know I do it really, really well."
–Andy Dwyer, Parks and Recreation

Let $\mathbf{u} = \langle \sqrt{3}, 1 \rangle$ and $\mathbf{v} = \langle -\sqrt{3}, 2 \rangle$

(a) Find $2\mathbf{u} - \mathbf{v}$.

(b) Find $\|\mathbf{u}\|$.

(c) Is $\mathbf{u}$ parallel to $\mathbf{v}$?

(d) Find a unit vector parallel to $\mathbf{u}$.

(e) What is the angle $\mathbf{u}$ makes with the $+y$-direction?

Name: _____

MAT 397
Fall 2020
Quiz 2: Due 08/28

"The answer was so simple, I was too smart to see it!"
–Princess Bubblegum, Adventure Time

Let $\mathbf{u} = \langle 1, -2, 1 \rangle$ and $\mathbf{v} = \langle 1, -1, 3 \rangle$.

(a) Find any nonzero vector perpendicular to $\mathbf{u}$.

(b) Is $\mathbf{u}$ perpendicular to $\mathbf{v}$?

(c) Find the angle between $\mathbf{u}$ and $\mathbf{v}$.

(d) Find $\mathbf{proj}_{\mathbf{v}}\, \mathbf{u}$.

Name: _____

MAT 397
Fall 2020
Quiz 3: Due 08/28

"Look. There's something you should know about me. I've been trying to hide it but, it's time I told someone the truth. I know it's gonna sound crazy but... here it goes... I'm awkward."

–Ryan Newman, Wilfred

Let $\mathbf{u} = 2\,\mathbf{i} + \mathbf{k}$ and $\mathbf{v} = \mathbf{i} - 3\,\mathbf{j} + \mathbf{k}$.

(a) Find a unit vector perpendicular to both $\mathbf{u}$ and $\mathbf{v}$.

(b) Find the area of the triangle that can be formed using $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{u} - \mathbf{v}$.

Name: _____

MAT 397
Fall 2020
Quiz 4: Due 09/04

"I don't know. I'm trying very hard not to connect with people right now."
–David Rose, Schitt's Creek

Find the vector, parametric, and symmetric forms of the lines through the point $(6, -1, 4)$ and parallel to the line $x(t) = t - 1, y(t) = 2t + 6, z(t) = 4 - 3t$.

Name: _____

MAT 397
Fall 2020
Quiz 5: Due 09/04

"Now tomorrow there'll be a pop quiz on the effects of thermodynamics. Now remember, it's a pop quiz, so if you study, I'll know. "
–Dick Solomon, Third Rock from the Sun

Find the equation of the plane through $(1, -1, 1)$, $(1, 0, 1)$, and $(3, 4, 2)$.

Name: _____

MAT 397
Fall 2020
Quiz 6: Due 09/04

"Who has the time, with work, family, and hobbies, and listing excuses?"
– Tracy Jordan, 30 Rock

Identify the following surfaces in $\mathbb{R}^3$:

(a) _____: $y = 2x - z$

(b) _____: $x^2 + y^2 = \frac{z^2}{2} + 1$

(c) _____: $\frac{x^2}{2} - 3y^2 - z^2 = 0$

(d) _____: $z = y^2 + 1$

(e) _____: $2x^2 + 2y^2 = 3 - 2z^2$

(f) _____: $y = \frac{x^2}{7} + z^2$

(g) _____: $2x^2 + 3y^2 + 4z^2 = 5$

(h) _____: $y = z^2 - x^2$

(i) _____: $y^2 - x^2 = z^2 + 4$

(j) _____: $x^2 + y^2 = 1$

Name: _____

MAT 397
Fall 2020
Quiz 7: Due 09/11

"Ugh, the kids get worse and worse every year. Why do people keep making them."

–Esther, Bob's Burgers

Find parametrizations for the following geometric objects:

(a) the directed line segment from $(1, 0, 1)$ to $(-1, 2, 4)$.

(b) the circle with center $(-2, 1)$ and radius 3, oriented counterclockwise.

(c) the portion of $y = x^2 + 1$ from $(0, 1)$ to $(2, 5)$.

(d) the curve resulting from intersecting $z = y^2$ and $x = e^y - \cos z$.

Name: _____

MAT 397
Fall 2020
Quiz 8: Due 09/11

"Two oil changes for the price of one! Now if I could afford the one, and the car."

–Dr. Zoidberg, Futurama

Find the length of the curve $\mathbf{x}(t) = \langle 2t, \frac{4}{3}t^{3/2}, \frac{1}{2}t^2 \rangle$, $0 \leq t \leq 2$.

Name: _____

MAT 397

Fall 2020

Quiz 9: Due 09/11

"Those scientists better check their hypotenuses, dude."

–Adam DeMamp, Workaholics

Show that the following limit does not exist by considering paths along the x-axis, y-axis, $y = x$, and the curve $x = y^2$. Would the curve $x = 1$ also work as one of the curve to show that the limit does not exist?

$$\lim_{(x,y)\to(0,0)} \frac{x^4y^4}{(x^2+y^4)^3}$$

Name: _____

MAT 397

Fall 2020

Quiz 10: Due 09/11

"I talk a lot, so I've learned to tune myself out."

–Kelly Kapoor, The Office

Define $f(x,y) = \dfrac{ye^{xy}}{\ln x}$. Find $\dfrac{\partial f}{\partial x}$ and $\dfrac{\partial f}{\partial y}$.

Name: _____

MAT 397
Fall 2020
Quiz 11: Due 09/18

"I don't get history. If I wanted to know what happened in Europe a long time ago, I'd watch Game of Thrones."

–Troy Barnes, Community

Find the tangent plane to the surface $z = f(x, y)$ at $(x, y) = (1, -2)$, where $f(x, y) = x^2 \cos(y + 2) + \dfrac{y}{x}$. Use this plane to approximate $f(1.1, -2.2)$.

Name: _____

MAT 397
Fall 2020
Quiz 12: Due 09/18

"The greatest illusion of this world is the illusion of separation. Things you think are separate and different are actually one and the same. We are all one people, but we live as if divided."

– Guru Pathik, Avatar

Let $w(x,y) = 2^x \arctan y$, $x(s) = e^s$, and $y(s,t) = \tan(st)$. Use the Chain Rule to find $\dfrac{\partial w}{\partial t}$ in terms of x, y, s, t.

Name: _____

MAT 397
Fall 2020
Quiz 13: Due 09/18

"Sometimes in life, when you get what you want, you end up missing what you left behind."

–John Dorian (J.D.), Scrubs

Let $f(x,y) = \dfrac{x}{x+3y}$, and define $\mathbf{u} = \langle -3, 4 \rangle$.

(a) Find $D_{\mathbf{u}} f(-2,1)$.

(b) Find the direction of maximum increase for $f(x,y)$ at the point $(-2,1)$.

(c) Find the direction of maximum decrease for $f(x,y)$ at the point $(-2,1)$.

(d) Approximately what would be the change in the value for $f(x,y)$ if you traveled a 'distance' of 0.5 in the direction of $\mathbf{u}$?

Name: _____

MAT 397
Fall 2020
Quiz 14: Due 09/25

"If you're not willing to look stupid, nothing great is ever going to happen to you."

– Gregory House, House

Find and classify the extrema of $3x^2 + 2y^2 - 6x - 4y + 16$.

Name: _____

MAT 397

Fall 2020

Quiz 15: Due 09/25

"Hard work is worthless for those that don't believe in themselves."

–Naruto Uzumaki, Naturo

Find and classify the critical points of $f(x, y, z) = x^2 - xy + z^2 - 2xz + 6z$.

Name: _____

MAT 397
Fall 2020
Quiz 16: Due 10/02

"The three true branches of the government are military, corporate, and Hollywood."

–Steven Hyde, That 70's Show

Find the maximum and minimum values of $f(x, y, z) = x + y - z$ if (x, y, z) must lie on the sphere $x^2 + y^2 + z^2 = 81$.

Name: _____

MAT 397

Fall 2020

Quiz 17: Due 10/02

"I'm afraid that once your heart's involved, it all comes out in moron."
–Lorelai Gilmore, Gilmore Girls

Sketch the region of integration for the following integral. In addition, evaluate the integral.

$$\int_{1}^{\ln 6} \int_{e^x}^{6} \frac{1}{y^2} \, dy \, dx$$

Name: _____

MAT 397
Fall 2020
Quiz 18: Due 10/02

"It's not the battles we lose that bother me; it's the ones we don't suit up for."
– Toby Ziegler, West Wing

Let R be the region bounded by $x = y^2$, $y = z$, $x = y$, and $z = 0$. Evaluate the following integral:

$$\iiint_R (2x - y)\, dV$$

Name: _____

MAT 397
Fall 2020
Quiz 19: Due 10/09

"You've gotta be a little skeptical, Sharona. Otherwise, you end up believing in everything: UFOs, elves, income tax rebates."

–Adrian Monk, Monk

Change the order of integration and evaluate the integral.

$$\int_0^1 \int_y^1 x^2 \sin xy \; dx \; dy$$

Name: _____

MAT 397
Fall 2020
Quiz 20: Due 10/09

"Bobby, some things are like a tire fire, trying to put it out only makes it worse. You just gotta grab a beer and let it burn."

–Hank Hill, King of the Hill

Consider the following integral:

$$\int_0^2 \int_{x/2}^{x/2+1} x^5(2y-x)e^{(2y-x)^2}\,dy\,dx$$

Set-up (but do not evaluate) an integral in terms of u, v, where $u = x$ and $v = 2y - x$.

Name: _____

MAT 397
Fall 2020
Quiz 21: Due 10/09

"But even the strongest of imaginations can't protect us once we know the truth."

–Dexter Morgan, Dexter

Evaluate the following:

$$\int_0^{\pi} \int_0^{3} \int_0^{x} \frac{dy\ dx\ dz}{\sqrt{x^2+y^2}}$$

Name: _____

MAT 397

Fall 2020

Quiz 22: Due 10/16

"I'm cuddly. Deal with it."

–Marshall Eriksen, How I Met Your Mother

Let R be the region bounded by the two sphere $x^2 + y^2 + z^2 = 1$ and $x^2 + y^2 + z^2 = 5$. Evaluate the following

$$\iiint_R \frac{dV}{\sqrt{x^2 + y^2 + z^2}}$$

Name: _____

MAT 397

Fall 2020

Quiz 23: Due 10/16

"If they survive, they're fairies. If they don't, I have tenure!"

–Denzel Crocker, Fairly Odd Parents

Find the center of mass of a lamina given by the region $\{(x, y) \colon 0 \leq y \leq \sqrt{x}, 0 \leq x \leq 9\}$ with density varying as xy. [You may use an integration calculator for the integrals.]

Name: _____

MAT 397
Fall 2020
Quiz 24: Due 10/16

"You need three ingredients for a cocktail. Vodka and Mountain Dew is an emergency."

–Peggy Olson, Mad Men

Let R be the region under the plane $z = 1 + x + y$ and above the region lying in the xy-plane bounded by $y = \sqrt{x}$, $y = 0$, and $x = 1$. Evaluate the following:

$$\iiint_R 3xy \, dV$$

Name: _____

MAT 397
Fall 2020
Quiz 25: Due 10/23

"When you look at me you probably see a guy who has it all, but really there's a large part of me that's immature and undeveloped."
–Nathan Fielder, Nathan for You

Sketch the vector field $\mathbf{F}(x, y) = -(x + y)\,\mathbf{i} + (x - y)\,\mathbf{j}$. On your vector plot, sketch a few streamlines.

Name: _____

MAT 397

Fall 2020

Quiz 26: Due 10/23

"Before I leaped, I should have seen the view from halfway down."
–BoJack Horseman, BoJack Horseman

Find the divergence and curl of the vector field $\mathbf{F}(x, y) = \langle x^2 y, x \cos y \rangle$.

Name: _____

MAT 397

Fall 2020

Quiz 27: Due 10/30

"All problems are boring until they're your own."

–Galina Reznikov (Red), Orange is the New Black

Let C be the curve given by $\mathbf{r}(t) = t\,\mathbf{i} + (2-t)\,\mathbf{j}$ for $0 \leq t \leq 2$. Compute the following

$$\int_C 3(x-y)\,ds$$

Name: _____

MAT 397

Fall 2020

Quiz 28: Due 10/30

"I hate my life, but I keep on doing it!"

–Frank Murphy, F is for Family

Let C be the curve given by $y^2 = x^3$ from $(1, -1)$ to $(1, 1)$. Evaluate the following

$$\int_C x^2 y \, dx - xy \, dy$$

Name: _____

MAT 397
Fall 2020
Quiz 29: Due 10/30

"It's not for me, but people will like it. It's Starbucks. It" what America wants."

–Matthew MacDell, Big Mouth

Let C be the curve given by $\mathbf{r}(t) = \dfrac{t^3 e^{t(3-t)}}{3}\,\mathbf{i} + \dfrac{10\sin(\pi t/6)\cos(2\pi t)}{1+t^2}\,\mathbf{j}$, $0 \leq t \leq 3$. Evaluate the following integral

$$\int_C (2xy - y)\,dx + (x^2 - x + 1)\,dy$$

Name: _____

MAT 397
Fall 2020
Quiz 30: Due 11/06

"Don't worry, demons can't die. He'll slowly re-form himself over a few months, passing through all the stages of demon growth: larvae, slug monster, spooky little girl, teenaged boy, giant ball of tongues, social media CEO, and then finally demon"

–Michael, The Good Place

Use Green's Theorem to evaluate the line integral

$$\oint_C x^2y^2\,dx + x^3y\,dy$$

where C is the triangle with vertices $(0,0), (1,0), (1,3)$, oriented counterclockwise.

Name: _____

MAT 397
Fall 2020
Quiz 31: Due 11/06

"I'm pretty but tough like a diamond. Or beef jerky in a ball gown."
–Titus Andromedon, Unbreakable Kimmy Schmidt

Let $\mathbf{F}(x, y) = e^x \sin y\,\mathbf{i} + (e^x \cos y + 2y)\,\mathbf{j}$, and C be the line segment from $(1, 0)$ to $(0, \pi/2)$. Evaluate

$$\int_C \mathbf{F} \cdot d\mathbf{r}$$

Name: _____

MAT 397
Fall 2020
Quiz 32: Due 11/06

"I am not a successful adult. I don't eat vegetables and/or take care of myself."

–Nick Miller, New Girl

Parametrize the part of the cylinder $x^2 + z^2 = 4$ between $y = -1$ and $y = 3$, and find an $\mathbf{N}$ for this surface.

Name: _____

MAT 397
Fall 2020
Quiz 33: Due 11/13

"If you're not well educated or informed you start your own party and yell the loudest."

– Charlie Kelly, It's Always Sunny in Philadelphia

Let S be the surface with bottom $z = 0$, top $z = 4$, and sides $x^2 + y^2 = 9$, oriented outward normals. Evaluate

$$\iint_S z \, dS$$

Name: _____

MAT 397

Fall 2020

Quiz 34: Due 11/13

"Maybe we have to get a little messed up before we can step up."

–Alex Karev, Grey's Anatomy

Let $\mathbf{F}(x, y, z) = \langle 2x, 2y, z^2 \rangle$, and define S to be the portion of the cone $x^2 + y^2 = z^2$ between the planes $z = -2$ and $z = 1$, oriented outwards. Find the value of the following:

$$\iint_S \mathbf{F} \cdot d\mathbf{S}$$

Name: _____

MAT 397

Fall 2020

Quiz 35: Due 11/13

"Minimum wage? Just a fancy term for industrialized slavery."
–Frank Gallagher, Shameless

Let S be the surface given by the four sides and the bottom of the cube with vertices $(\pm 1, \pm 1, \pm 1)$. Orient S with outward-pointing normals. Let $\mathbf{F}(x, y, z) = x^2yz^3\,\mathbf{i} + x^2y\,\mathbf{j} + xe^x \sin yz\,\mathbf{k}$. Compute

$$\iint_S \nabla \times \mathbf{F} \cdot d\mathbf{S}$$