

## Homework 1 – Due September 11, 2013

- 1.1. (10 pt.) Given two vectors:  $\mathbf{A} = 4\mathbf{u}_x - 2\mathbf{u}_y + 6\mathbf{u}_z$  and  $\mathbf{B} = 12\mathbf{u}_x + 18\mathbf{u}_y - 8\mathbf{u}_z$ , find:
- $\mathbf{A} - 3\mathbf{B}$
  - $(2\mathbf{A} + 5\mathbf{B})/|\mathbf{B}|$
  - $\mathbf{u}_x \times \mathbf{A}$
  - $(\mathbf{B} \times \mathbf{u}_x) \cdot \mathbf{u}_y$
- 1.2. (10 pt.) Let  $\mathbf{A} = \alpha\mathbf{u}_x + 3\mathbf{u}_y - 2\mathbf{u}_z$  and  $\mathbf{B} = 4\mathbf{u}_x + \beta\mathbf{u}_y + 8\mathbf{u}_z$ .
- Find  $\alpha$  and  $\beta$  such that  $\mathbf{A}$  and  $\mathbf{B}$  are parallel
  - Find  $\alpha$  and  $\beta$  such that  $\mathbf{A}$  and  $\mathbf{B}$  are perpendicular
- 1.3. (15 pt.) Points  $P_1(1,2,3)$ ,  $P_2(-5,2,0)$ , and  $P_3(2,7,-3)$  form a triangle in space.
- Find the area of this triangle
  - Find the three angles of the triangle
- 1.4. (10 pt.) Given that  $\mathbf{H} = x^2\mathbf{u}_x + y^2\mathbf{u}_y$ , evaluate  $\int_L \mathbf{H} \cdot d\mathbf{l}$  where  $L$  is along the curve  $y = x^2$  from  $(0,0)$  to  $(1,1)$ .
- 1.5. (15 pt.) Calculate the gradient of:
- $V_1 = 6xy - 2xz + z$
  - $V_2 = 10\rho \cos \phi - \rho z$
  - $V_3 = \frac{2}{r} \cos \phi$
- 1.6. (15 pt.) Evaluate the divergence of the following vector fields:
- $\mathbf{A} = xy\mathbf{u}_x + y^2\mathbf{u}_y - xz\mathbf{u}_z$
  - $\mathbf{B} = \rho z^2\mathbf{u}_\rho + \rho \sin^2 \phi \mathbf{u}_\phi + 2\rho z \sin^2 \phi \mathbf{u}_z$
  - $\mathbf{C} = r\mathbf{u}_r + r \cos^2 \theta \mathbf{u}_\phi$
- 1.7. (15 pt.) Let  $V = \frac{\sin \theta \cos \phi}{r}$  Determine:
- $\nabla V$
  - $\nabla \times \nabla V$
  - $\nabla \cdot \nabla V$
- 1.8. (10 pt.) For a phasor  $\mathbf{V}(\chi) = 8 + 4j$  find the sinusoidal signal that it represents if the frequency is 50 Hz.