1.1 $a(\vec{B}+\vec{C}) = a\vec{B} + a\vec{C}$

$$a((B_x\hat{x}+B_y\hat{y}+B_z\hat{z}) + (C_x\hat{x}+C_y\hat{y}+C_z\hat{z}))$$

$$a((B_x+C_x)\hat{x} + (B_y+C_y)\hat{y} + (B_z+C_z)\hat{z})$$

$$a(B_x+C_x)\hat{x} + a(B_y+C_y)\hat{y} + a(B_z+C_z)\hat{z}$$

$$(aB_x+aC_x)\hat{x} + (aB_y+aC_y)\hat{y} + (aB_z+aC_z)\hat{z}$$

$$= a\vec{B} + a\vec{C}$$

1.2 $\nabla(f(x,y) + \nabla g(x,y)) = \nabla f(x,y) + \nabla^2 g(x,y)$

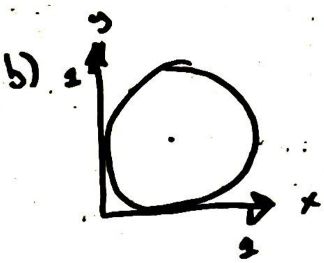
The first term is the gradient of $f(x,y)$ while the second is the Laplacian of $g(x,y)$. Both produce a vector or vector field, but one is a second derivative.

1.3 a) $\vec{v} = \hat{x}+\hat{y}+\hat{z}$ $\quad \nabla\times\vec{v}\ \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 1 & 1 & 1 \end{vmatrix} = 0$

c) $\nabla\cdot\vec{v} = \frac{\partial}{\partial x}\hat{x} + \frac{\partial}{\partial y}\hat{y} + \frac{\partial}{\partial z}\hat{z} = 0+0+0=0$

$x=\cos\theta \quad y=\sin\theta$

b)



$$\int_0^{2\pi}(\cos\theta,\sin\theta)\cdot(\cos\theta,\sin\theta)\,d\theta$$

$$\int_0^{2\pi}\cancelto{1}{\cos^2\theta+\sin^2\theta} + 2\cos\theta\sin\theta$$

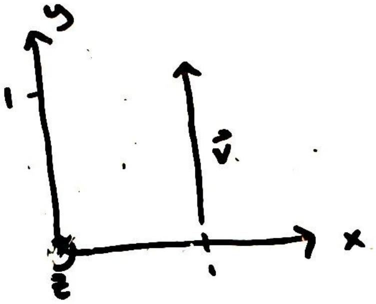
$$\int_0^{2\pi}1\,d\theta + \int_0^{2\pi}\cancelto{0}{2\cos\theta\sin\theta}\,d\theta$$

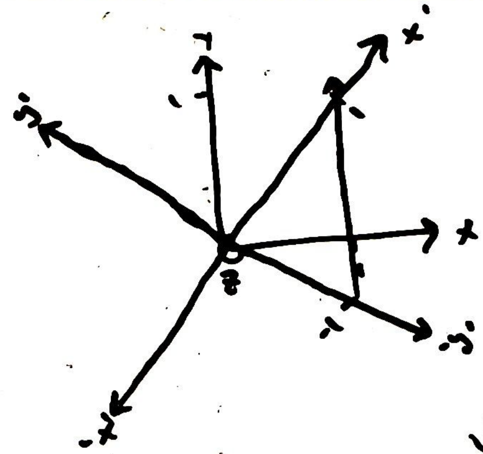
$$\theta\Big|_0^{2\pi} = 2\pi$$

3.1 For a closed boundary stokes theorem will just equal zero.

$\int(\nabla\times\vec{v})\cdot d\vec{a} = 0$ The boundary line shrinks down to a point

2.1





$\sqrt{1^2 + 1^2} = \sqrt{2}$

$\sqrt{1^2 + -1^2} = \sqrt{2}$

4.1

$\int_{-\infty}^{\infty} (f(x) \cdot g(x))\, \delta(x)\, dx$

$f(x) \cdot g(x) = \dfrac{f(x) - g(x)}{f(x) + g(x)}$

$\int_{-\infty}^{\infty} \delta(x)\, dx = 1$

$\int_{-\infty}^{\infty} (\cos(x) \cdot \sin(x))\, \delta(x)\, dx = 1 \cdot 0 \int_{-\infty}^{\infty} \delta(x)\, dx = 0$

$\int_{-\infty}^{\infty} f(x)\, \delta(x)\, dx = f(0)$

$\int_{-\infty}^{\infty} (\cosh(x) \cdot \sinh(x))\, \delta(x)\, dx = 1 \cdot 0 \int_{-\infty}^{\infty} \delta(x)\, dx = 0$

$\int_{-\infty}^{\infty} ((a + ax + ax^2 \ldots) \cdot (b + bx + bx^2))\, \delta(x)\, dx = a \cdot b \int_{-\infty}^{\infty} \delta(x)\, dx = a \cdot b$