Equation Arrays: it's automatically in the mathematics environment; you don't need to use $ signs

$$
\begin{aligned}
\sum_{i=1}^{k+1} i^2 &= \sum_{i=1}^{k} i^2 + (k+1)^2 \\
&= \frac{k(k+1)(2k+1)}{6} + (k+1)^2 \\
&= \text{etc. } \ldots .
\end{aligned}
$$

Following are examples of matrices; the {cccc}: is telling the computer to center the entry in the cells, there are four c's because there are (at least) four columns. The other possibilities are left {llll} and right {rrrr}. You can also mix them: {clrc}.

Theorem.

$$
AB = \left[\begin{array}{cccc} a_{1,1} & a_{1,2} & \ldots & a_{1,n} \\ a_{2,1} & a_{2,2} & \ldots & a_{2,n} \\ \vdots & & & \\ a_{m,1} & a_{m,2} & \ldots & a_{m,n} \end{array}\right] \left[\begin{array}{cccc} b_{1,1} & b_{1,2} & \ldots & b_{1,k} \\ b_{2,1} & b_{2,2} & \ldots & b_{2,k} \\ \vdots & & & \\ b_{n,1} & b_{n,2} & \ldots & a_{n,k} \end{array}\right] = \left[\begin{array}{cccc} c_{1,1} & c_{1,2} & \ldots & c_{1,k} \\ c_{2,1} & c_{2,2} & \ldots & c_{2,k} \\ \vdots & & & \\ c_{n,1} & & \ldots & c_{m,k} \end{array}\right] = C
$$

$$
f'(P)(\vec{v}) = \left[\begin{array}{cccc} D_1(f_1)(P) & D_2(f_1)(P) & \ldots & D_n(f_1)(P) \\ D_1(f_2)(P) & D_2(f_2)(P) & \ldots & D_n(f_2)(P) \\ \vdots & & & \\ D_1(f_m)(P) & D_2(f_m)(P) & \ldots & D_n(f_m)(P) \end{array}\right] \left[\begin{array}{c} v_1 \\ v_2 \\ \vdots \\ v_n \end{array}\right]
$$

$$
\begin{array}{cccc} D_1(f_1)(P) & D_2(f_1)(P) & v_1 & 2 \\ D_1(f_2)(P) & D_2(f_2)(P) & v_2 & 3 \\ \vdots & & \vdots & \\ D_1(f_m)(P) & D_2(f_m)(P) & v_n & 4 \end{array}
$$

$$
\begin{array}{cc} D_1(f_1)(P) & v_1 \\ D_1(f_2)(P) & v_2 \\ \vdots & \vdots \\ D_1(f_m)(P) & v_n \end{array}
$$

Function definitions:

$$h(x) = \begin{cases} f(x) & \text{if } a \leq x < b \\ d & \text{if } x = b \\ g(x) & \text{if } b < x \leq c. \end{cases}$$

$$f = \left\{ \begin{array}{c} y_1 + \sin x \\ y_2 + \cos x \\ y_3 + \tan x \\ y_4 \end{array} \right.$$

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Function definition: $f = \left\{ \begin{array}{c} y_1 + \sin x \\ y_2 + \cos x \\ y_3 + \tan x \\ y_4 \\ y_5 + e^x \end{array} \right.$

Commuting diagram:

$$\begin{array}{ccc} x_{i-1} & \overset{f_{i-1}}{\longleftarrow} & x_i \\ \downarrow & \circlearrowleft & \downarrow \\ p_{i-1} & \overset{g_{i-1}}{\longleftarrow} & p_i \end{array}$$

$$\begin{CD} \hat{M} @>{\hat{h}}>> \hat{M} \\ @V{\pi}VV @VV{\pi}V \\ \hat{M}/G @>{h}>> \hat{M}/G \end{CD}$$

$$\begin{CD} \hat{M} @<{\hat{h}}<< \hat{M} \\ @V{\pi}VV @VV{\pi}V \\ \hat{M}/G @<{h}<< \hat{M}/G \end{CD}$$

$$\begin{array}{ccc}
\hat{M} & \xleftarrow{\hat{h}} & \hat{M} \\
\downarrow{\scriptstyle \pi} & & \downarrow{\scriptstyle \pi} \\
\hat{M} & \xleftarrow{\hat{h}} & \hat{M} \\
\downarrow{\scriptstyle \pi} & & \downarrow{\scriptstyle \pi} \\
\hat{M}/G = M & \xleftarrow{h} & M = \hat{M}/G
\end{array}$$

Following is the format for a table (e.g. , multiplication tables, logic tables).

D_2	e	ρ_1	ρ_2	ρ_3	μ_1	μ_2	δ_1	δ_2
e	e	ρ_1	ρ_2	ρ_3	μ_1	μ_2	δ_1	δ_2
ρ_1	ρ_1	ρ_2	ρ_3	e	δ_1	δ_2	μ_2	μ_1
ρ_2	ρ_2	ρ_3	e	ρ_1	μ_2	μ_1	δ_2	δ_1
ρ_3	ρ_3	e	ρ_1	ρ_2	δ_2	δ_1	μ_1	μ_2
μ_1	μ_1	δ_2	μ_2	δ_1	e	ρ_2	ρ_3	ρ_1
μ_2	μ_2	δ_1	μ_1	δ_2	ρ_2	e	ρ_1	ρ_3
δ_1	δ_1	μ_1	δ_2	μ_2	ρ_1	ρ_3	e	ρ_2
δ_2	δ_2	μ_2	δ_1	μ_1	ρ_3	ρ_1	ρ_2	e

Commuting diagrams:

$$\begin{array}{ccc}
\hat{M} & \xleftarrow{\hat{h}} & \hat{M} \\
\downarrow{\scriptstyle \pi} & & \downarrow{\scriptstyle \pi} \\
\hat{M}/G = M & \xleftarrow{h} & M = \hat{M}/G
\end{array}$$