$$\left\langle \frac{1}{\sqrt{2}}(\uparrow + \downarrow) \right| = \frac{1}{\sqrt{2}}(\langle\uparrow| + \langle\downarrow|)$$

$$\langle \frac{1}{\sqrt{2}}(\uparrow + \downarrow)| = \frac{1}{\sqrt{2}}(\langle\uparrow| + \langle\downarrow|)$$

$$\langle \psi_1 | \psi_2 \rangle = \int_{-\infty}^{\infty} \psi_1^* \psi_2 dx$$

If the function $f:\ \mathbb{R} \to \mathbb{R}$ be defined by$f(x) = 2x - 3$ and $g : \mathbb{R} \to \mathbb{R}$ by $g(x) = x^3 + 5$, then find $f \circ g$ and show that $f \circ g$ is invertible.

Also, find $(f \circ g)^{-1}, hence, find (f \circ g)^{-1}(9)$.

$$\text{Unit step function } u(t) = \begin{cases} 1, & t \geqslant 0 \\ 0, & t < 0 \end{cases}$$

$$\text{Unit ramp function } r(t) = \begin{cases} t, & t \geqslant 0 \\ 0, & t < 0 \end{cases}$$

$$C(n, r) = {}_nC_r = \binom{n}{r} = \frac{n!}{(n-r)!r!}$$

$$
\begin{aligned}
sinx &= x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ... \\
&= \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+1}}{(2n+1)!} \\
cosx &= 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + ... \\
&= \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n}}{(2n)!}
\end{aligned}
$$

The formal series of the Dirac delta function is:

$$\delta(x) = \sum_{n=-\infty}^{\infty} e^{2\pi inx}$$

This can be interpreted via the following semi-formal computation
on period-1 functions F using their Fourier series:

$$\begin{aligned} F(x) &= \sum_{n=\infty}^{\infty} e^{2\pi inx} \hat{F}(n) = \int_{-\infty}^{\infty} e^{-2\pi int} F(t) dt \\ &= \int_{-\infty}^{\infty} \sum_{n=\infty}^{\infty} e^{-2\pi n(x-t)} F(t) dt \end{aligned}$$

A linear system might be described by the following equations:

$$
\begin{aligned}
a_{11}x_1 + a_{12}x_2 + a_{13}x_3 &= b_1 \\
a_{21}x_1 + a_{22}x_2 + a_{23}x_3 &= b_2 \\
a_{31}x_1 + a_{32}x_2 + a_{33}x_3 &= b_3
\end{aligned}
$$

These equations could be written in matrix form as:

$$
\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{11} & a_{12} & a_{13} \\ a_{11} & a_{12} & a_{13} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}
$$

The matrix equation could be written as: $\mathbf{Ax} = \mathbf{b}$

$$\iint\limits_{v} (\vec{\nabla} \times \vec{F}) \cdot \vec{n} dS = \oint\limits_{c} \vec{F} \cdot d\vec{r}$$

$$\iiint\limits_{v} (\vec{\nabla} \cdot \vec{F}) \; dV = \oiint\limits_{s} (\vec{F} \cdot \hat{n}) dS$$

$$I = I_0 cos^2\left(\frac{\pi d \sin\theta}{\lambda}\right)\left[\frac{sin(\pi a \sin\theta/\lambda)}{\pi a \sin\theta/\lambda}\right]^2$$

$$
\begin{aligned}
\nabla \cdot \mathbf{E} &= \frac{\rho}{\epsilon_o} \\
\nabla \cdot \mathbf{B} &= 0 \\
\nabla \times \mathbf{E} &= -\frac{\partial \mathbf{B}}{\partial t} \\
\nabla \times \mathbf{B} &= \mu_o \mathbf{J} + \mu_o \epsilon_o \frac{\partial \mathbf{E}}{\partial t}
\end{aligned}
$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{enc}}{\mu_o}$$
$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_m}{dt}$$
$$\oint \vec{B} \cdot d\vec{A} = 0$$
$$\oint \vec{B} \cdot d\vec{s} = \mu_o I + \mu_o \epsilon_o \frac{d\Phi_e}{dt}$$

$$e^{ix} = \sum_{n=0}^{\infty} \frac{(-1)^n \ x^{2n}}{n!} = \sum_{n=0}^{\infty} \frac{(-1)^n \ x^{2n}}{2n!} + \iota \sum_{n=0}^{\infty} \frac{(-1)^n \ x^{2n+1}}{(2n+1)!}$$