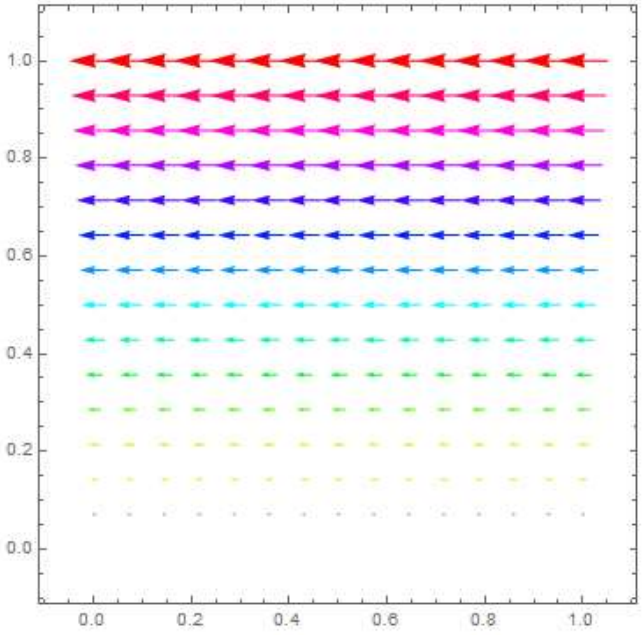
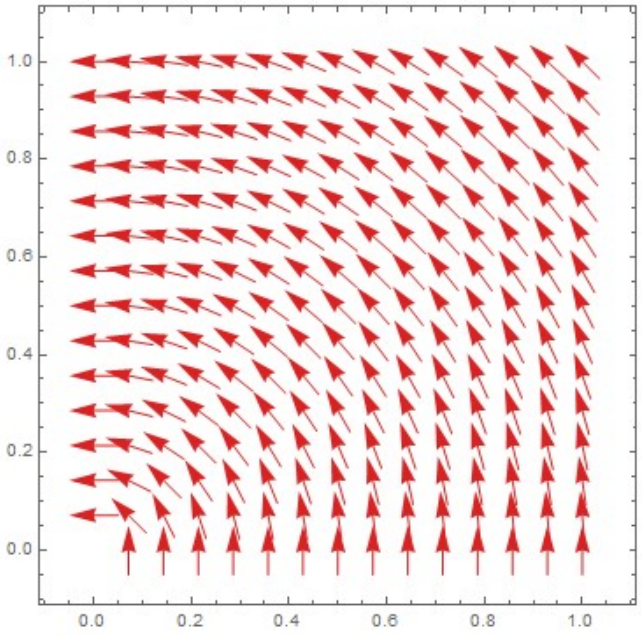
Week	Dates	Book chapters	Topic
1	March 1–4	**1 and 2**	Electromagnetic model, field concepts. Vector algebra, vector analysis.
2	March 8–11	**3**	Electrostatics. Coulomb's law, scalar potential, electric dipole, permittivity, conductors and insulators, capacitance, electrostatic energy and forces.
3	March 15–18	**4 and 5**	Static electric currents, Ohm's law, conductivity. Magnetostatics, Biot-Savart's law, vector potential, permeability, magnetic dipole, inductance.
4	March 22–25	**6**	Faraday's law, Maxwell equations for dynamic electromagnetic fields. Complex representation of time-harmonic fields.
5	March 29 – April 1	**7**	Plane waves in lossless and lossy media. Attenuation of waves, Wave reflection from planar interfaces. Brewster angle.
6	April 6–8	**(8,9) 10**	Electromagnetic radiation. Fields generated by a Hertzian dipole.

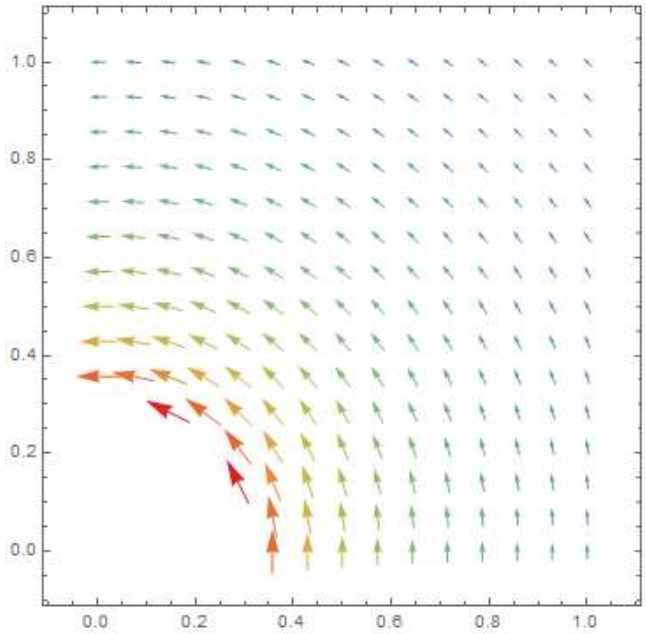
Is there curl?



$$\mathbf{F}_1 = -y\,\mathbf{a}_x$$

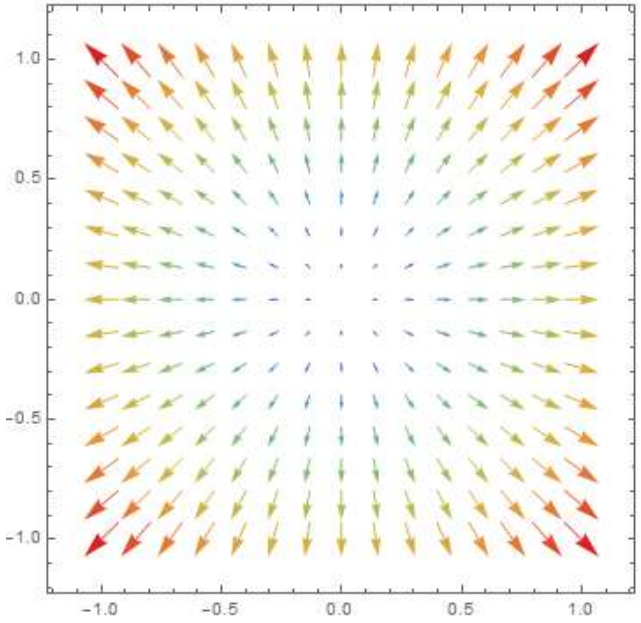


$$\mathbf{F}_2 = \mathbf{a}_\phi$$



$$\mathbf{F}_3 = \frac{\mathbf{a}_\phi}{r}$$

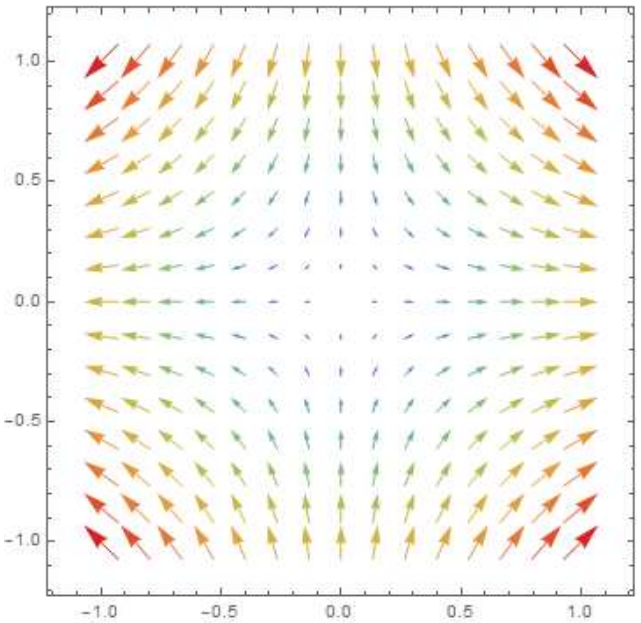
$$\mathbf{A}_1 = x\,\mathbf{a}_x + y\,\mathbf{a}_y$$



$$\nabla \cdot \mathbf{A}_1 = 2$$

$$\nabla \times \mathbf{A}_1 = 0$$

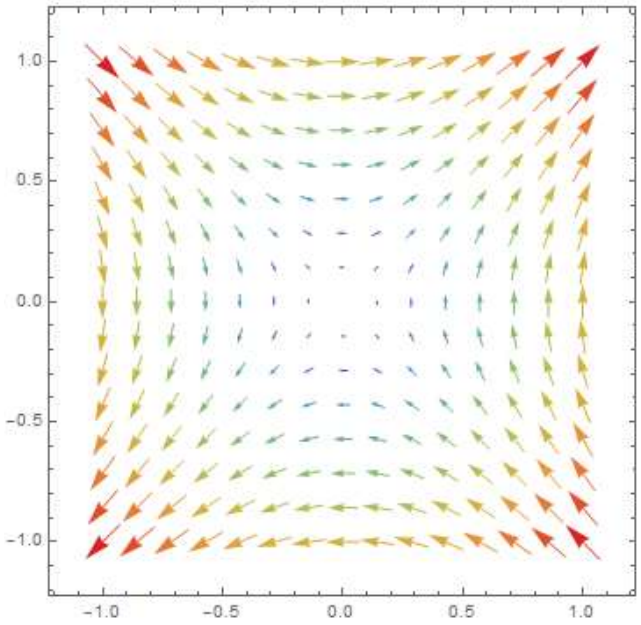
$$\mathbf{A}_2 = x\,\mathbf{a}_x - y\,\mathbf{a}_y$$



$$\nabla \cdot \mathbf{A}_2 = 0$$

$$\nabla \times \mathbf{A}_2 = 0$$

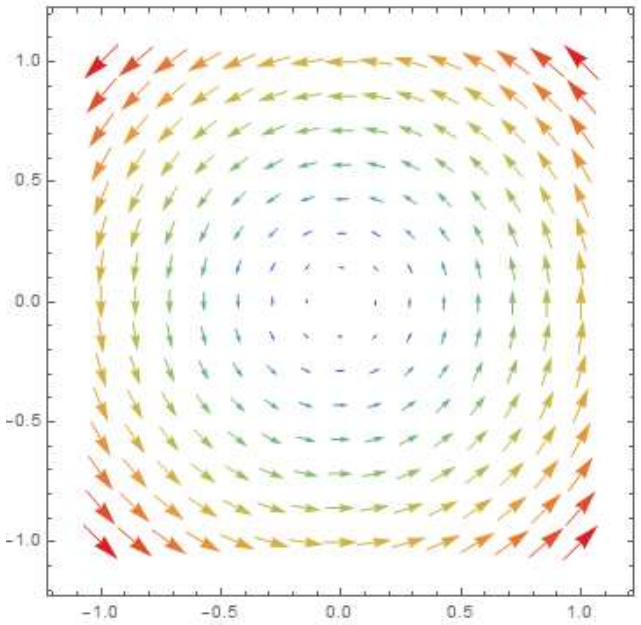
$$\mathbf{A}_3 = y\,\mathbf{a}_x + x\,\mathbf{a}_y$$



$$\nabla \cdot \mathbf{A}_3 = 0$$

$$\nabla \times \mathbf{A}_3 = 0$$

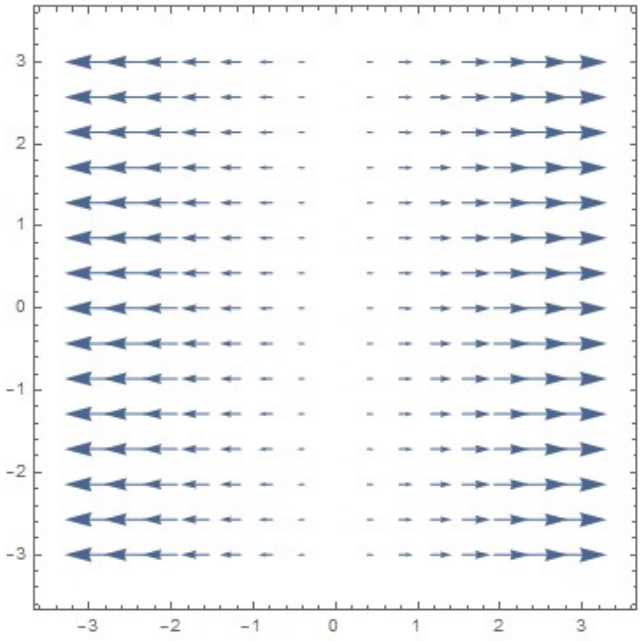
$$\mathbf{A}_4 = -y\,\mathbf{a}_x + x\,\mathbf{a}_y$$



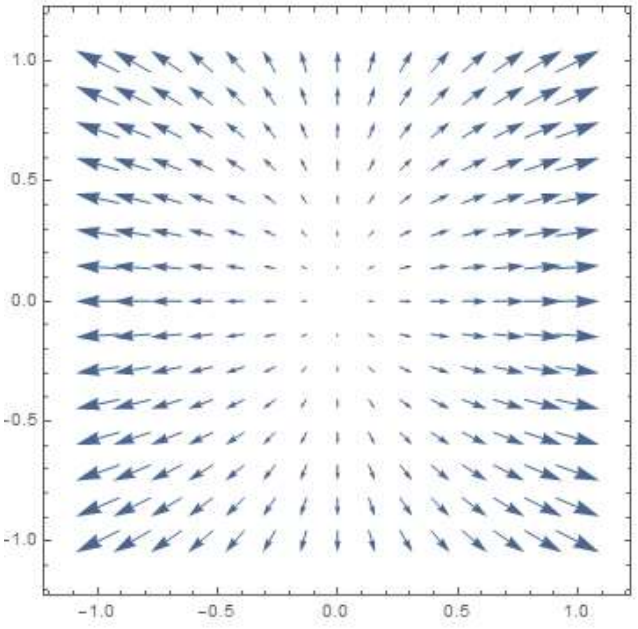
$$\nabla \cdot \mathbf{A}_4 = 0$$

$$\nabla \times \mathbf{A}_4 = 2\,\mathbf{u}_z$$

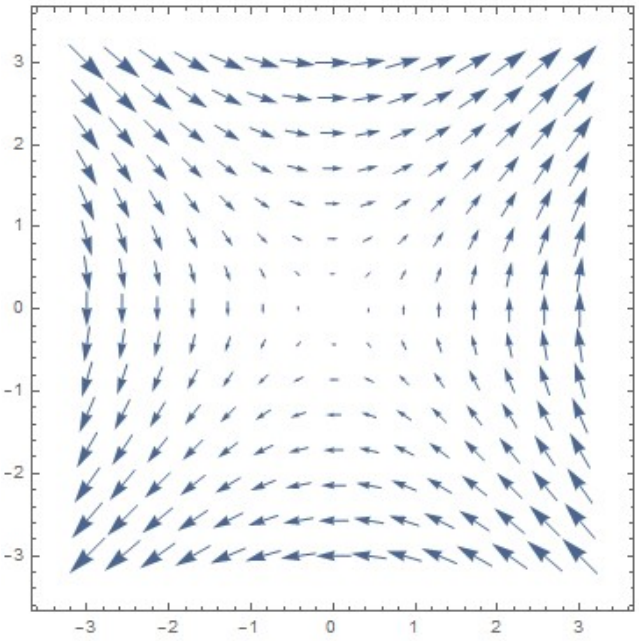
What about divergence?



$$\mathbf{D}_1 = x\,\mathbf{a}_x$$

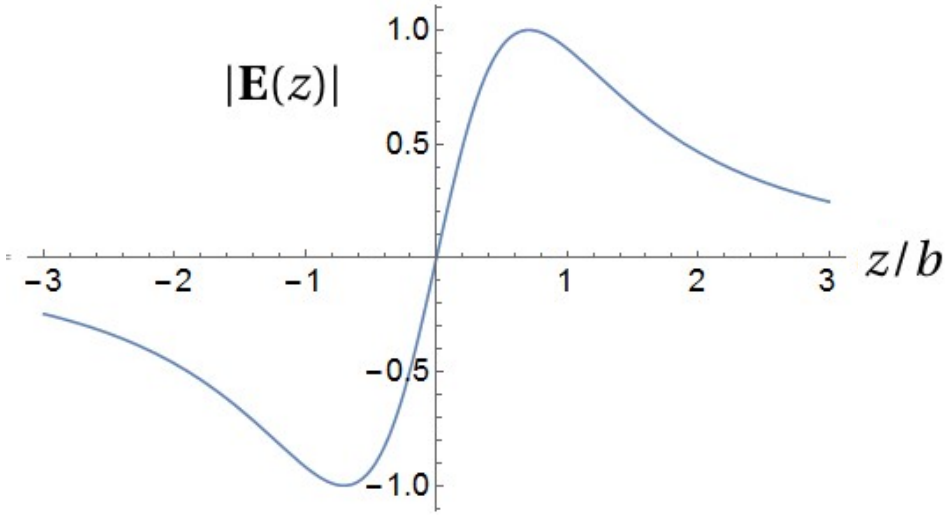


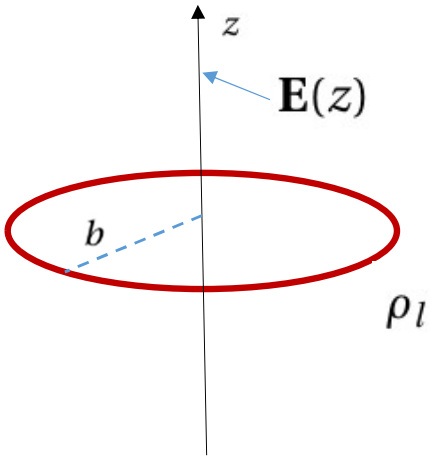
$$\mathbf{D}_2 = 2x\,\mathbf{a}_x + y\,\mathbf{a}_y$$



$$\mathbf{D}_3 = y\,\mathbf{a}_x + x\,\mathbf{a}_y$$

Field of a circular line charge on the symmetry axis

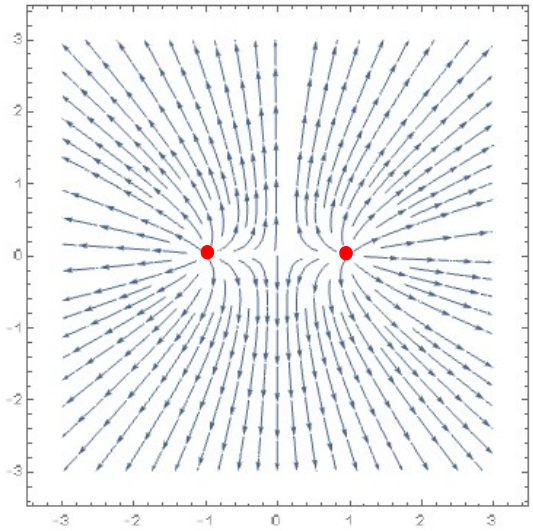




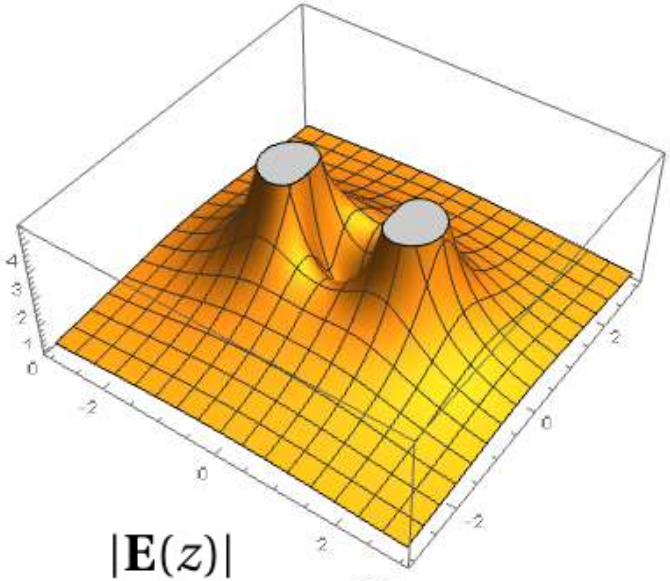
$$\mathbf{E}(z) = \mathbf{a}_z \frac{Q}{4\pi\varepsilon_0} \frac{z}{(z^2 + b^2)^{3/2}}$$

$$Q = (2\pi b)\rho_l$$

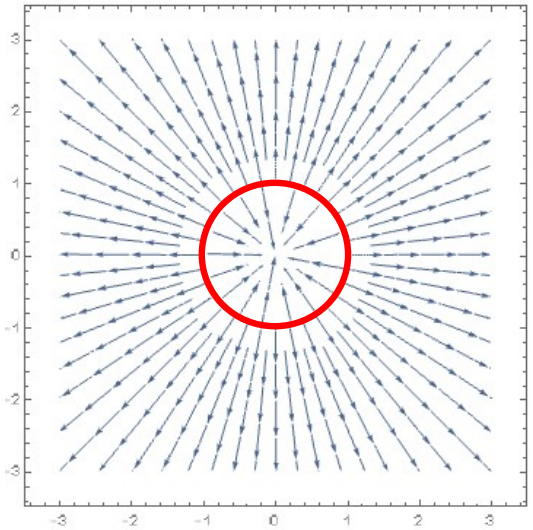
Field of circular line charge everywhere (elliptic integrals!)



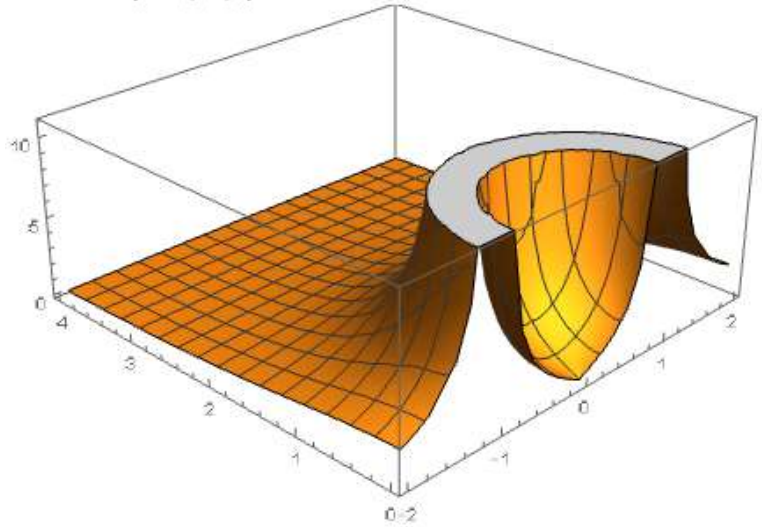
zx plane

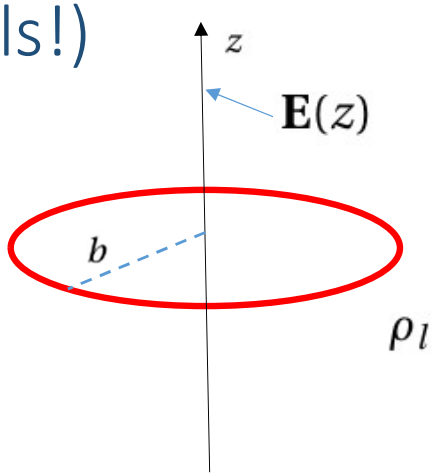


$|\mathbf{E}(z)|$

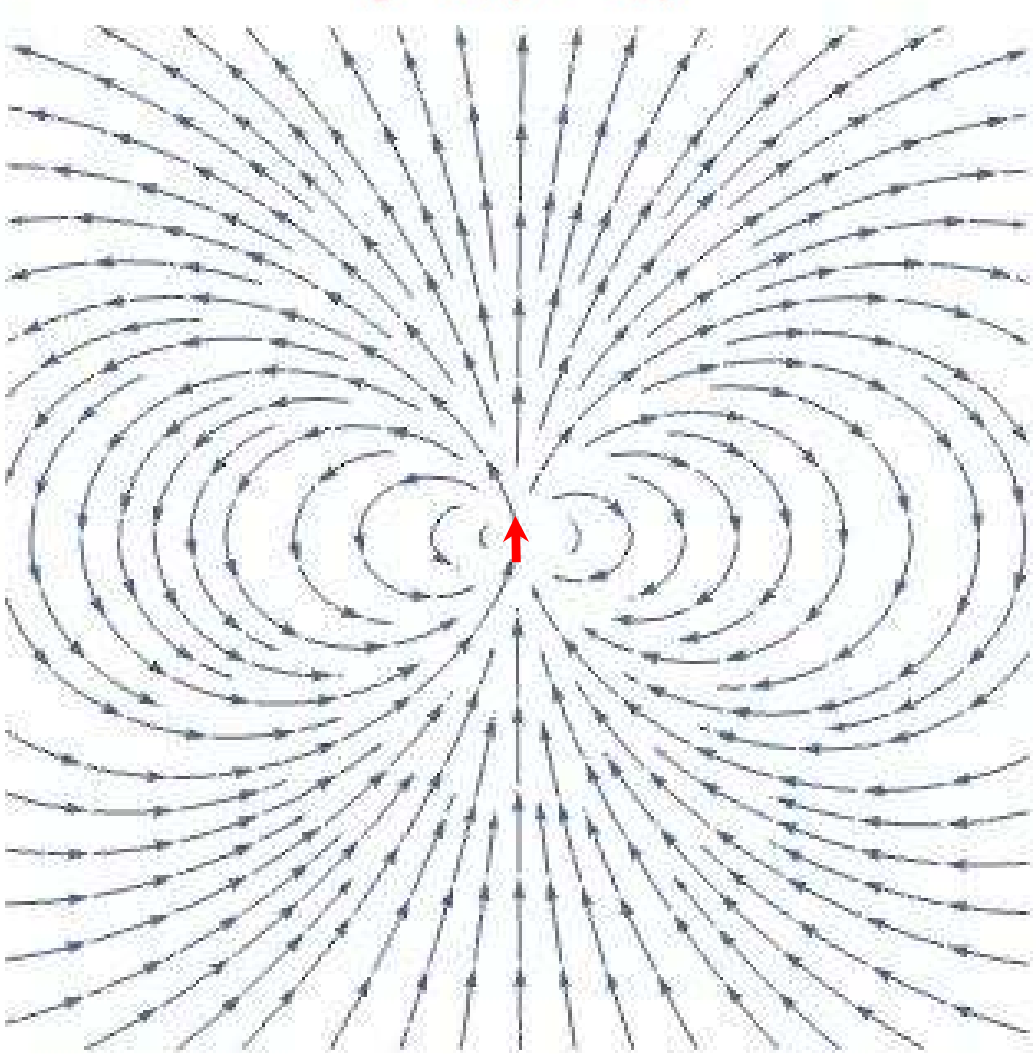


xy plane





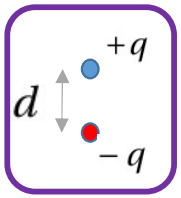
$$\mathbf{p} = \mathbf{a}_z\, qd = \mathbf{a}_z\, p$$

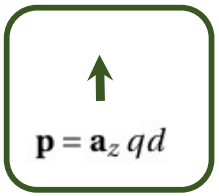


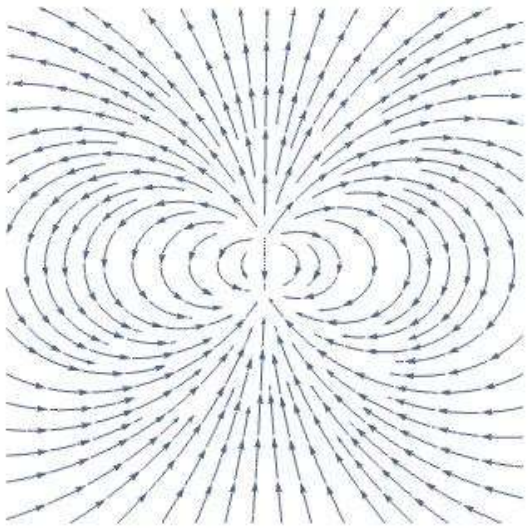
$$V(\mathbf{R}) = \frac{\mathbf{p}\cdot\mathbf{a}_R}{4\pi\varepsilon_0 R^2}$$

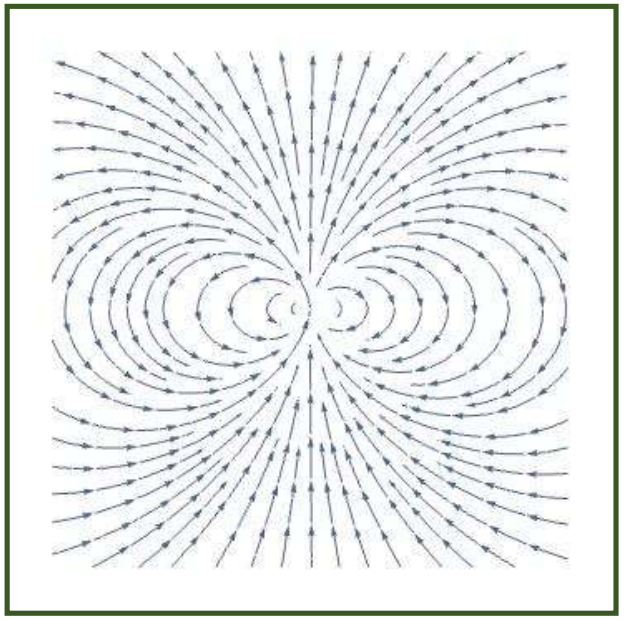
$$\mathbf{E}(\mathbf{R}) = \frac{p}{4\pi\varepsilon_0 R^3}\left(\mathbf{a}_R\, 2\cos\theta + \mathbf{a}_\theta\, \sin\theta\right)$$

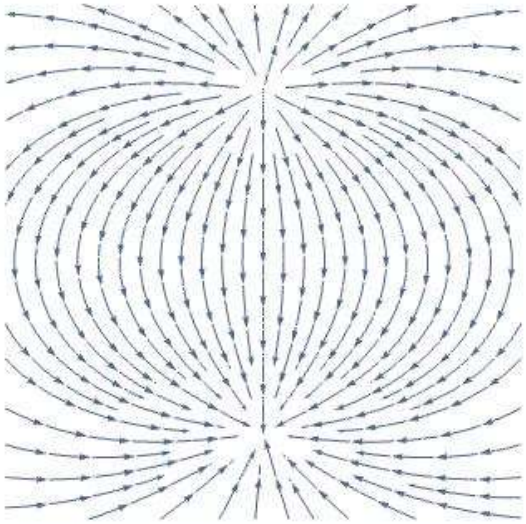
Two point charges
or **a dipole**?

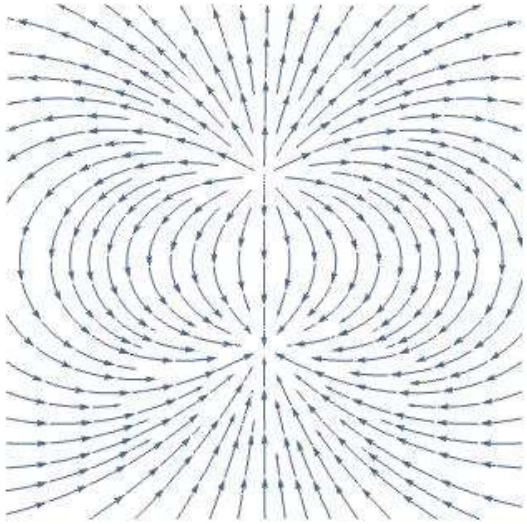












About the accuracy of the Taylor series

x	$\frac{1}{1+x}$	$1-x$	error		$\sqrt{1+x}$	$1+\frac{x}{2}$	error

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x	$\frac{1}{1+x}$	$1-x$	error		$\sqrt{1+x}$	$1+\frac{x}{2}$	error
0,1	0,90909090909	0,9	1 %		1,0488088482	1,05	0,114 %

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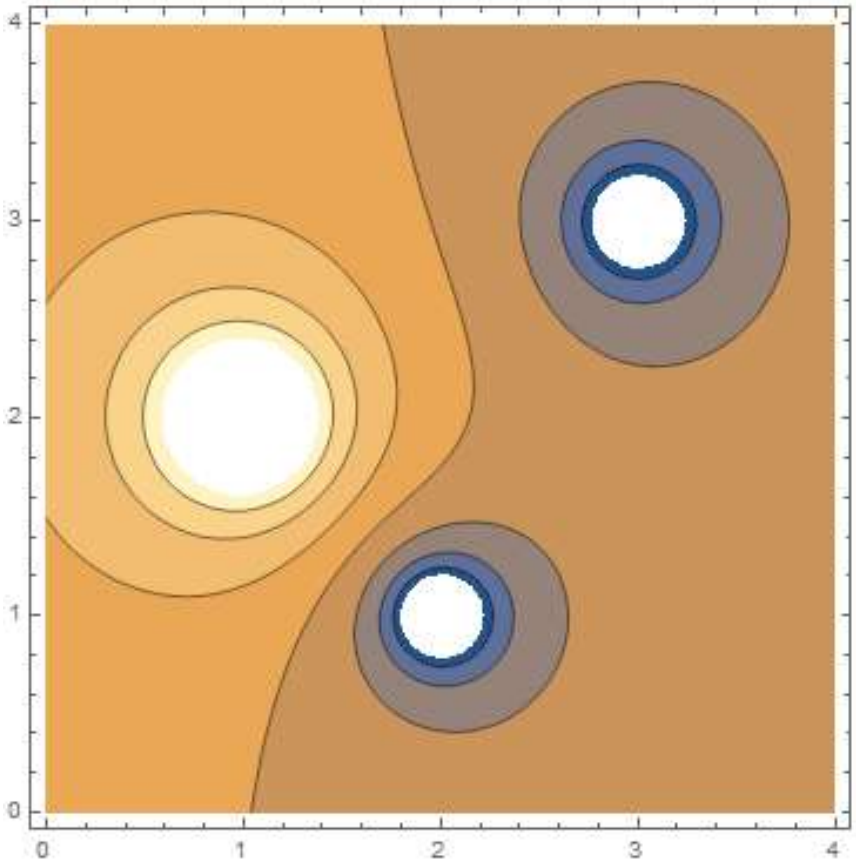
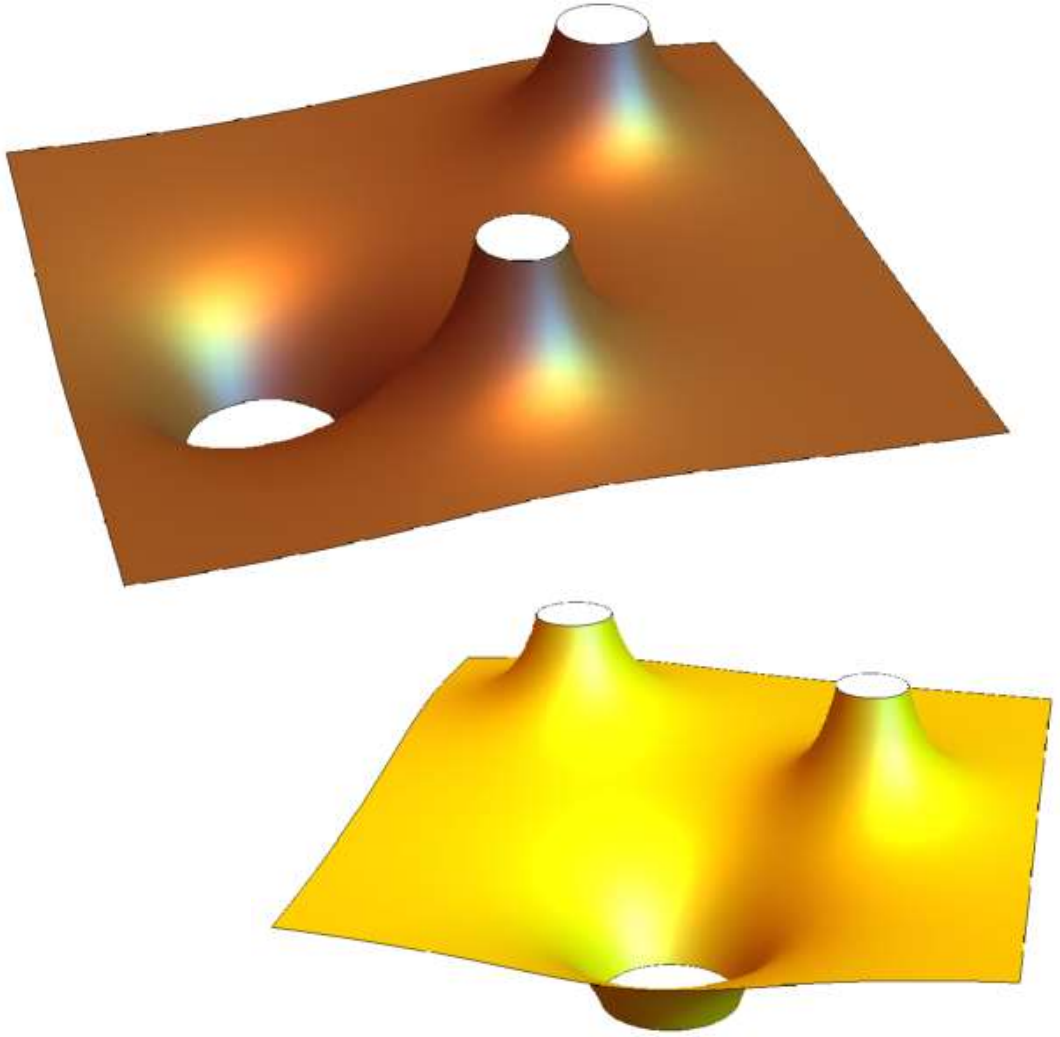
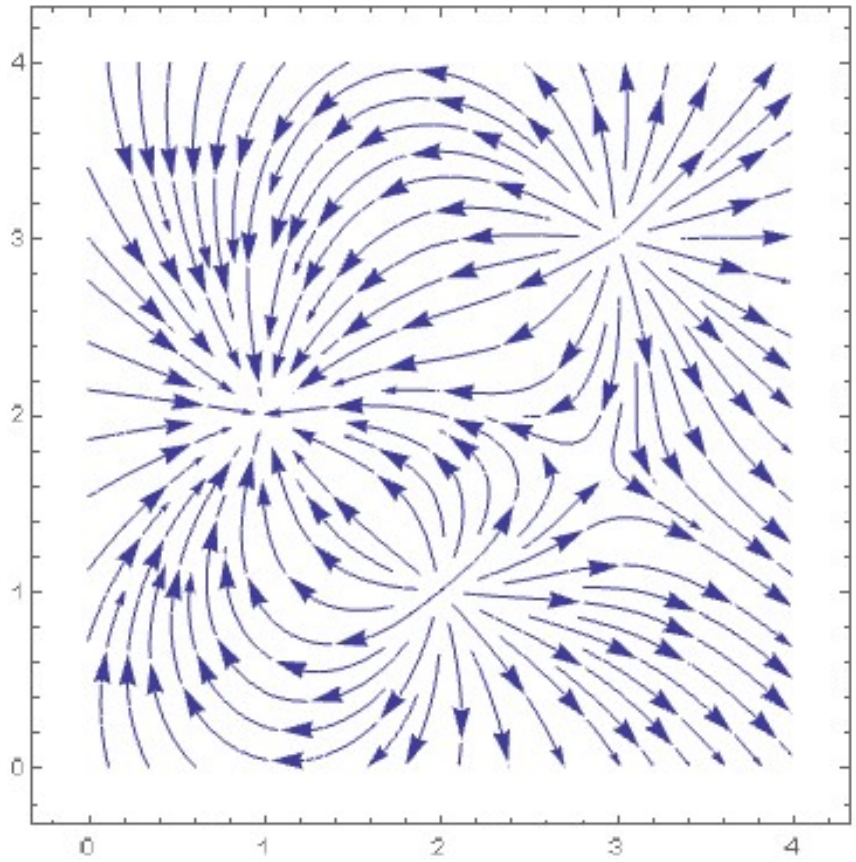
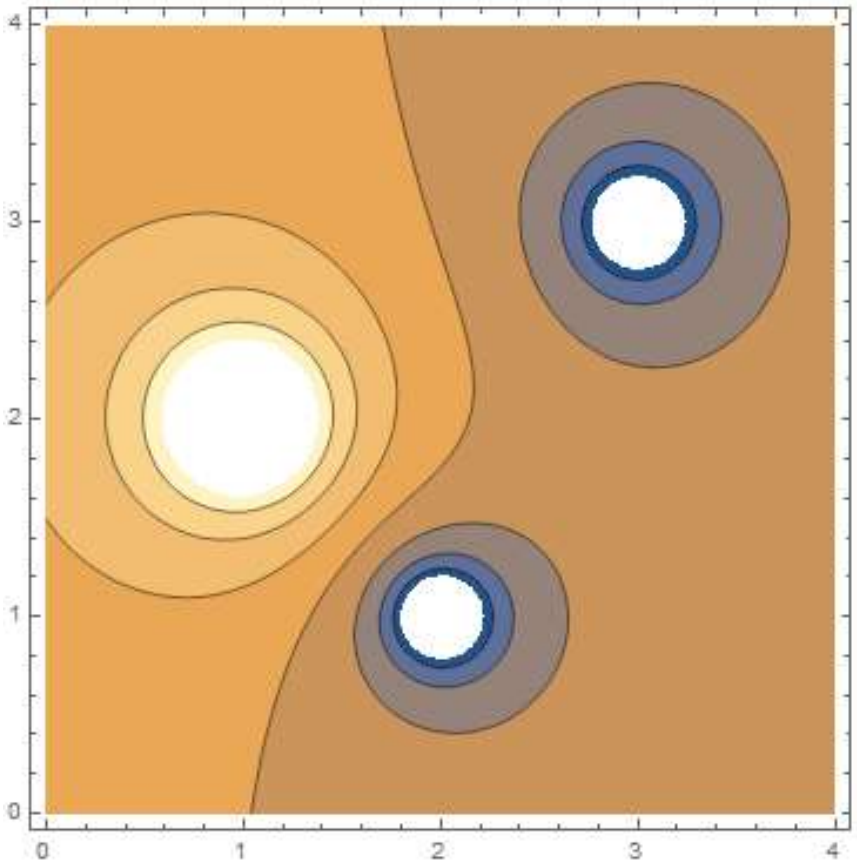




Three point charges: **+1[C]** & **+1[C]** & **-2[C]**





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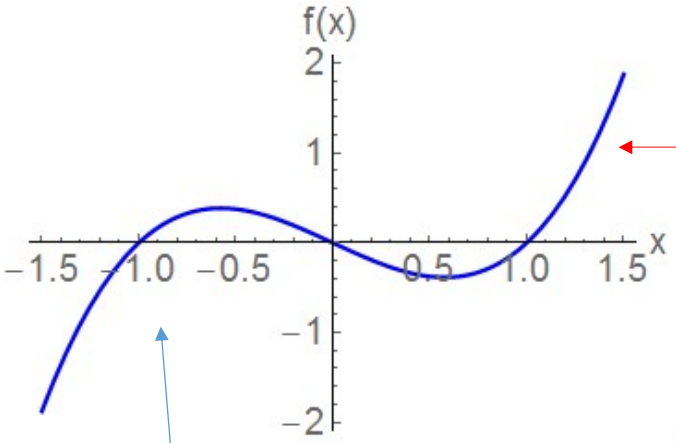
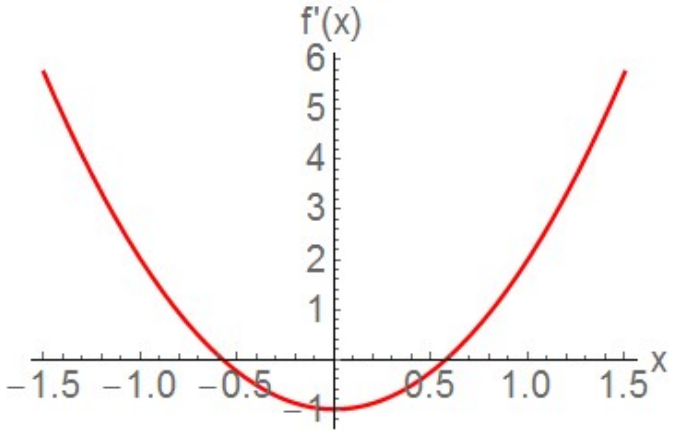
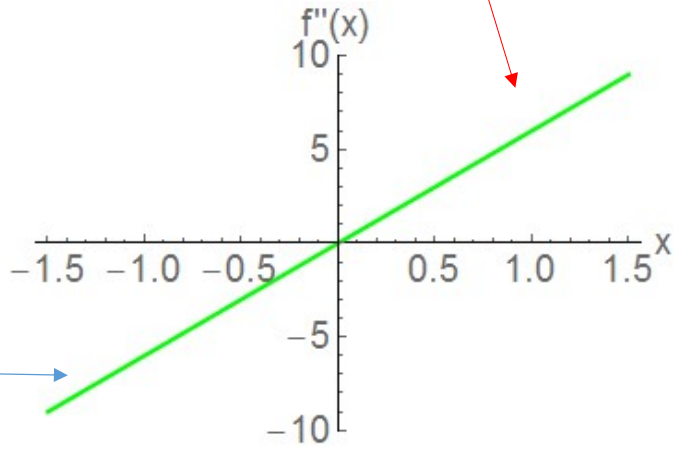


positive curvature





negative curvature