Math 126
Exam 1
May 1, 2025

Name ______________________________

Student ID #_______________

Section _______________

HONOR STATEMENT

"I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam."

SIGNATURE:______________________________

- This exam consists of this cover, four pages of questions, and a blank "scratch sheet". If you put work on the scratch sheet and you want it to be graded, then you must clearly tell us in the problem to "see scratch page".
- You will have 50 minutes.
- You are allowed to use a Ti-30x IIS Calculator model ONLY (**no other calculators allowed**) and one 8.5 by 11 inch sheet of handwritten notes (front and back). All other sources are forbidden.
- Turn your cell phone OFF and put it away for the duration of the exam. You may not listen to headphones or earbuds during the exam.
- **You must show your work.** The correct answer with no supporting work may result in no credit.
- Leave your answer in exact form. Simplify standard trig, inverse trig, natural logarithm, and root values. Here are several examples: you should write $\sqrt{4} = 2$ and $\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$ and $\ln(1) = 0$ and $\tan^{-1}(1) = \frac{\pi}{4}$.
- Unless otherwise indicated, when rounding is necessary, you may round your final answer to two digits after the decimal.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- There may be multiple versions, you have signed an honor statement, and cheating is a hassle for everyone involved. If we find that you give an answer that is only appropriate for the other version of the exam and there is no work to support your answer, then you will get a zero on the entire exam and your work will be submitted to the academic misconduct board. JUST DO NOT CHEAT.

GOOD LUCK!

1. (12 pts)

(a) Find the area of the triangle through $P(1,2,3)$, $Q(-1,3,5)$, and $R(2,1,6)$.

Area = __________________

(b) The curves $y = x^3$ and $y = 3x + 2$ intersect at the point $(2, 8)$. Find the angle between the curves at this point of intersection. Give your final answer in degrees rounded to one decimal place.

Angle = __________________ degrees

(c) Consider the sphere, S, which has a diameter with endpoints at $A(0,0,1)$ and $B(6,4,3)$. Find the radius of the circular intersection of the sphere, S, with the xy-plane.

Radius of intersection of the sphere and the xy-plane = __________________

2. (14 pts)

(a) (2 pts) Give the precise name for the surface given by the equation $2x^2 - y^2 + z = 4$.

Surface name: ________________________________

(b) Find parametric equations for the line of intersection of the planes $2x + y + z = 3$ and $3x + y - z = 7$.

Line Equations: ________________________________

(c) Find the equation of the plane that passes through the point $P(3, 4, 1)$ and contains the line $x = 5 + t$, $y = 2t - 1$, $z = -2t$. And find the y-intercept of the plane.

Plane Equation: ________________________________

y-intercept: $(x, y, z) =$ ________________________________

3. (12 pts) An object 'accidentally' thrown toward a certain math professor has location given by $\mathbf{r}(t) = \langle t^2, 10t, 40t - 10t^2 \rangle$ at time t seconds, where distances are in feet.

(a) Find parametric equations for the tangent line to the curve at the moment when the tangent line is parallel to the xy-plane.

Tangent Line Equations: ____

(b) Find the speed of the object at the positive time when it intersects the xy-plane.

Speed: ______________________ feet/sec

(c) Find the time at which the tangential component of acceleration, a_T, is equal to zero. You may round your final answer to two digits after the decimal.

$t =$ ______________________ seconds

4. (12 pts)

(a) Set up (but do NOT evaluate) an integral that gives the arc length of the curve of intersection of the cylinder $x^2 + y^2 = 4$ and the plane $z = 3x$. Hint: First, find parametric equations for the curve of intersection. And again don't try to evaluate the integral, just set it up with the correct bounds and integrand and write your integral below.

Arc Length Set-Up = ______________________

(b) The velocity of an object is given by $\mathbf{r}'(t) = \langle 2\sin(t), 5, te^{t^2} \rangle$ at time t seconds and its initial position is $\mathbf{r}(0) = \langle 0, 0, 1 \rangle$.

i. Find the vector function, $\mathbf{r}(t)$, for the position of this object at time t.

$\mathbf{r}(t) =$ ______________________

ii. Find the curvature of the curve given by $\mathbf{r}(t)$ at $t = 0$. Hint: Plug in $t = 0$ as early as possible!

$\kappa(0) =$ ______________________

You may use this page for scratch-work or extra room.
All work on this page will be ignored unless you write and circle "see scratch page" on the problem page and you label your work below.