Staple!

Team:_____

Calc III
MAC2313 3191

Z-Home

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Touch: 16Nov2017

Note. The order of your hand-in should be: PROBLEM SHEET (P-S, this side up), TYPESETTING CONVENTIONS (if any), followed by the write-up to the essay question.

General instructions are on the CHECKLIST. If you find an unfamiliar term, look in "Notes & Hints" at the end of this P-S. Do ***not*** approx.: If your result is "$\sin(\sqrt{\pi})$" then write that rather than .9797$\cdots$.Use "$f(x)$ notation" when writing fncs; in particular, for trig and log fncs. E.g, write "$\sin(x)$" rather than the horrible $\sin x$ or $[\sin x]$. Write expressions unambiguously e.g, "$1/a+b$" should be bracketed either $[1/a]+b$ or $1/[a+b]$. (Be careful with **negative** signs!)

Z1: Show no work. Questions (a)–(b) refer to these three vectors/points in $\mathbb{R}^3$:

$$\mathbf{w} := (2,1,-2)\,, \quad \mathbf{v} := (5,1,2)\,, \quad \mathbf{a} := (3,-1,3)\,.$$

___ a Compute the norm, $\|\mathbf{w}\| =$,and the cross-product, $\mathbf{v} \times \mathbf{w} =$,
and the projection of $\mathbf{v}$ in the $\mathbf{w}$-direction, $\text{Proj}_{\mathbf{w}}(\mathbf{v}) =$.

___ b The distance from the origin to Plane$(\mathbf{w}, \mathbf{v}, \mathbf{a})$ equals .

___ c List the six vertices of some regular octahedron H:

So cos(dihedral $\measuredangle$ of H) = .

___ d The quadratic surface $x^2+y^2+6x+4y+2z = z^2-11$ is a .
[*Hint:* Complete the square for each of x, y, z.]

___ e In $\mathbb{R}^4$, let $\mathbb{L}_0$ be the line passing through the origin and the point $Q = (1,2,3,4)$. Let $\mathbb{L}_1$ be the line $t \mapsto (2,-1,0,1)+t(5,0,1,2)$. The (orthogonal) distance between lines $\mathbb{L}_0$ and $\mathbb{L}_1$ equals

.

___ f Let $\mathbb{L}_3$ be the line $3-x = \frac{y-6}{2} = z-3$. Let $\mathbb{L}_2$ be the line passing through the origin and the point $Q = (4,-8,-4)$. Then
Dist$(\mathbb{L}_2, \mathbb{L}_3)$= .

___ g Compute the **arclength** of the curve $\mathbf{w}(t) := t^2\widehat{\boldsymbol{\imath}} + [\cos(t)+t\sin(t)]\widehat{\boldsymbol{\jmath}} + [\sin(t)-t\cos(t)]\widehat{\mathbf{k}}$ from $t=0$ to $t=\pi$.
Arclength= .

h For a posreal B, define helix $\mathbf{r}_B(t) := \cos(t)\widehat{\boldsymbol{\imath}} + \sin(t)\widehat{\boldsymbol{\jmath}} + B\cdot t\cdot\widehat{\mathbf{k}}$. Compute the radius-of-curvature RoC$_B$= .

i Let $\mathbf{A}$ and $\mathbf{R}$ be the surf-acc and radius of some nice planet. Then the golden-snitch speed is: $S_{\text{gold}} =$.
The *period* of the snitch is $L_{\text{gold}} =$.
The snitch goes around the equator in the same direction that the Earth turns. How many times a day do you have to duck? Same≈ .
If it goes in the opposite dir.? Opp≈ .

Z2: (Let $\mathbf{A}$ denote the surf-acc of Earth, in $\mathsf{in/sec^2}$.) The Boston Science Museum has a curvy-funnel (AoS vertical; with diam= 4ft). Pushing a button releases a ball-bearing (BaB) which rolls angled into the funnel; its path looks like a planetary orbit, because the funnel is shaped correctly. Let $g(r)$ denote the depth of the funnel at radius r (each in inches). Design $g()$ st., for each r, if BaB is rolling at the correct speed to stay at the radius=r circle, then the toward-AoS component of force is

$$\mathbf{A}\cdot\frac{U}{r^2}\,,$$

where $U := 24\cdot\mathsf{in}^2$.
So $g(r)$= and
BaB-speed(r) = .
(Answers *must* be ITOf $\mathbf{A}$ and U; your units *must* be correct. **I may add a small part to this question**, to be announced in class.)

Notes & Hints. (Be aware that Marston Science Library has mathematical dictionaries.) There is a convenient way to place a cube in 3-space. Since the octahedron is the dual of a cube, there is an easy way to place an octahedron in space. The dihedral angle at an edge of a polyhedron, is the angle between the two *faces* which meet at that edge. (You'll need to think about exactly what this means.)

End of Z-Home

Z1:	___ ___ ___	180pts
Z2:	___ ___	75pts
Total:	___ ___ ___	255pts

HONOR CODE: *"I have neither requested nor received help on this exam other than from my team-mates and my professor (or his colleague)."* *Name/Signature/Ord*

Ord:

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