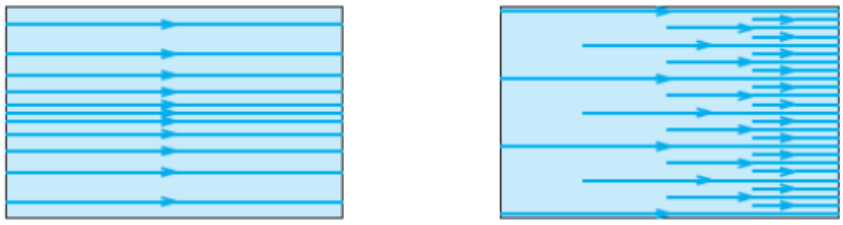
Divergence-free and/or curl-free vector fields. Consider the field pattern (showing lines of a vector field $\mathbf{a}$ in a part of free space) in Fig. Q4.11(a) and that in Fig. Q4.11(b), and whether each of the fields is divergence-free ($\nabla \cdot \mathbf{a} = 0$) and/or curl-free ($\nabla \times \mathbf{a} = 0$). Which of the following statements is true?



(a) (b)

Figure Q4.11 Two patterns of vector fields in a part of space (recall that the magnitude of the vector at a point is proportional to the density of field lines at that point); for Question 4.16.

(A) Field in Fig. Q4.11(a) is divergence-free and field in Fig. Q4.11(b) is curl-free.
(B) Field in Fig. Q4.11(a) is curl-free and field in Fig. Q4.11(b) is divergence-free.
(C) Both fields are divergence-free and none of the fields is curl-free.
(D) Both fields are curl-free and none of the fields is divergence-free.
(E) None of the fields is divergence-free nor curl-free.

Solution: (A)
Answer: (A)