

ECEN 4005 Homework #6

Problem 1(d)

```
In[1]:= Integrate[  $\frac{(m * \omega)}{\pi * \hbar} * e^{(-m * \frac{\omega}{\hbar}) * (p^2)}$  * p, {p, 0, r}, {θ, 0, 2 * π}]
```

```
Out[1]=  $1 - e^{-\frac{m r^2 \omega}{\hbar}}$ 
```

```
In[2]:= m = 0.063 * (9.11 * 10-31);
```

```
ω = 200 * π * 2 * 109;
```

```
ħ = 1.05 * 10-34;
```

```
Solve[ $1 - e^{-\frac{m r^2 \omega}{\hbar}} == 0.9990$ , r]
```

... Solve : Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

```
Out[5]= {{r → -1.00283 × 10-7}, {r → 1.00283 × 10-7}}
```

Problem 2 (a)

```
In[6]:= sz = {{1, 0}, {0, -1}};
```

```
sx = {{0, 1}, {1, 0}};
```

```
Hqubit = -10 * t * sz + t * sx; MatrixForm[Hqubit]
```

```
Eigenvalues[Hqubit];
```

```
Eigenvectors[Hqubit]
```

```
Out[8]//MatrixForm=
```

$$\begin{pmatrix} -10t & t \\ t & 10t \end{pmatrix}$$

```
Out[10]= {{-10 - √101, 1}, {-10 + √101, 1}}
```

```
In[11]:= v1 = {-10 - √101, 1};
```

```
MatrixForm[Normalize[v1]]
```

```
MatrixForm[N[Normalize[v1]]]
```

```
Out[12]//MatrixForm=
```

$$\begin{pmatrix} \frac{-10 - \sqrt{101}}{\sqrt{1 + (10 + \sqrt{101})^2}} \\ \frac{1}{\sqrt{1 + (10 + \sqrt{101})^2}} \end{pmatrix}$$

```
Out[13]//MatrixForm=
```

$$\begin{pmatrix} -0.998759 \\ 0.0498137 \end{pmatrix}$$

```
In[14]:= v2 = {-10 +  $\sqrt{101}$ , 1};  
MatrixForm[Normalize[v2]]  
MatrixForm[N[Normalize[v2]]]
```

Out[15]//MatrixForm=

$$\begin{pmatrix} \frac{-10 + \sqrt{101}}{\sqrt{1 + (-10 + \sqrt{101})^2}} \\ \frac{1}{\sqrt{1 + (-10 + \sqrt{101})^2}} \end{pmatrix}$$

Out[16]//MatrixForm=

$$\begin{pmatrix} 0.0498137 \\ 0.998759 \end{pmatrix}$$