1–10 Sketch the vector field $\mathbf{F}$ by drawing a diagram like Figure 5 or Figure 9.

4. $\mathbf{F}(x, y) = (x - y)\,\mathbf{i} + x\,\mathbf{j}$ **5.** $\mathbf{F}(x, y) = \dfrac{y\,\mathbf{i} + x\,\mathbf{j}}{\sqrt{x^2 + y^2}}$

9. $\mathbf{F}(x, y, z) = x\,\mathbf{k}$

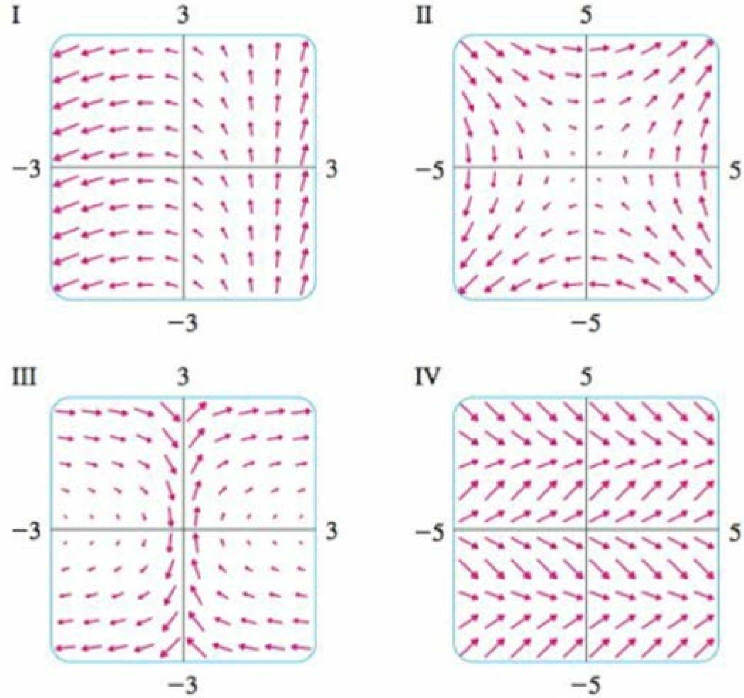
11–14 Match the vector fields $\mathbf{F}$ with the plots labeled I–IV. Give reasons for your choices.

11. $\mathbf{F}(x, y) = \langle y, x \rangle$

12. $\mathbf{F}(x, y) = \langle 1, \sin y \rangle$

13. $\mathbf{F}(x, y) = \langle x - 2, x + 1 \rangle$

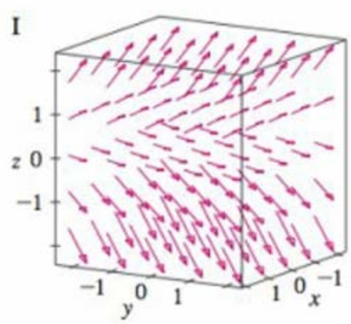
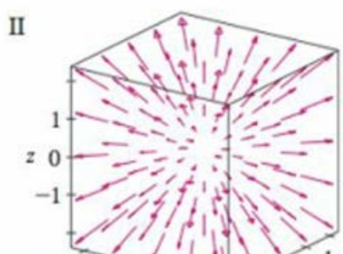
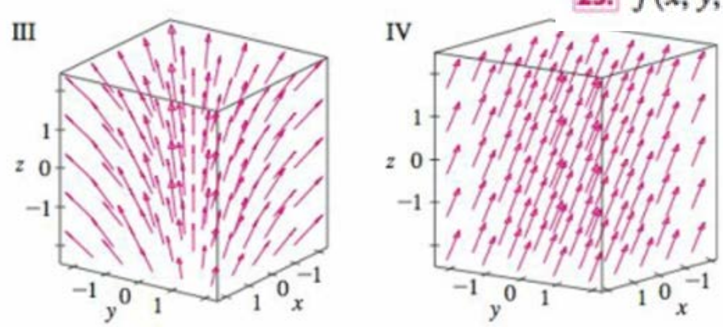
14. $\mathbf{F}(x, y) = \langle y, 1/x \rangle$



15–18 Match the vector fields $\mathbf{F}$ on $\mathbb{R}^3$ with the plots labeled I–IV. Give reasons for your choices.

15. $\mathbf{F}(x, y, z) = \mathbf{i} + 2\,\mathbf{j} + 3\,\mathbf{k}$ **16.** $\mathbf{F}(x, y, z) = \mathbf{i} + 2\,\mathbf{j} + z\,\mathbf{k}$

17. $\mathbf{F}(x, y, z) = x\,\mathbf{i} + y\,\mathbf{j} + 3\,\mathbf{k}$ **18.** $\mathbf{F}(x, y, z) = x\,\mathbf{i} + y\,\mathbf{j} + z$

19. If you have a CAS that plots vector fields (the command is `fieldplot` in Maple and `PlotVectorField` in Mathematica), use it to plot

$$\mathbf{F}(x, y) = (y^2 - 2xy)\,\mathbf{i} + (3xy - 6x^2)\,\mathbf{j}$$

Explain the appearance by finding the set of points (x, y) such that $\mathbf{F}(x, y) = \mathbf{0}$.

21–24 Find the gradient vector field of f.

23. $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$ **24.** $f(x, y, z) = x\cos(y/z)$

27–28 Plot the gradient vector field of f together with a contour map of f. Explain how they are related to each other.

28. $f(x, y) = \sin(x + y)$