HOMEWORK 08

Problem 1

PART B

In[ ]:=
$$|a\rangle_y = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ i\end{pmatrix};\quad |b\rangle_y = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ -i\end{pmatrix};$$

```
ψ = 1/Sqrt[2] E^(-i w t/2) |a⟩_y + 1/Sqrt[2] E^(i w t/2) |b⟩_y // MatrixForm
```

Out[ ]//MatrixForm=
$$\begin{pmatrix} \frac{1}{2}e^{-\frac{1}{2}itw} + \frac{1}{2}e^{\frac{itw}{2}} \\ \frac{1}{2}i\,e^{-\frac{1}{2}itw} - \frac{1}{2}i\,e^{\frac{itw}{2}} \end{pmatrix}$$

In[ ]:=
```
g = Cos[t w/2] + i Sin[t w/2];
h = Cos[t w/2] - i Sin[t w/2];
ψ = 1/2 ( h + g
          i h - i g ) // MatrixForm // Simplify
```

Out[ ]//MatrixForm=
$$\begin{pmatrix} \text{Cos}\left[\frac{tw}{2}\right] \\ \text{Sin}\left[\frac{tw}{2}\right] \end{pmatrix}$$

PART C

In[ ]:=
```
(Cos[t w/2]/Sqrt[2] + Sin[t w/2]/Sqrt[2])^2 // Simplify
```

Out[ ]=
$$\frac{1}{2}\left(1 + \text{Sin}[tw]\right)$$

Problem 2

PART B

In[11]:=
$$|a\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\1\end{pmatrix};\quad |b\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\1\end{pmatrix};$$

$$\psi = \frac{1}{\sqrt{2}} E^{-i w t/2}|a\rangle + \frac{1}{\sqrt{2}} E^{i w t/2}|b\rangle \text{ // MatrixForm}$$

Out[12]//MatrixForm=
$$\begin{pmatrix} \frac{1}{2} e^{-\frac{1}{2} i t w} + \frac{1}{2} e^{\frac{i t w}{2}} \\ \frac{1}{2} e^{-\frac{1}{2} i t w} + \frac{1}{2} e^{\frac{i t w}{2}} \end{pmatrix}$$

In[16]:=
$$g = \text{Cos}\left[\frac{t w}{2}\right] + i \,\text{Sin}\left[\frac{t w}{2}\right];$$

$$h = \text{Cos}\left[\frac{t w}{2}\right] - i \,\text{Sin}\left[\frac{t w}{2}\right];$$

$$\frac{1}{2}\begin{pmatrix}h+g\\h+g\end{pmatrix} \text{ // MatrixForm}$$

Out[18]//MatrixForm=
$$\begin{pmatrix} \text{Cos}\left[\frac{t w}{2}\right] \\ \text{Cos}\left[\frac{t w}{2}\right] \end{pmatrix}$$

In[23]:=
$$\left(\text{Cos}\left[\frac{t w}{2}\right]\right)^2$$

Out[23]=
$$\text{Cos}\left[\frac{t w}{2}\right]^2$$