**ASSIGNMENT 1**

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Course: TE 262  
Department: Electrical Engineering

1. **(a)** Magnitude of |A|
2. Unit vector
3. Angle that vector A makes with the z-axis

Taking the dot product of **A** and , we have

So we have

1. **(a)**

**(b)**

**(c)**

Taking the dot product of **A** and **B**, we have

1. **(a)** The magnitude of B

**(b)** The expression of

**(c**) The angles that **B** makes with the x, y, and z axis

* **x-axis**

Taking the dot product of **B** and , we have

* **y-axis**

Taking the dot product of **B** and , we have

* **z-axis**

Taking the dot product of **B** and , we have

1. The total charges contained in the region

Let be the charge density. We have

The number of charges Q is given by Q =, with v being the volume.

We’ll need to perform a triple integral, and use the spherical coordinates.

In this case, , so we have:

Using integration by parts to integrate , we have

1. **(a)** Total outward flux

To obtain the total outward flux, we should use the divergence theorem.

Where and the limits of integration are given by the dimensions of the cylinder.

**(b)** The divergence of A

**(c)** Verification of the divergence theorem

The divergence theorem states that

* Front surface, we have
* Bottom surface, we have
* Top surface, we have r

The divergence theorem is verified.

1. Prove the two null identities mathematically

The two null identities involves repeated del operation and are important in the study of electromagnetism especially when dealing with potential function.

* **Identity 1**

This implies the curve of the gradient of any scalar field is indistinguishably zero. Character 1 can be demonstrated in Cartesian directions. Generally if the surface integral of over any surface, the outcome is equivalent to the line necessary of ∇V around the path bounded limited by the strokes theorem.

Therefore,

The combination of these two conditions shows that the surface vital of ∇\*∇V is equivalent to zero. If the vector field is curve free, at that point it tends to be expressed as the gradient of a scalar field. In the event that the vector field is E. At that point if ∇\*E=0. We can characterize the scalar field V with the end goal that E=-∇V. Where the negative is inconsequential as long as character 1 is concerned.

Realizing that a curl free vector field is a conservative field, hence an irrotational vector field can be expressed as the gradient of the scalar field.

* **Identity 2**

The divergence of the curl of any vector field is identically zero, it can be proved taking the volume integral of . We have

Taking a volume V with a surface S and assuming the surface is in reality to surfaces with a common boundary. We apply Stokes’ theorem to those two surfaces. We then have:

are the vectors normal to surfaces S1 and S2 respectively. Since the two boundary contours of S1 and S2 are actually the same but in opposite direction, their sum is zero and the volume integral of on the left side of Eq.1 disappears. Therefore the identity is verified since this is true for any arbitrary volume: the integrand must zero.