

Selecta from first review

THERE WERE 200 SLIDES IN GENERAL, AND NOT ALL ARE PUBLISHABLE. HERE IS A SELECTION, DUE TO HUGE DEMAND

OLIVER KNILL (REVIEWS FROM DEC 12 AND 13, 2012)

Formula

TO COMPUTE

$$\vec{u} \cdot \vec{v} = |\vec{u}| |\vec{v}| \cos(\alpha)$$

ANGLE

$$|\vec{u} \times \vec{v}| = |\vec{u}| |\vec{v}| \sin(\alpha)$$

AREA

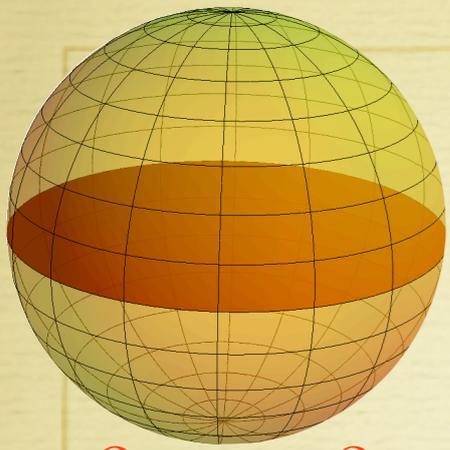
$$\text{proj}_{\vec{w}}(\vec{v}) = \frac{\vec{v} \cdot \vec{w}}{|\vec{w}|^2} \vec{w}$$

LENGTH

$$|\vec{u} \cdot \vec{v} \times \vec{w}|$$

VOLUME

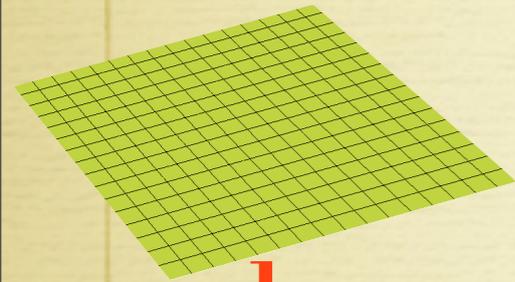
4 multiplications to remember



$$\vec{r}(t,s) = \langle \sin(s) \cos(t), \sin(s) \sin(t), \cos(s) \rangle$$

$$x^2 + y^2 + z^2 = 1$$

$$\vec{r}(t,s) = \langle x + v_1 s + w_1 t, y + v_2 s + w_2 t, z + v_3 s + w_3 t \rangle$$



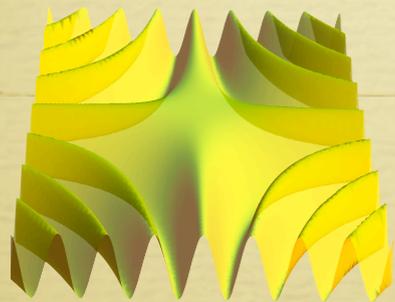
$$ax + by + cz = d$$

$$\vec{r}(t,s) = \langle r(z) \cos(t), r(z) \sin(t), z \rangle$$



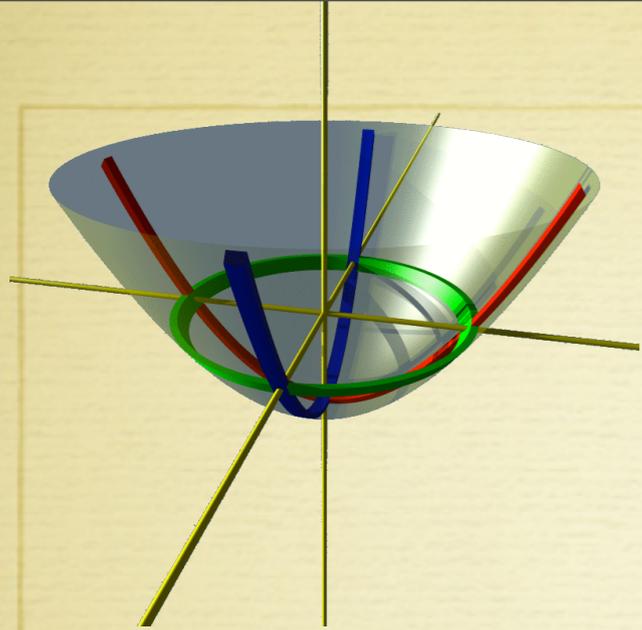
$$x^2 + y^2 = g(z)$$

$$\vec{r}(t,s) = \langle s, t, f(s,t) \rangle$$

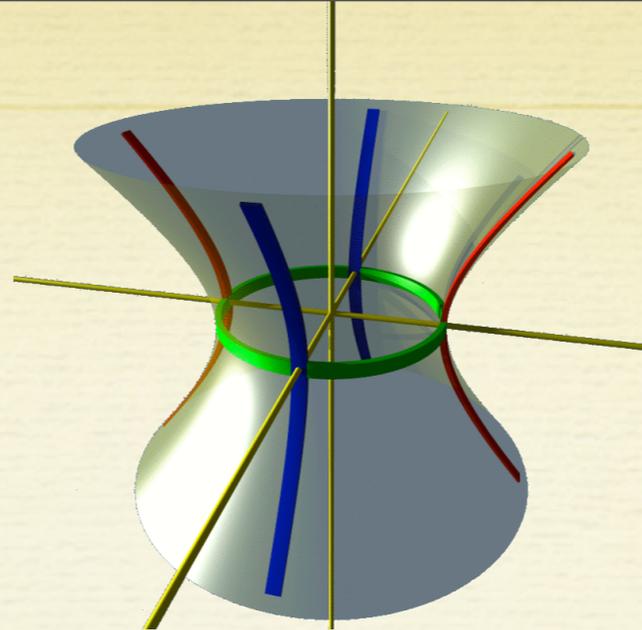


$$z = f(x,y)$$

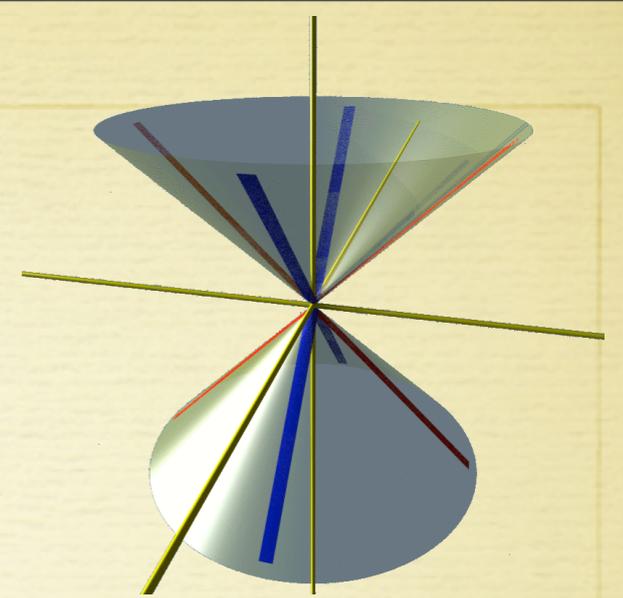
4 Surface
types



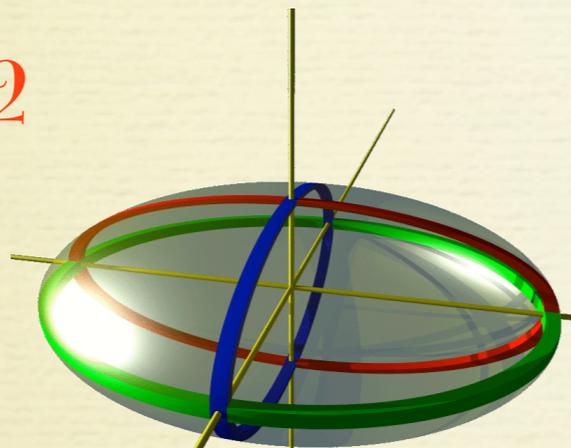
$$z = x^2 + y^2$$



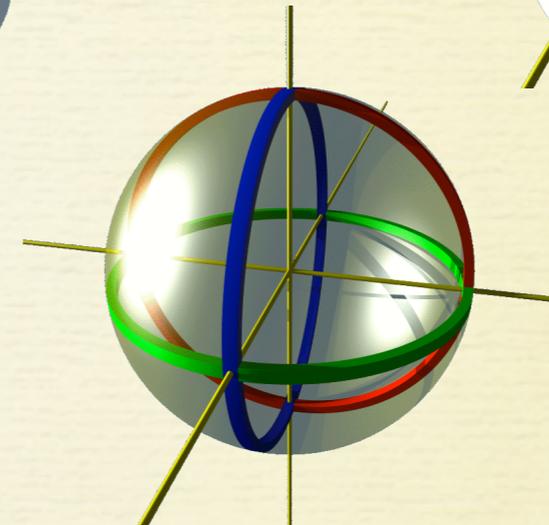
$$x^2 + y^2 - z^2 = 1$$



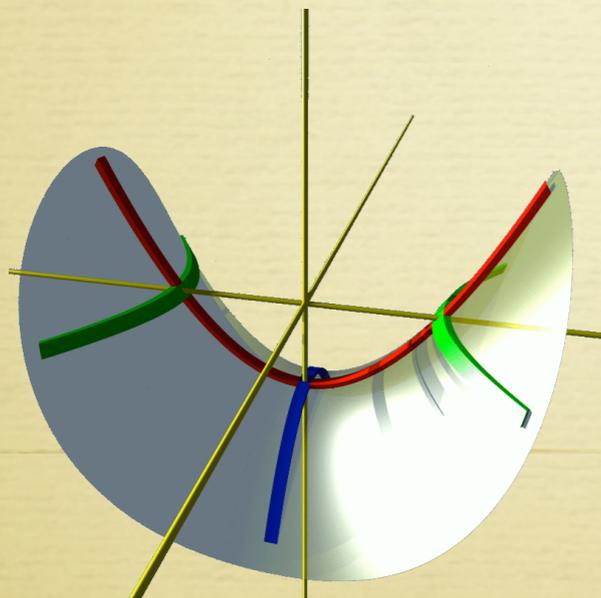
$$z^2 = x^2 + y^2$$



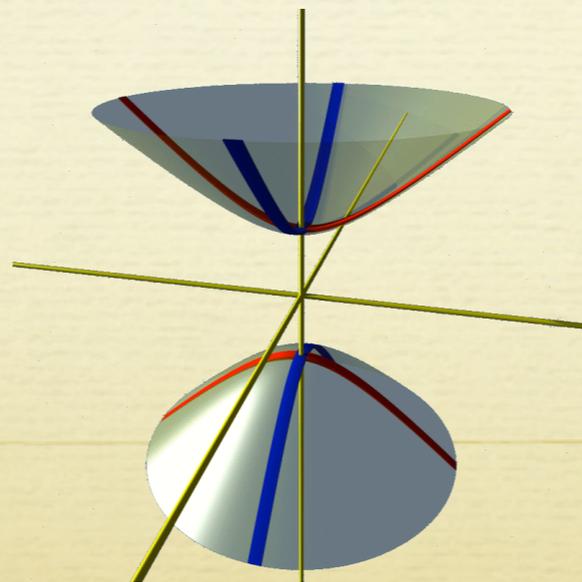
$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$



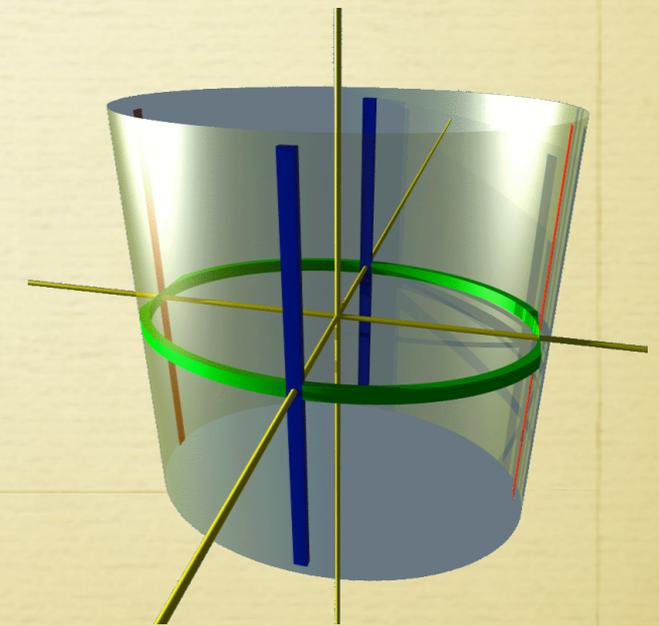
$$x^2 + y^2 + z^2 = 1$$



$$z = x^2 - y^2$$



$$x^2 + y^2 - z^2 = -1$$



$$1 = x^2 + y^2$$

Top 10 Mistakes in 21a

1) NONLINEAR LINEARIZATION

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- 9) WRONG ORIENTATION

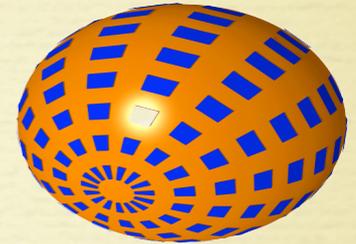
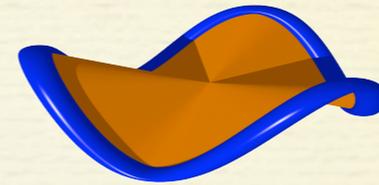
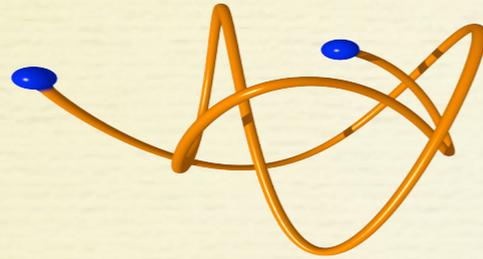
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- 9) WRONG ORIENTATION
- 10) FINAL RESULT IS NOT WRITTEN

Top 10 Mistakes in 21a

Selecta from Second review

Overview Theorems



DIM=1

FTC

DIM=2

FTLI

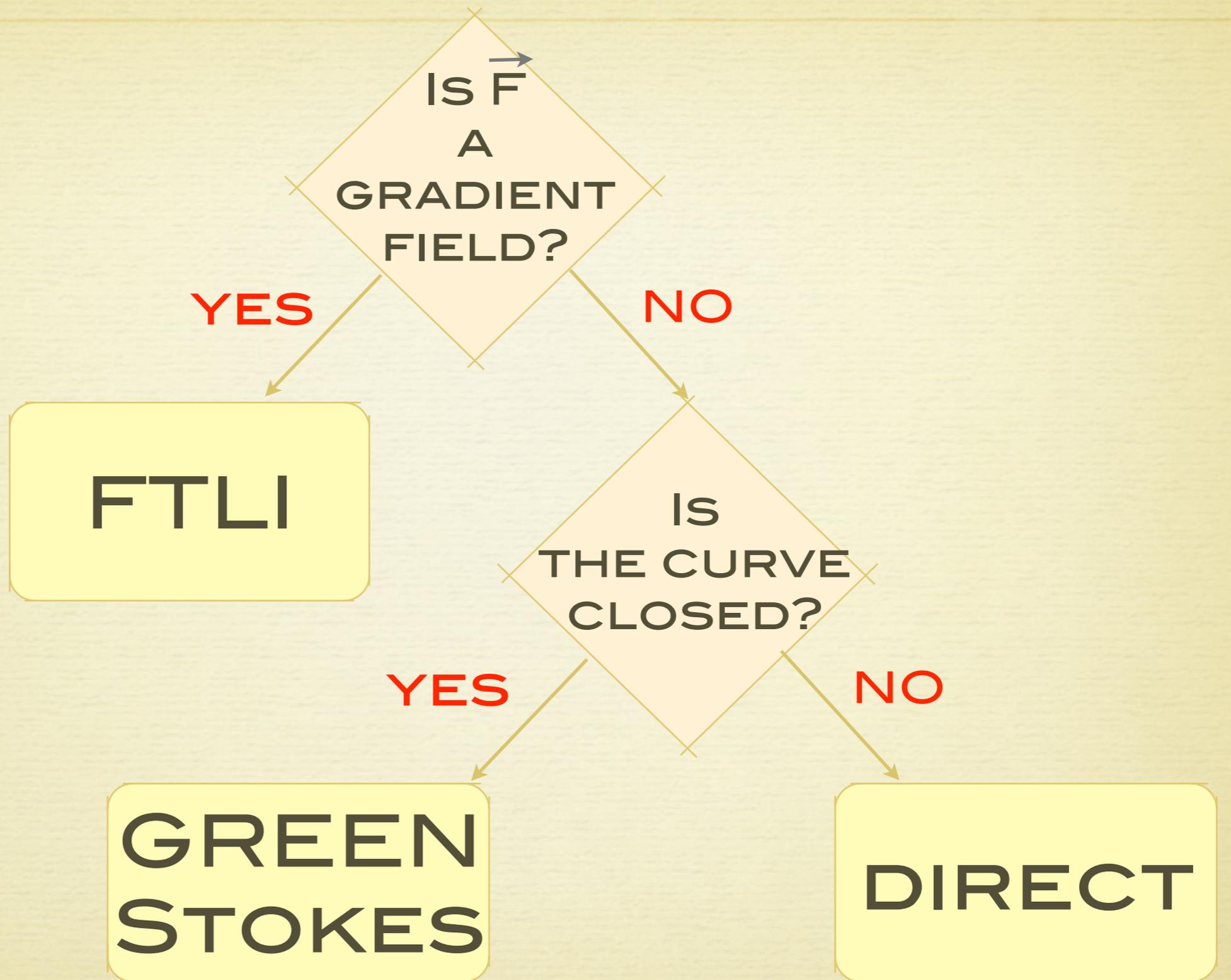
GREEN

DIM=3

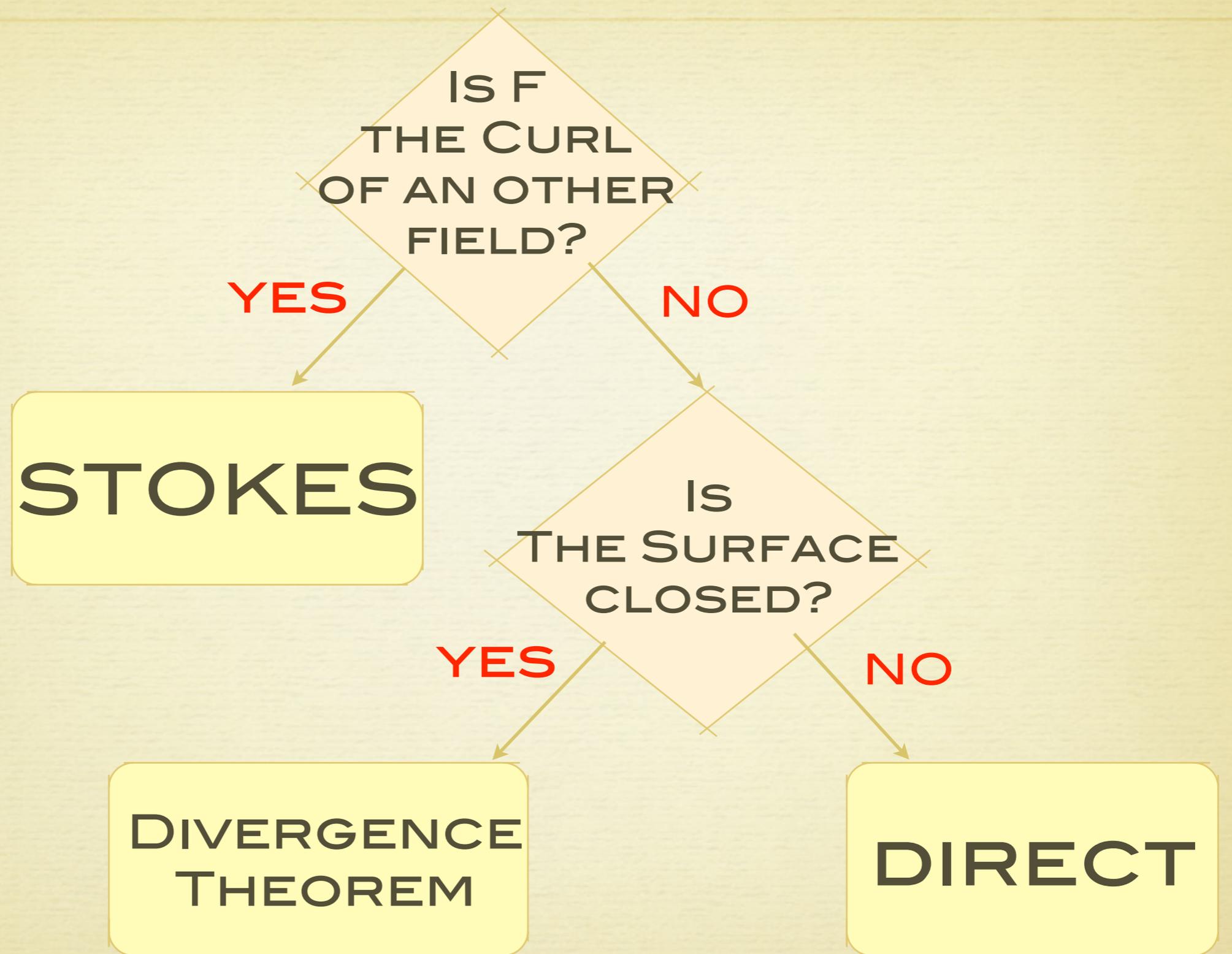
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STOKES

GAUSS



Decision Tree for Line integrals



Decision Tree for Flux integrals

Which integral Thm?

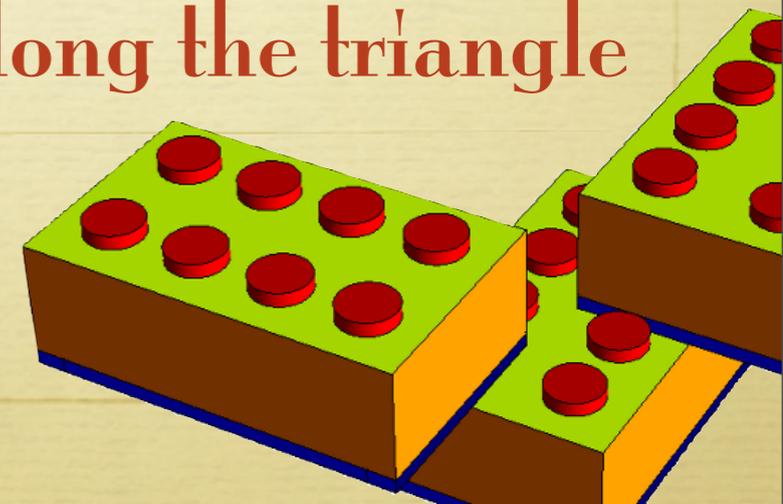
Find the flux of the curl of F through the cylinder

Find the line integral of $F(x,y,z) = \langle x,y,\sin(z) \rangle$ along ...

Find the flux of $F(x,y,z) = \langle y,x,z \rangle$ through the doughnut

What is the area of the region enclosed by $r(t) = \dots$

What is the line integral of $F(x,y) = \langle -y,x \rangle$ along the triangle



CHEN GONG

CARL FRIEDRICH GAUSS



1777-1855

JEAN MARY AMPERE



1775-1846

GEORGE GREEN



1793-1841

MIKHAEL OSTROGRADSKY



1801-1862

GEORGE STOKES



1819-1903

AUGUSTINE CAUCHY



1789-1857



1750

1800

1850

1900

FTLI
1840

GAUSS
THEOREM

GREEN
THEOREM

STOKES
THEOREM