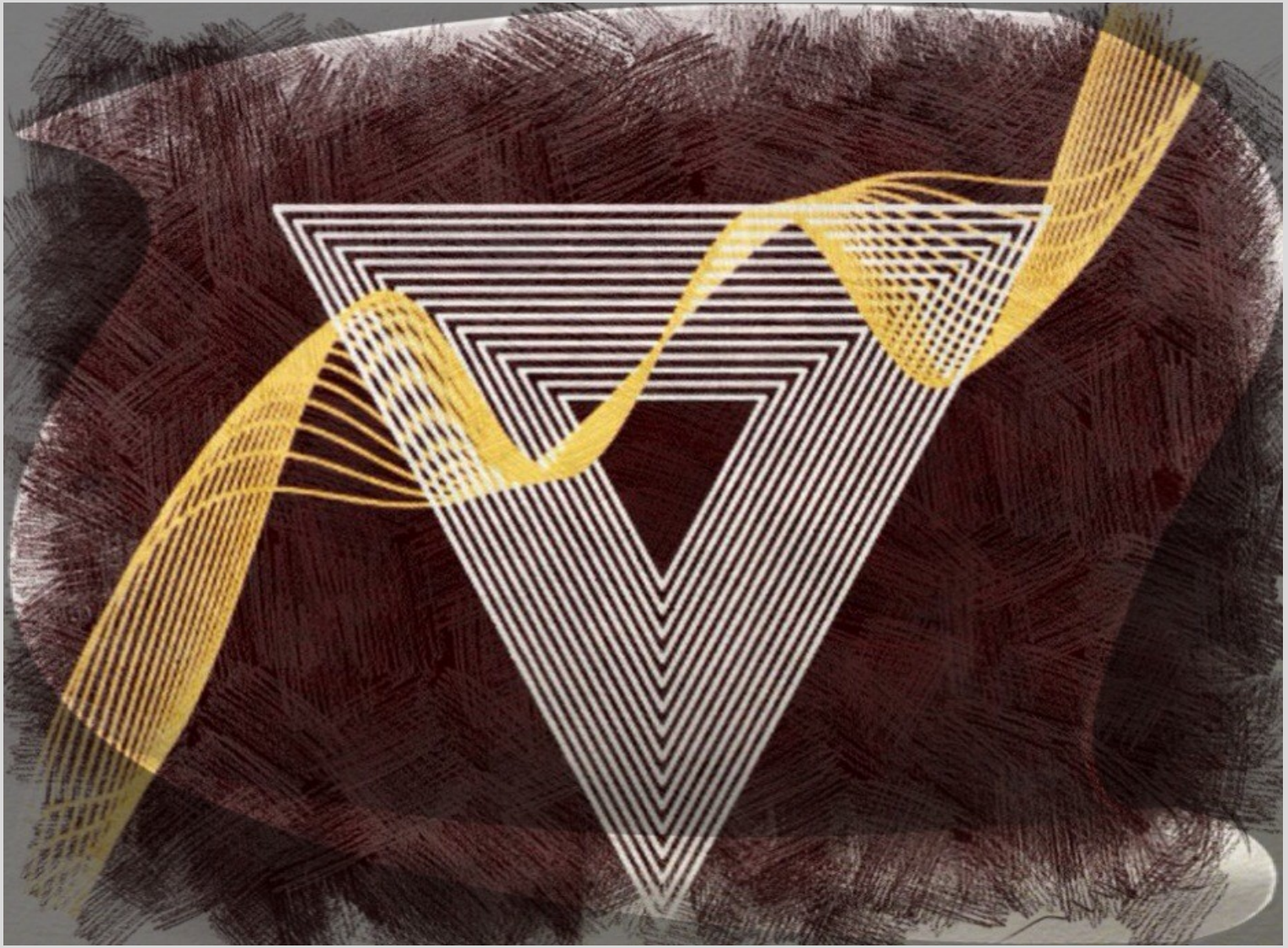

Gradient eines Skalarfeldes, Aufgaben


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Gesucht ist der Gradient der folgenden Funktionen. Zeichnen Sie, wo möglich, das entsprechende Gradientenfeld.

1) $\Phi(x, y) = 2 + x$

2) $\Phi(x, y) = -3 + y$

3) $\Phi(x, y) = 2 + x + y$

4) $\Phi(x, y) = x^2$

5) $\Phi(x, y) = -y^2$

6) $\Phi(x, y) = 4 - x^2 - y^2$

7) $\Phi(x, y) = x\,y$

8) $\Phi(x, y) = x^2 - y^2$

9) $\Phi(x, y) = x^2\ y^2$

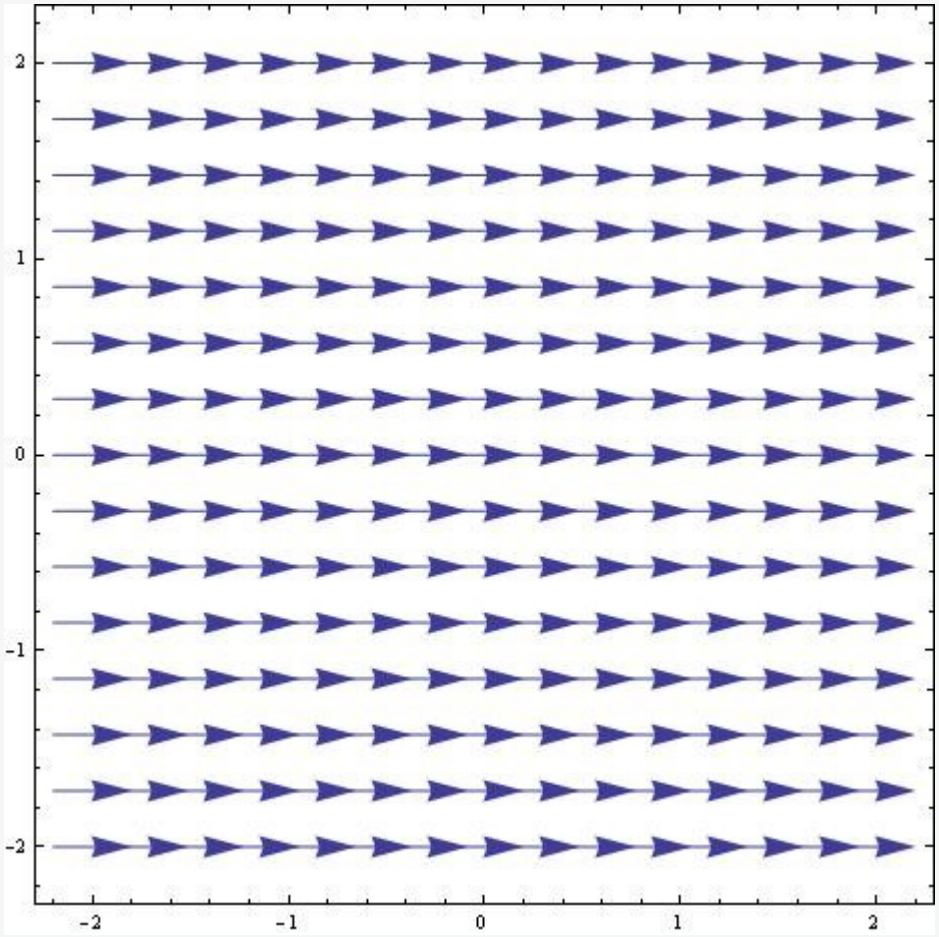

Abb. 2-1: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = 2 + x, \qquad grad\ \Phi = \vec{i}$$

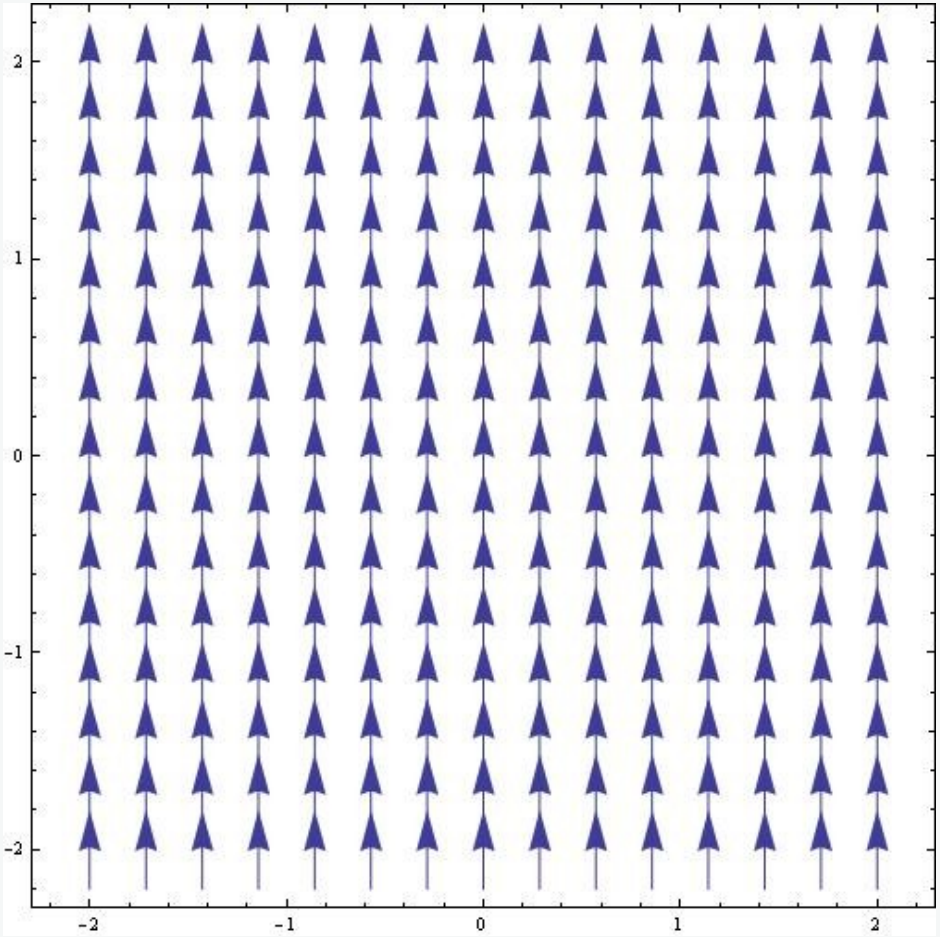

Abb. 2-2: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = -3 + y, \qquad grad\ \Phi = \vec{j}$$

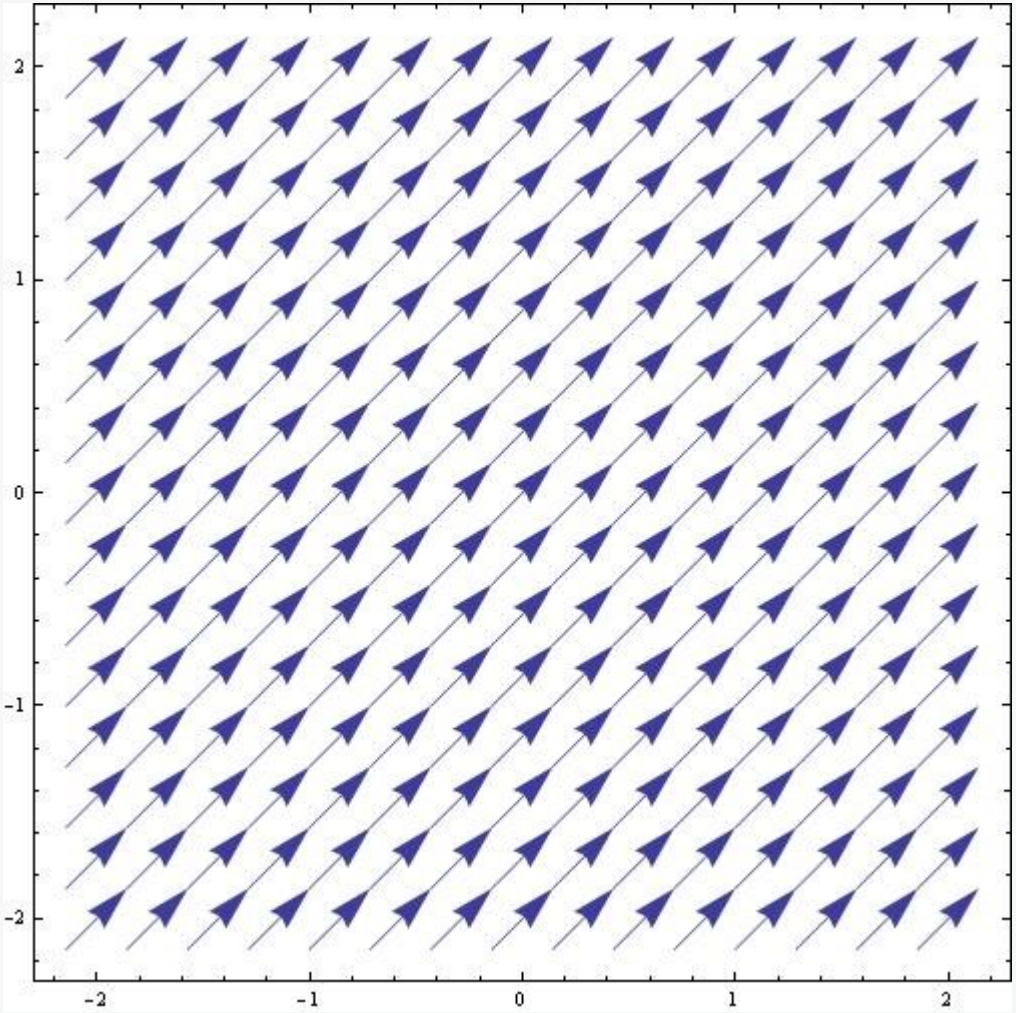

Abb. 2-3: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = 2 + x + y, \qquad grad\ \Phi = \vec{i} + \vec{j}$$

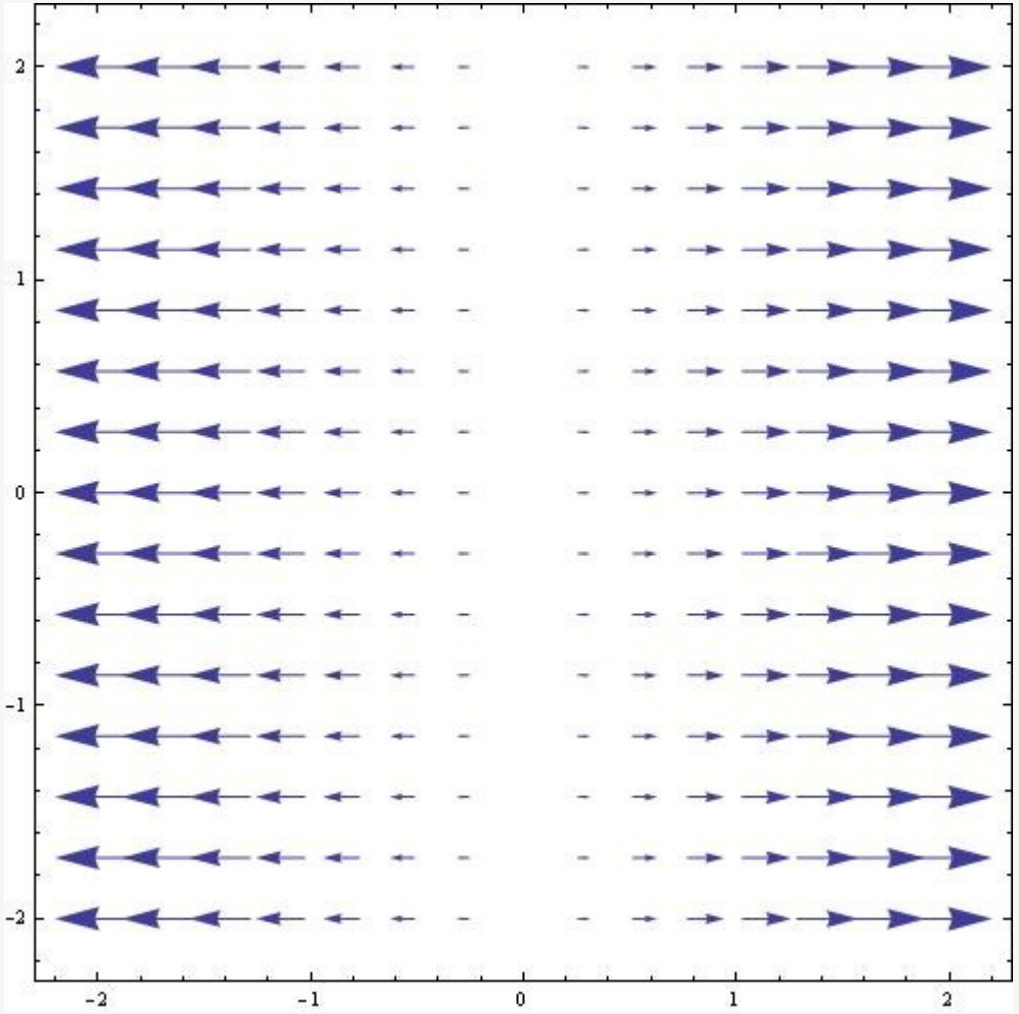

Abb. 2-4: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^2, \qquad grad\ \Phi = 2x\,\vec{i}$$

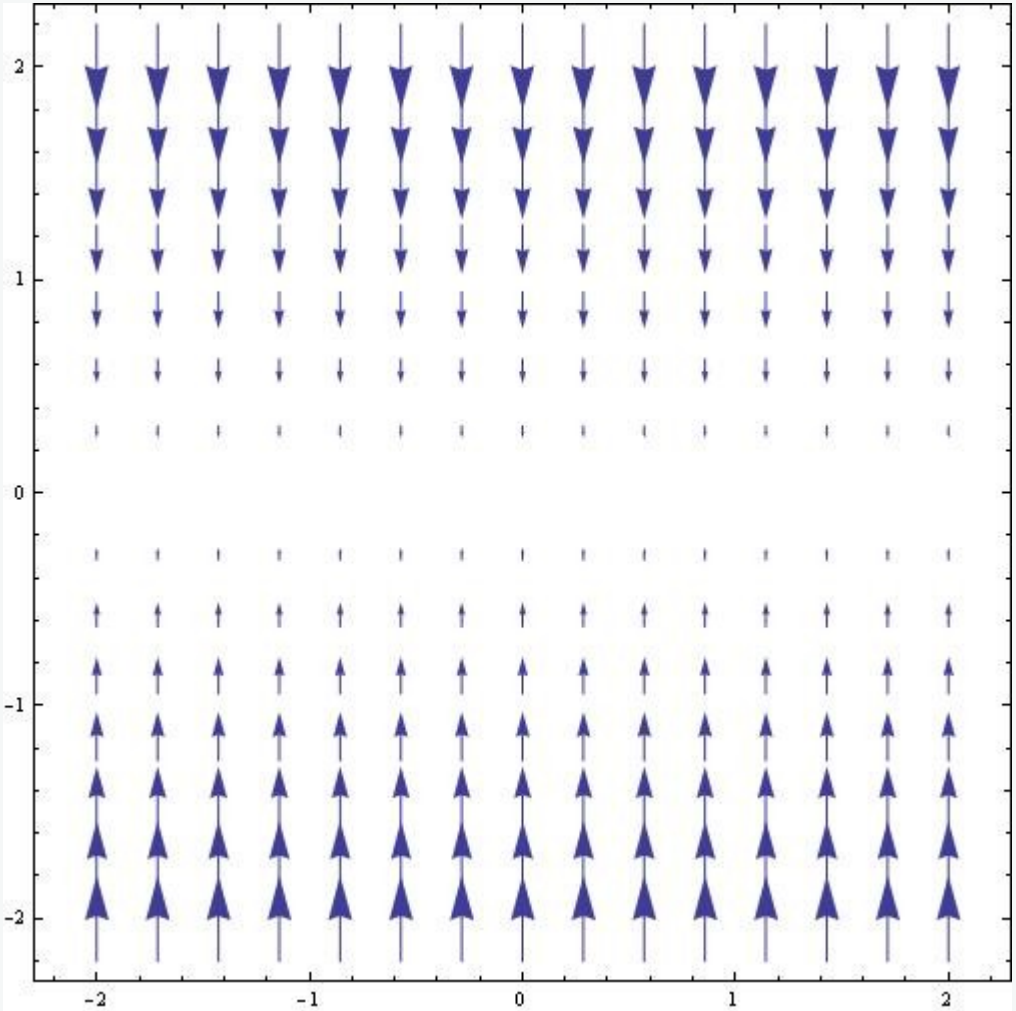

Abb. 2-5: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = -y^2, \qquad grad\ \Phi = -2\,y\,\vec{j}$$

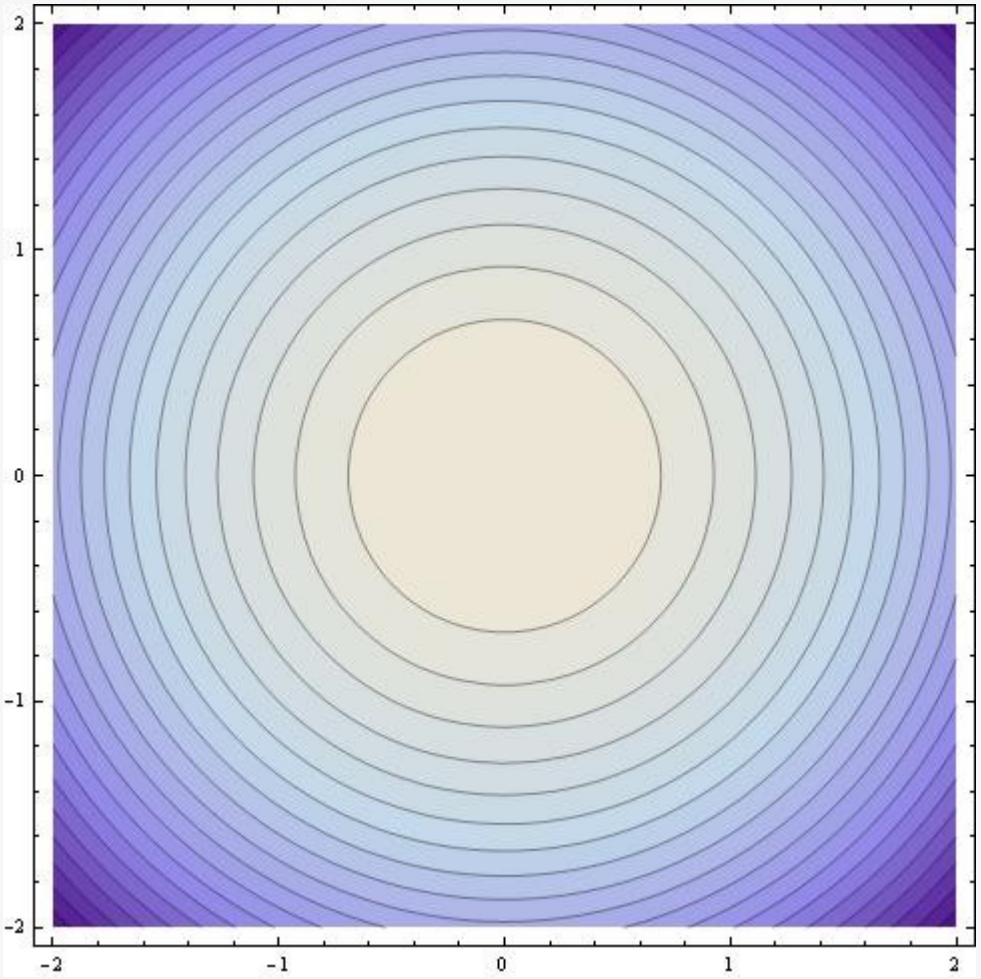

Abb. 2-6a: Höhenliniendiagramm des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = 4 - x^2 - y^2$$

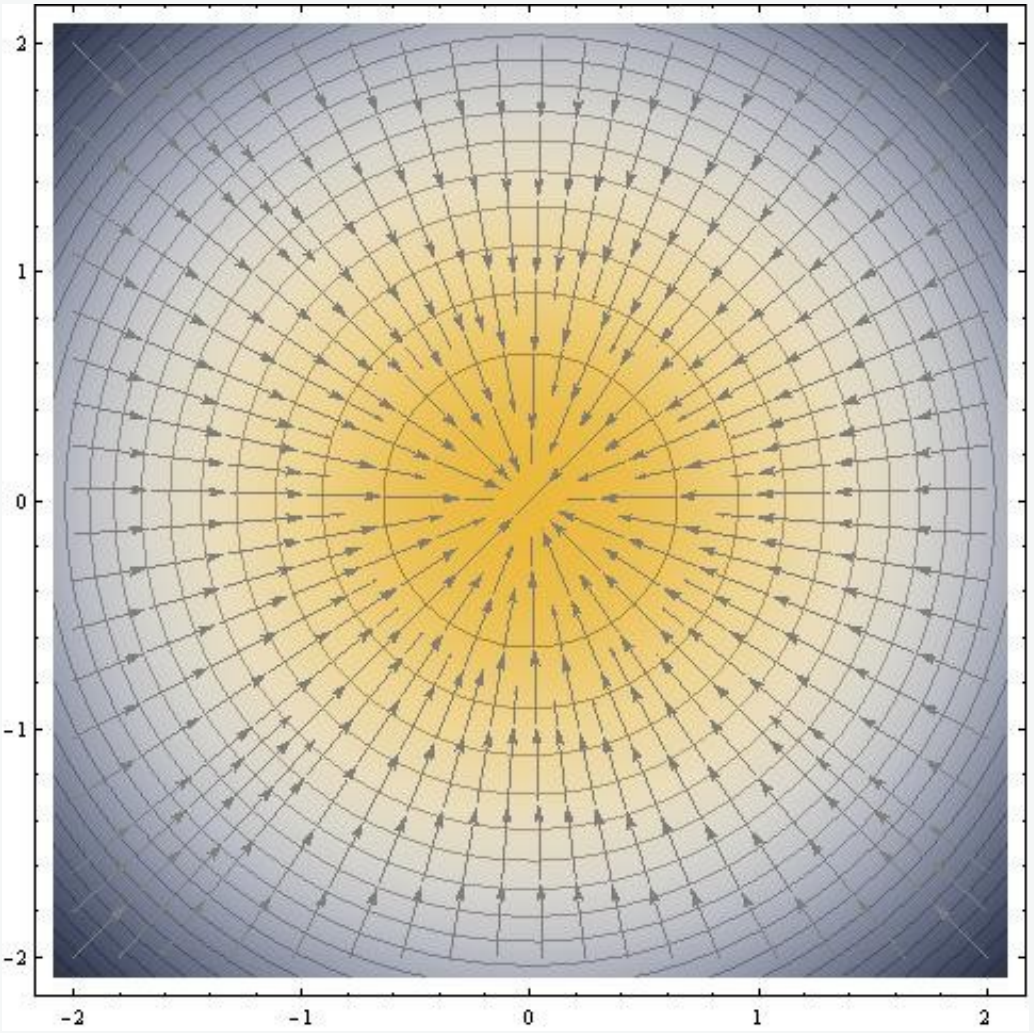

Abb. 2-6b: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = 4 - x^2 - y^2, \qquad grad\ \Phi = -2(x\,\vec{i} + y\,\vec{j})$$

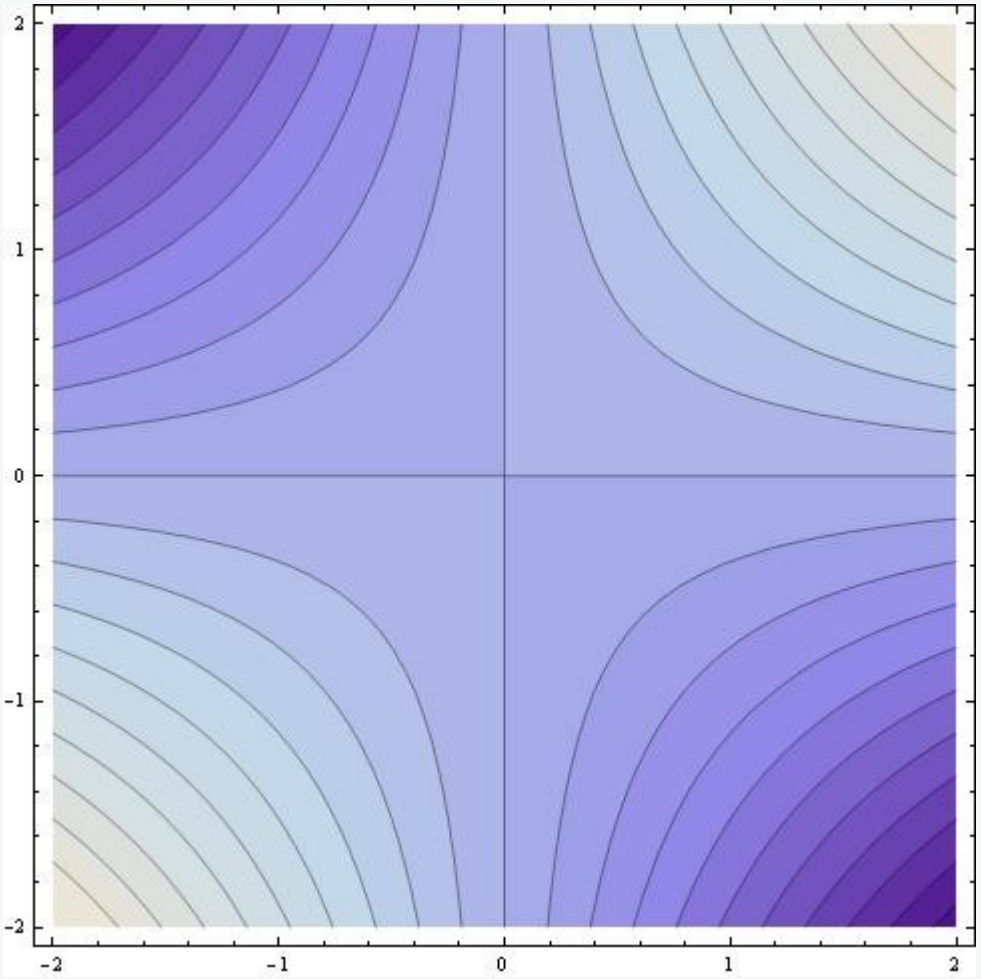

Abb. 2-7a: Höhenliniendiagramm des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x\, y$$

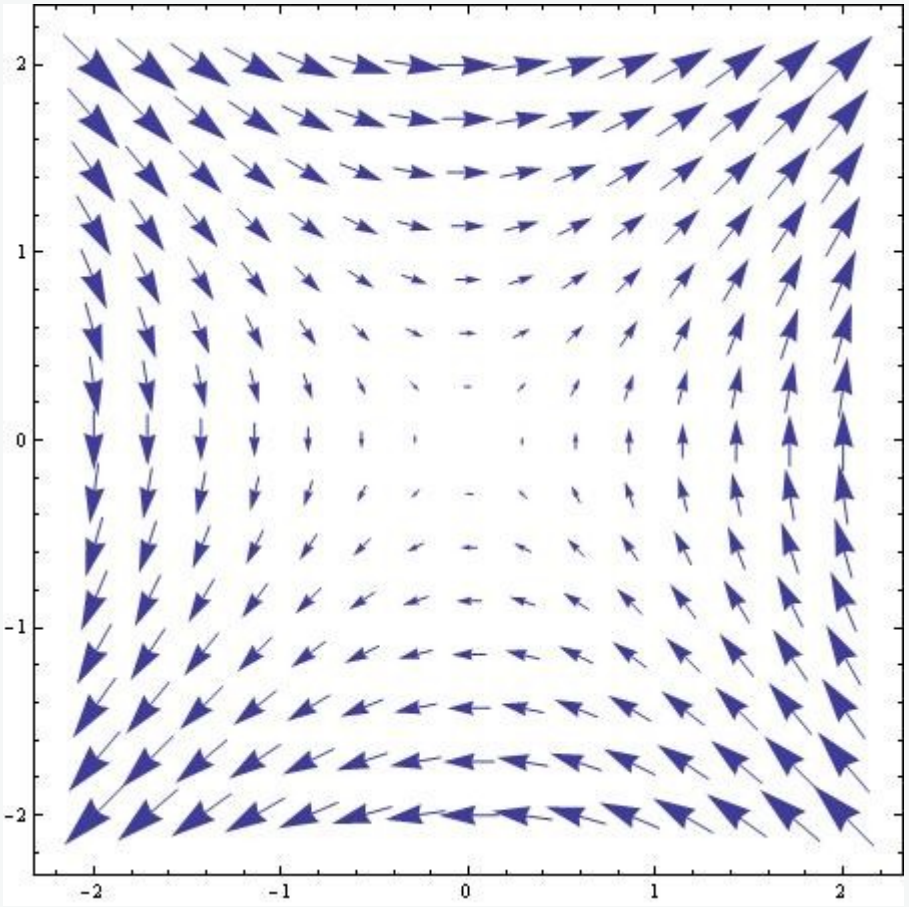

Abb. 2-7b: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x\, y, \qquad grad\ \Phi = y\, \vec{i} + x\, \vec{j}$$

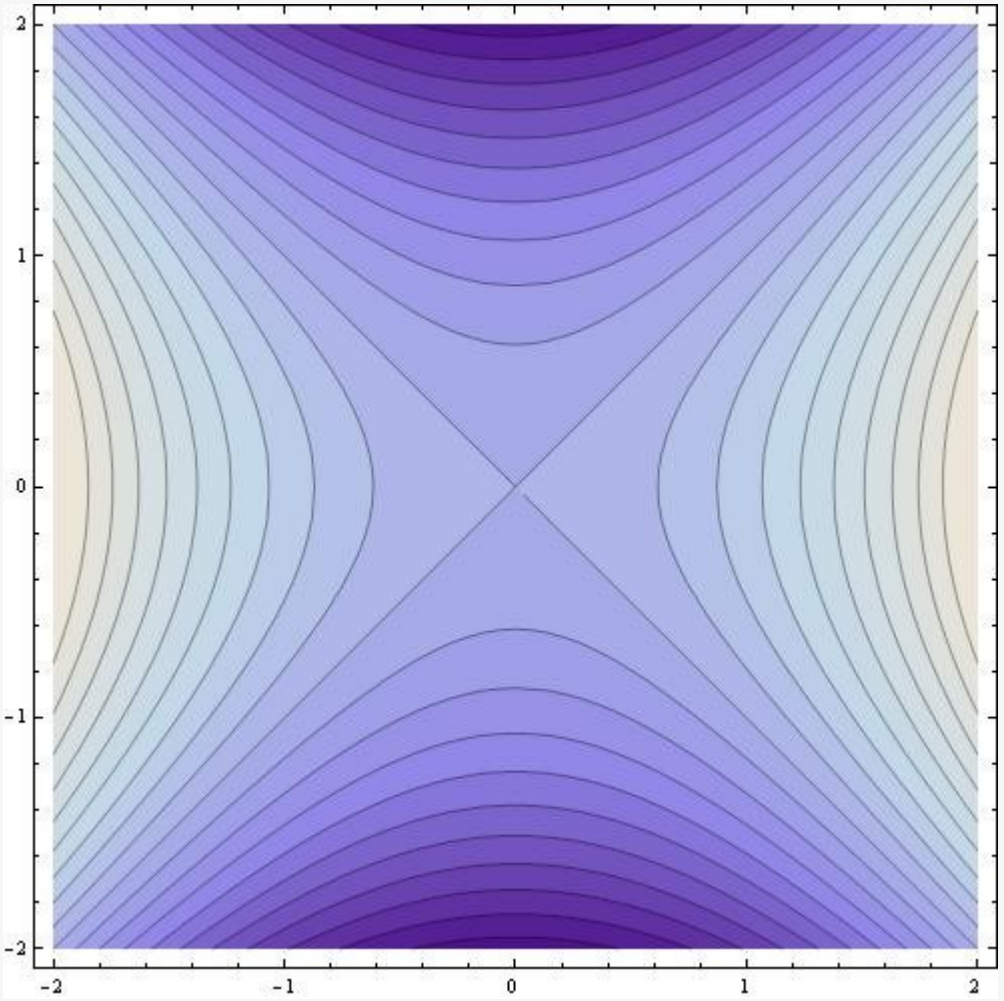

Abb. 2-8a: Höhenliniendiagramm des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^2 - y^2$$

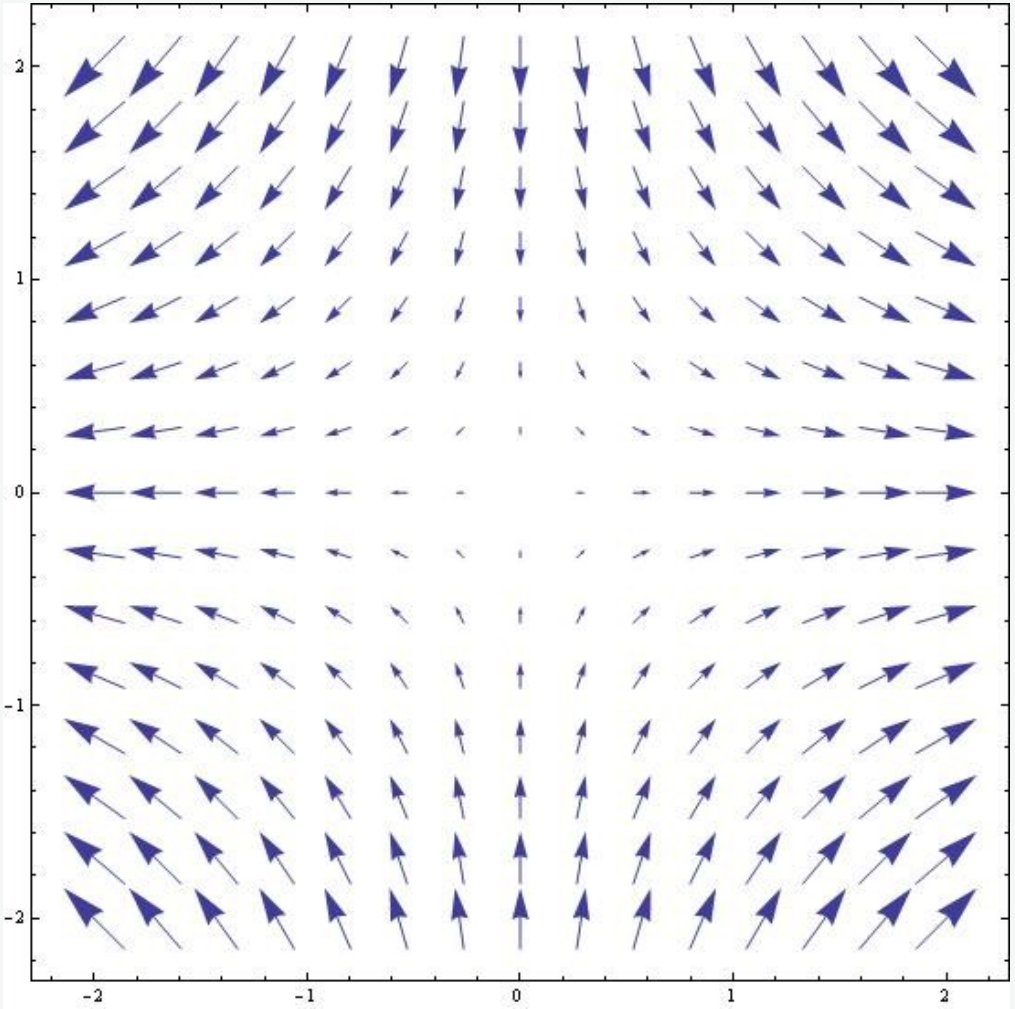

Abb. 2-8b: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^2 - y^2, \qquad grad\ \Phi = 2x\,\vec{i} - 2y\,\vec{j}$$

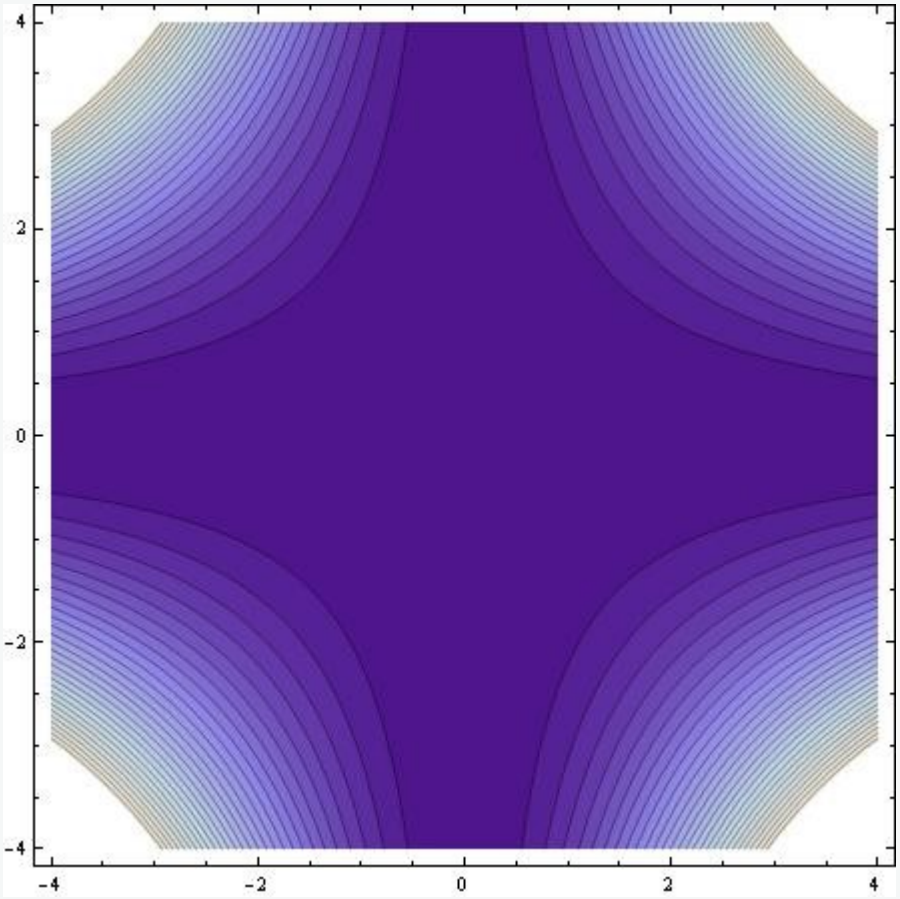

Abb. 2-9a: Höhenliniendiagramm des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^2 \; y^2$$

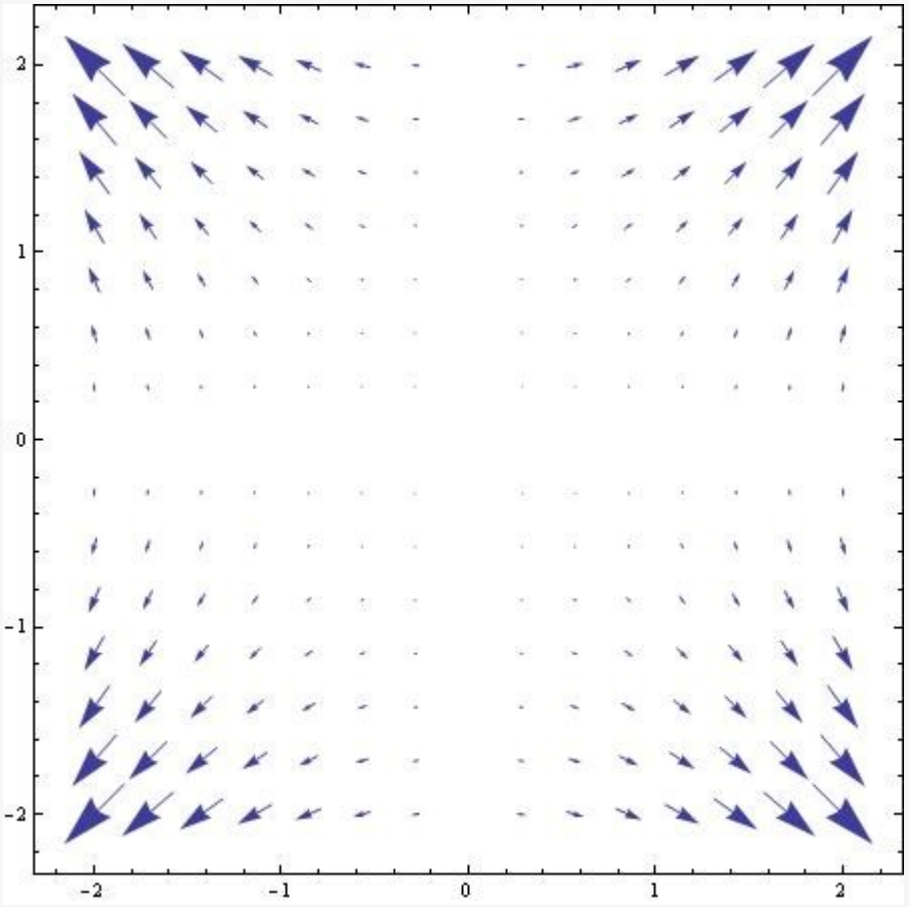

Abb. 2-9b: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^2\ y^2, \qquad grad\ \Phi = 2\,x\,y^2\,\vec{i} + 2\,x^2\,y\,\vec{j} = 2\,x\,y\,(y\,\vec{i} + x\,\vec{j})$$

Gesucht ist der Gradient folgender Skalarfelder. Zeichnen Sie, wo möglich, das entsprechende Gradientenfeld.

1) $\Phi(x, y) = \sin x$

2) $\Phi(x, y) = \cos y$

3) $\Phi(x, y) = x^3 + 2\cos y$

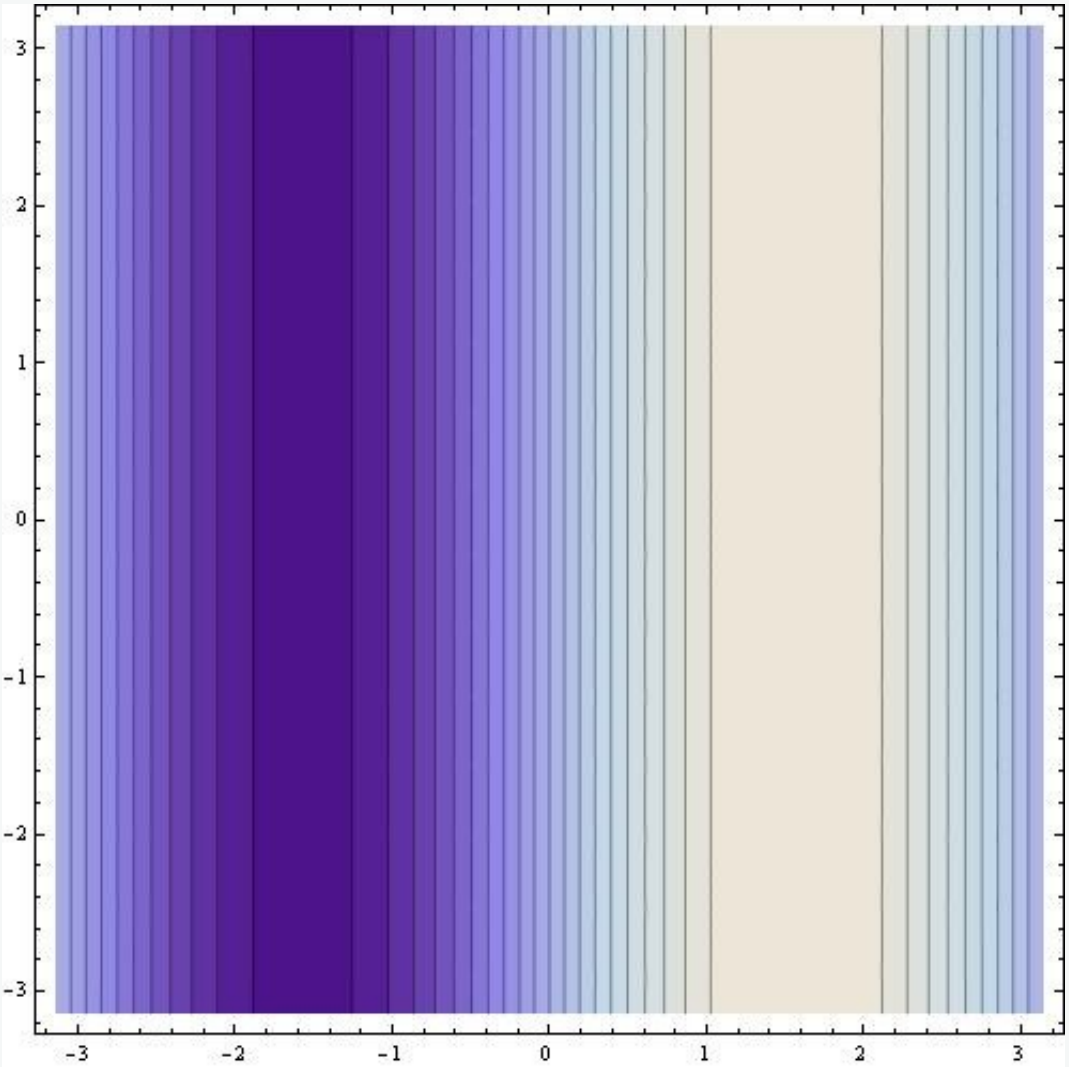

Abb. 3-1a: Höhenliniendiagramm des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = \sin x$$

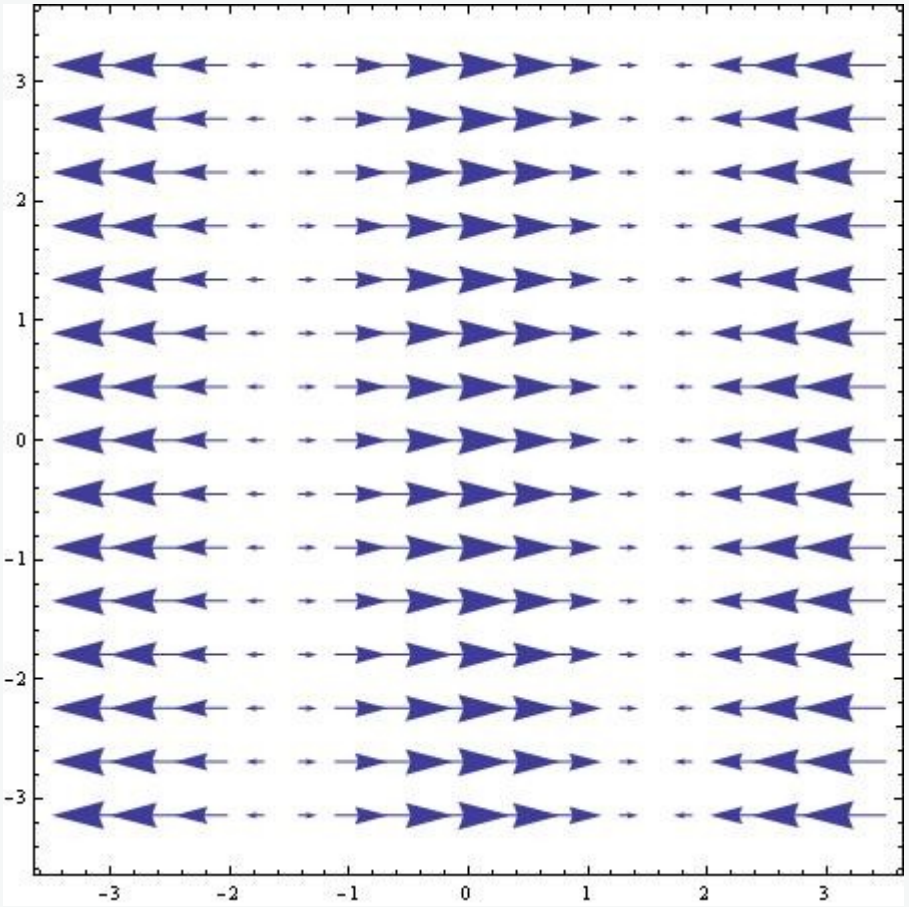

Abb. 3-1b: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = \sin x, \qquad grad\ \Phi = \cos x \cdot \vec{i}$$

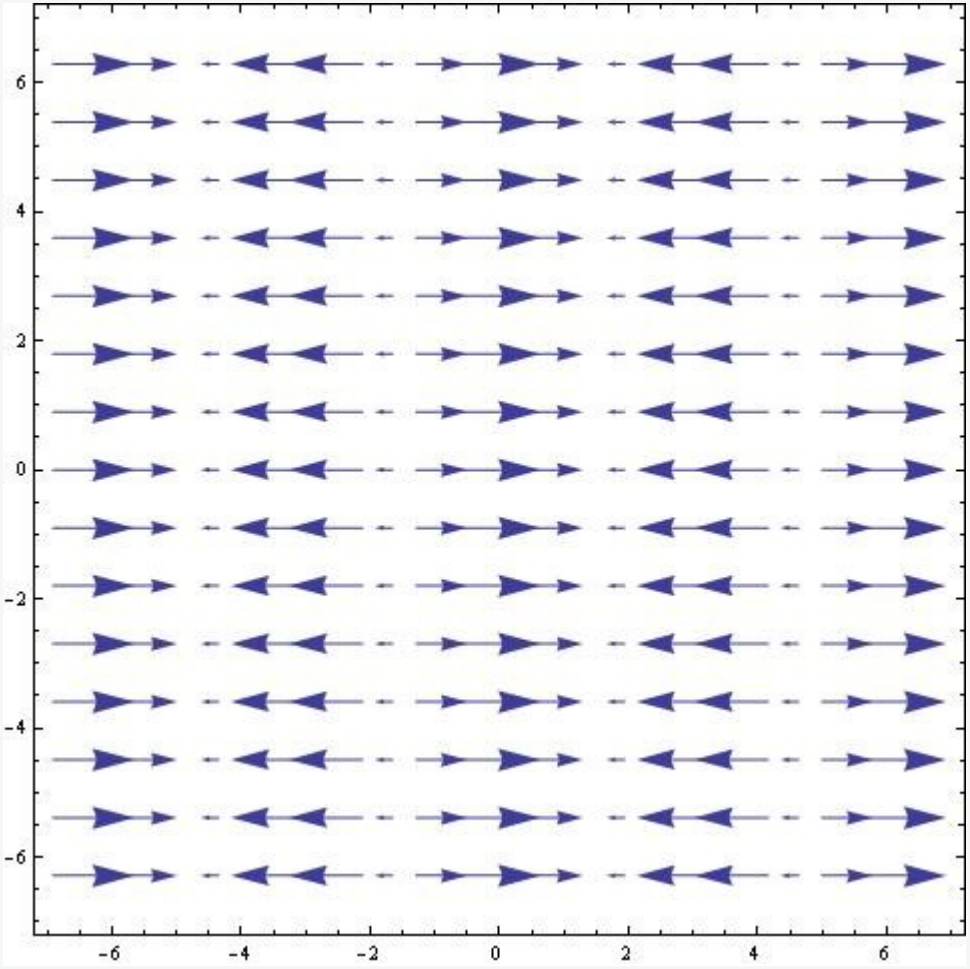

Abb. 3-1c: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = \sin x, \qquad grad\ \Phi = \cos x \cdot \vec{i}$$

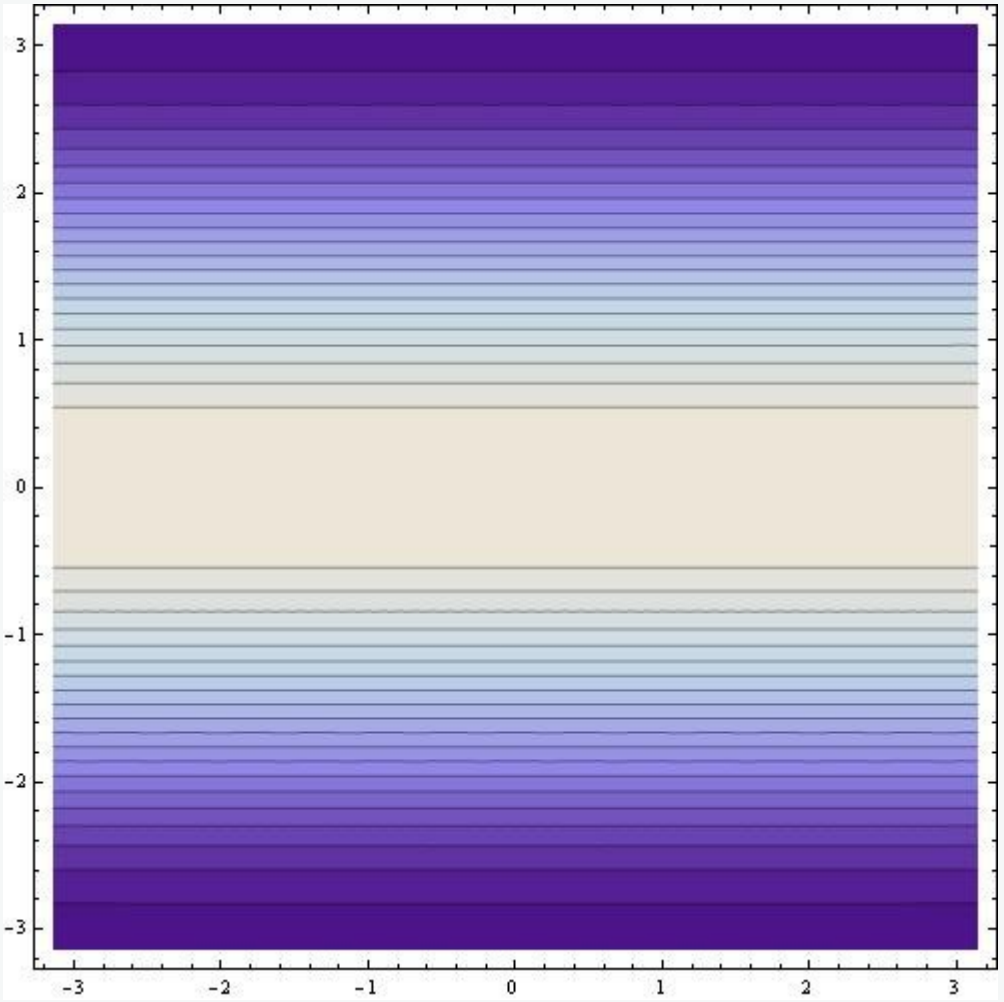

Abb. 3-2a: Höhenliniendiagramm des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = \cos y$$

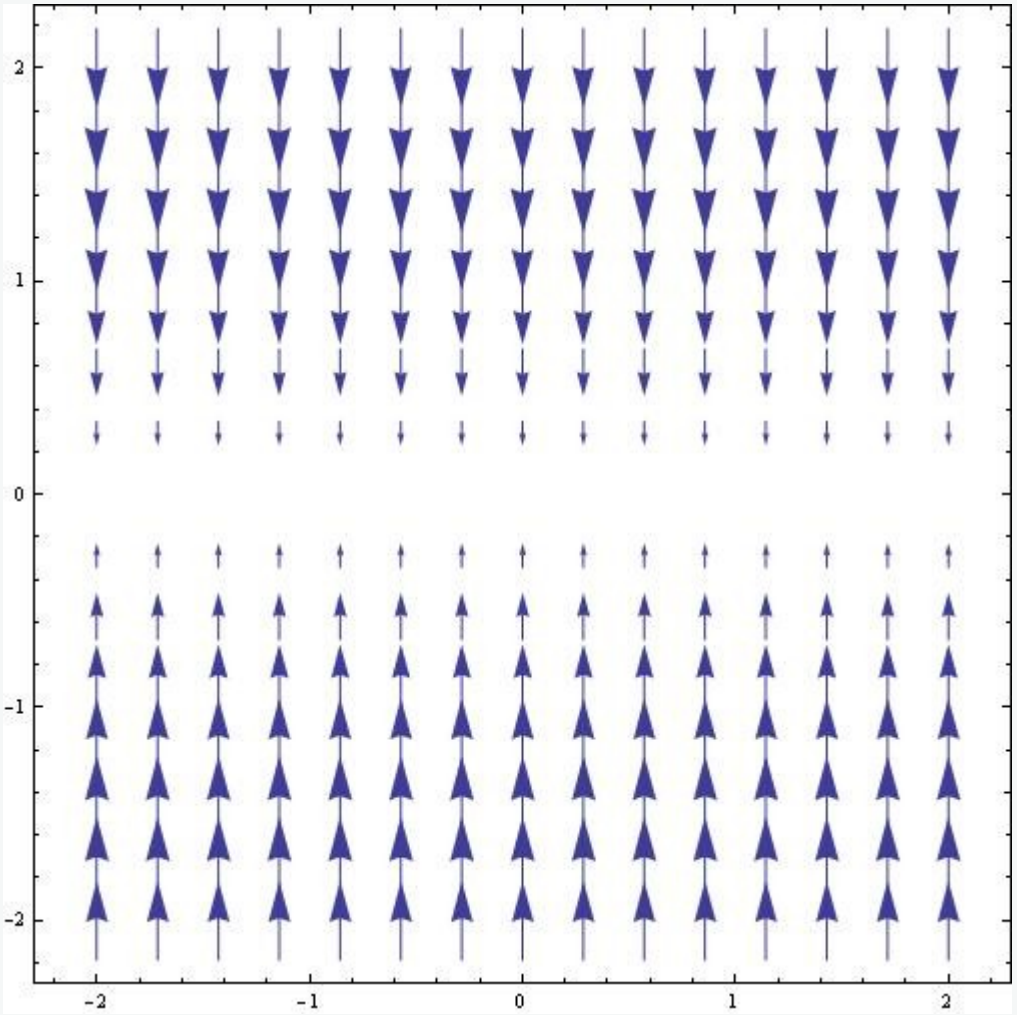

Abb. 3-2b: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = \cos y, \qquad grad\ \Phi = -\sin y \cdot \vec{j}$$

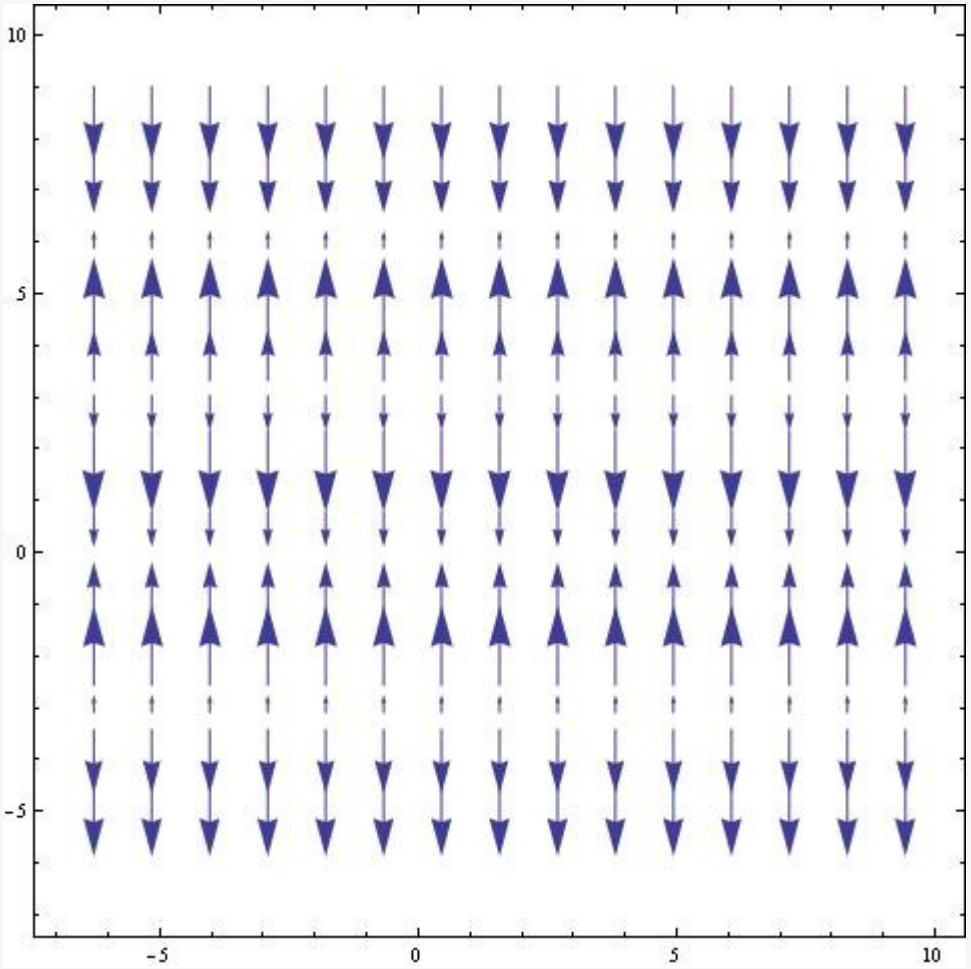

Abb. 3-2c: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = \cos y, \qquad grad\ \Phi = -\sin y \cdot \vec{j}$$

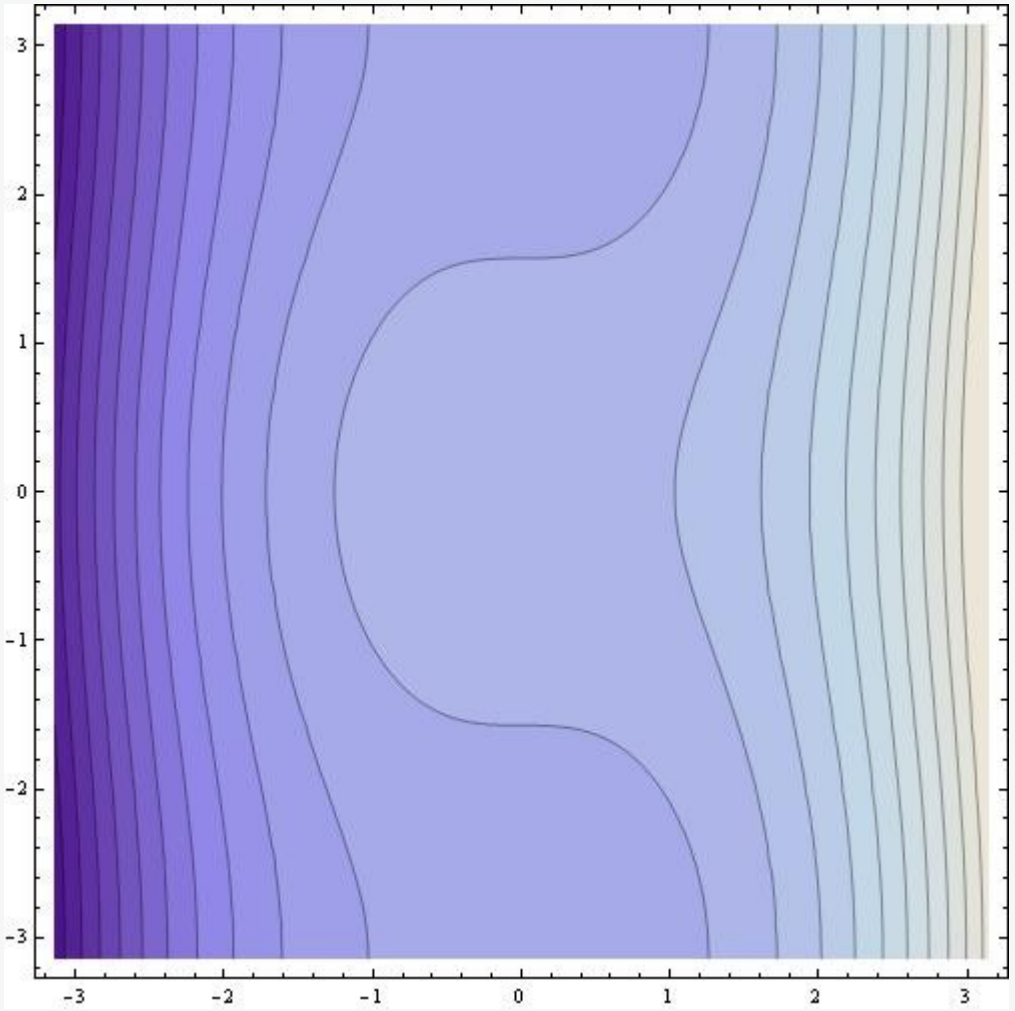

Abb. 3-3a: Höhenliniendiagramm des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^3 + 2\cos y$$

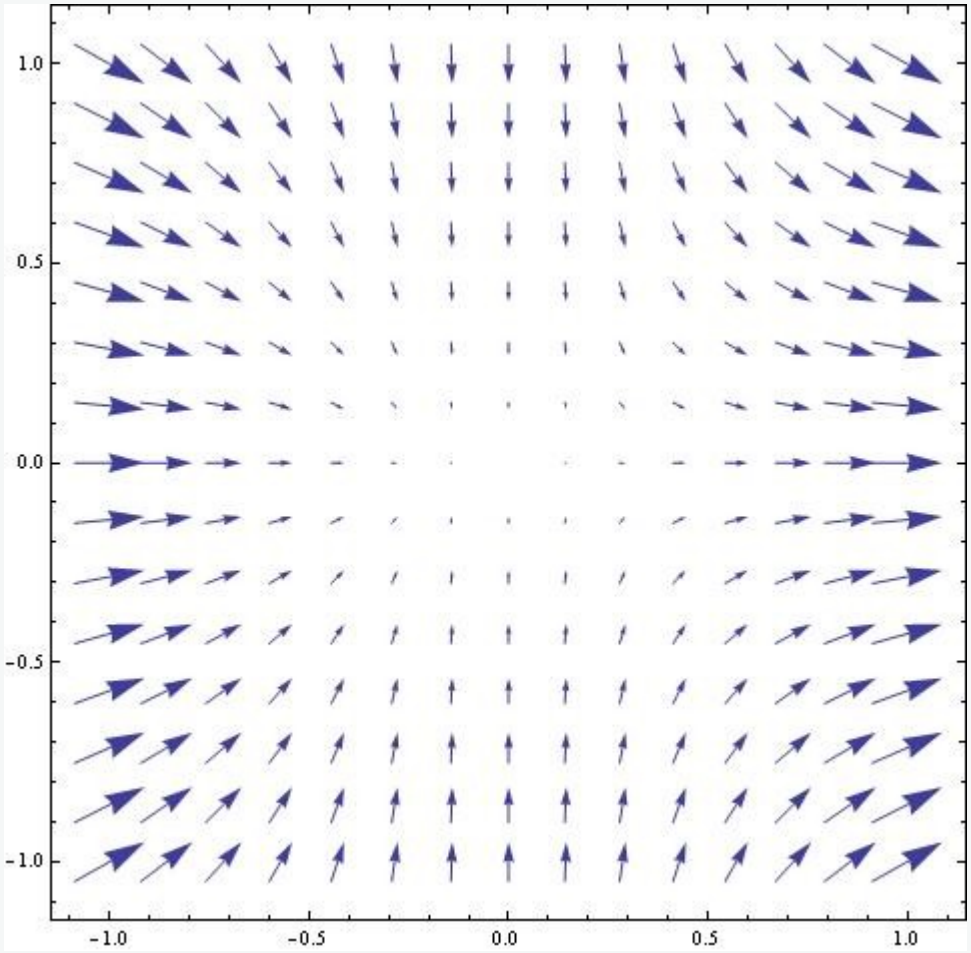

Abb. 3-3b: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^3 + 2\cos y, \qquad grad\ \Phi = 3x^2 \cdot \vec{i} - 2\sin y \cdot \vec{j}$$

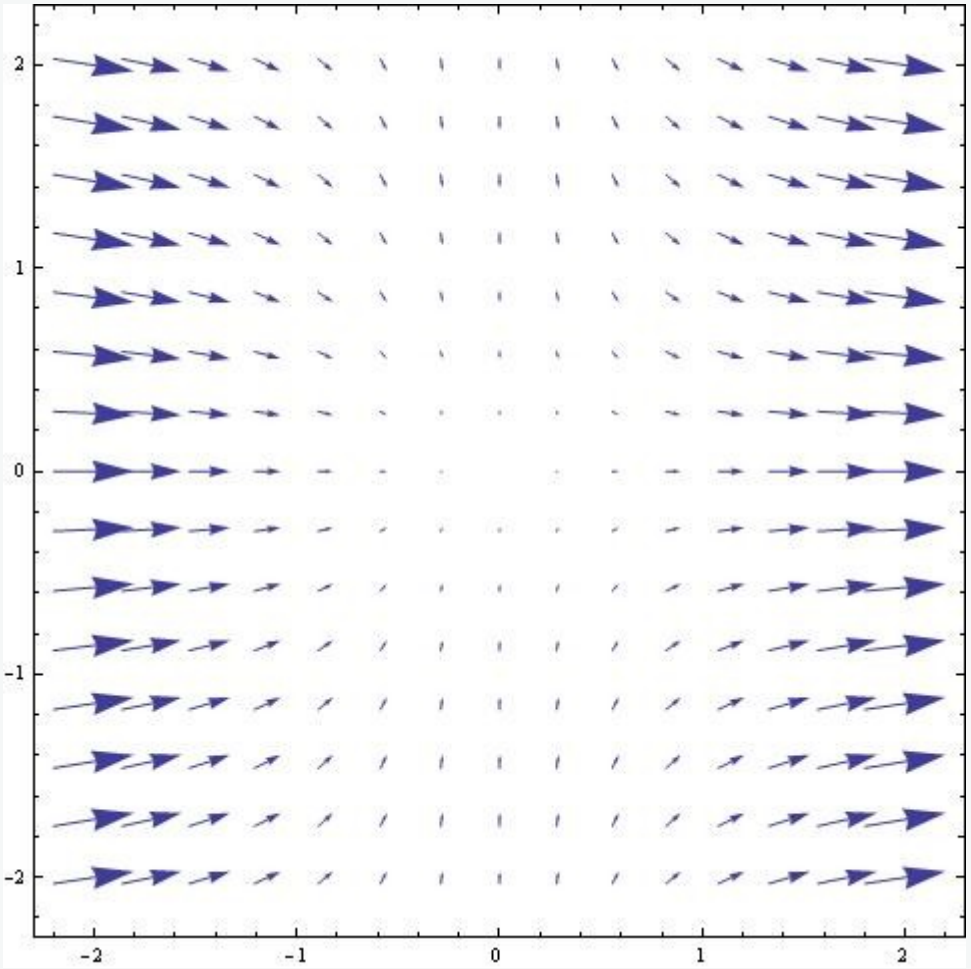

Abb. 3-3c: Gradientenfeld des Skalarfeldes $\Phi = \Phi(x, y)$

$$\Phi(x, y) = x^3 + 2\cos y, \qquad grad\ \Phi = 3x^2 \cdot \vec{i} - 2\sin y \cdot \vec{j}$$


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