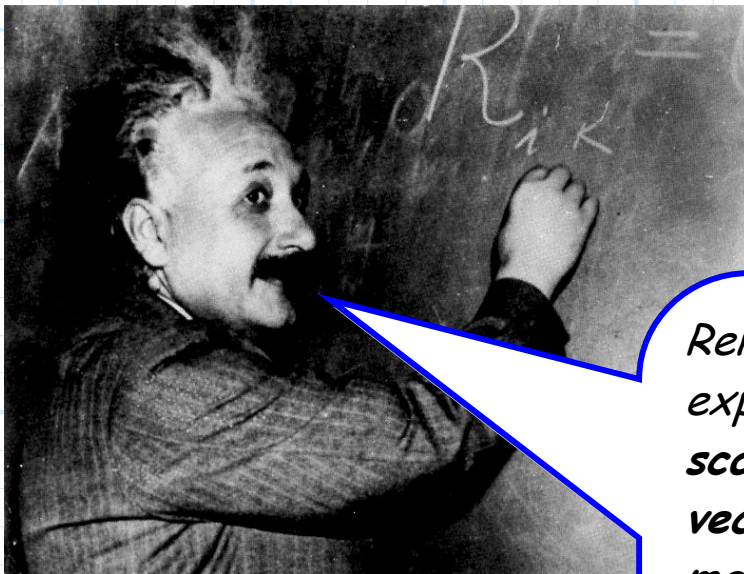


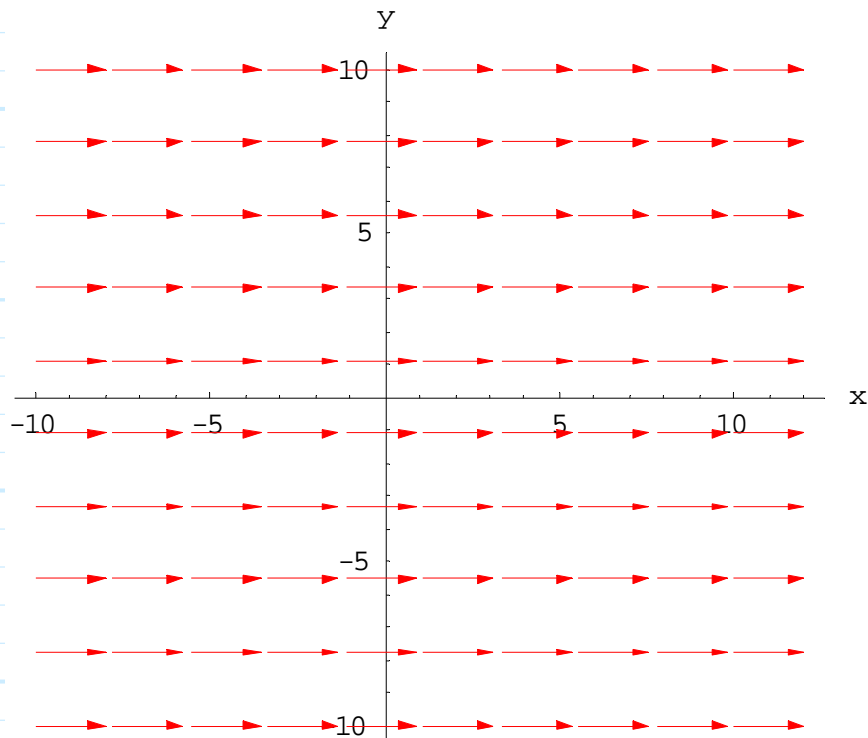
# A Gallery of Vector Fields

To help **understand** how a vector field relates to its mathematical representation using base vectors, carefully examine and consider these **examples**, plotted on either the  **$x$ - $y$  plane** (i.e, the plane with all points whose coordinate  $z=0$ ) or the  **$x$ - $z$  plane** (i.e, the plane with all points whose coordinate  $y=0$ ).

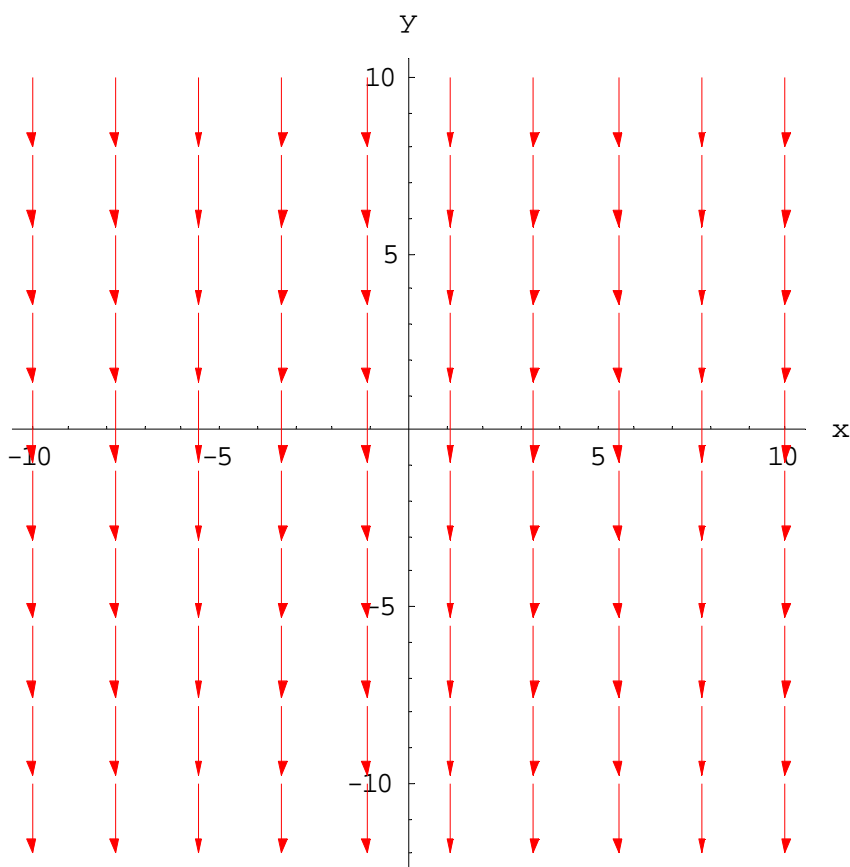
Spend some **time** studying each of these examples, until you see how the **math** relates to the vector field **plot** and vice versa.



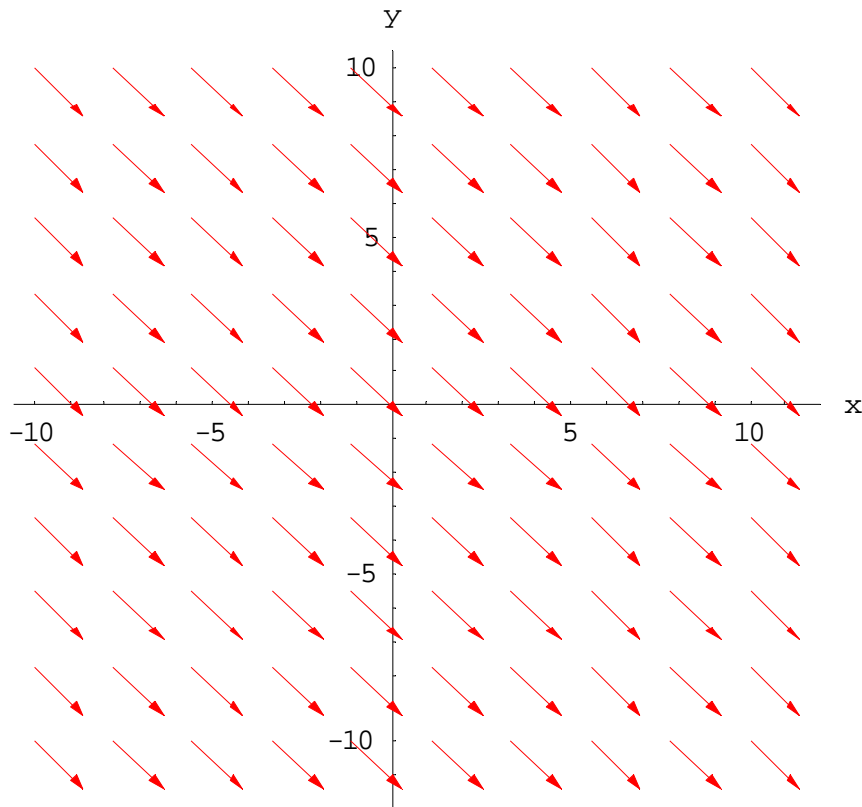
*Remember, **vector fields**—expressed in terms of **scalar components** and **base vectors**—are the **mathematical language** that we will use to describe much of **electromagnetics**—you must learn how to **speak** and **interpret** this language!*



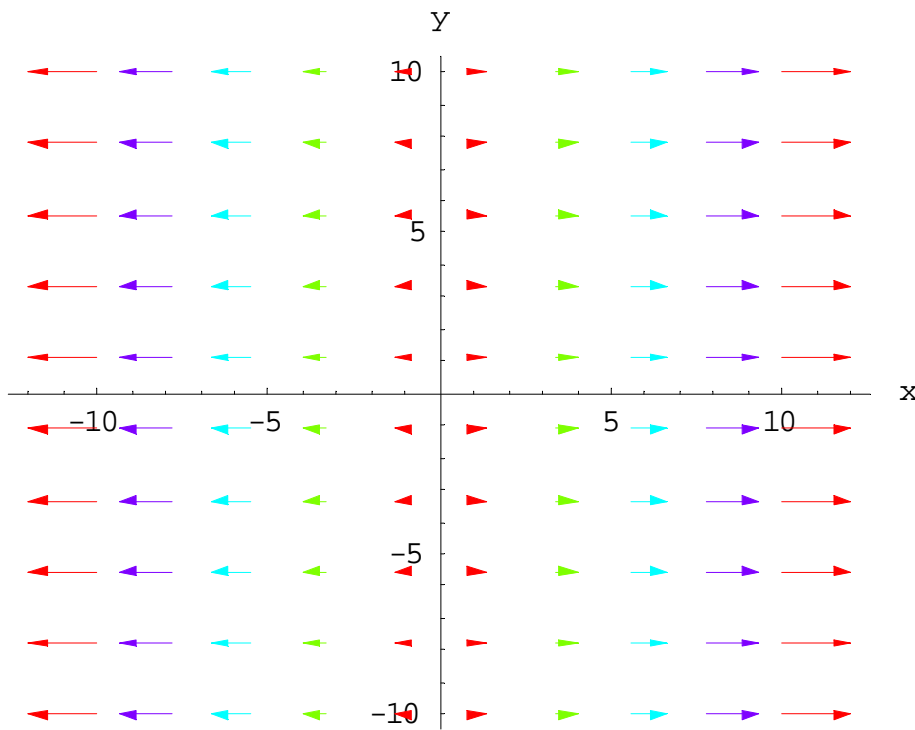
$$\mathbf{A}(\vec{r}) = \hat{a}_x$$



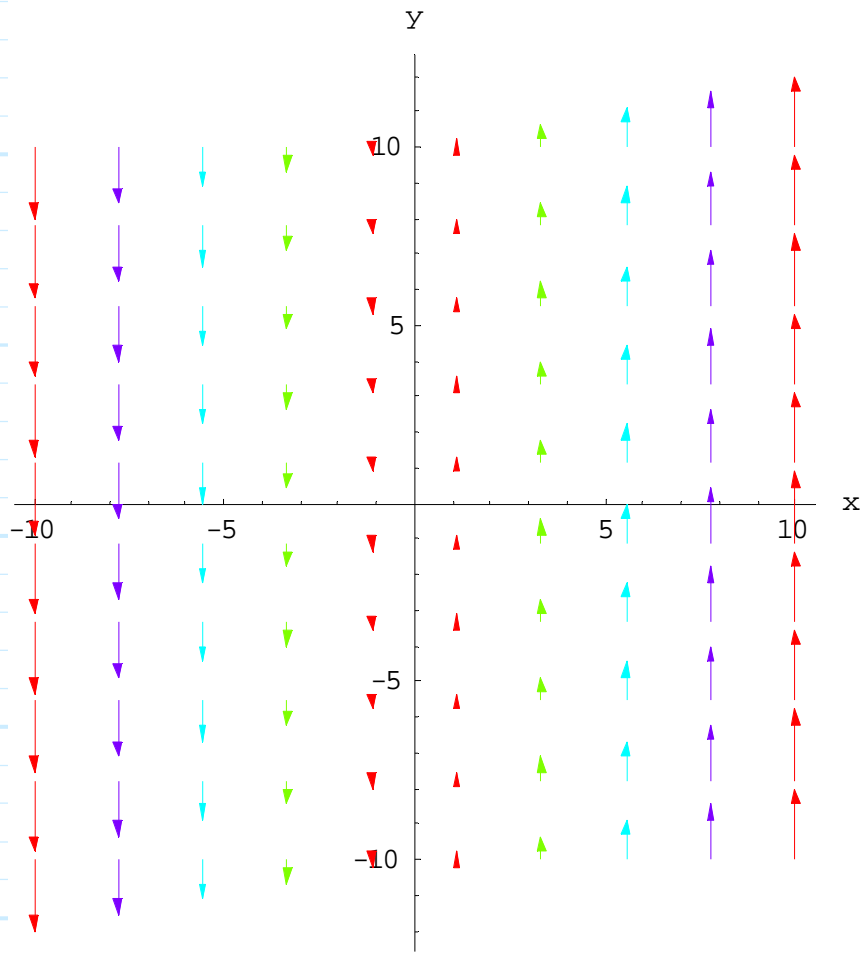
$$\mathbf{A}(\vec{r}) = -\hat{a}_y$$



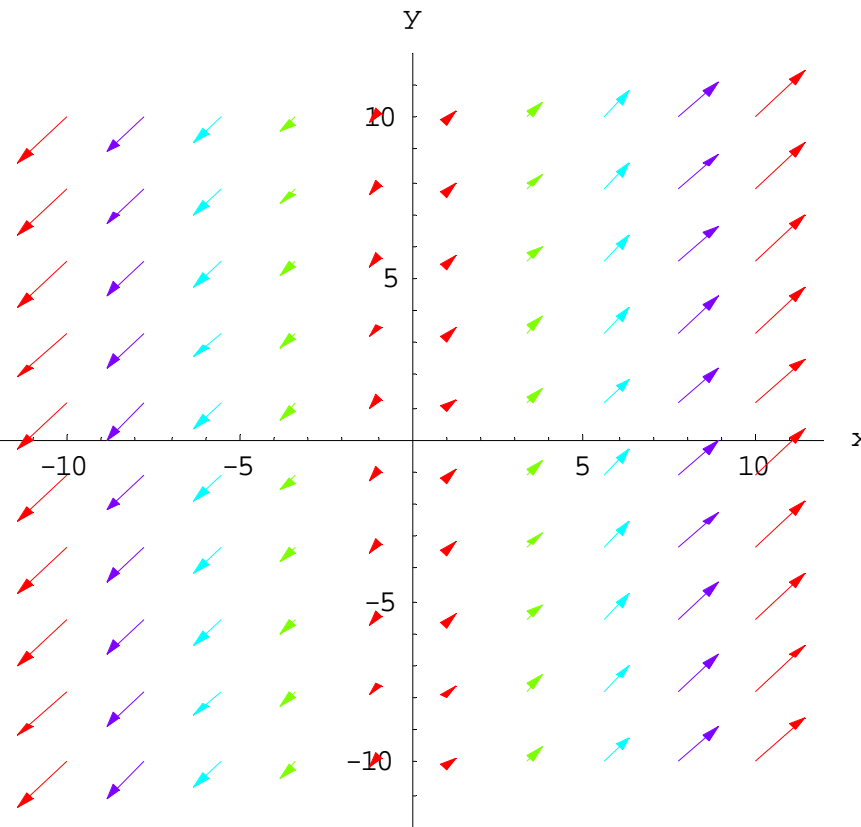
$$\mathbf{A}(\vec{r}) = \hat{a}_x - \hat{a}_y$$



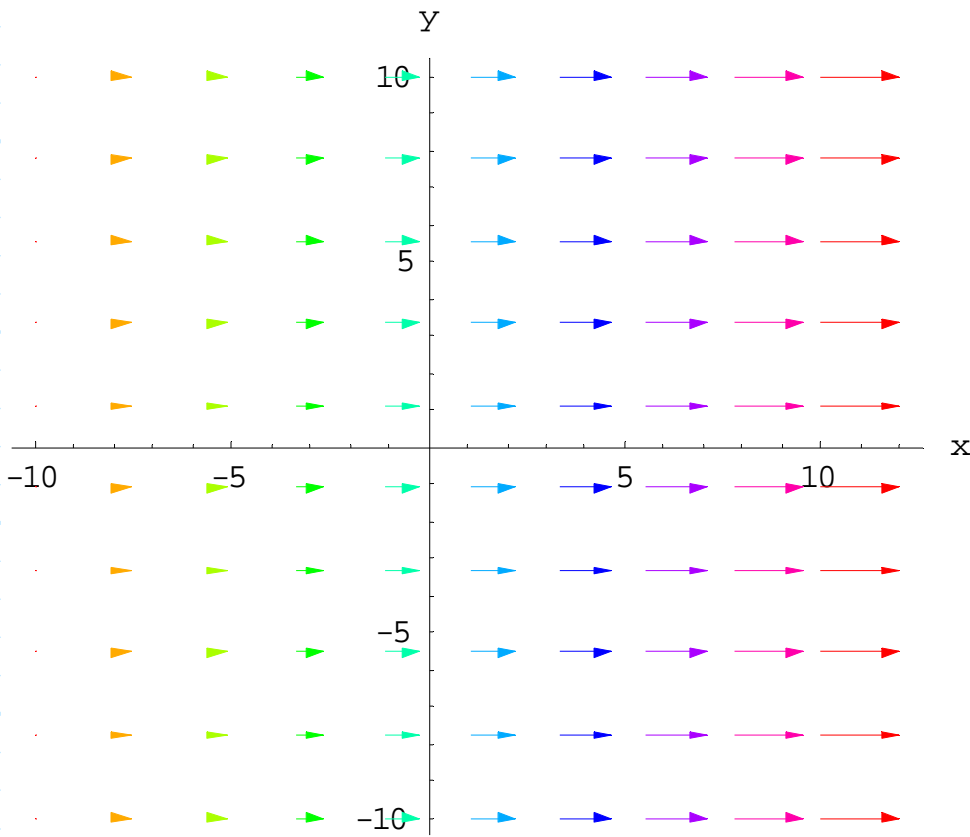
$$\mathbf{A}(\vec{r}) = x \hat{a}_x$$



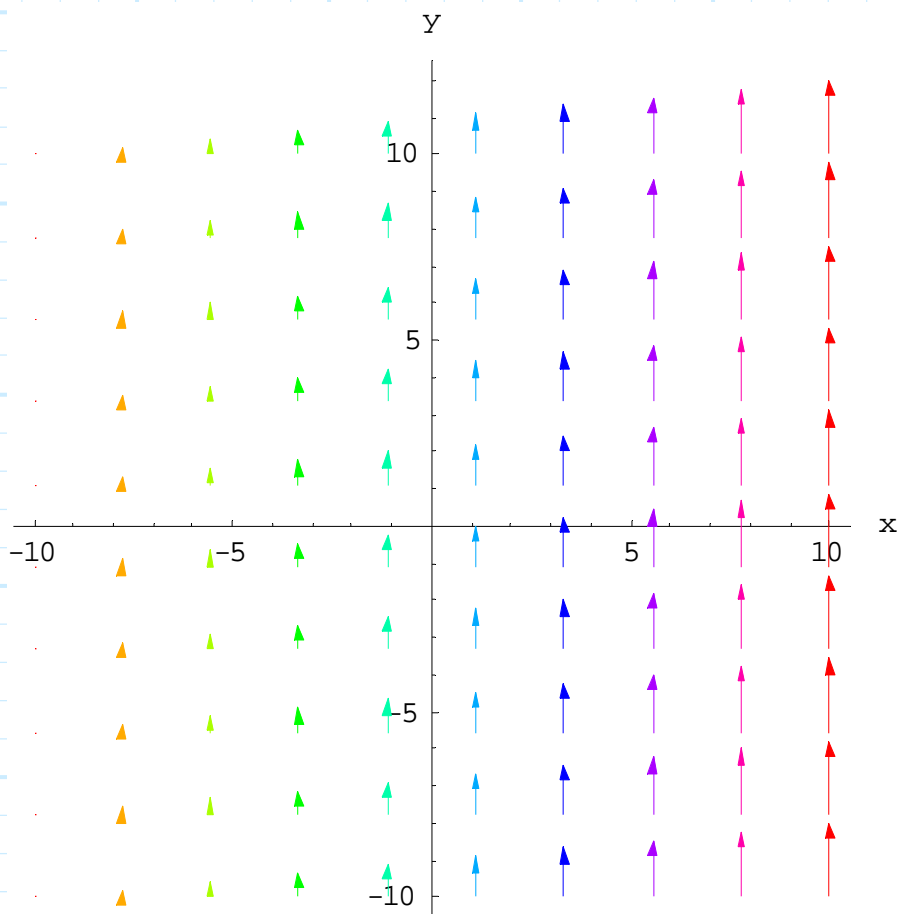
$$\mathbf{A}(\vec{r}) = x \hat{\mathbf{a}}_y$$



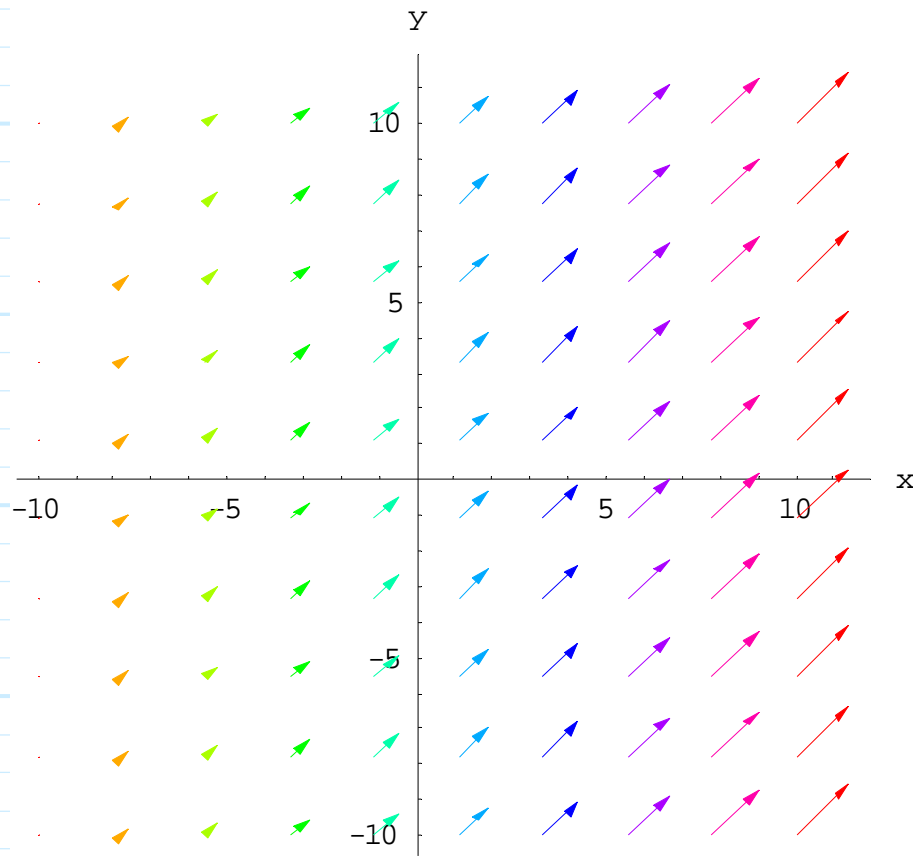
$$\mathbf{A}(\vec{r}) = x \hat{\mathbf{a}}_x + x \hat{\mathbf{a}}_y$$



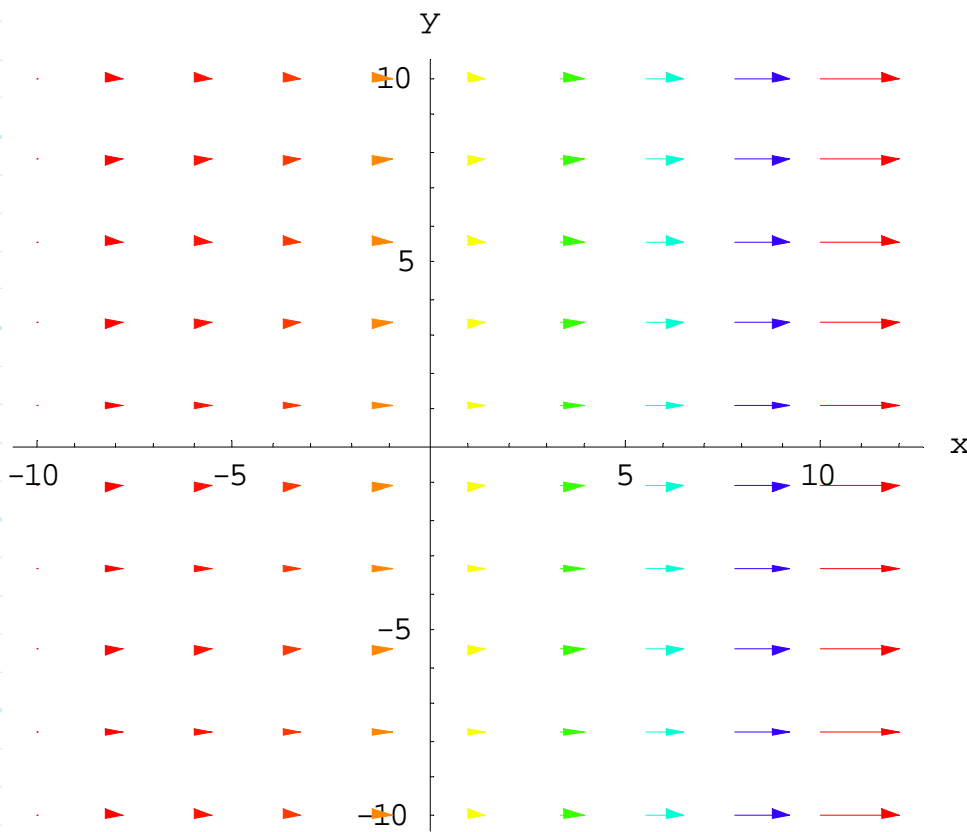
$$A(\vec{r}) = (10 + x)\hat{a}_x$$



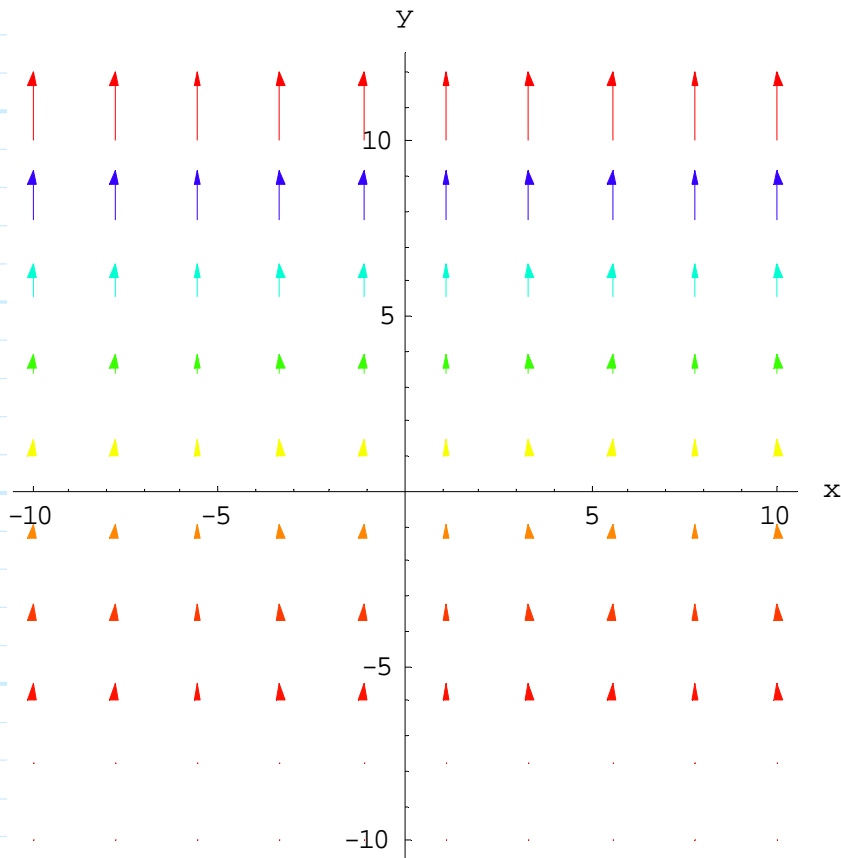
$$A(\vec{r}) = (10 + x)\hat{a}_y$$



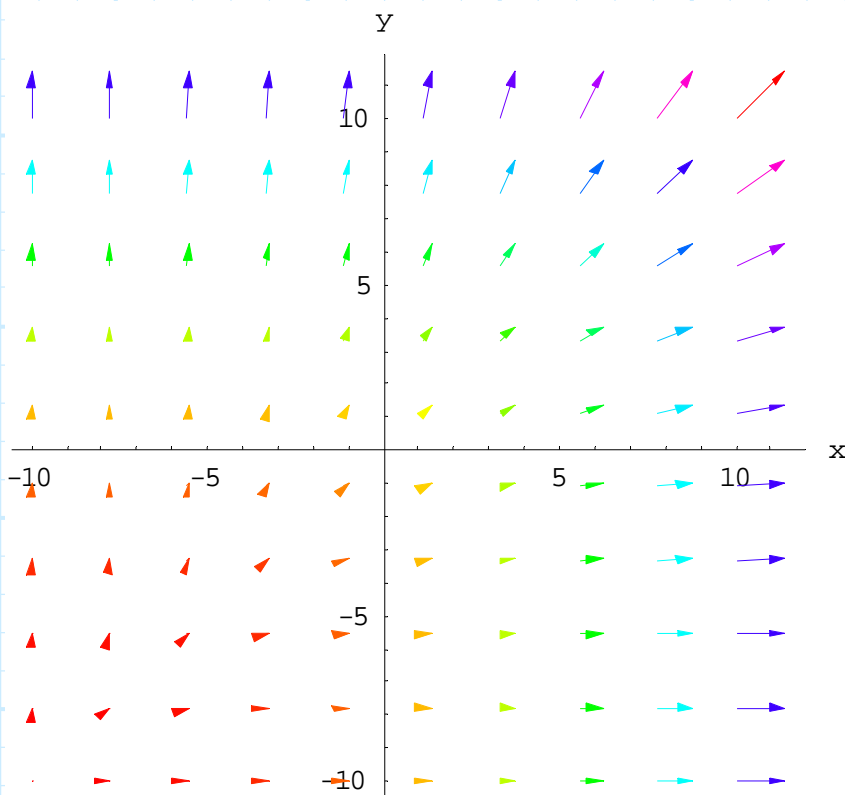
$$\mathbf{A}(\vec{r}) = (10 + x)\hat{a}_x + (10 + x)\hat{a}_y$$



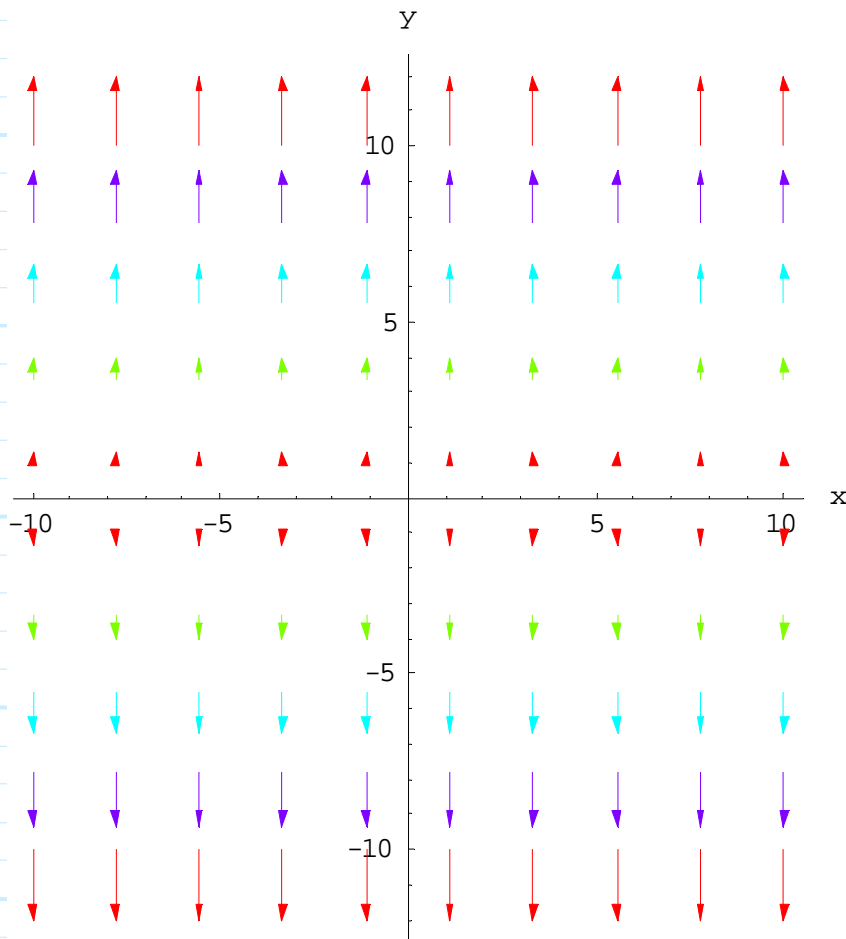
$$\mathbf{A}(\vec{r}) = (10 + x)^3 \hat{a}_x$$



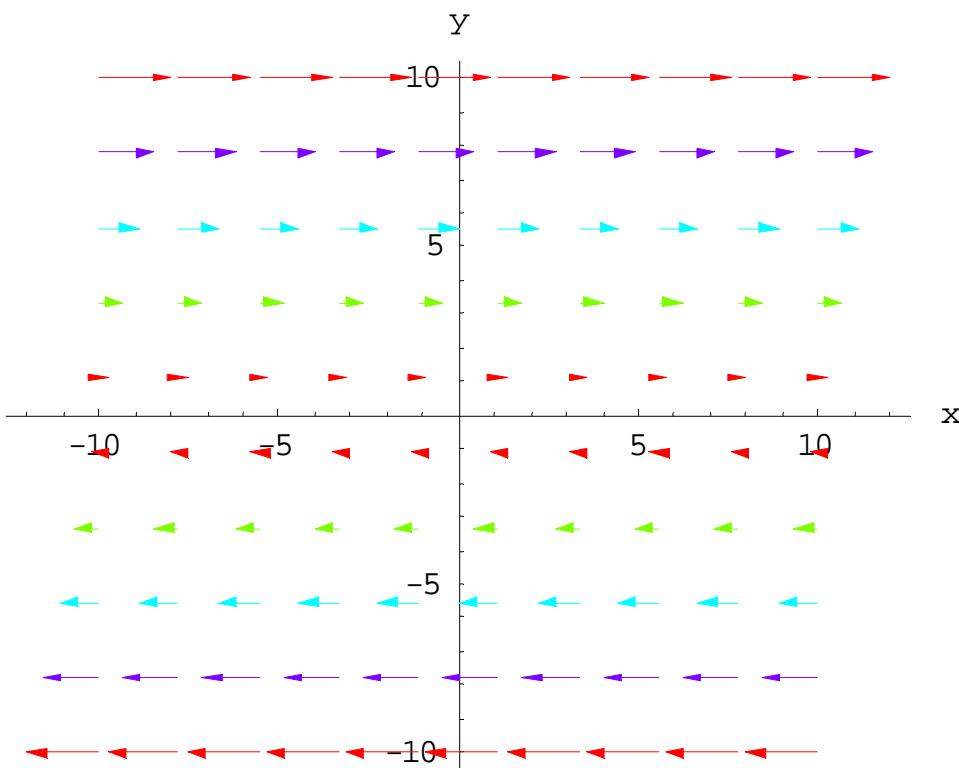
$$\mathbf{A}(\vec{r}) = (10 + y)^3 \hat{a}_y$$



$$\mathbf{A}(\vec{r}) = (10 + x)^3 \hat{a}_x + (10 + y)^3 \hat{a}_y$$

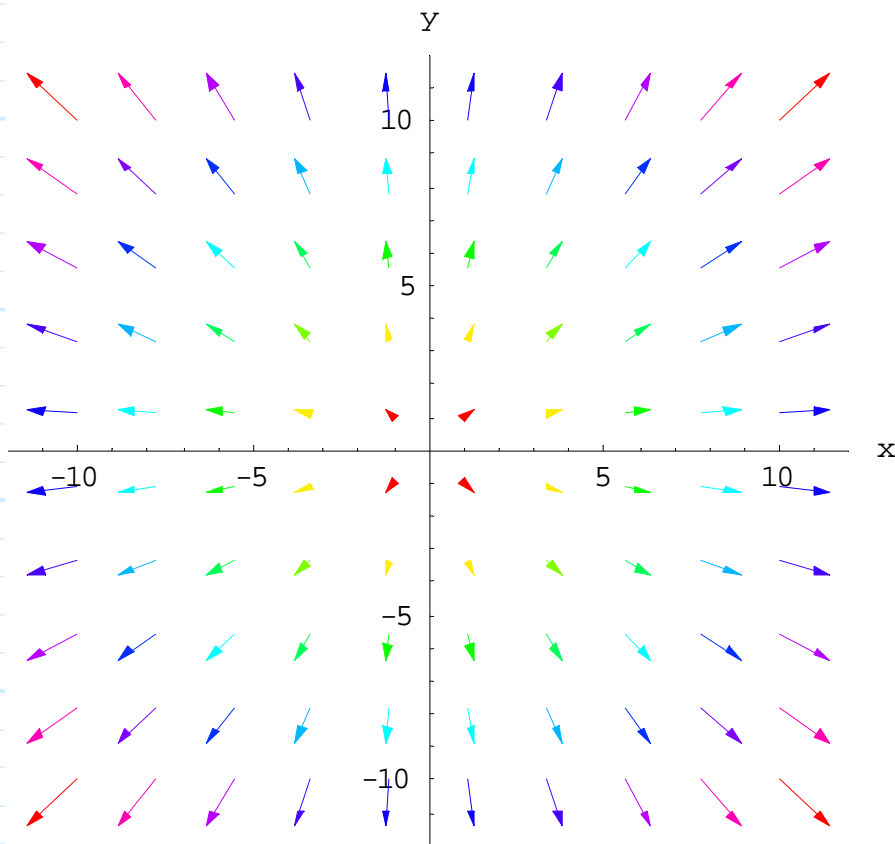


$$A(\vec{r}) = y \hat{a}_y$$

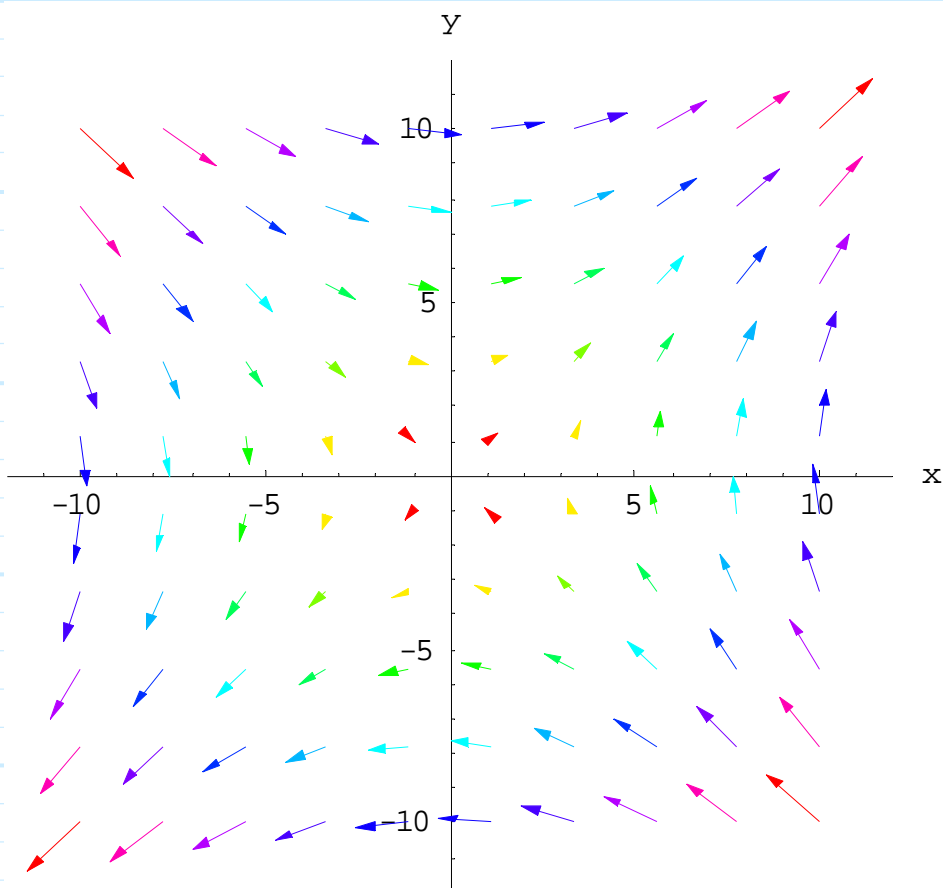


$$A(\vec{r}) = y \hat{a}_x$$

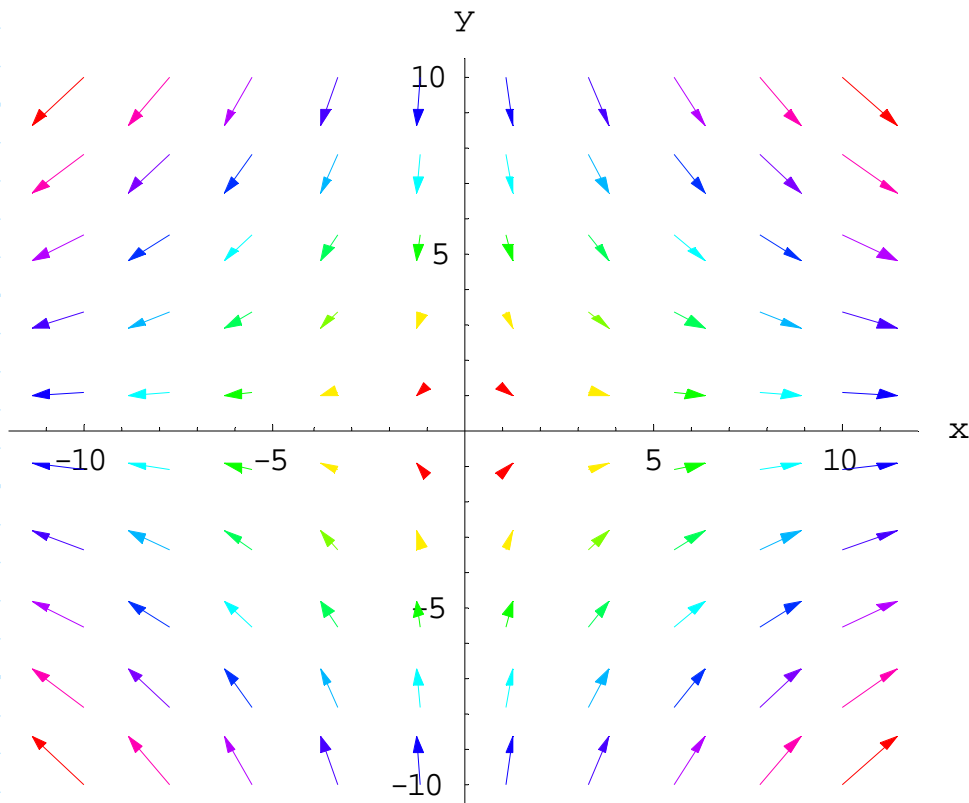




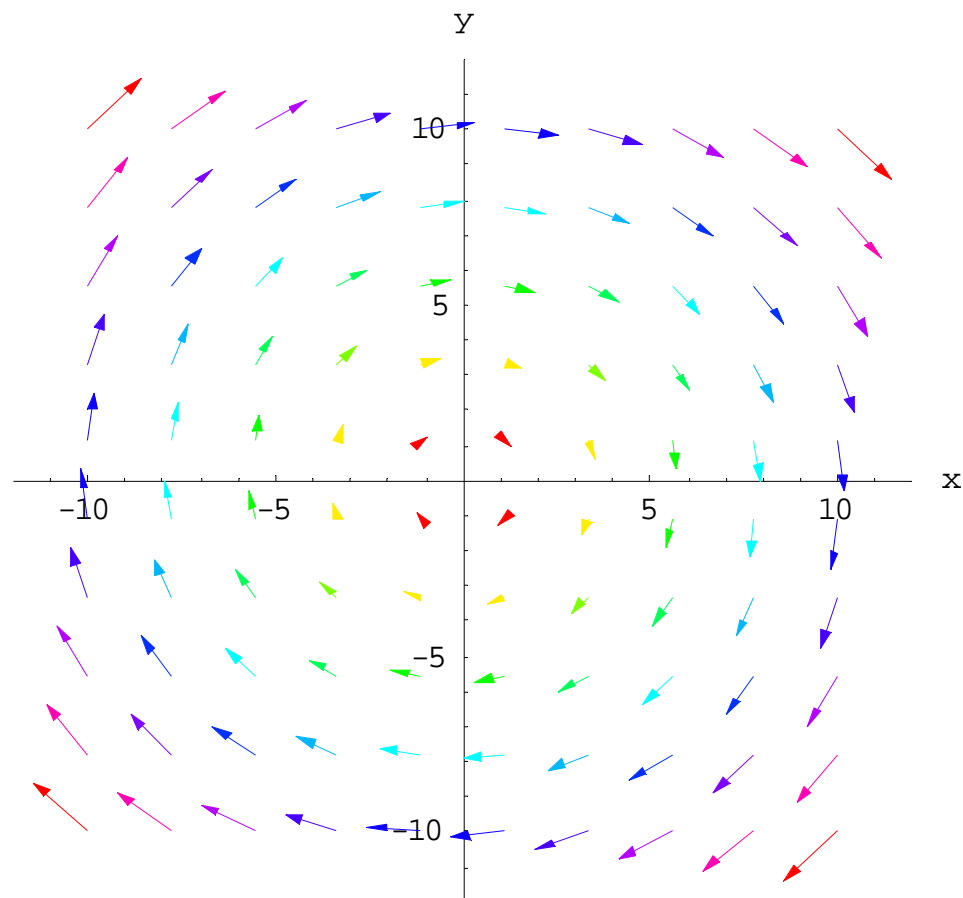
$$\mathbf{A}(\vec{r}) = x \hat{a}_x + y \hat{a}_y$$



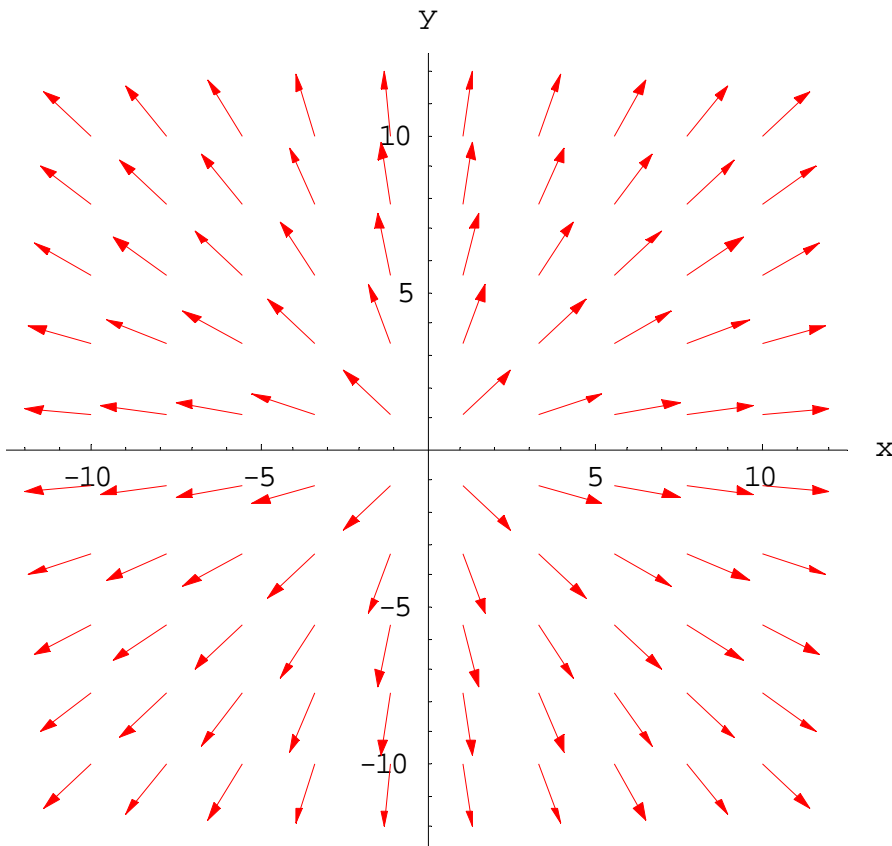
$$\mathbf{A}(\vec{r}) = y \hat{a}_x + x \hat{a}_y$$



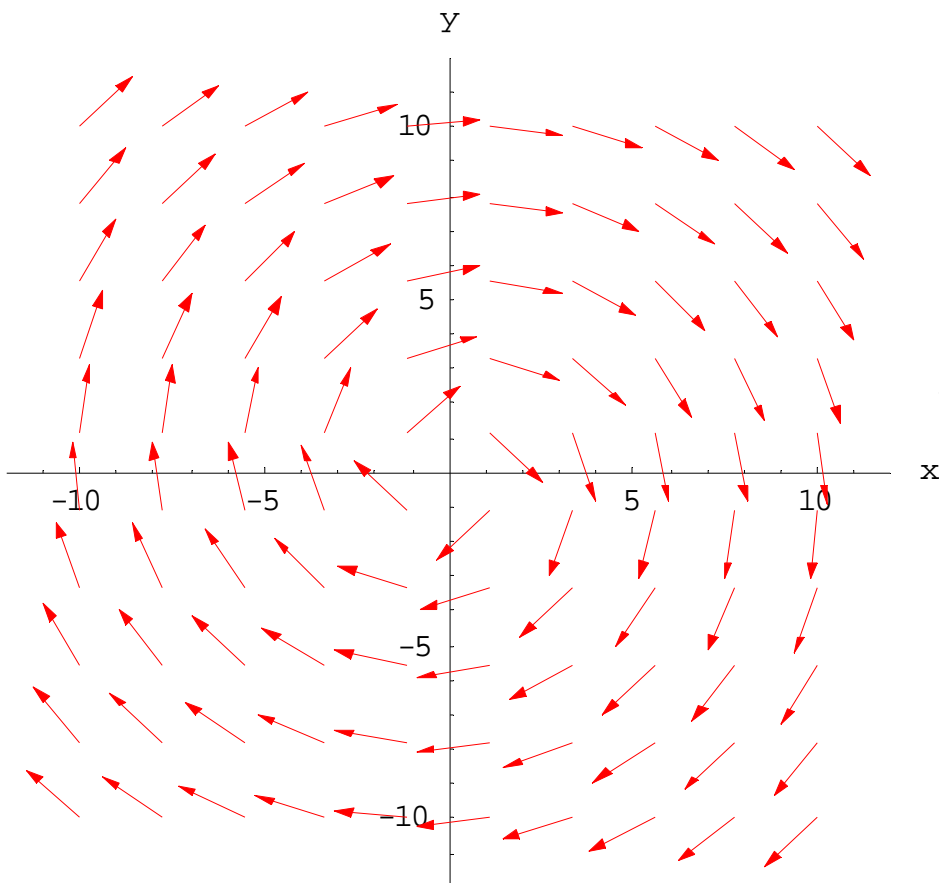
$$\mathbf{A}(\vec{r}) = x \hat{a}_x - y \hat{a}_y$$



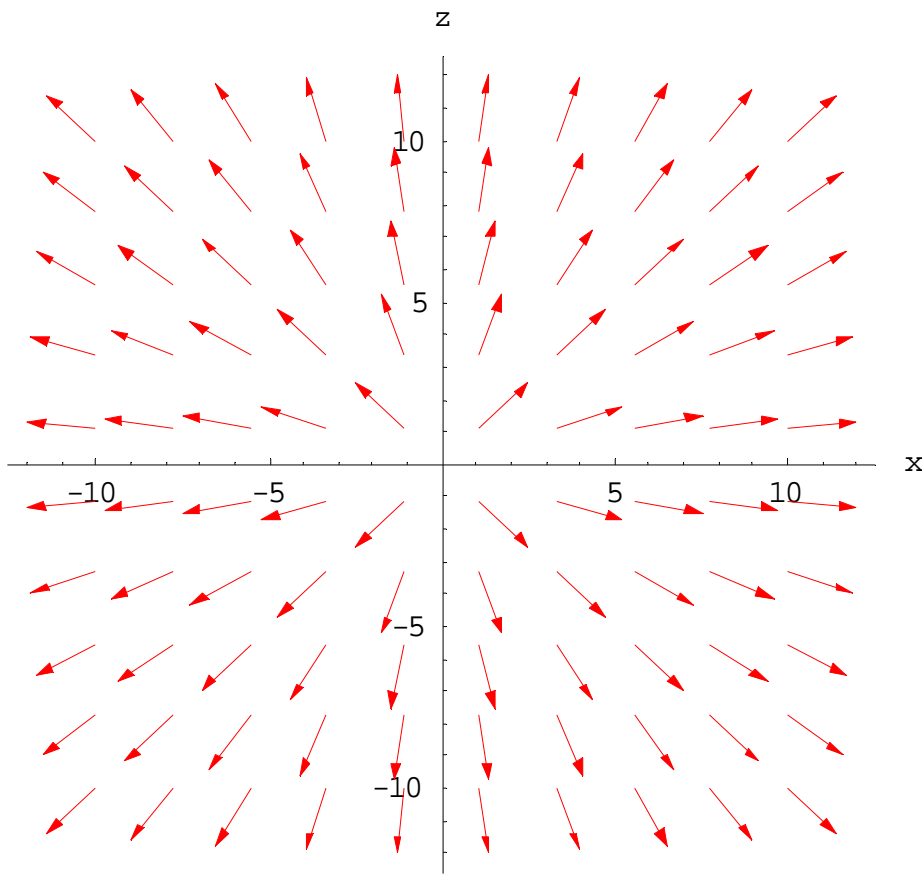
$$\mathbf{A}(\vec{r}) = y \hat{a}_x - x \hat{a}_y$$



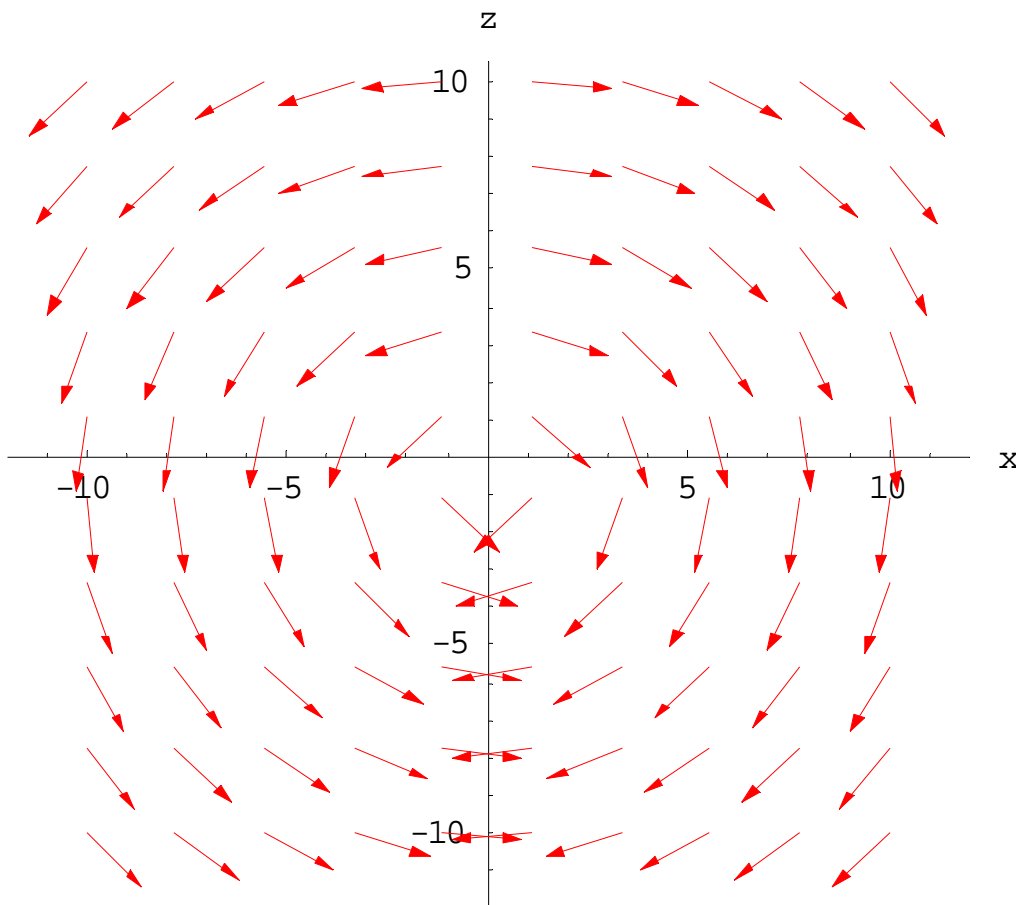
$$\begin{aligned} \mathbf{A}(\vec{r}) &= \hat{\mathbf{a}}_\rho \\ &= \cos \phi \hat{\mathbf{a}}_x + \sin \phi \hat{\mathbf{a}}_y \end{aligned}$$



$$\begin{aligned} \mathbf{A}(\vec{r}) &= \hat{\mathbf{a}}_\phi \\ &= \sin \phi \hat{\mathbf{a}}_x - \cos \phi \hat{\mathbf{a}}_y \end{aligned}$$



$$\begin{aligned} \mathbf{A}(\bar{r}) &= \hat{\mathbf{a}}_r \\ &= \sin\theta \cos\phi \hat{\mathbf{a}}_x \\ &\quad + \cos\theta \hat{\mathbf{a}}_y \end{aligned}$$



$$\begin{aligned} \mathbf{A}(\bar{r}) &= \hat{\mathbf{a}}_\theta \\ &= \cos\theta \cos\phi \hat{\mathbf{a}}_x \\ &\quad - \sin\theta \hat{\mathbf{a}}_z \end{aligned}$$