# CSS221: Computer Graphics
# Midterm Mock Exam

curated by The Peanuts

Name.....ID.....Section.....Seat No.....

**Conditions:** Semi-Closed Book

## Directions:

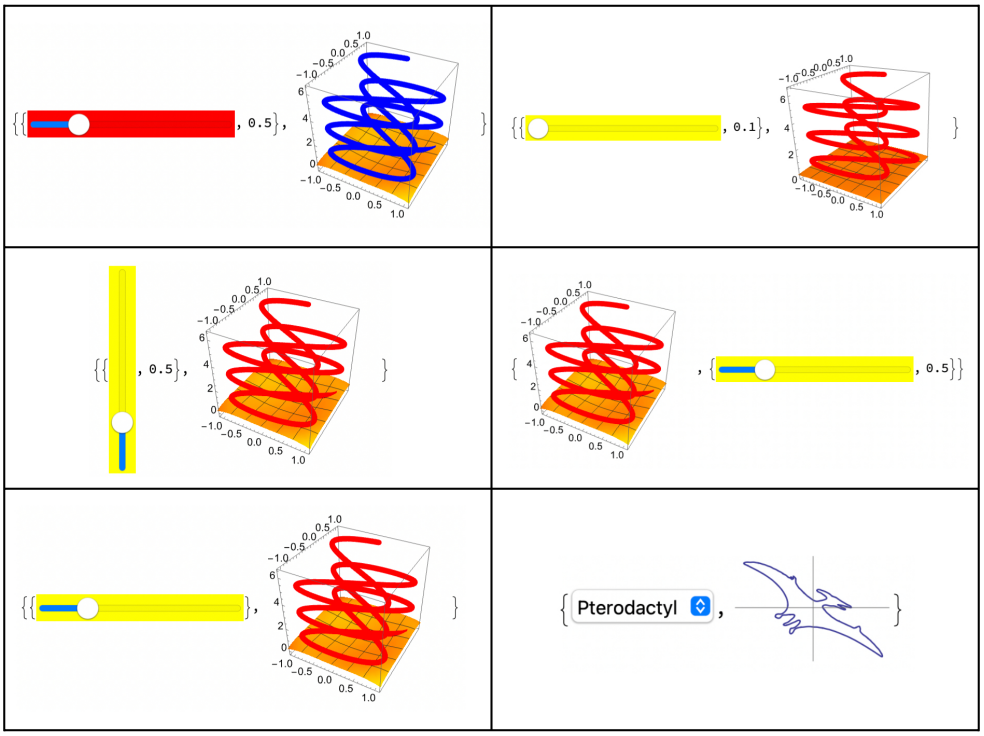
1. This exam has 6 pages (including this page).
2. Please write your name on each page.
3. Reading the problem is optional but highly recommended.
4. Please use a pen or pencil for your answers. Attempting to use a 3D input device or graphics tablet will not be recognized by the paper.
5. When asked to PlotRange, please ensure your answer fits within the margins of the answer sheet.
6. For all parametric plots, the parameter $t$ must not exceed the time remaining in the exam.

*For solution, click here.*

# Problem 1

Analyze the code below. Select the correct graphic output (tick or circle around).

```
f1[x_, y_, a_] := a*Sin[x^2 + y^2]
C1[t_] := {Sin[2*t], Cos[t], t/3}
PlotB1[s_] := Plot3D[f1[x, y, s], {x, -3, 3}, {y, -3, 3}, BoxRatios -> 1,
    PlotRange -> {{-3, 3}, {-3, 3}, {-5, 5}}]
PlotA1[s_] := ParametricPlot3D[C1[t], {t, 0, 6*Pi},
    PlotStyle -> {Red, Thickness[0.03]}, BoxRatios -> 1]
a1 = 0.5;
Myslider1 := {Slider[Dynamic[a1], {0.1, 2, 0.1}, Background -> Yellow],
Dynamic[a1]}
PlotAB[s_] := Show[PlotA1[s], PlotB1[s]]
{Myslider1, Dynamic[PlotAB[a1]]}
```



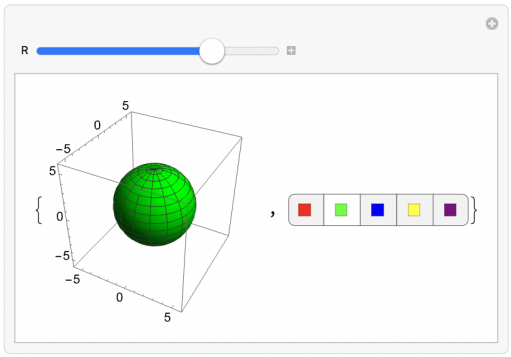
# Problem 2

Use Manipulate to animate a parametric surface (Sphere) with the elements given by:

$$x(u, v, R) = R \sin(u) \cos(v)$$
$$y(u, v, R) = R \sin(u) \sin(v)$$
$$z(u, v, R) = R \cos(u)$$

where $\{u, 0, \pi\}$, $\{v, 0, 2\pi\}$ and animation parameter is $\{R, 1, 5, 0.5\}$.

Change the color of the Sphere using $\{Red, Green, Blue, Yellow, Purple\}$ with a SetterBar.



# Problem 3

Create an interactive visualization of two superimposed functions:

- An explicit function $f(x, y) = \sin(x)\cos(y)$ for $\{x, -\pi, \pi\}$, $\{y, -\pi, \pi\}$
- A parametric function given by:

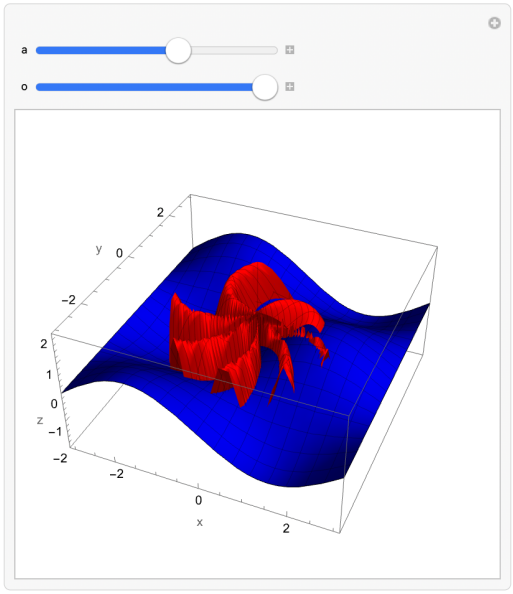
$$x(u, v) = u\cos(v)$$

$$y(u, v) = u\sin(v)$$

$$z(u, v) = a\sin(u^2 + v^2)$$

for $\{u, 0, 2\}$, $\{v, 0, 2\pi\}$

Use a Slider to animate the parameter $a$ in the range $\{a, 0, 2, 0.1\}$ and control the opacity of both surfaces using another Slider in the range $\{o, 0, 1, 0.1\}$.



# Problem 4

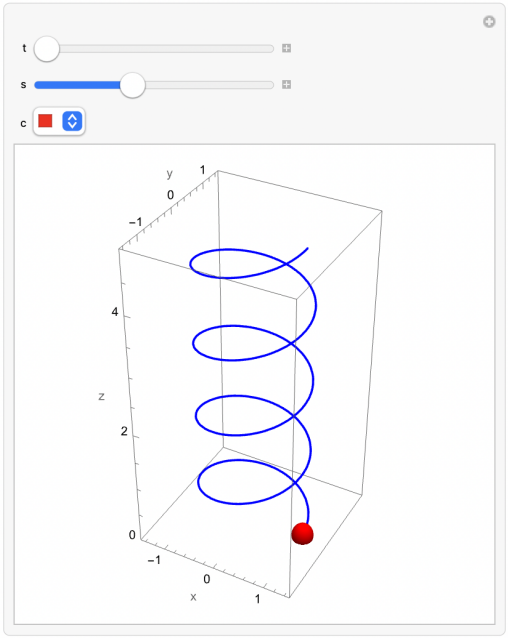
Animate a 3D helix curve given by:

$$x(t) = \cos(t)$$
$$y(t) = \sin(t)$$
$$z(t) = 0.2t$$

for $\{t, 0, 8\pi\}$

Along this helix, animate a spherical particle with radius $R = 0.2$. Create controls to:

- Change the speed of animation using a Slider for $\{s, 0.5, 2, 0.1\}$
- Change the particle color using a PopupMenu with options $\{Red, Yellow, Green, Blue\}$



# Problem 5

A trajectory of the sphere with the radius $R = 0.4$ is defined by a 3D parametric curve given by

$$x(t) = t \cdot \sin(t),$$
$$y(t) = \sqrt{t^2 + 1},$$
$$z(t) = \cos(2t),$$

for $0 \leq t \leq 12$.

Animate the movement of the sphere along the above trajectory
for $0 \leq t \leq 12$ with increment 0.2. Use the graphic primitive Sphere.