

タリラリランのコニャニャチワ  
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block

This environment is block

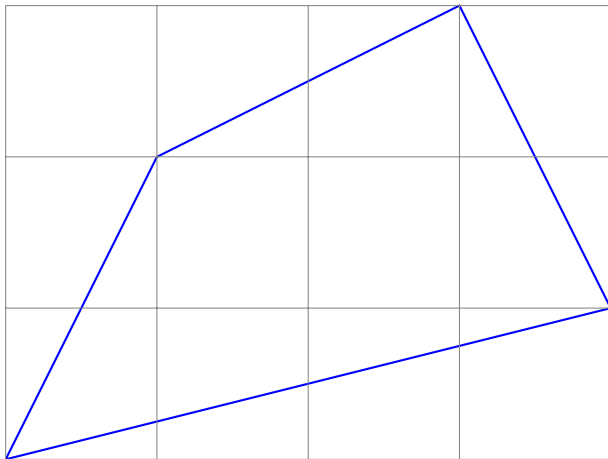
alertblock

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exampleblock

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$$\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{x^2}{2}} dx$$



# commutative diagram

## five lemma

$$\begin{array}{ccccccccc} M_1 & \xrightarrow{f_1} & M_2 & \xrightarrow{f_2} & M_3 & \xrightarrow{f_3} & M_4 & \xrightarrow{f_4} & M_5 \\ \downarrow h_1 & & \downarrow h_2 & & \downarrow h_3 & & \downarrow h_4 & & \downarrow h_5 \\ N_1 & \xrightarrow{g_1} & N_2 & \xrightarrow{g_2} & N_3 & \xrightarrow{g_3} & N_4 & \xrightarrow{g_4} & N_5 \end{array}$$

- (1)  $h_1$ : surjection,  $h_2, h_4$ : injection  $\implies h_3$ : injection
- (2)  $h_5$ : surjection,  $h_2, h_4$ : surjection  $\implies h_3$ : surjection
- (3)  $h_1, h_2, h_4, h_5$ : bijection  $\implies h_3$ : bijection

# five lemma

$$\begin{array}{ccccccccc} M_1 & \xrightarrow{f_1} & M_2 & \xrightarrow{f_2} & M_3 & \xrightarrow{f_3} & M_4 & \xrightarrow{f_4} & M_5 \\ \downarrow h_1 & & \downarrow h_2 & & \downarrow h_3 & & \downarrow h_4 & & \downarrow h_5 \\ N_1 & \xrightarrow{g_1} & N_2 & \xrightarrow{g_2} & N_3 & \xrightarrow{g_3} & N_4 & \xrightarrow{g_4} & N_5 \end{array}$$

Let  $x$  be an element of  $\ker h_3$ . If  $x = 0$ , then  $h_3$  is injective.

## snake lemma

$$\begin{array}{ccccccc}
 \text{Ker } h_1 & \xrightarrow{\bar{f}_1} & \text{Ker } h_2 & \xrightarrow{\bar{f}_2} & \text{Ker } h_3 & & \\
 \downarrow & & \downarrow & & \downarrow & & \\
 M_1 & \xrightarrow{f_1} & M_2 & \xrightarrow{f_2} & M_3 & \longrightarrow & 0 \\
 \downarrow h_1 & & \downarrow h_2 & & \downarrow h_3 & & \\
 0 \longrightarrow & N_1 & \xrightarrow{g_1} & N_2 & \xrightarrow{g_2} & N_3 & \\
 \downarrow & & \downarrow & & \downarrow & & \\
 \text{Coker } h_1 & \xrightarrow{\bar{g}_1} & \text{Coker } h_2 & \xrightarrow{\bar{g}_2} & \text{Coker } h_3 & & 
 \end{array}$$