MATH 237

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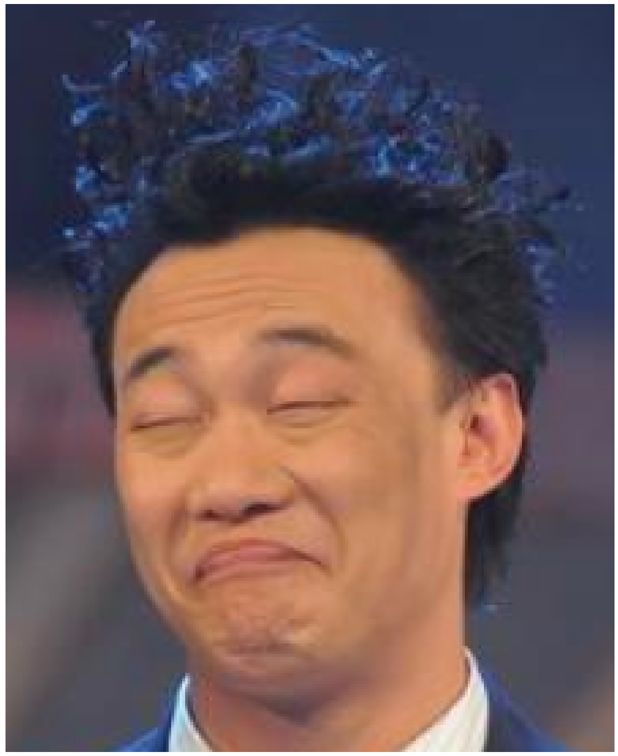

Figure 1: Close-up of a Eason

1 Lecture 1 Basic ideas of this course

1.1 What is calculus?

Calculus: how things *change*

1.2 What to focus?

$$\mathbb{R}^n \to \mathbb{R}^m \qquad n = 2,3 \;\; m = 1$$

1.2.1 Some advices on triple integral

For a triple integral, there are 6 different orders of integration[1]:

$$dxdydz,\ dxdzdy,\ dydzdx,\ dydxdz,\ dzdxdy,\ dzdydx$$

Order of integration that you choose depends on 2 factors:

1. the region might be easier to describe in terms of inequalities using some particular order.
2. it might be easier to find anti-derivatives with respect to one particular variable versus the others.

Theorem 1.2.1 (EVT)**.** *If $f : \mathbb{R}^n \to \mathbb{R}$ is continuous, and S is compact, then f has a global max and a global min on S.*

[1] Integration, the computation of an integral

2 Lecture 2 Continuity

2.1 Just sth...

Let $f : \mathbb{R}^n \to \mathbb{R}$. Let $\vec{a} \in Dom(f)$.

Suppose $\vec{a}$ is an interior point. i.e. f is is defined at all points sufficiently close to $\vec{a}$.

Definition 2.1.1. We say f is <u>continuous</u> at $\vec{a}$ if

$$\lim_{\vec{x} \to \vec{a}} f(\vec{x})$$

exists and equals $f(\vec{a})$.

Informally, f is continuous at $\vec{a}$ means $f(\vec{x})$ gets close to $f(\vec{a})$ as $\vec{x}$ gets close to $\vec{a}$.

3 Lecture ∞ Some linear algebra staff

3.1 Important LaTeX Theorem

Theorem 3.1.1 (WTF theorem). *Let* $A \in M_{n\times n}(\mathbb{C})$ *be* ***normal***.

1. $||A\vec{z}|| = ||A^*\vec{z}||$ *for all* $\vec{z} \in \mathbb{C}^n$
2. $A - \lambda I$ *is normal for all* $\lambda \in \mathbb{C}$
3. $A\vec{z} = \lambda\vec{z} \implies A^*\vec{z} = \overline{\lambda}\vec{z}$

Proof. $||A\vec{z}||^2 =< A\vec{z}, A\vec{z} >= ... =< A^*\vec{z}, A^*\vec{z} >= ||A^*\vec{z}||^2$ □

3.2 Trying with dot product

$a \cdot b$ bit small...
$a \bullet b$ too thick...
$a \mathbin{\vcenter{\hbox{\scriptsize$\bullet$}}} b$ great!!!