Ord: __ __

Calc III
MAC2313 3191

Y-class

Prof. JLF King
Touch: 4Aug2016

Please. 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 $[\sin x]$. Do ***not*** approx.: If your result is "$\sin(\sqrt{\pi})$" then write that rather than .9797⋯. Please write **DNE** in a blank <u>if</u> the described object does not exist or if the indicated operation cannot be performed.

Y3: Show no work.

__ __ z) Prof. King believes that writing in complete sentences aids in communicating technical ideas. *Circle one:* **True** ***What's a sentence?*** **DNE**

__ __ a) Let $P_0 := (2\pi, 1, 2)$. Compute the gradient of $h(x,y,z) := xy + z \cdot \sin(x)$.

$[\nabla h](P_0) =$ ____.

Give an example of a *polynomial* f which has a saddle-point at $R := (-3, 5)$.

$f(x,y) :=$ ____.

__ __ b) In $\mathbb{R}^3$, let S be the surface

$$6x - 3x^2 + 3 \quad = \quad 2y^2 + z^2 .$$

Vector $\mathbf{v}$= ____ $\neq \mathbf{0}$ is $\perp \mathsf{S}$ at $Q := (0, 1, 1)$.

In form $A[x - x_0] + B[y - y_0] + C[z - z_0] = 0$, write an *equation* for the tangent plane to S at Q.

Eqn: ____

Have arranged that A, B, C are <u>**integers**</u> with no common factor; also, that $A \geqslant 0$.

__ __ c) Let $f(x,y) := x - 14y$. *Subject to the constraint that* $y^2 = x$, compute the location (x_0, y_0) of <u>a</u> **global maximum** of f, and compute the location (x_1, y_1) of <u>a</u> **global minimum** of f.

Max=(____ , ____); Min=(____ , ____).

__ __ d) At the point $P := (1, 0)$, the *curvature* of curve $y = \ln(x)$ is ____.

__ __ e) Glued to a massless plate is a 10 lb weight at the origin, a 15 lb weight at the point $(3, -1)$, and 5 lb at point (____ , ____), thus putting the center-of-mass of the weighted-plate at $(2, 1)$.

Y4: A cylindrical soup-can has radius r and height y. Let $A(r,y)$= ____ denote the *surface area* of the can. Note that the volume of the can is $\pi \cdot r^2 \cdot y$.

Subject to the volume being held constant (say, 10 cubic inches), what is the *ratio* of r/y that <u>minimizes</u> surface area (i.e, minimizes the cost of the can)? Use Lagrange multipliers.

Let $g(r,y) :=$ ____ denote the specifier fnc that you choose. Compute the three equations (one constraint eqn. followed by two Lagrange eqns.). Use β for your L.Multiplier.

C_g**:** ____ = ____ .

L_r**:** ____ = ____ .

L_y**:** ____ = ____ .

Solve the system to compute $\dfrac{r}{y} =$ ____.

End of Y-class

Y-home:	__ __ __	265pts
Y3:	__ __ __	120pts
Y4:	__ __	40pts
Total:	__ __ __	425pts

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

____ Ord: __ __