QUESTION
Evaluate
(a) $\nabla \times (\nabla \times \mathbf{a})$, (b) $\nabla(\nabla \cdot \mathbf{a}) - \nabla^2 \mathbf{a}$
for $\mathbf{a} = (x^2 y, -2xz, 2yz)$.

ANSWER

(a) $\mathbf{a} = (x^2 y, -2xz, 2yz)$
$\quad \nabla \times \mathbf{a} = (2z - 2x, 0, -2z - x^2)$
$\quad \nabla \times (\nabla \times \mathbf{a}) = (0, 2 + 2x, 0)$

(b) Same vector $\mathbf{a}$, $\quad \nabla \cdot \mathbf{a} = 2xy + 2y$
$\quad \nabla(\nabla \cdot \mathbf{a}) = (2y, 2x + 2, 0)$
$\quad \nabla^2 \mathbf{a} = (2y, 0, 0)$
$\quad \nabla(\nabla \cdot \mathbf{a}) - \nabla^2 \mathbf{a} = (0, 2x + 2, 0)$
$\quad$ This should agree with 2(a) by a general formula!