Math 126 - Fall 2018
Exam 1
October 23, 2018

Name: ______________________________

Section: ______________________________

Student ID Number: ______________________________

PAGE 1	13	
PAGE 2	12	
PAGE 3	13	
PAGE 4	12	
Total	50	

- There are 4 pages of questions. Make sure your exam contains all these questions.
- You are allowed to use a Ti-30x IIS Calculator model ONLY (**no other calculators allowed**). And you are allowed one **hand-written** 8.5 by 11 inch page of notes (front and back).
- 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 $\frac{7}{2} - \frac{3}{5} = \frac{29}{10}$ and $\ln(1) = 0$ and $\tan^{-1}(1) = \frac{\pi}{4}$.
- Show your work on all problems. The correct answer with no supporting work may result in no credit. **Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.**
- If you need more room, use backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- There may be **multiple versions** of the exam so if you copy off a neighbor and put down the answers from another version we will know you cheated. Any student found engaging in academic misconduct will receive a score of 0 on this exam. All suspicious behavior will be reported to the student misconduct board.
- You have 50 minutes to complete the exam. Budget your time wisely.
SPEND NO MORE THAN 10 MINUTES PER PAGE!

GOOD LUCK!

1. (13 pts)

(a) Multiple choice (circle **all** that apply, no work needed):

i. Let ℓ be the line $\mathbf{r}(t) = \langle -3t, 2t+7, 6-t \rangle$ and $\mathcal{P}$ the plane $6x - 4y + 2z = 4$. Then ℓ is...

(i) parallel to $\mathcal{P}$ (ii) orthogonal to $\mathcal{P}$

(iii) contained in $\mathcal{P}$ (iv) intersects $\mathcal{P}$ at one point

ii. Which of the following vector functions give points that are always on the curve of intersection of $x^2 + z^2 = 4$ and $x = 2y$:

(i) $\left\langle t, \frac{1}{2}t, \sqrt{4-t^2} \right\rangle$ (ii) $\langle 2\cos(t), \cos(t), 2\sin(t) \rangle$

(iii) $\langle 2\sin(t^3), \sin(t^3), 2\cos(t^3) \rangle$ (iv) $\langle 2t, t, 0 \rangle$

(b) A line, L, passes thru $(1,2,2)$ and the *center* of the sphere, S, given by $x^2+y^2+z^2-6z = 27$. Find all (x,y,z) points of intersection of the line, L, and the sphere, S.

2. (12 pts)

(a) Find an equation for the surface consisting of all points that are equidistant from the x-axis and the point $(0, 0, 1)$ **AND** give a precise name for the corresponding 3D surface.

SURFACE NAME: ____________________

(b) Find the equation of the plane that contains the points $P(1, 5, 0)$ and $Q(0, 8, 2)$ and is orthogonal to the plane $x - 2y + z = 10$.

3. (13 pts)

(a) For some curve, $\mathbf{r}(t)$, you are given $\mathbf{T}(0) = \left\langle \frac{3}{5}, 0, -\frac{4}{5} \right\rangle$ = 'unit tangent at $t = 0$'.
(The three parts below are short answer and all refer to the vector $\mathbf{T}(0)$ above)

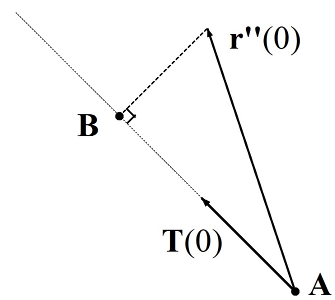
i. If $|\mathbf{r}'(0)| = 3$, then give the vector $\mathbf{r}'(0) =$

ii. If you are told that $\mathbf{N}(0) = \langle 0, a, b \rangle$ = 'the principal unit normal at $t = 0$' for some numbers a and b, then what can you conclude about a and b? (list all possibilities)

$a =$

$b =$

iii. If $\mathbf{r}''(0) = \left\langle \frac{5}{4}, 2, -\frac{5}{3} \right\rangle$ is drawn tail-to-tail with $\mathbf{T}(0)$ as shown below. What is the distance from point A to point B in the picture?



(b) Find $\mathbf{p}(t)$ if $\mathbf{p}'(t) = \langle 3t^2, 2te^{t^2}, 4te^t \rangle$ and $\mathbf{p}(0) = \langle 0, 0, 0 \rangle$.

4. (12 pts)

(a) Find the angle of intersection (to the nearest degree) of the two curves

$$\mathbf{r}_1(t) = \langle t, 6 - 2t, 15 + t^2 \rangle \text{ and } \mathbf{r}_2(s) = \langle 5 - s, 2s - 4, s^2 \rangle.$$

(b) For $x > 0$, find the x-value at which curvature is maximum for $f(x) = \dfrac{x^3}{3}$.