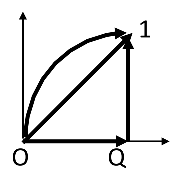
http://wn.com/Wile_E_Coyote

Last Class:

A. Work $\Delta T = T_2 - T_1 = \int_1^2 \mathbf{F} \cdot d\mathbf{r} \equiv W(1 \rightarrow 2)$

Line integral along a specific path



B. Conservative Forces

1. F(r)
2. Work independent of the path

C. Tutorial

Concepts: Equipotential surface, PE,Gradient, Force

Motivation: Force is proportional to gradient of PE but opposite direction

This Class:

- Rigorous definition of potential energy U(**r**)
- Formal derivation of the relation between force and potential energy

Given U find F
Given F find U

- Rigorous understanding of conservative forces.

Do you agree or disagree with the following statements?

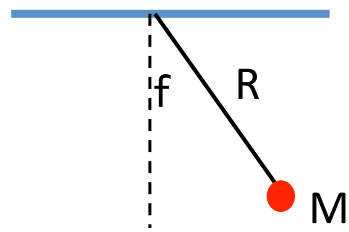
1) "For a conservative force, the magnitude of the force is related to potential energy. The larger the potential energy, the larger the magnitude of the force."

2) "For a conservative force, the magnitude of the force is related to potential energy. For any equipotential contour line, the magnitude of the force must be the same at every point along that contour."

A) Agree with 1 and 2
B) Agree only with 1
C) Agree only with 2
D) Disagree with both

What is the potential energy of M in terms of ϕ? (Take U=0 at ϕ=0)

A) $MgR\phi$
B) $MgR(\cos(\phi)-1)$
C) $MgR\sin(\phi)$
D) $MgR(1-\cos(\phi))$
E) $MgR(1-\sin(\phi))$



A charge q sits in an electric field **E** = E_0 **i**, what is the potential energy U(r)?

A) $+qE_0x\,\hat{\mathbf{i}}$

B) $-qE_0x\,\hat{\mathbf{i}}$

C) $+qE_0x$

D) $-qE_0x$

E) Something else!

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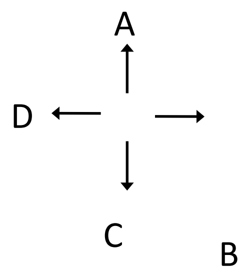
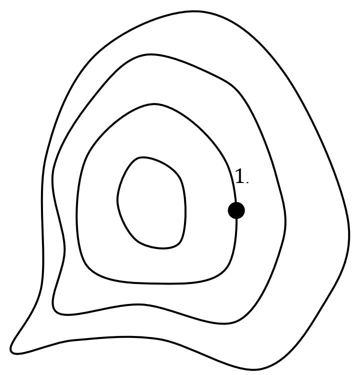
Consider the contour plot of a function f(x,y), where the central contour corresponds to the largest value of f.

Which way does ∇f point, at point 1?



E) Other/???



Can you explain why?

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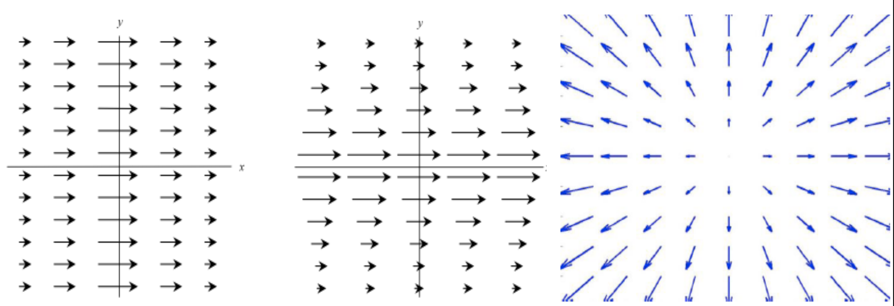
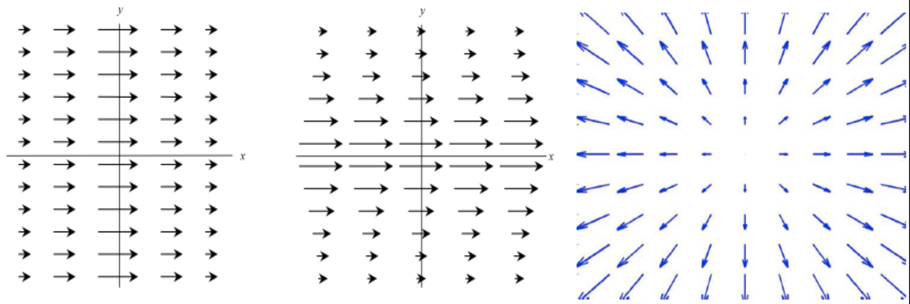
Can you come up with equipotential lines for the 3 force fields below?



Draw it if possible

What is the curl (∇x**F**) of this vector field, **F**?

A) = 0 everywhere
B) ≠ 0 everywhere
C) =0 in some places
D) Not enough info to decide



We learned that

- F(r) is a conservative force
- $\int_{r_o}^{r_1} \vec{F}(r') \cdot d\vec{r}'$ is path independent
- Potential energy is well defined $U(r) = -\int_{r_o}^{r} \vec{F}(r') \cdot d\vec{r}'$
- $\vec{F}(r) = -\vec{\nabla} U(r)$
- $\vec{\nabla} \times \vec{F}(r) = \mathbf{0}$
- $\oint \vec{F}(r') \cdot d\vec{r}' = \mathbf{0}$