

بسم الله الرحمن الرحيم

King Abdulaziz University - Physics Department - The 2nd Semester of 1429 H.

Computational Physics 393 - Lab #3.

Question 1

(12 Marks)

The magnetic field of a long wire is given by : $B = \frac{\mu_0 I (-y i + x j)}{2 (x^2 + y^2)}$ where i and j are the x and y unit vectors, I the current and $\mu_0 = 4\pi \times 10^{-7}$.

- A) Plot the component B_x at $y=2$, and the component B_y at $x= 5$. (Let $I=1$ in each case)
- B) Plot $B_x + B_y$ as a function of x at $y=2$.
- C) Use **fieldplot** to visualize the total magnetic field along the wire.

Question 2

(8 Marks)

- A) Visualize the difference in **3 dimensions** between the two functions:

$$Z_1 = \sin(xy) \quad \text{and} \quad Z_2 = x + y$$

from $x = -\pi$ to π and $y = -\pi$ to π . Use the **color option** to distinguish between the two functions and show the graph at the angels $\theta = -25^\circ$ & $\phi = 75^\circ$.

Question 3

(10 Marks)

The formula for a traveling wave is given by:

$$U = A \sin (k x - \omega t)$$

Assume that $A = 1.5$, $k = \frac{5\pi}{2}$, and $\omega = \frac{\pi}{2}$.

- A) Test the moving of the above formula using **animate3d** command.
- B) Show by using **animate3d** that the sum of two waves of equal amplitude traveling in opposite directions is a standing wave.

Lab # 3

Question 1

(12 Marks)

```
> restart;
> Bx:=mu0*i*(-y)/(2*Pi)/(x^2+y^2);
  By:= mu0*i*(x)/(2*Pi)/(x^2+y^2);
> mu0:=Pi*4e-7;i:=1.;
> y:=2.;plot(Bx,x);
> y:='y';x:=5.;plot(By,y=-20..20);
> x:='x';y:=2.;plot(Bx+By,x=-20..20);
> with(plots):
> y:='y';x:='x';fieldplot([Bx,By],x=-1..1,y=-1..1,arrows=thick,
  color=tan(x));
```

Question 2

(8 Marks)

```
> restart;
> z1:=sin(x*y);z2:=x+2*y;
> plot3d([z1,z2],x=-6..6,y=-6..6,color=[pink,blue],orientation=
  [-25,75]);
```

Question 3

(10 Marks)

```
> restart;with(plots):
> u1:=A*sin(k*x-w*t);
  u2:=A*sin(-k*x-w*t);
> A:=1.5;k:=5.*Pi/2.;w:=Pi/2.;
> animate3d(u1,x=-1..1,y=-1..1,t=0..10,frames=100);
> animate3d(u1+u2,x=-50..50,y=-50..50,t=0..10,orientation=[45,45],
  frames=100);
```