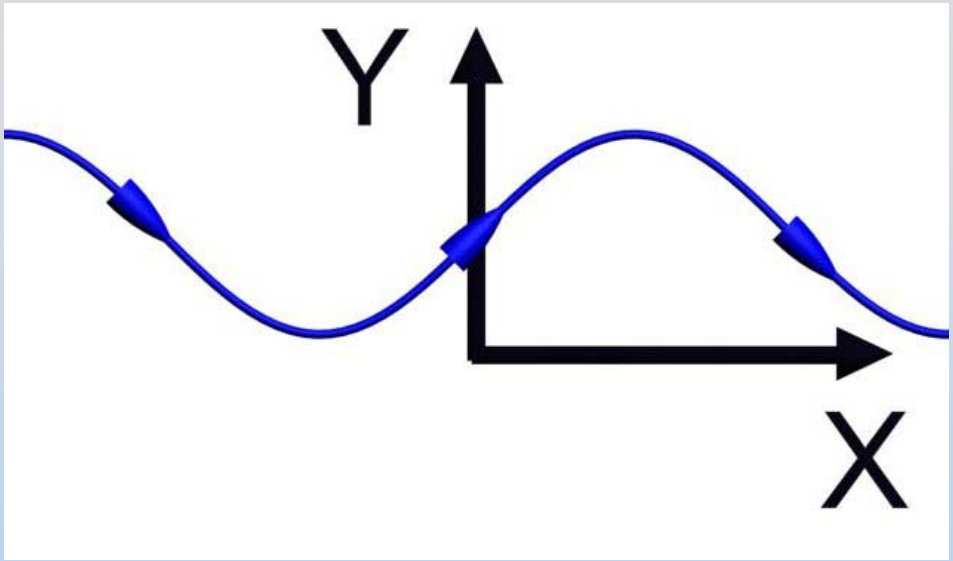
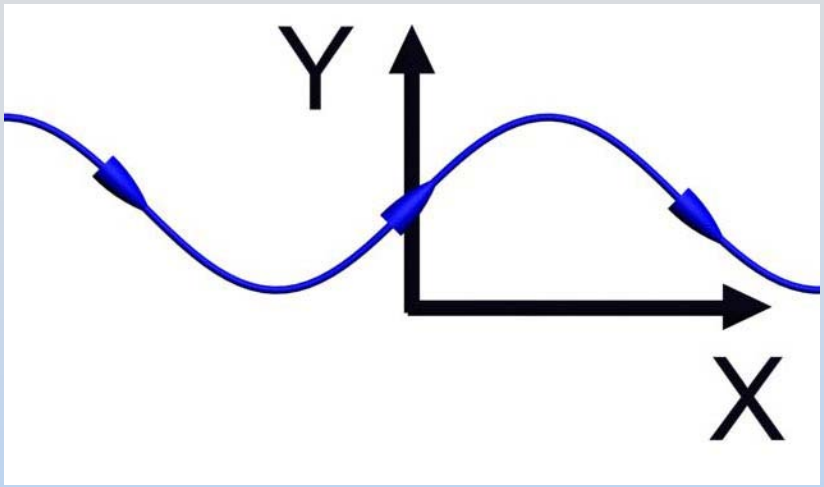
Concept Question: Vector Field



The field line at left corresponds to the vector field:

1. $\vec{\mathbf{F}}(x,y) = \sin(x)\,\hat{\mathbf{i}} + \hat{\mathbf{j}}$
2. $\vec{\mathbf{F}}(x,y) = \hat{\mathbf{i}} + \sin(x)\,\hat{\mathbf{j}}$
3. $\vec{\mathbf{F}}(x,y) = \cos(x)\,\hat{\mathbf{i}} + \hat{\mathbf{j}}$
4. $\vec{\mathbf{F}}(x,y) = \hat{\mathbf{i}} + \cos(x)\,\hat{\mathbf{j}}$
5. I don't know

Concept Question Answer: Vector Field

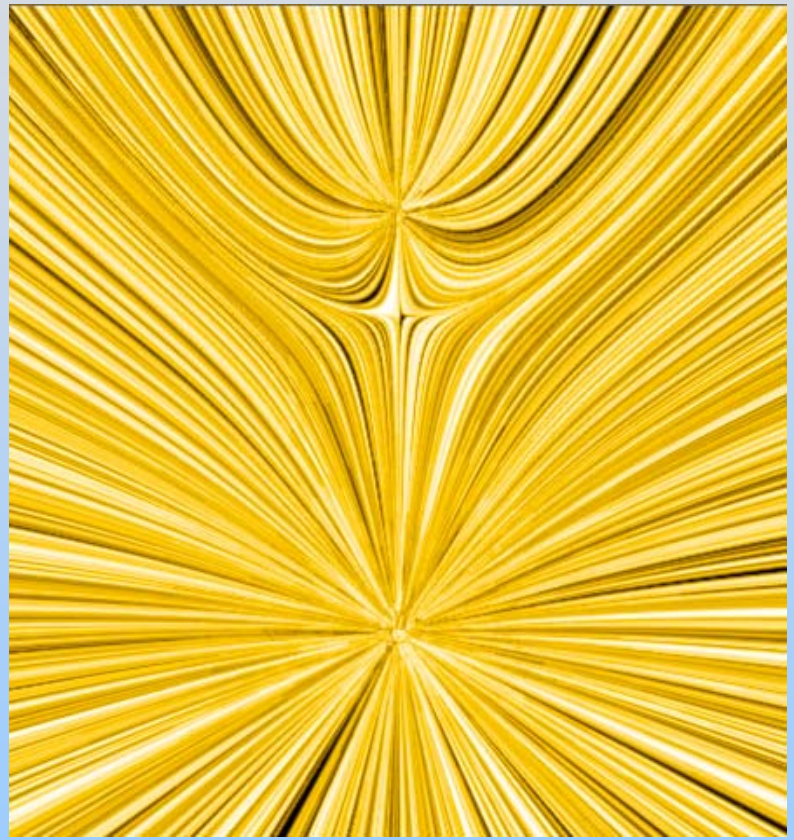


Answer:

4. $\vec{\mathbf{F}}(x,y) = \hat{\mathbf{i}} + \cos(x)\,\hat{\mathbf{j}}$

The curve above has a slope of 1 at the origin, and only (3) or (4) has this property. Moreover, the tangent to the curve above has a y-component changes sign as x changes and an x-component that is always positive, so the answer must be (4).

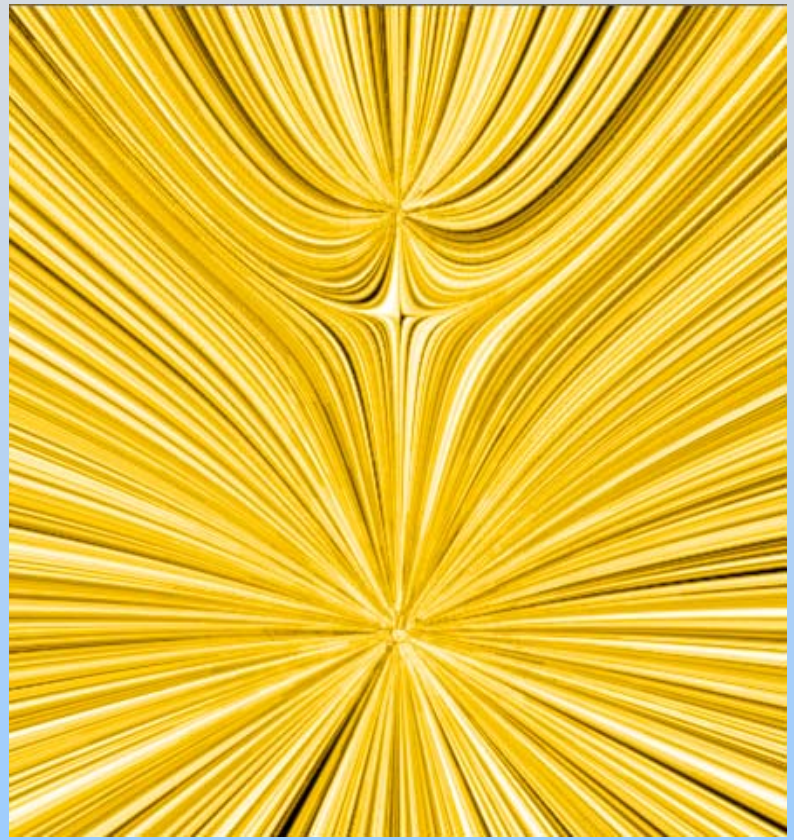
Concept Question: Grass Seeds



The vector field at left is created by:

1. Two sources (equal strength)
2. Two sources (top stronger)
3. Two sources (bottom stronger)
4. Source & Sink (equal strength)
5. Source & Sink (top stronger)
6. Source & Sink (bottom stronger)
7. I don’t know

Concept Question Answer: Grass Seeds



Answer:

3. Two sources (bottom stronger)

Both sources because lines leaving one *don't* enter the other.

Bottom is stronger because it "pushes" further

Concept Question: Grass Seeds

Here there is an initial downward flow.

1. The point is a source
2. The point is a sink
3. I don’t know

Concept Question Answer: Grass Seeds

Answer:

1. The point is a source

(link to movie)

It's a **source**, because otherwise the downward flow would flow right into it.

NOTE: If the background flow were *upward*, then the flow would be just flowing right into the point, so in that case the point would be a *sink*.

Concept Question: Circulation

These two circulations are in:

1. The same direction (e.g. both clockwise)
2. Opposite directions (e.g. one cw, one ccw)
3. I don't know

Concept Question Answer: Circulation

These two circulations are in:

2. Opposite directions

(link to movie)

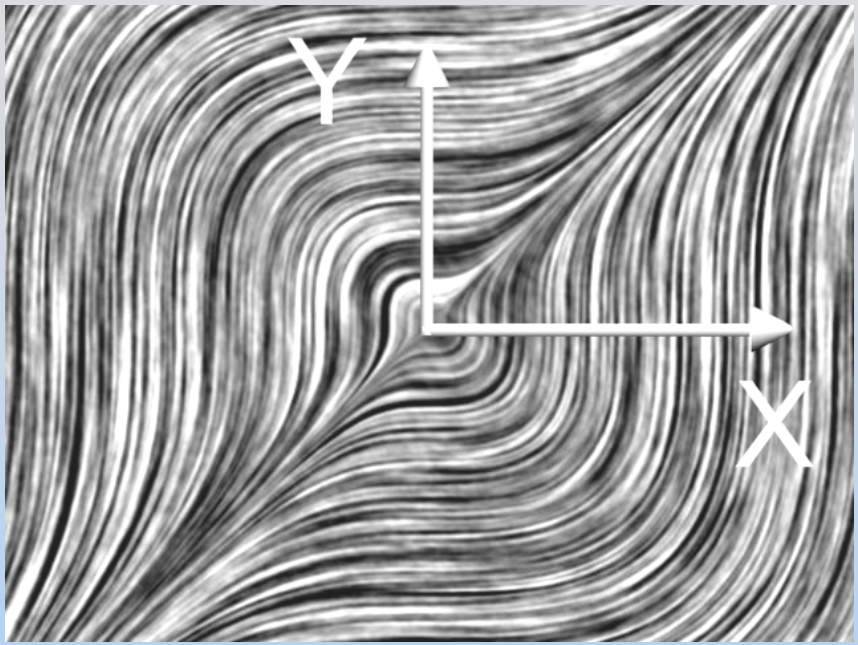
You can tell by looking in between. Both circulations push the flow in the same direction, so they must be circulating counter to each other.

Concept Question Answer cont.: Circulation

If the two circulations were in the *same* direction they'd look like this:

(link to movie)

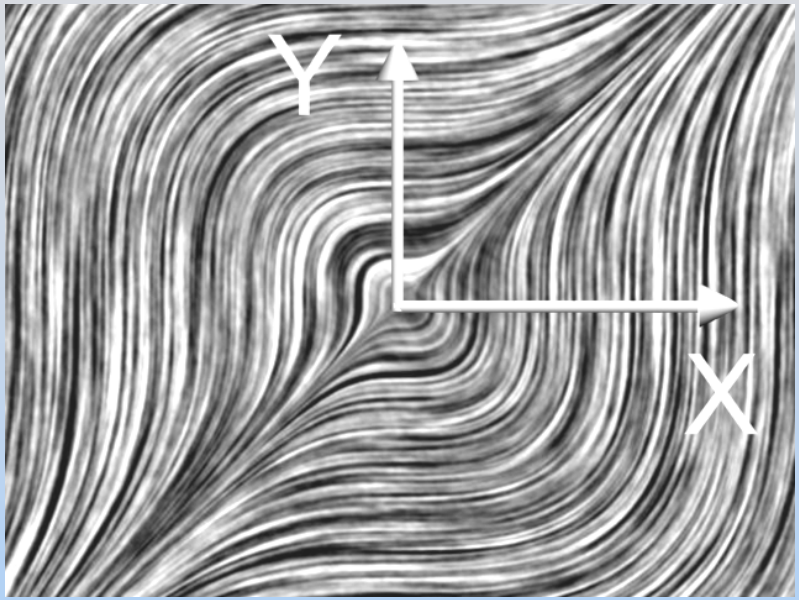
Concept Question: Vector Field



The grass seeds field plot at left is a representation of the vector field:

1. $\vec{\mathbf{F}}(x,y) = x^2\hat{\mathbf{i}} + y^2\hat{\mathbf{j}}$
2. $\vec{\mathbf{F}}(x,y) = y^2\hat{\mathbf{i}} + x^2\hat{\mathbf{j}}$
3. $\vec{\mathbf{F}}(x,y) = \sin(x)\hat{\mathbf{i}} + \cos(y)\hat{\mathbf{j}}$
4. $\vec{\mathbf{F}}(x,y) = \cos(x)\hat{\mathbf{i}} + \sin(y)\hat{\mathbf{j}}$
5. I don't know

Concept Question Answer: Vector Field



Answer:

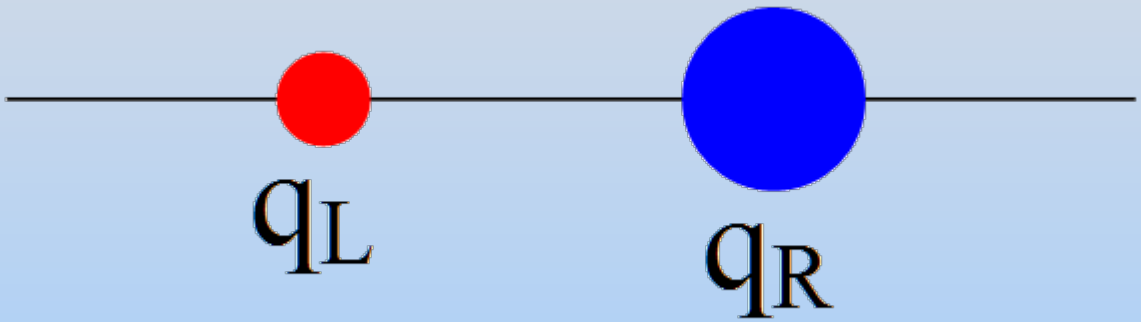
2. $\vec{\mathbf{F}}(x, y) = y^2\hat{\mathbf{i}} + x^2\hat{\mathbf{j}}$

(link to grass seeds applet)

Look along the positive x-axis. Along this axis the grass seed textures are vertical. This means **F** has only a y component when y is zero and x is non-zero. Only consistent with (2).

Concept Question: Electric Field

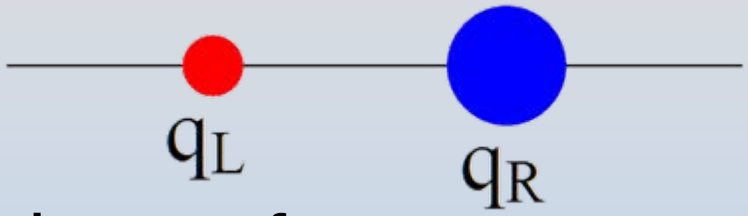
Two opposite charges are placed on a line as shown below. The charge on the right is three times larger than the charge on the left. Other than at infinity, where is the electric field zero?



1. Between the two charges
2. To the right of the charge on the right
3. To the left of the charge on the left
4. The electric field is nowhere zero
5. Not enough info – need to know which is positive
6. I don't know

Concept Question Answer: Electric Field

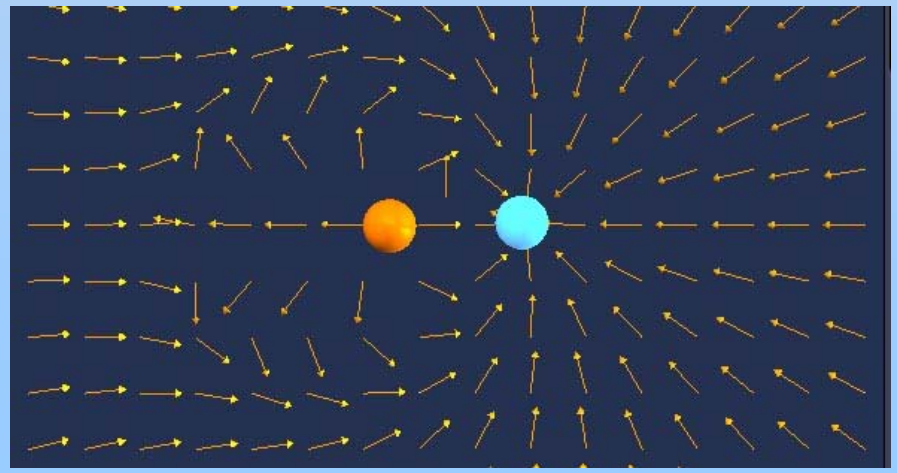
Answer: 3. To the left of the charge on the left



Between: field goes from source to sink.

On right: field dominated by q_R (bigger & closer).

On left: because q_L is weaker, its "push" left will somewhere be balanced by q_R's "pull" right



8.02SC Physics II: Electricity and Magnetism

Fall 2010