



Staple!

Ord: _____

Calc III
MAC3474 3129

Y-class

Prof. JLF King
Touch: 30Sep2019

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 $.9797\dots$. Write expressions unambiguously e.g, “ $1/a + b$ ” should be bracketed either $[1/a] + b$ or $1/[a + b]$. (Be careful with **negative signs!**)

Write **DNE** if the object does not exist or the operation cannot be performed. NB: **DNE** $\neq \{\} \neq 0 \neq$ Empty-word.

Y3: Show no work.

a Give an example of a polynomial f which has a saddle-point at $(5, 17)$.

$$f(x, y) := \underline{\quad}$$

b,c In \mathbb{R}^3 , let S be the surface $3 + 6x - 3x^2 = 2y^2 + z^2$. Find a non-zero vector \mathbf{v} which is orthogonal to S at $P := (0, 1, 1)$. $\mathbf{v} = \underline{\quad}$.

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

Eqn: $\underline{\quad \dots \quad}$

Arrange that A, B, C are integers with no common factor; also, that $A \geq 0$.

d,e Let $f(x, y) := x + 6y$. Subject to the constraint that $y^2 = x$, compute the location (x_0, y_0) of a **global maximum** of f , and compute the location (x_1, y_1) of a **global minimum** of f .

$$\text{Max} = (\underline{\quad \dots \quad}, \underline{\quad \dots \quad}); \text{ Min} = (\underline{\quad \dots \quad}, \underline{\quad \dots \quad}).$$

f 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 $(\underline{\quad \dots \quad}, \underline{\quad \dots \quad})$, thus putting the center-of-mass of the weighted-plate at $(2, 1)$.

Y4: Center the radius-1 disk at the origin. For a radius $0 < r < 1$, drill a radius- r hole, tangent to the disk’s boundary at the point $(-1, 0)$. Compute the x -coord of the *centroid* of the holed-disk.

$$\bar{x}(r) = \underline{\dots \dots \dots}$$

What are

$$\lim_{r \searrow 0} \bar{x}(r) = \underline{\dots \dots \dots} \text{ and } \lim_{r \nearrow 1} \bar{x}(r) = \underline{\dots \dots \dots} ?$$

End of Y-class

Y-home: _____ 440pts

Y3: _____ 180pts

Y4: _____ 40pts

Total: _____ 660pts

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

Ord: _____

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