True or False The following mathematical operation makes sense and is technically valid.

$$\nabla \cdot \nabla T(x, y, z)$$

A. Yes, it will produce a vector field.
B. Yes, it will produce a scalar field.
C. No, you can not take the divergence of a scalar field.
D. I don't remember what this means.

You are trying to compute the work done by a force, $\mathbf{F} = a\hat{x} + x\hat{y}$, along the line $y = 2x$ from $\langle 0, 0 \rangle$ to $\langle 1, 2 \rangle$. What is $d\mathbf{l}$?

A. dl
B. $dx\ \hat{x}$
C. $dy\ \hat{y}$
D. $2dx\ \hat{x}$
E. Something else

You are trying to compute the work done by a force, $\mathbf{F} = a\hat{x} + x\hat{y}$, along the line $y = 2x$ from $\langle 0, 0\rangle$ to $\langle 1, 2\rangle$. Given that $d\mathbf{l} = dx\ \hat{x} + dy\ \hat{y}$, which of the following forms of the integral is correct?

A. $\int_0^1 a\ dx + \int_0^2 x\ dy$
B. $\int_0^1 (a\ dx + 2x\ dx)$
C. $\frac{1}{2}\int_0^2 (a\ dy + y\ dy)$
D. More than one is correct

A certain fluid has a velocity field given by $\mathbf{v} = x\hat{x} + z\hat{y}$. Which component(s) of the field contributed to "fluid flux" integral ($\int_S \mathbf{v} \cdot d\mathbf{A}$) through the x-z plane?

A. v_x
B. v_y
C. both
D. neither

A certain fluid has a velocity field given by $\mathbf{v} = x\hat{x} + z\hat{y}$. If we intend to calculate the "fluid flux" integral ($\int_S \mathbf{v} \cdot d\mathbf{A}$) through the x-z plane, what is $d\mathbf{A}$ in this case? Be specific!

A. $\langle dx\, dy, 0, 0 \rangle$
B. $\langle dx\, dz, 0, 0 \rangle$
C. $\langle dy\, dz, 0, 0 \rangle$
D. It's none of these

For the same fluid with velocity field given by $\mathbf{v} = x\hat{x} + z\hat{y}$. What is the value of the "fluid flux" integral ($\int_S \mathbf{v} \cdot d\mathbf{A}$) through the entire x-y plane?

A. It is zero
B. It is something finite
C. It is infinite
D. I can't tell without doing the integral

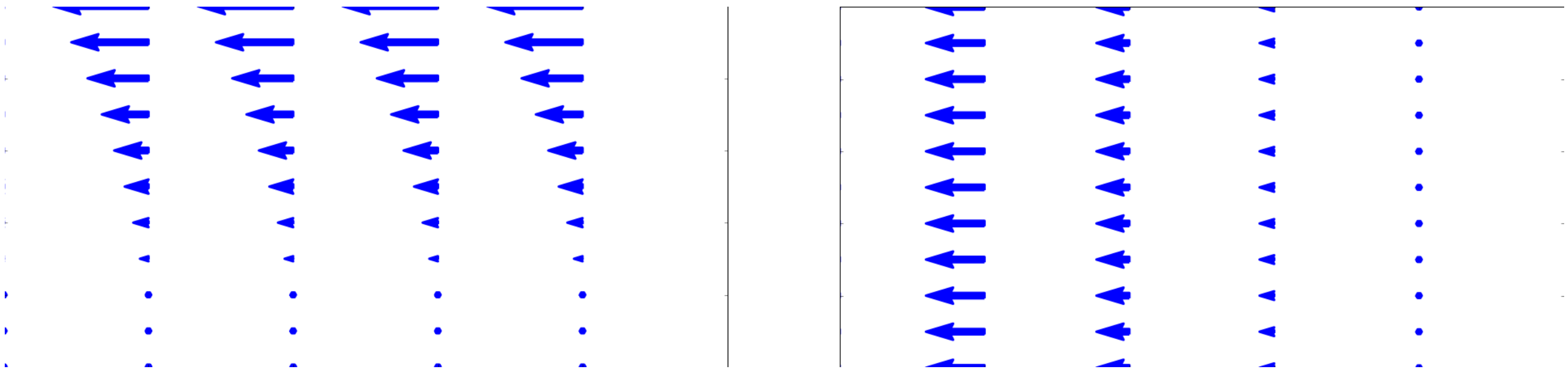
A rod (radius R) with a hole (radius r) drilled down its entire length L has a mass density of $\frac{\rho_0 \phi}{\phi_0}$ (where ϕ is the normal polar coordinate).

To find the total mass of this rod, which coordinate system should be used (take note that the mass density varies as a function of angle):

A. Cartesian (x, y, z)
B. Spherical (r, ϕ, θ)
C. Cylindrical (s, ϕ, z)
D. It doesn't matter, just pick one.

Which of the following two fields has zero divergence?

I	II



A. Both do.

B. Only I is zero

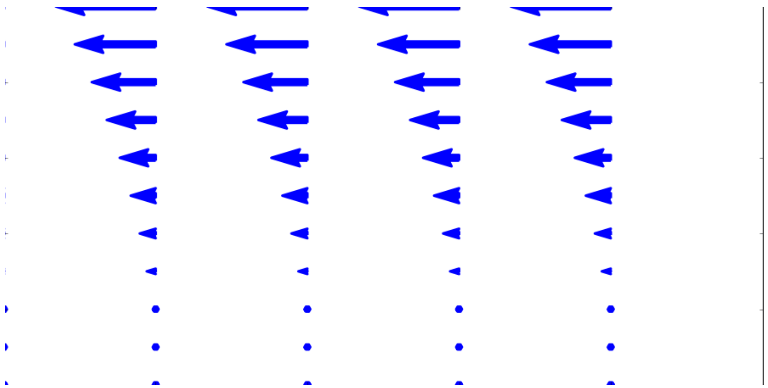
C. Only II is zero

D. Neither is zero

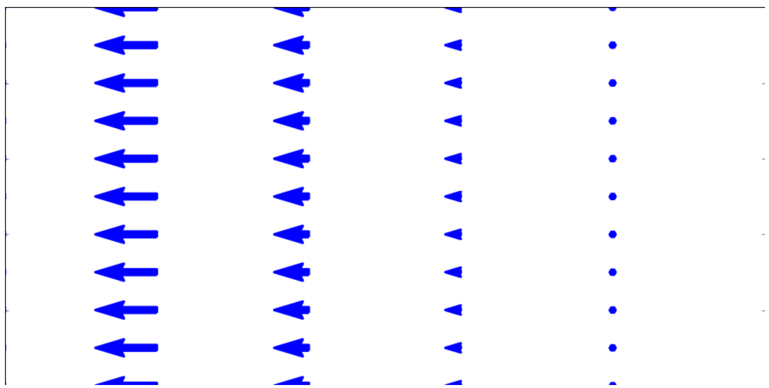
E. ???

Which of the following two fields has zero curl?

I



II



A. Both do.

B. Only I is zero

C. Only II is zero

D. Neither is zero

E. ???