1. A wrong as $x^2 + y^2 + \frac{1}{4} = 1$ so $x^2 + y^2 \neq \frac{1}{2} - \frac{3}{4}$

3. $X|0\rangle = |1\rangle$

$H|1\rangle = \begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix}\begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} \end{pmatrix}$

$X\left(\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle\right) = \frac{1}{\sqrt{2}}|1\rangle - \frac{1}{\sqrt{2}}|0\rangle$

$H\left(\frac{1}{\sqrt{2}}|1\rangle - \frac{1}{\sqrt{2}}|0\rangle\right) = \frac{1}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle\right)$

$- \frac{1}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle\right)$

$X\left[\frac{1}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle\right) - \frac{1}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle\right)\right]$

$= \frac{1}{2}|1\rangle - \frac{1}{2}|0\rangle - \frac{1}{2}|1\rangle - \frac{1}{2}|0\rangle$

$= -|0\rangle$

4. $H|w\rangle = H\left(\frac{3}{5}|0\rangle - \frac{4}{5}|1\rangle\right)$

$= \frac{3}{5}\left(\frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle\right) - \frac{4}{5}\left(\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle\right)$

$= -\frac{1}{\sqrt{2}}\frac{1}{5}|0\rangle + \frac{1}{\sqrt{2}}\frac{7}{5}|1\rangle$

$P(1) = \frac{1}{2} \times \frac{49}{25} = \frac{49}{50}$

5. $\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix} = \begin{pmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$.

6. $x^2 + 9x^2 = 1 \qquad 10x^2 = 1 \qquad x = \frac{1}{\sqrt{10}}$

$P(0) = x^2 = \frac{1}{10}$

7. $X\underbrace{HHHHH}_{I} XXX \underbrace{HHH\ HHH}_{I} X|0\rangle$

$= XXXXH X|0\rangle$

$\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$

$= \underbrace{XXXX}_{I} H X|0\rangle$

$= H X|0\rangle = H|1\rangle = \frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle$

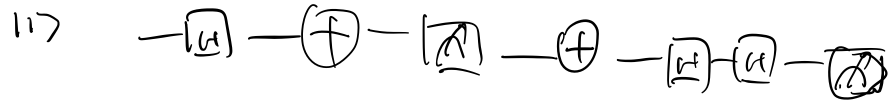
8. $H|1\rangle = \frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle$

$H \downarrow$

$\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle$

$P(0) = \frac{3}{4} \qquad times = 375 \qquad A$

9.



10.

$|1\rangle \xrightarrow{H} \frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle$

$i = 0, 1, 2, 3$

$i = 0 \quad x = 0 \bmod 2 = 0 \quad \frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle$

↙

$\frac{1}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle\right)$

$i = 1 \quad x = 1 \bmod 2 = 1 \quad \frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle$

↙

$-\frac{1}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle\right)$

50% $|0\rangle$ 50% $|1\rangle$