Exam 2

# TMath 126

Practice

Note: This is a practice exam and is intended only for study purposes. The actual exam will contain different questions and may have a different layout.

1. TRUE/FALSE: Identify a statement as True in each of the following cases if the statement is *always* true and provide a brief justification. Otherwise, identify it as false and provide a counterexample.

   Let $\vec{a}$, $\vec{b}$, and $\vec{c}$ be vectors in $\mathbb{R}^3$.
   Recall that $\cdot$ refers to the dot product, and $\times$ refers to the cross product.

   (a) Let $f$ be a function of $x$ and $y$. If $\nabla f(c,d) = (2,1)$, then the vector $\langle 2,1\rangle$ is tangent to the contour line of the surface of $f$ at $(c,d,f(c,d))$.

   (b) $\int_{-1}^{2}\int_{0}^{6} x^2\sin(x-y)\,dx\,dy = \int_{0}^{6}\int_{-1}^{2} x^2\sin(x-y)\,dy\,dx$

   (c) $\int_{-1}^{x}\int_{0}^{6} x^2\sin(x-y)\,dx\,dy = \int_{0}^{6}\int_{-1}^{x} x^2\sin(x-y)\,dy\,dx$

Note: This practice exam is light on Section 14.6 but I wanted to get *something* to you!!! Check out class activities, WebHW & WrittenHW from the section and add that here! (Pick something with pictures, I like pictures.)

2. You are given the following data of a function $g(x, y)$. Your boss wants you to approximate $g(.8, 1.4)$ and wants to be convinced you're doing something sophisticated. Find a linear approximation for your boss and explain your choices (there are many that you will make!).

| $x$ | $y$ | $g(x, y)$ |
|---|---|---|
| 0.55 | 1.2 | 27 |
| 0.65 | 1.0 | 31 |
| 0.65 | 1.1 | 29 |
| 0.75 | 1.2 | 50 |

3. Find the maximum and minimum volumes of a rectangular box with the constraints that the surface area is $1500\text{cm}^2$ and total edge length is 200cm.

4. Common blood types are determined by three alleles, $A$, $B$, and $O$. If $p$ is the percent of allele $A$ in the population, $q$ is the percent of allele $b$ in the population and $r$ is the percent of allele $O$ in the population then the proportion of individuals with a mixed blood type (e.g. $AB$, $AO$ or $BO$) is $P(p, q, r) = 2pq + 2pr + 2qr$. Find the maximal $P$ value.

5. Consider the double integral

$$\int_0^1 \int_{\arcsin y}^{\frac{\pi}{2}} \cos(x)\sqrt{1+\cos^2 x}\, dx dy$$

(a) Sketch the region in the $xy$-plane where the integral is taken over.

(b) Switch the order of integration.

(c) Compute the double integral.