

#### Universidade Federal da Bahia - UFBA Instituto de Matemática e Estatística - IME Departamento de Matemática



MAT A07 - Álgebra Linear A

Aula 14

Subespaços Vetoriais: Intersecção, União, Soma

Bases e Dimensão

Professora: Isamara C. Alves

Data: 20/04/2021

Bases Canônicas

1.  $\mathcal{V} = \mathbb{R}^n$ 

1. 
$$\mathcal{V} = \mathbb{R}^n$$

$$\forall u \in \mathbb{R}^n$$

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$$\forall u \in \mathbb{R}^n \Rightarrow u = (x_1, x_2, \dots, x_n) =$$

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$$\forall u \in \mathbb{R}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0)$$

1. 
$$\mathcal{V} = \mathbb{R}^n$$

$$\forall u \in \mathbb{R}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0)$$

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Bases Canônicas

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 $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0)$ 

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 $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$   
 $\Rightarrow \mathbb{C}^n = [(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)] \text{ e}$   
 $\sum_{i=1}^n \lambda_i v_i = 0 = (0, 0, \dots, 0) \Leftrightarrow \lambda_1 = \dots = \lambda_n = 0 \Rightarrow \text{ os vetores são } \mathbf{LI}$   
 $\Rightarrow \beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}; \forall \lambda_i \in \mathbb{C}; i = 1, \dots, n.$ 

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2. \mathcal{V} = \mathbb{C}^n sobre \mathbb{K} = \mathbb{C} \forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1) \Rightarrow \mathbb{C}^n = [(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)] \text{ e} \sum_{i=1}^n \lambda_i v_i = 0 = (0, 0, \dots, 0) \Leftrightarrow \lambda_1 = \dots = \lambda_n = 0 \Rightarrow \text{ os vetores são } \mathbf{L}\mathbf{I} \Rightarrow \beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\} \; \forall \lambda_i \in \mathbb{C}; i = 1, \dots, n. Nesta base, os vetores são CANÔNICOS: v_1 = (1, 0, \dots, 0)
```

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2. \mathcal{V} = \mathbb{C}^n sobre \mathbb{K} = \mathbb{C} \forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1) \Rightarrow \mathbb{C}^n = [(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)] \text{ e} \sum_{i=1}^n \lambda_i v_i = 0 = (0, 0, \dots, 0) \Leftrightarrow \lambda_1 = \dots = \lambda_n = 0 \Rightarrow \text{ os vetores são } \mathbf{LI} \Rightarrow \beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\} \; \forall \lambda_i \in \mathbb{C}; i = 1, \dots, n. Nesta base, os vetores são CANÔNICOS: v_1 = (1, 0, \dots, 0) = e_1;
```

2. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{C}$   $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$   $\Rightarrow \mathbb{C}^n = [(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)] \text{ e}$   $\sum_{i=1}^n \lambda_i v_i = 0 = (0, 0, \dots, 0) \Leftrightarrow \lambda_1 = \dots = \lambda_n = 0 \Rightarrow \text{ os vetores } \tilde{\text{sao}} \text{ LI}$   $\Rightarrow \beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\} \; ; \; \forall \lambda_i \in \mathbb{C}; \; i = 1, \dots, n.$  Nesta base, os vetores  $\tilde{\text{sao}} \text{ CANÔNICOS:}$   $v_1 = (1, 0, \dots, 0) = e_1; \; v_2 = (0, 1, \dots, 0)$ 

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$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$$
 
$$\Rightarrow \mathbb{C}^n = [(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)] \text{ e}$$
 
$$\sum_{i=1}^n \lambda_i v_i = 0 = (0, 0, \dots, 0) \Leftrightarrow \lambda_1 = \dots = \lambda_n = 0 \Rightarrow \text{ os vetores são } \mathbf{LI}$$
 
$$\Rightarrow \beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\} ; \forall \lambda_i \in \mathbb{C}; i = 1, \dots, n.$$
 Nesta base, os vetores são CANÔNICOS: 
$$v_1 = (1, 0, \dots, 0) = e_1; v_2 = (0, 1, \dots, 0) = e_2;$$

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 Nesta base, os vetores são CANÔNICOS: 
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$$\Rightarrow \beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\} ; \forall \lambda_i \in \mathbb{C}; i = 1, \dots, n.$$
 Nesta base, os vetores são CANÔNICOS: 
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 sobre  $\mathbb{K} = \mathbb{C}$   $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$   $\Rightarrow \mathbb{C}^n = [(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)] \in \sum_{i=1}^n \lambda_i v_i = 0 = (0, 0, \dots, 0) \Leftrightarrow \lambda_1 = \dots = \lambda_n = 0 \Rightarrow \text{ os vetores são } \mathbf{LI}$   $\Rightarrow \beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\} \; ; \; \forall \lambda_i \in \mathbb{C}; \; i = 1, \dots, n.$  Nesta base, os vetores são CANÔNICOS:  $v_1 = (1, 0, \dots, 0) = e_1; \; v_2 = (0, 1, \dots, 0) = e_2; \dots; v_n = (0, 0, \dots, 1) = e_n$  Portanto,  $\beta_{\mathbb{C}^n} = \{e_1, e_2, \dots, e_n\}$ 

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 $\Rightarrow \mathbb{C}^n = [(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)] \text{ e}$ 

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Portanto.

$$\beta_{\mathbb{C}^n} = \{e_1, e_2, \dots, e_n\}$$

é denominada BASE CANÔNICA do espaço vetorial complexo  $\mathbb{C}^n$ .

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 $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$   
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Bases Canônicas

3.  $\mathcal{V} = \mathbb{C}^n$  sobre  $\mathbb{K} = \mathbb{R}$ 

Bases Canônicas

3. 
$$V = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

 $\forall u \in \mathbb{C}^n$ 

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u\in\mathbb{C}^n\Rightarrow$$

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) =$$

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0)$$

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0)$$

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$$

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Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n$ 

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Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n \Rightarrow x_i = a_i + b_i i$ ;  $a_i, b_i \in \mathbb{R}$ .

Bases Canônicas

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

 $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$ Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n \Rightarrow x_i = a_i + b_i i$ ;  $a_i, b_i \in \mathbb{R}$ . Então,  $x_i$  não pode ser um escalar no corpo  $\mathbb{R}$ .

Bases Canônicas

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$$\mathcal{V} = \mathbb{C}^n$$
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 $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$ Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n \Rightarrow x_i = a_i + b_i i$ ;  $a_i, b_i \in \mathbb{R}$ . Então,  $x_i$  não pode ser um escalar no corpo  $\mathbb{R}$ . Porém, como  $a_i, b_i \in \mathbb{K} = \mathbb{R}$ 

Bases Canônicas

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Bases Canônicas

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Bases Canônicas

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$$u = (a_1 + b_1 i)(1, 0, \ldots, 0)$$

Bases Canônicas

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 $u = (a_1 + b_1 i)(1, 0, \dots, 0) + (a_2 + b_2 i)(0, 1, \dots, 0)$ 

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3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$$
  
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Bases Canônicas

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Bases Canônicas

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

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Bases Canônicas

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

 $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$  Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n \Rightarrow x_i = a_i + b_i i$ ;  $a_i, b_i \in \mathbb{R}$ . Então,  $x_i$  não pode ser um escalar no corpo  $\mathbb{R}$ . Porém, como  $a_i, b_i \in \mathbb{K} = \mathbb{R}$  podem ser os escalares:  $u = (a_1 + b_1 i)(1, 0, \dots, 0) + (a_2 + b_2 i)(0, 1, \dots, 0) + \dots + (a_n + b_n i)(0, 0, \dots, 1)$ ;  $\forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $u = a_1(1, 0, \dots, 0)$ 

Bases Canônicas

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

 $\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$  Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n \Rightarrow x_i = a_i + b_i i$ ;  $a_i, b_i \in \mathbb{R}$ . Então,  $x_i$  não pode ser um escalar no corpo  $\mathbb{R}$ . Porém, como  $a_i, b_i \in \mathbb{K} = \mathbb{R}$  podem ser os escalares:  $u = (a_1 + b_1 i)(1, 0, \dots, 0) + (a_2 + b_2 i)(0, 1, \dots, 0) + \dots + (a_n + b_n i)(0, 0, \dots, 1)$ ;  $\forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $u = a_1(1, 0, \dots, 0) + b_1 i(1, 0, \dots, 0)$ 

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Bases Canônicas

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Bases Canônicas

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Bases Canônicas

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 Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n \Rightarrow x_i = a_i + b_i i; a_i, b_i \in \mathbb{R}$ . Então,  $x_i$  não pode ser um escalar no corpo  $\mathbb{R}$ . Porém, como  $a_i, b_i \in \mathbb{K} = \mathbb{R}$  podem ser os escalares:  $u = (a_1 + b_1 i)(1, 0, \dots, 0) + (a_2 + b_2 i)(0, 1, \dots, 0) + \dots + (a_n + b_n i)(0, 0, \dots, 1); \forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $u = a_1(1, 0, \dots, 0) + b_1 i(1, 0, \dots, 0) + a_2(0, 1, \dots, 0) + b_2 i(0, 1, \dots, 0) + \dots + a_n(0, 0, \dots, 1) + b_n i(0, 0, \dots, 1); \forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $u = a_1(1, 0, \dots, 0) + b_1(i, 0, \dots, 0) + a_2(0, 1, \dots, 0) + b_2(0, i, \dots, 0) + \dots + a_n(0, 0, \dots, 1) + b_n(0, 0, \dots, i); \forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $\mathbb{C}^n = \underbrace{(1, 0, \dots, 0); (0, 1, \dots, 0); (0, 1, \dots, 0)}_{e_1}; \underbrace{(i, 0, \dots, 0); (0, 1, \dots, 0); (0, 1, \dots, 0);}_{e_2}; \underbrace{(i, 0, \dots, 0); (0, 1, \dots, 0);}_{e_3}; \underbrace{(i, 0, \dots, 0);}_{e_3}$ 

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$$
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Bases Canônicas

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

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Bases Canônicas

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Bases Canônicas

3. 
$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$$
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Bases Canônicas

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$$\mathcal{V} = \mathbb{C}^n$$
 sobre  $\mathbb{K} = \mathbb{R}$ 

$$\forall u \in \mathbb{C}^n \Rightarrow u = (x_1, x_2, \dots, x_n) = x_1(1, 0, \dots, 0) + x_2(0, 1, \dots, 0) + \dots + x_n(0, 0, \dots, 1)$$
 Observe que neste caso,  $x_i \in \mathbb{C}$ ;  $\forall i = 1, \dots, n \Rightarrow x_i = a_i + b_i i; a_i, b_i \in \mathbb{R}$ . Então,  $x_i$  não pode ser um escalar no corpo  $\mathbb{R}$ . Porém, como  $a_i, b_i \in \mathbb{K} = \mathbb{R}$  podem ser os escalares:  $u = (a_1 + b_1 i)(1, 0, \dots, 0) + (a_2 + b_2 i)(0, 1, \dots, 0) + \dots + (a_n + b_n i)(0, 0, \dots, 1); \forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $u = a_1(1, 0, \dots, 0) + b_1 i(1, 0, \dots, 0) + a_2(0, 1, \dots, 0) + b_2 i(0, 1, \dots, 0) + \dots + a_n(0, 0, \dots, 1) + b_n i(0, 0, \dots, 1); \forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $u = a_1(1, 0, \dots, 0) + b_1(i, 0, \dots, 0) + a_2(0, 1, \dots, 0) + b_2(0, i, \dots, 0) + \dots + a_n(0, 0, \dots, 1) + b_n(0, 0, \dots, i); \forall a_i, b_i \in \mathbb{K} = \mathbb{R}$   $\mathbb{C}^n = \underbrace{[(1, 0, \dots, 0); (i, 0, \dots, 0); (0, 1, \dots, 0); (0, i, \dots, 0); \dots; (0, 0, \dots, 1); (0, 0, \dots, i)]}_{e_1} \underbrace{(0, 0, \dots, i)}_{e_2} \underbrace{(0, 1, \dots, 0); (0, i, \dots, 0); \dots; (0, 0, \dots, 1); (0, 0, \dots, i)}_{e_2n} \underbrace{(0, 0, \dots, i)}_{e_2n} \underbrace{($ 

4. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{R})$$
; então,  $\forall A \in \mathcal{M}_n(\mathbb{R})$ ;  $A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$ 

4. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{R})$$
; então,  $\forall A \in \mathcal{M}_n(\mathbb{R})$ ;  $A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$ 

$$A = a_{11} \underbrace{\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{C}$$

4. 
$$V = \mathcal{M}_{n}(\mathbb{R}); \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{R}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \underbrace{\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{1}} + a_{12} \underbrace{\begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}}$$

4. 
$$V = \mathcal{M}_{n}(\mathbb{R}); \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{R}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

4. 
$$V = \mathcal{M}_{n}(\mathbb{R}); \text{ então, } \forall A \in \mathcal{M}_{n}(\mathbb{R}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

4. 
$$V = \mathcal{M}_{n}(\mathbb{R}); \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{R}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{R}) = [e_{1}; e_{2}; \dots; e_{n2}].$$

4. 
$$V = \mathcal{M}_{n}(\mathbb{R}); \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{R}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{R}) = [e_{1}; e_{2}; \dots; e_{n^{2}}], e \{e_{1}; e_{2}; \dots; e_{n^{2}}\} \text{ é LI.}$$

4. 
$$V = \mathcal{M}_{n}(\mathbb{R}); \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{R}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{R}) = [e_{1}; e_{2}; \dots; e_{n^{2}}], e \{e_{1}; e_{2}; \dots; e_{n^{2}}\} \text{ \'e LI}.$$

$$\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1, e_2, \ldots, e_{n^2}\}$$

Bases Canônicas

4. 
$$V = \mathcal{M}_{n}(\mathbb{R})$$
; então,  $\forall A \in \mathcal{M}_{n}(\mathbb{R})$ ;  $A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$ 

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{R}) = [e_{1}; e_{2}; \dots; e_{n2}], e_{1} \in \{e_{1}; e_{2}; \dots; e_{n2}\} \in \mathsf{LI}.$$

$$\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1, e_2, \ldots, e_{n^2}\}$$

é denominada BASE CANÔNICA do espaço vetorial real  $\mathcal{M}_n(\mathbb{R})$ .

Bases Canônicas

4. 
$$V = \mathcal{M}_{n}(\mathbb{R})$$
; então,  $\forall A \in \mathcal{M}_{n}(\mathbb{R})$ ;  $A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$ 

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{R}) = [e_{1}; e_{2}; \dots; e_{n2}], e_{1} \in \{e_{1}; e_{2}; \dots; e_{n2}\} \in \mathsf{LI}.$$

$$\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1, e_2, \ldots, e_{n^2}\}$$

é denominada BASE CANÔNICA do espaço vetorial real  $\mathcal{M}_n(\mathbb{R})$ .

5. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C})$$
;

5. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \ \forall A \in \mathcal{M}_n(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

5. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_n(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \underbrace{\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{a_{1}}$$

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \underbrace{\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{1}} + a_{12} \underbrace{\begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{1}}$$

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \underbrace{\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{1}} + a_{12} \underbrace{\begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \ldots + \underbrace{\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}}_{e_{2}}$$

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A =$$

$$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{C}) = [e_{1}; e_{2}; \dots; e_{n2}],$$

Bases Canônicas

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A =$$

$$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{C}) = [e_{1}; e_{2}; \dots; e_{n2}], e_{1} \{e_{1}; e_{2}; \dots; e_{n2}\} \notin LI.$$

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Bases Canônicas

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A =$$

$$\begin{cases}
a_{11} & a_{12} & \cdots & a_{1n} \\
a_{21} & a_{22} & \cdots & a_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
a_{n1} & a_{n2} & \cdots & a_{nn}
\end{cases}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{C}) = [e_{1}; e_{2}; \dots; e_{n^{2}}], e \{e_{1}; e_{2}; \dots; e_{n^{2}}\} \text{ é LI}.$$

$$\beta_{\mathcal{M}_{n}}(\mathbb{C}) = \{e_{1}, e_{2}, \dots, e_{n^{2}}\}$$

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Bases Canônicas

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{C}) = [e_{1}; e_{2}; \dots; e_{n^{2}}], e \{e_{1}; e_{2}; \dots; e_{n^{2}}\} \text{ \'e LI}.$$

$$\beta_{\mathcal{M}_n(\mathbb{C})} = \{e_1, e_2, \ldots, e_{n^2}\}$$

é denominada BASE CANÔNICA do espaço vetorial complexo  $\mathcal{M}_n(\mathbb{C})$  sobre  $\mathbb{K}=\mathbb{C}$ .

Bases Canônicas

5. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{C}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

$$A = a_{11} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + a_{12} \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{nn} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{C}) = [e_{1}; e_{2}; \dots; e_{n^{2}}], e \{e_{1}; e_{2}; \dots; e_{n^{2}}\} \text{ \'e LI}.$$

$$\beta_{\mathcal{M}_n(\mathbb{C})} = \{e_1, e_2, \ldots, e_{n^2}\}$$

é denominada BASE CANÔNICA do espaço vetorial complexo  $\mathcal{M}_n(\mathbb{C})$  sobre  $\mathbb{K}=\mathbb{C}$ .

6. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C})$$
;

6. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C}); \mathbb{K} = \mathbb{R};$$
 então,  $\forall A \in \mathcal{M}_n(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} =$ 

6. 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C}); \mathbb{K} = \mathbb{R}; \text{ então, } \forall A \in \mathcal{M}_n(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \end{pmatrix}$$

$$=a_1\underbrace{\begin{pmatrix}1&0&\cdots&0\\0&0&\cdots&0\\\vdots&\vdots&\ddots&\vdots\\0&0&0&0\end{pmatrix}}_{e_1}$$

6. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{R}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} =$$

$$= a_{1} \underbrace{\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{1}} + b_{1} \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}}$$

6. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{R}; \text{ então}, \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} =$$

$$= a_{1} \underbrace{\begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{1}} + b_{1} \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix}}_{e_{2}} + \dots + \underbrace{\begin{pmatrix} i & 0 &$$

6. 
$$V = \mathcal{M}_{n}(\mathbb{C}); \mathbb{K} = \mathbb{R}; \text{ então, } \forall A \in \mathcal{M}_{n}(\mathbb{C}); A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} =$$

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$$\mathcal{M}_{n}(\mathbb{C}) == [e_{1}; e_{2}; \dots; e_{2n^{2}}]$$

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$$\mathcal{M}_{n}(\mathbb{C}) == [e_{1}; e_{2}; \dots; e_{2n^{2}}] e_{1} e_{1}; e_{2}; \dots; e_{2n^{2}} e_{2n^{2}} \in \mathsf{LI}.$$

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$$\mathcal{M}_{n}(\mathbb{C}) == [e_{1}; e_{2}; \dots; e_{2n^{2}}] e_{1} e_{1}; e_{2}; \dots; e_{2n^{2}} e_{2n^{2}} \in \mathsf{LI}.$$

$$\beta_{\mathcal{M}_n(\mathbb{C})} = \{e_1, e_2, \dots, e_{2n^2}\}$$

Bases Canônicas

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$$= a_{1} \begin{pmatrix} 1 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + b_{1} \begin{pmatrix} i & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 \end{pmatrix} + \dots + a_{n^{2}} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix} + b_{n^{2}} \begin{pmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\mathcal{M}_{n}(\mathbb{C}) == [e_{1}; e_{2}; \dots; e_{2n^{2}}] e_{1} \{e_{1}; e_{2}; \dots; e_{2n^{2}}\} \notin LI.$$

$$\beta_{\mathcal{M}_n(\mathbb{C})} = \{e_1, e_2, \dots, e_{2n^2}\}$$

é denominada BASE CANÔNICA do espaço vetorial real  $\mathcal{M}_n(\mathbb{C})$  sobre  $\mathbb{K}=\mathbb{R}$ .

Bases Canônicas

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$$\mathcal{M}_{n}(\mathbb{C}) == [e_{1}; e_{2}; \dots; e_{2n^{2}}] \in \{e_{1}; e_{2}; \dots; e_{2n^{2}}\} \text{ \'e LI.}$$

 $\beta_{M_n(\mathbb{C})} = \{e_1, e_2, \dots, e_{2n^2}\}$ 

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7. 
$$\mathcal{V} = \mathcal{P}_n(\mathbb{R})$$

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  $\forall p(t) \in \mathcal{P}_n(\mathbb{R}) \Rightarrow$ 

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 $\forall p(t) \in \mathcal{P}_n(\mathbb{R}) \Rightarrow p(t) = a_0 + a_0$ 

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$$\mathcal{V} = \mathcal{P}_n(\mathbb{R})$$
  
 $\forall p(t) \in \mathcal{P}_n(\mathbb{R}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t + \ldots + a$ 

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$$\mathcal{V} = \mathcal{P}_n(\mathbb{R})$$
  
 $\forall p(t) \in \mathcal{P}_n(\mathbb{R}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t^n$ 

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 $\forall p(t) \in \mathcal{P}_n(\mathbb{R}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t^n = a_0(1) + a_1(t) + a_1(t)$ 

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 $\Rightarrow \mathcal{P}_n(\mathbb{R}) = [1];$ 

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 $\forall p(t) \in \mathcal{P}_n(\mathbb{R}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t^n = a_0(1) + a_1(t) + \ldots + a_n(t^n)$   
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 $\forall p(t) \in \mathcal{P}_{n}(\mathbb{R}) \Rightarrow p(t) = a_{0} + a_{1}t + \ldots + a_{n}t^{n} = a_{0}(1) + a_{1}(t) + \ldots + a_{n}(t^{n})$   
 $\Rightarrow \mathcal{P}_{n}(\mathbb{R}) = \underbrace{1}_{e_{1}}; \underbrace{t}_{e_{2}}; \ldots; \underbrace{t^{n}}_{e_{n+1}} \in \{e_{1}, e_{2}, \ldots, e_{n+1}\} \in \mathsf{LI}.$   
 $\beta_{\mathcal{P}_{n}(\mathbb{R})} = \{e_{1}, e_{2}, \ldots, e_{n+1}\}$ 

Bases Canônicas

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Bases Canônicas

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$$V = \mathcal{P}_n(\mathbb{C})$$
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Bases Canônicas

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Bases Canônicas

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Bases Canônicas

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 $\forall p(t) \in \mathcal{P}_{n}(\mathbb{R}) \Rightarrow p(t) = a_{0} + a_{1}t + \dots + a_{n}t^{n} = a_{0}(1) + a_{1}(t) + \dots + a_{n}(t^{n})$   
 $\Rightarrow \mathcal{P}_{n}(\mathbb{R}) = \underbrace{1}_{e_{1}}; \underbrace{t}_{e_{2}}; \dots; \underbrace{t^{n}}_{e_{n+1}}] \in \{e_{1}, e_{2}, \dots, e_{n+1}\} \text{ \'e LI.}$   
 $\beta_{\mathcal{P}_{n}(\mathbb{R})} = \{e_{1}, e_{2}, \dots, e_{n+1}\}$ 

8. 
$$\mathcal{V} = \mathcal{P}_n(\mathbb{C})$$
; sobre o corpo  $\mathbb{K} = \mathbb{C}$   
 $\forall p(t) \in \mathcal{P}_n(\mathbb{C}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t^n = a_0(1) + a_1(t) + a_1($ 

Bases Canônicas

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$$\mathcal{V} = \mathcal{P}_{n}(\mathbb{R})$$
  
 $\forall p(t) \in \mathcal{P}_{n}(\mathbb{R}) \Rightarrow p(t) = a_{0} + a_{1}t + \dots + a_{n}t^{n} = a_{0}(1) + a_{1}(t) + \dots + a_{n}(t^{n})$   
 $\Rightarrow \mathcal{P}_{n}(\mathbb{R}) = \underbrace{1}_{e_{1}}; \underbrace{t}_{e_{2}}; \dots; \underbrace{t^{n}}_{e_{n+1}}] \in \{e_{1}, e_{2}, \dots, e_{n+1}\} \text{ \'e LI.}$   
 $\beta_{\mathcal{P}_{n}(\mathbb{R})} = \{e_{1}, e_{2}, \dots, e_{n+1}\}$ 

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$$\mathcal{V} = \mathcal{P}_n(\mathbb{C})$$
; sobre o corpo  $\mathbb{K} = \mathbb{C}$   $\forall p(t) \in \mathcal{P}_n(\mathbb{C}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t^n = a_0(1) + a_1(t) + \ldots + a_n(t) + a$ 

Bases Canônicas

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Bases Canônicas

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Bases Canônicas

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 $\Rightarrow \mathcal{P}_{n}(\mathbb{R}) = \underbrace{1}_{e_{1}}; \underbrace{t}_{e_{2}}; \dots; \underbrace{t^{n}}_{e_{n+1}}] \in \{e_{1}, e_{2}, \dots, e_{n+1}\} \text{ \'e LI.}$   
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Bases Canônicas

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 $\Rightarrow \mathcal{P}_n(\mathbb{C}) = \underbrace{1}_{\mathbb{C}}; \underbrace{t}_{\mathbb{C}}; \ldots;$ 

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Bases Canônicas

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 $\Rightarrow \mathcal{P}_{n}(\mathbb{R}) = [\underbrace{1}_{e_{1}}; \underbrace{t}_{e_{2}}; \ldots; \underbrace{t^{n}}_{e_{n+1}}] \in \{e_{1}, e_{2}, \ldots, e_{n+1}\} \text{ \'e LI.}$   
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 $\beta_{\mathcal{P}_n(\mathbb{R})} = \{e_1, e_2, \ldots, e_{n+1}\}$ 

é denominada BASE CANÔNICA do espaço vetorial real  $\mathcal{P}_n(\mathbb{R})$ .

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$$\mathcal{V} = \mathcal{P}_n(\mathbb{C})$$
; sobre o corpo  $\mathbb{K} = \mathbb{C}$   
 $\forall p(t) \in \mathcal{P}_n(\mathbb{C}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t^n = a_0(1) + a_1(t) + \ldots + a_n(t^n)$   
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9. 
$$\mathcal{V} = \mathcal{P}_n(\mathbb{C})$$
; sobre  $\mathbb{K} = \mathbb{R}$ 

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$$V = \mathcal{P}_n(\mathbb{C})$$
; sobre  $\mathbb{K} = \mathbb{R}$   $\forall p(t) \in \mathcal{P}_n(\mathbb{C}) \Rightarrow$ 

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; sobre  $\mathbb{K} = \mathbb{R}$   $\forall p(t) \in \mathcal{P}_n(\mathbb{C}) \Rightarrow p(t) = a_0 + a_$ 

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 $\forall p(t) \in \mathcal{P}_n(\mathbb{C}) \Rightarrow p(t) = a_0 + a_1 t + \ldots +$ 

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 $\forall p(t) \in \mathcal{P}_n(\mathbb{C}) \Rightarrow p(t) = a_0 + a_1 t + \ldots + a_n t^n$ ;  $a_0, a_1, \ldots, a_n \in \mathbb{C}$ 

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 $\Rightarrow p(t) = (c_1 + d_1 i).1 +$ 

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 $\Rightarrow p(t) = (c_1 + d_1 i).1 + (c_2 + d_2 i).t +$ 

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 $\Rightarrow p(t) = (c_1 + d_1 i).1 + (c_2 + d_2 i).t + \ldots + (c_{n+1} + d_{n+1} i).t^n; \forall c_i, d_i \in \mathbb{R}$ 

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 $\Rightarrow p(t) = (c_1 + d_1i).1 + (c_2 + d_2i).t + \ldots + (c_{n+1} + d_{n+1}i).t^n; \forall c_i, d_i \in \mathbb{R}$   
 $\Rightarrow p(t) = c_1(1) + d_1(i) + c_2(t) + d_2(it) + \ldots + c_{n+1}(t^n) + d_{n+1}(it^n)$   
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Teorema da Invariância:

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Seja  $\mathcal{V}$  um espaço vetorial, **finitamente gerado**, sobre o corpo  $\mathbb{K}$ .

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Base

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#### Dimensão

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 e  $\beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix}$ 

Dimensão

$$\begin{aligned} \mathbf{5}. & \ \, \mathbf{Seja} \,\, \mathcal{V} = \mathcal{M}_3(\mathbb{R}) \\ & \ \, \mathbf{e} \,\, \beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0$$

Dimensão

$$\begin{aligned} \mathbf{5}. \ \ \mathbf{Seja} \ \ \mathcal{V} &= \mathcal{M}_3(\mathbb{R}) \\ \mathbf{e} \ \beta_{\mathcal{M}_3(\mathbb{R})} &= \left\{ \begin{array}{ccc} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ \end{pmatrix}; \, \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0$$

Dimensão

Dimensão

5. Seja 
$$\mathcal{V} = \mathcal{M}_3(\mathbb{R})$$

$$\mathbf{e} \; \beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 &$$

Dimensão

5. Seja 
$$\mathcal{V} = \mathcal{M}_{3}(\mathbb{R})$$

$$e \, \beta_{\mathcal{M}_{3}(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 &$$

Dimensão

5. Seja 
$$\mathcal{V} = \mathcal{M}_{3}(\mathbb{R})$$

$$e \, \beta_{\mathcal{M}_{3}(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \right\};$$

Dimensão

5. Seja 
$$\mathcal{V} = \mathcal{M}_{3}(\mathbb{R})$$

$$e \ \beta_{\mathcal{M}_{3}(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \text{então,}$$

$$dim(\mathcal{M}_{3}(\mathbb{R})) = 9$$

Dimensão

#### EXEMPLOS:

$$\begin{aligned} \textbf{5. Seja } & \mathcal{V} = \mathcal{M}_3(\mathbb{R}) \\ & \textbf{e} \; \beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \right\}; \textbf{então,} \\ & & \textit{dim}(\mathcal{M}_3(\mathbb{R})) = 9 \end{aligned}$$

6. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;

Dimensão

#### EXEMPLOS:

5. Seja 
$$\mathcal{V} = \mathcal{M}_3(\mathbb{R})$$

$$e \, \beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \right\}; então,$$

$$dim(\mathcal{M}_3(\mathbb{R})) = 9$$

6. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$ ,

Dimensão

#### EXEMPLOS:

5. Seja 
$$\mathcal{V} = \mathcal{M}_3(\mathbb{R})$$

$$e \ \beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \right\}; então,$$

$$dim(\mathcal{M}_3(\mathbb{R})) = 9$$

6. Seia  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ :  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathcal{M}_2(\mathbb{C})} = \beta_{\mathcal{M}_2(\mathbb{R})}$ 

Dimensão

#### EXEMPLOS:

$$\begin{aligned} \textbf{5. Seja } & \mathcal{V} = \mathcal{M}_3(\mathbb{R}) \\ & \textbf{e} \; \beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{array}{ccc} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{array} \right\}; \; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{array} \right\}; \; \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \; \text{então,} \\ & & & & \\ &$$

6. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathcal{M}_3(\mathbb{C})} = \beta_{\mathcal{M}_3(\mathbb{R})}$  então  $\dim(\mathcal{M}_3(\mathbb{C})) = 9$ .

Dimensão

#### EXEMPLOS:

$$\begin{aligned} \textbf{5. Seja } & \mathcal{V} = \mathcal{M}_3(\mathbb{R}) \\ & \textbf{e} \; \beta_{\mathcal{M}_3(\mathbb{R})} = \left\{ \begin{array}{ccc} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{array} \right\}; \; \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{array} \right\}; \; \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \; \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; \; \text{então,} \\ & & & & \\ &$$

6. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathcal{M}_3(\mathbb{C})} = \beta_{\mathcal{M}_3(\mathbb{R})}$  então  $\dim(\mathcal{M}_3(\mathbb{C})) = 9$ .

7. Seja 
$$\mathcal{V} = \mathcal{M}_3(\mathbb{C})$$
;

7. Seja 
$$\mathcal{V}=\mathcal{M}_3(\mathbb{C});~\mathbb{K}=\mathbb{R}$$
,

7. Seja 
$$\mathcal{V}=\mathcal{M}_3(\mathbb{C});\,\mathbb{K}=\mathbb{R},\,$$
e  $\beta_{\mathcal{M}_3(\mathbb{C})}=\{\emph{v}_1;\emph{v}_2;\ldots;\emph{v}_{18}\}$ 

7. Seja 
$$\mathcal{V}=\mathcal{M}_3(\mathbb{C}); \ \mathbb{K}=\mathbb{R}, \ \mathbf{e} \ \beta_{\mathcal{M}_3(\mathbb{C})}=\{v_1; v_2; \dots; v_{18}\}$$
 então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C}))=2(9)=18.$ 

7. Seja 
$$\mathcal{V}=\mathcal{M}_3(\mathbb{C}); \ \mathbb{K}=\mathbb{R}, \ e \ \beta_{\mathcal{M}_3(\mathbb{C})}=\{v_1; v_2; \dots; v_{18}\}$$
 então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C}))=2(9)=18.$ 

8. Seja 
$$\mathcal{V} = \mathcal{P}_3(\mathbb{R})$$

Dimensão

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_3(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_2(\mathbb{R})} = \{1; t; t^2; t^3\};$

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_3(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_2(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_3(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_2(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .
- 9. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_2(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_3(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .
- 9. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C}); \mathbb{K} = \mathbb{C} \text{ e } \beta_{\mathcal{P}_3(\mathbb{C})} = \{1; t; t^2; t^3\} \text{ então}$

Dimensão

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_2(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_3(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .
- 9. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; t; t^2; t^3\}$  então  $\dim(\mathcal{P}_3(\mathbb{C})) = 4$ .

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_2(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_2(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .
- 9. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; t; t^2; t^3\}$  então  $\dim(\mathcal{P}_3(\mathbb{C})) = 4$ .
- 10. Seia  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ :  $\mathbb{K} = \mathbb{R}$

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_2(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_3(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .
- 9. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; t; t^2; t^3\}$  então  $\dim(\mathcal{P}_3(\mathbb{C})) = 4$ .
- 10. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; i; t; it; t^2; it^2; t^3; it^3\}$  então

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_2(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_3(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .
- 9. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; t; t^2; t^3\}$  então  $\dim(\mathcal{P}_3(\mathbb{C})) = 4$ .
- 10. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; i; t; it; t^2; it^2; t^3; it^3\}$  então  $\dim(\mathcal{P}_3(\mathbb{C})) = 8$ .

- 7. Seja  $\mathcal{V} = \mathcal{M}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathcal{M}_2(\mathbb{C})} = \{v_1; v_2; \dots; v_{18}\}$  então  $\Rightarrow dim(\mathcal{M}_3(\mathbb{C})) = 2(9) = 18.$
- 8. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{R})$  e  $\beta_{\mathcal{P}_3(\mathbb{R})} = \{1; t; t^2; t^3\}$ ; então  $\dim(\mathcal{P}_3(\mathbb{R})) = 4$ .
- 9. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; t; t^2; t^3\}$  então  $\dim(\mathcal{P}_3(\mathbb{C})) = 4$ .
- 10. Seja  $\mathcal{V} = \mathcal{P}_3(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{R}$  e  $\beta_{\mathcal{P}_3(\mathbb{C})} = \{1; i; t; it; t^2; it^2; t^3; it^3\}$  então  $\dim(\mathcal{P}_3(\mathbb{C})) = 8$ .

### EXEMPLOS:

11. Seja  $\mathcal{V} = \mathbb{R}^n$ 

11. Seja 
$$\mathcal{V}=\mathbb{R}^n$$
 e  $\beta_{\mathbb{R}^n}=\{(1,0,\dots,0);(0,1,\dots,0);\dots;(0,0,\dots,1)\}$ , então

11. Seja 
$$\mathcal{V} = \mathbb{R}^n$$
 e  $\beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{R}^n) = n$ .

11. Seja 
$$\mathcal{V} = \mathbb{R}^n$$
 e  $\beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{R}^n) = n$ .

```
11. Seja \mathcal{V} = \mathbb{R}^n e \beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}, então dim(\mathbb{R}^n) = n.
```

12. Seja 
$$\mathcal{V} = \mathbb{C}^n$$
;

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{R}^n) = n$ .
- 12. Seja  $\mathcal{V} = \mathbb{C}^n$ ;  $\mathbb{K} = \mathbb{C}$ .

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{R}^n) = n$ .
- 12. Seia  $\mathcal{V} = \mathbb{C}^n$ :  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1,0,\ldots,0); (0,1,\ldots,0); \ldots; (0,0,\ldots,1)\}$ , então  $\dim(\mathbb{R}^n) = n$ .
- 12. Seja  $\mathcal{V} = \mathbb{C}^n$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{C}^n) = n$ .

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1,0,\ldots,0); (0,1,\ldots,0); \ldots; (0,0,\ldots,1)\}$ , então  $\dim(\mathbb{R}^n) = n$ .
- 12. Seja  $\mathcal{V} = \mathbb{C}^n$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{C}^n) = n$ .
- 13. Seja  $\mathcal{V} = \mathbb{C}^n$ :

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1,0,\ldots,0); (0,1,\ldots,0); \ldots; (0,0,\ldots,1)\}$ , então  $\dim(\mathbb{R}^n) = n$ .
- 12. Seja  $\mathcal{V} = \mathbb{C}^n$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{C}^n) = n$ .
- 13. Seia  $\mathcal{V} = \mathbb{C}^n$ :  $\mathbb{K} = \mathbb{R}$ .

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $\dim(\mathbb{R}^n) = n$ .
- 12. Seja  $\mathcal{V} = \mathbb{C}^n$ :  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{C}^n) = n$ .
- 13. Seja  $\mathcal{V} = \mathbb{C}^n$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (i, 0, \dots, 0); \dots; (0, 0, \dots, 1); (0, 0, \dots, i)\}$ , então

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $\dim(\mathbb{R}^n) = n$ .
- 12. Seja  $\mathcal{V} = \mathbb{C}^n$ :  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{C}^n) = n$ .
- 13. Seja  $\mathcal{V} = \mathbb{C}^n$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (i, 0, \dots, 0); \dots; (0, 0, \dots, 1); (0, 0, \dots, i)\}$ , então  $dim(\mathbb{C}^n)=2n$ .

- 11. Seja  $\mathcal{V} = \mathbb{R}^n$  e  $\beta_{\mathbb{R}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $\dim(\mathbb{R}^n) = n$ .
- 12. Seja  $\mathcal{V} = \mathbb{C}^n$ :  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (0, 1, \dots, 0); \dots; (0, 0, \dots, 1)\}$ , então  $dim(\mathbb{C}^n) = n$ .
- 13. Seja  $\mathcal{V} = \mathbb{C}^n$ ;  $\mathbb{K} = \mathbb{R}$ , e  $\beta_{\mathbb{C}^n} = \{(1, 0, \dots, 0); (i, 0, \dots, 0); \dots; (0, 0, \dots, 1); (0, 0, \dots, i)\}$ , então  $dim(\mathbb{C}^n)=2n$ .

EXEMPLOS:

14. Seja  $\mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R})$ 

Dimensão

```
14. Seja \mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R}) e \beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\};
```

Dimensão

```
14. Seja \mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R}) e \beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m,n}\}; então, \dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.
```

Dimensão

### EXEMPLOS:

```
14. Seja \mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R}) e \beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\}; então, dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.
```

15. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{R})$ 

Dimensão

### EXEMPLOS:

```
14. Seja \mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R}) e \beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\}; então, \dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.
```

15. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{R})$  e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\};$ 

Dimensão

#### EXEMPLOS:

```
14. Seja \mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R}) e \beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\}; então, dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.
```

15. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{R})$  e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\}$ ; então,  $\dim(\mathcal{M}_n(\mathbb{R})) = n^2$ .

Dimensão

```
14. Seja \mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R}) e \beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\}; então, \dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.
```

15. Seja 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{R})$$
 e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\}$ ; então,  $\dim(\mathcal{M}_n(\mathbb{R})) = n^2$ .

16. Seja 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C})$$
;

Dimensão

```
14. Seja \mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R}) e \beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\}; então, dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.
```

15. Seja 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{R})$$
 e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\}$ ; então,  $\dim(\mathcal{M}_n(\mathbb{R})) = n^2$ .

16. Seja 
$$\mathcal{V} = \mathcal{M}_n(\mathbb{C})$$
;  $\mathbb{K} = \mathbb{C}$ ,

Dimensão

- 14. Seja  $\mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R})$  e  $\beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1, e_2, e_3, \dots, e_{m,n}\}; \text{ então}, \dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.$
- 15. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{R})$  e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\}$ ; então,  $\dim(\mathcal{M}_n(\mathbb{R})) = n^2$ .
- 16. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{C})$ :  $\mathbb{K} = \mathbb{C}$ . e  $\beta_{\mathcal{M}_n(\mathbb{C})} = \beta_{\mathcal{M}_n(\mathbb{R})}$

Dimensão

- 14. Seja  $\mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R})$  e  $\beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\};$  então,  $dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.$
- 15. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{R})$  e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\}$ ; então,  $\dim(\mathcal{M}_n(\mathbb{R})) = n^2$ .
- 16. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathcal{M}_n(\mathbb{C})} = \beta_{\mathcal{M}_n(\mathbb{R})}$  então  $\dim(\mathcal{M}_n(\mathbb{C})) = n.n = n^2$ .

Dimensão

- 14. Seja  $\mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R})$  e  $\beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{m.n}\};$  então,  $dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.$
- 15. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{R})$  e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\}$ ; então,  $\dim(\mathcal{M}_n(\mathbb{R})) = n^2$ .
- 16. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathcal{M}_n(\mathbb{C})} = \beta_{\mathcal{M}_n(\mathbb{R})}$  então  $\dim(\mathcal{M}_n(\mathbb{C})) = n.n = n^2$ .
- 17. Seia  $\mathcal{V} = \mathcal{M}_n(\mathbb{C})$ :

Dimensão

- 14. Seja  $\mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R})$  e  $\beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1, e_2, e_3, \dots, e_{m,n}\}; \text{ então}, \dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.$
- 15. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{R})$  e  $\beta_{\mathcal{M}_n(\mathbb{R})} = \{e_1; e_2; e_3; \dots; e_{n^2}\}$ ; então,  $\dim(\mathcal{M}_n(\mathbb{R})) = n^2$ .
- 16. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathcal{M}_n(\mathbb{C})} = \beta_{\mathcal{M}_n(\mathbb{R})}$  então  $\dim(\mathcal{M}_n(\mathbb{C})) = n.n = n^2$ .
- 17. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{C})$ :  $\mathbb{K} = \mathbb{R}$ .

Dimensão

- 14. Seja  $\mathcal{V} = \mathcal{M}_{m \times n}(\mathbb{R})$  e  $\beta_{\mathcal{M}_{m \times n}(\mathbb{R})} = \{e_1, e_2, e_3, \dots, e_{m,n}\}; \text{ então}, \dim(\mathcal{M}_{m \times n}(\mathbb{R})) = m.n.$
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- 16. Seja  $\mathcal{V} = \mathcal{M}_n(\mathbb{C})$ ;  $\mathbb{K} = \mathbb{C}$ , e  $\beta_{\mathcal{M}_n(\mathbb{C})} = \beta_{\mathcal{M}_n(\mathbb{R})}$  então  $\dim(\mathcal{M}_n(\mathbb{C})) = n.n = n^2$ .
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#### Exemplos:

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Base e Dimensão

Exercício.1:

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Sejam  $\mathcal{V} = \mathcal{M}_2(\mathbb{R})$  um espaço vetorial sobre o corpo  $\mathbb{K} = \mathbb{R}$ ,  $\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$ 

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Sejam 
$$\mathcal{V}=\mathcal{M}_2(\mathbb{R})$$
 um espaço vetorial sobre o corpo  $\mathbb{K}=\mathbb{R}$ ,  $\mathcal{W}_1=\{A\in\mathcal{M}_2(\mathbb{R})|A=A^t\}$  e  $\mathcal{W}_2=\{A\in\mathcal{M}_2(\mathbb{R})|A=-A^t\}$  subespaços vetoriais de  $\mathcal{V}$ .

1. Determine uma base e a dimensão para  $\mathcal{W}_1$  e  $\mathcal{W}_2$ .

Base e Dimensão

### Exercício.1:

Sejam  $\mathcal{V} = \mathcal{M}_2(\mathbb{R})$  um espaco vetorial sobre o corpo  $\mathbb{K} = \mathbb{R}$ ,  $\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$  e  $\mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$  subespaços vetoriais de  $\mathcal{V}$ .

- 1. Determine uma base e a dimensão para  $W_1$  e  $W_2$ .
- 2. Determine uma base e a dimensão para  $(\mathcal{W}_1 \cap \mathcal{W}_2) \subseteq \mathcal{V}$ .

Sejam  $\mathcal{V} = \mathcal{M}_2(\mathbb{R})$  um espaco vetorial sobre o corpo  $\mathbb{K} = \mathbb{R}$ ,  $\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$  e  $\mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$  subespaços vetoriais de  $\mathcal{V}$ .

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- 3. Determine uma base e a dimensão para  $(W_1 + W_2) \subseteq V$ .

Sejam  $\mathcal{V}=\mathcal{M}_2(\mathbb{R})$  um espaço vetorial sobre o corpo  $\mathbb{K}=\mathbb{R}$ ,  $\mathcal{W}_1=\{A\in\mathcal{M}_2(\mathbb{R})|A=A^t\}$  e  $\mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$  subespaços vetoriais de  $\mathcal{V}$ .

- 1. Determine uma base e a dimensão para  $\mathcal{W}_1$  e  $\mathcal{W}_2$ .
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- 4. Determine a dimensão de  $\mathcal{V} = \mathcal{M}_2(\mathbb{R})$ .

Sejam  $\mathcal{V} = \mathcal{M}_2(\mathbb{R})$  um espaco vetorial sobre o corpo  $\mathbb{K} = \mathbb{R}$ ,  $\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$  e  $\mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$  subespaços vetoriais de  $\mathcal{V}$ .

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- Determine um subespaco  $W_3$  de V tal que  $V = W_2 \oplus W_3$  onde,  $W_3 \neq W_1$ .

Sejam  $\mathcal{V} = \mathcal{M}_2(\mathbb{R})$  um espaco vetorial sobre o corpo  $\mathbb{K} = \mathbb{R}$ ,  $\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$  e  $\mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$  subespaços vetoriais de  $\mathcal{V}$ .

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Base e Dimensão

Exercício.2:

Base e Dimensão

### Exercício.2:

Sejam  $\mathcal{V} = \mathcal{P}_2(\mathbb{R})$  um espaço vetorial sobre o corpo  $\mathbb{K} = \mathbb{R}$ ,  $\mathcal{W}_1 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2\}$ 

Base e Dimensão

#### Exercício.2:

Sejam  $\mathcal{V}=\mathcal{P}_2(\mathbb{R})$  um espaço vetorial sobre o corpo  $\mathbb{K}=\mathbb{R}$ ,  $\mathcal{W}_1=\{p(t)\in\mathcal{P}_2(\mathbb{R})|a_0=a_1+a_2\}$ e  $\mathcal{W}_2 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0\}$  subespaços vetoriais de  $\mathcal{V}$ .

Base e Dimensão

### Exercício.2:

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- Determine um subespaco  $W_3$  de V tal que  $V = W_1 \oplus W_3$  onde,  $W_3 \neq W_2$ .

#### Exercício.2:

Sejam  $\mathcal{V} = \mathcal{P}_2(\mathbb{R})$  um espaço vetorial sobre o corpo  $\mathbb{K} = \mathbb{R}$ ,  $\mathcal{W}_1 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2\}$ e  $W_2 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0\}$  subespaços vetoriais de  $\mathcal{V}$ .

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Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS)

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$$W_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } W_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$

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$$W_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } W_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$

$$W_1 = \underbrace{\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}}_{v_1 = e_1};$$

EXERCÍCIO.1: (RESPOSTAS)
$$\mathcal{W}_{1} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = A^{t}\} \text{ e } \mathcal{W}_{2} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = -A^{t}\}$$

$$\mathcal{W}_{1} = \underbrace{\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}}_{v_{1}=e_{1}}; \underbrace{\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}}_{v_{2}=e_{2}+e_{3}};$$

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$$\mathcal{W}_{1} = \underbrace{\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}}_{v_{1}=e_{1}} \underbrace{\begin{pmatrix} 0 & 1 \\ v_{2}=e_{2}+e_{3} \end{pmatrix}; \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}}_{v_{3}=e_{4}}$$

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$$\mathcal{W}_{1} = \left[\underbrace{\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}}_{V_{1} = e_{1}}; \underbrace{\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}}_{V_{2} = e_{1} + e_{3}}; \underbrace{\begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}}_{V_{3} = e_{4}}\right]; \text{ e}$$

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$$W_{1} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = A^{t}\} \text{ e } W_{2} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = -A^{t}\}$$

$$W_{1} = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}; \underbrace{\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}}_{v_{1} = e_{1}}; \underbrace{e_{1}; e_{2} + e_{3}; e_{4}}_{v_{3} = e_{4}} \end{bmatrix}; \text{ e } \{e_{1}; e_{2} + e_{3}; e_{4}\} \text{ é LI} \Rightarrow \beta_{W_{1}} = \{e_{1}; e_{2} + e_{3}; e_{4}\}$$

$$\Rightarrow dim(W_{1}) = 3$$

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$$\mathcal{W}_{1} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = A^{t}\} \text{ e } \mathcal{W}_{2} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = -A^{t}\}$$

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$$\mathcal{W}_{2} = \begin{bmatrix} \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \end{bmatrix}$$

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$$W_{1} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = A^{t} \} \text{ e } W_{2} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = -A^{t} \}$$

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$$W_{1} = \underbrace{\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}}_{v_{2}=e_{1}}; \text{ e } \{e_{1}; e_{2} + e_{3}; e_{4}\} \text{ é LI} \Rightarrow \beta_{\mathcal{W}_{1}} = \{e_{1}; e_{2} + e_{3}; e_{4}\}$$

$$\Rightarrow dim(\mathcal{W}_{1}) = 3.$$

$$W_{2} = \underbrace{\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}}_{v_{2}=e_{2}}; \text{ e } \{e_{2} - e_{3}\} \text{ é LI} \Rightarrow \beta_{\mathcal{W}_{2}} = \{e_{2} - e_{3}\}$$

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$$W_{1} = \left[ \underbrace{\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}; \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}}_{v_{2} = e_{2} + e_{3}}; \underbrace{e_{4}} \right]; \text{ e } \{e_{1}; e_{2} + e_{3}; e_{4}\} \text{ é LI} \Rightarrow \beta_{W_{1}} = \{e_{1}; e_{2} + e_{3}; e_{4}\}$$

$$\Rightarrow \dim(\mathcal{W}_{1}) = 3.$$

$$W_{2} = \left[ \underbrace{\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}}_{u_{1} = e_{2} - e_{3}} \right]; \text{ e } \{e_{2} - e_{3}\} \text{ é LI} \Rightarrow \beta_{W_{2}} = \{e_{2} - e_{3}\} \Rightarrow \dim(\mathcal{W}_{2}) = 1.$$

EXERCÍCIO. 1: (RESPOSTAS)
$$W_{1} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = A^{t}\} \text{ e } W_{2} = \{A \in \mathcal{M}_{2}(\mathbb{R}) | A = -A^{t}\}$$

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$$\Rightarrow \dim(\mathcal{W}_{1}) = 3.$$

$$W_{2} = \left[ \underbrace{\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}}_{u_{1} = e_{2} - e_{3}} \right]; \text{ e } \{e_{2} - e_{3}\} \text{ é LI} \Rightarrow \beta_{W_{2}} = \{e_{2} - e_{3}\} \Rightarrow \dim(\mathcal{W}_{2}) = 1.$$

Base e Dimensão

Exercício.1:(respostas)

EXERCÍCIO.1: (RESPOSTAS)
$$W_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } W_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$

EXERCÍCIO.1:(RESPOSTAS)
$$\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$

$$\mathcal{W}_1 \cap \mathcal{W}_2 = \{0\}$$

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EXERCÍCIO.1: (RESPOSTAS)
\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}
\mathcal{W}_1 \cap \mathcal{W}_2 = \{0\}
\Rightarrow
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\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}
\mathcal{W}_1 \cap \mathcal{W}_2 = \{0\}
\Rightarrow \mathcal{W}_1 \cap \mathcal{W}_2 = [\emptyset] \Rightarrow
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\mathcal{W}_1 \cap \mathcal{W}_2 = \{0\}
\Rightarrow \mathcal{W}_1 \cap \mathcal{W}_2 = [\emptyset] \Rightarrow \beta_{\mathcal{W}_1 \cap \mathcal{W}_2} = \emptyset \Rightarrow
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\mathcal{W}_1 \cap \mathcal{W}_2 = \{0\}
\Rightarrow \mathcal{W}_1 \cap \mathcal{W}_2 = [\emptyset] \Rightarrow \beta_{\mathcal{W}_1 \cap \mathcal{W}_2} = \emptyset \Rightarrow \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 0.
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Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS)

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$$W_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } W_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$

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W_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } W_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}
dim(W_1 + W_2) =
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$$\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$

$$\dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) =$$

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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 3 + 1 - 0
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EXERCÍCIO.1:(RESPOSTAS)
\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}
\dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 3 + 1 - 0 = 4
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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 3 + 1 - 0 = 4   \Rightarrow \beta_{\mathcal{W}_1 + \mathcal{W}_2} = \{e_1, e_2, e_3, e_4\}.
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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 3 + 1 - 0 = 4   \Rightarrow \beta_{\mathcal{W}_1 + \mathcal{W}_2} = \{e_1, e_2, e_3, e_4\}.  E, como \mathcal{V} = \mathcal{M}_2(\mathbb{R}) = \mathcal{W}_1 + \mathcal{W}_2, temos que :
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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = \ 3 + 1 - 0 = 4   \Rightarrow \beta_{\mathcal{W}_1 + \mathcal{W}_2} = \{e_1, e_2, e_3, e_4\}.  E, como \mathcal{V} = \mathcal{M}_2(\mathbb{R}) = \mathcal{W}_1 + \mathcal{W}_2, temos que :
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$$\mathit{dim}(\mathcal{V}) = \mathit{dim}(\mathcal{W}_1 + \mathcal{W}_2) = 4$$

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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = \ 3 + 1 - 0 = 4   \Rightarrow \beta_{\mathcal{W}_1 + \mathcal{W}_2} = \{e_1, e_2, e_3, e_4\}.  E, como \mathcal{V} = \mathcal{M}_2(\mathbb{R}) = \mathcal{W}_1 + \mathcal{W}_2, temos que :
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$$\mathit{dim}(\mathcal{V}) = \mathit{dim}(\mathcal{W}_1 + \mathcal{W}_2) = 4$$

Base e Dimensão

Exercício.1:(respostas)

Exercício.1:(Respostas) 
$$\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$$
 e  $\mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$ 

EXERCÍCIO.1:(RESPOSTAS) 
$$W_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$$
 e  $W_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$   $\beta_{W_1} =$ 

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EXERCÍCIO.1:(RESPOSTAS)
\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}
\beta_{\mathcal{W}_1} = \{e_1;
```

EXERCÍCIO.1:(RESPOSTAS)
$$\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$

$$\beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3;$$

EXERCÍCIO.1:(RESPOSTAS) 
$$W_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\}$$
 e  $W_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$   $\beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\}$ 

EXERCÍCIO.1:(RESPOSTAS) 
$$\mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}$$
  $\beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\}$ 

EXERCÍCIO.1:(RESPOSTAS) 
$$\mathcal{W}_1 = \{ A \in \mathcal{M}_2(\mathbb{R}) | A = A^t \} \text{ e } \mathcal{W}_2 = \{ A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t \}$$
 
$$\beta_{\mathcal{W}_1} = \{ e_1; e_2 + e_3; e_4 \} \Rightarrow \dim(\mathcal{W}_1) = 3.$$

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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\}
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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\}
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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\} \Rightarrow \dim(\mathcal{W}_2) = 1.   \mathcal{W}_3 = ? \text{ um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_1.  Então, \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 se, e somente se,
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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\} \Rightarrow \dim(\mathcal{W}_2) = 1.   \mathcal{W}_3 = ? \text{ um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_1.  Então, \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 se, e somente se, (i) \mathcal{V} = \mathcal{W}_2 + \mathcal{W}_3;
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EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\} \Rightarrow \dim(\mathcal{W}_2) = 1.   \mathcal{W}_3 = ? \text{ um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_1.  Então,  \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 \text{ se, e somente se,}  (i)  \mathcal{V} = \mathcal{W}_2 + \mathcal{W}_3;   \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_2 + \mathcal{W}_3).
```

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EXERCÍCIO.1: (RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\} \Rightarrow \dim(\mathcal{W}_2) = 1.   \mathcal{W}_3 = ? \text{ um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_1.  Então, \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3;  \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_2 + \mathcal{W}_3).  (ii)  \mathcal{W}_2 \cap \mathcal{W}_3 = \{0\};
```

```
EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\} \Rightarrow \dim(\mathcal{W}_2) = 1.   \mathcal{W}_3 = \text{? um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_1.  Então, \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 se, e somente se,
```

- (i)  $V = W_2 + W_3$ ;  $\Rightarrow dim(V) = dim(W_2 + W_3)$ .
- (ii)  $\mathcal{W}_2 \cap \mathcal{W}_3 = \{0\};$  $\Rightarrow \dim(\mathcal{W}_2 \cap \mathcal{W}_3) = 0.$

```
EXERCÍCIO.1:(RESPOSTAS)  \mathcal{W}_1 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = A^t\} \text{ e } \mathcal{W}_2 = \{A \in \mathcal{M}_2(\mathbb{R}) | A = -A^t\}   \beta_{\mathcal{W}_1} = \{e_1; e_2 + e_3; e_4\} \Rightarrow \dim(\mathcal{W}_1) = 3.   \beta_{\mathcal{W}_2} = \{e_2 - e_3\} \Rightarrow \dim(\mathcal{W}_2) = 1.   \mathcal{W}_3 = ? \text{ um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_1.  Então, \mathcal{V} = \mathcal{W}_2 \oplus \mathcal{W}_3 se, e somente se,
```

- (i)  $V = W_2 + W_3$ ;  $\Rightarrow dim(V) = dim(W_2 + W_3)$ .
- (ii)  $\mathcal{W}_2 \cap \mathcal{W}_3 = \{0\};$  $\Rightarrow \dim(\mathcal{W}_2 \cap \mathcal{W}_3) = 0.$

Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS)

Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS) Por (i) e (ii), temos

```
Exercício.1:(respostas)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3)
```

```
EXERCÍCIO.1:(RESPOSTAS)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)
```

```
EXERCÍCIO.1:(RESPOSTAS)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)
\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2)
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```
EXERCÍCIO.1:(RESPOSTAS)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)
\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3
```

```
EXERCÍCIO.1:(RESPOSTAS)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)
\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3.
```

Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS) Por (i) e (ii), temos  $dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$  $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3$ .

Então, temos que obter vetores  $u_1, u_2, u_3 \in \mathcal{V}$  para gerar  $\mathcal{W}_3$ 

Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS)

Por (i) e (ii), temos  $dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$  $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3$ .

Então, temos que obter vetores  $u_1, u_2, u_3 \in \mathcal{V}$  para gerar  $\mathcal{W}_3$  porém, estes vetores  $u_1, u_2, u_3 \in \mathcal{V}$  complementam  $\beta_{\mathcal{W}_2}$ 

Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS) Por (i) e (ii), temos

$$dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$$
  
  $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3$ .

Então, temos que obter vetores  $u_1, u_2, u_3 \in \mathcal{V}$  para gerar  $\mathcal{W}_3$  porém, estes vetores  $u_1, u_2, u_3 \in \mathcal{V}$  complementam  $\beta_{\mathcal{W}_2}$  formando uma base para  $\mathcal{V}$ :

Base e Dimensão

EXERCÍCIO.1:(RESPOSTAS)

Por (i) e (ii), temos  $dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$  $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3$ .

Base e Dimensão

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EXERCÍCIO.1:(RESPOSTAS)
```

Por (i) e (ii), temos

$$dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$$
  
\Rightarrow dim(\mathcal{V}\_3) = dim(\mathcal{V}) - dim(\mathcal{V}\_2) \Rightarrow dim(\mathcal{W}\_3) = 4 - 1 = 3.

$$\Rightarrow$$
  $aim(vv_3) = aim(v) - aim(vv_2) \Rightarrow aim(vv_3) = 4 - 1 = 3$ 

podemos por exemplo, tomar 
$$u_1 = e_1, u_2 = e_3, u_3 = e_4$$

Base e Dimensão

```
EXERCÍCIO.1:(RESPOSTAS)
```

$$dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$$
  
  $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3$ .

$$\Rightarrow aim(vv_3) = aim(v) - aim(vv_2) \Rightarrow aim(vv_3) = 4 - 1 = 3$$

podemos por exemplo, tomar 
$$u_1=e_1,u_2=e_3,u_3=e_4\Rightarrow eta_{\mathcal{W}_3}=\{e_1,e_2,e_4\}$$

Base e Dimensão

```
EXERCÍCIO.1:(RESPOSTAS)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)
\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3.
```

```
podemos por exemplo, tomar u_1 = e_1, u_2 = e_3, u_3 = e_4 \Rightarrow \beta_{W_2} = \{e_1, e_2, e_4\}
\Rightarrow \beta_{12} = \{e_2 - e_3, e_1, e_2, e_4\}.
```

Base e Dimensão

```
EXERCÍCIO.1:(RESPOSTAS)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)
\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3.
```

Então, temos que obter vetores  $u_1, u_2, u_3 \in \mathcal{V}$  para gerar  $\mathcal{W}_3$  porém, estes vetores  $u_1, u_2, u_3 \in \mathcal{V}$  complementam  $\beta_{\mathcal{W}_2}$  formando uma base para  $\mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_2} \cup \{u_1, u_2, u_3\}$ ;

podemos por exemplo, tomar 
$$u_1 = e_1, u_2 = e_3, u_3 = e_4 \Rightarrow \beta_{W_3} = \{e_1, e_2, e_4\}$$
  
  $\Rightarrow \beta_{V} = \{e_2 - e_3, e_1, e_2, e_4\}.$ 

Agora, como  $\beta_{W_2} = \{e_1, e_2, e_4\}$ 

Base e Dimensão

#### EXERCÍCIO.1:(RESPOSTAS)

Por (i) e (ii), temos

$$dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$$
  
 
$$\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3.$$

podemos por exemplo, tomar 
$$u_1 = e_1, u_2 = e_3, u_3 = e_4 \Rightarrow \beta_{W_3} = \{e_1, e_2, e_4\}$$
  
 $\Rightarrow \beta_{V} = \{e_2 - e_3, e_1, e_2, e_4\}.$ 

Agora, como 
$$\beta_{\mathcal{W}_3} = \{e_1, e_2, e_4\} \Rightarrow \forall A \in \mathcal{W}_3, A = \lambda_1 e_1 + \lambda_2 e_2 + \lambda_3 e_4; \forall \lambda_i \in \mathbb{R}$$

Base e Dimensão

#### Exercício.1:(respostas)

Por (i) e (ii), temos

$$dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$$
  
  $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3$ .

podemos por exemplo, tomar 
$$u_1 = e_1, u_2 = e_3, u_3 = e_4 \Rightarrow \beta_{W_3} = \{e_1, e_2, e_4\}$$
  
 $\Rightarrow \beta_{V} = \{e_2 - e_3, e_1, e_2, e_4\}.$ 

Agora, como 
$$\beta_{\mathcal{W}_3} = \{e_1, e_2, e_4\} \Rightarrow \forall A \in \mathcal{W}_3, A = \lambda_1 e_1 + \lambda_2 e_2 + \lambda_3 e_4; \forall \lambda_i \in \mathbb{R} \Rightarrow \mathcal{W}_3 = \{A \in \mathcal{V} \mid a_{21} = 0\}.$$

Base e Dimensão

#### Exercício.1:(respostas)

Por (i) e (ii), temos

$$dim(\mathcal{V}) = dim(\mathcal{W}_2 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_2) + dim(\mathcal{W}_3)$$
  
  $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_2) \Rightarrow dim(\mathcal{W}_3) = 4 - 1 = 3$ .

podemos por exemplo, tomar 
$$u_1 = e_1, u_2 = e_3, u_3 = e_4 \Rightarrow \beta_{W_3} = \{e_1, e_2, e_4\}$$
  
 $\Rightarrow \beta_{V} = \{e_2 - e_3, e_1, e_2, e_4\}.$ 

Agora, como 
$$\beta_{W_3} = \{e_1, e_2, e_4\} \Rightarrow \forall A \in W_3, A = \lambda_1 e_1 + \lambda_2 e_2 + \lambda_3 e_4; \forall \lambda_i \in \mathbb{R} \Rightarrow W_3 = \{A \in V \mid a_{21} = 0\}.$$

Base e Dimensão

EXERCÍCIO.2:(RESPOSTAS)

EXERCÍCIO.2:(RESPOSTAS)  

$$W_1 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2\}$$

EXERCÍCIO.2:(RESPOSTAS) 
$$\mathcal{W}_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } \mathcal{W}_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.$$

EXERCÍCIO.2:(RESPOSTAS)
$$\mathcal{W}_1 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2\} \text{ e } \mathcal{W}_2 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0\}.$$

$$\forall p(t) \in \mathcal{W}_1 \Rightarrow$$

EXERCÍCIO.2:(RESPOSTAS) 
$$W_1 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2\} \text{ e } W_2 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0\}.$$
  $\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; \text{ e}$ 

EXERCÍCIO.2:(RESPOSTAS)
$$W_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } W_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.$$

$$\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; \text{ e } \{ (1+t); (1+t^2) \} \text{ é LI};$$

EXERCÍCIO.2: (RESPOSTAS)
$$W_1 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2\} \text{ e } W_2 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0\}.$$

$$\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; \text{ e } \{(1+t); (1+t^2)\} \text{ é LI}; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}$$

EXERCÍCIO.2:(RESPOSTAS)
$$W_1 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2\} \text{ e } W_2 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0\}.$$

$$\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; \text{ e } \{(1+t); (1+t^2)\} \text{ \'e LI}; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}$$

$$\Rightarrow \dim(\mathcal{W}_1) = 2.$$

```
Exercício.2:(Respostas)
\mathcal{W}_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } \mathcal{W}_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.
\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; e\{(1+t); (1+t^2)\} \in \mathsf{LI}; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}
\Rightarrow dim(\mathcal{W}_1) = 2.
\forall p(t) \in \mathcal{W}_2 \Rightarrow
```

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Exercício.2:(Respostas)
\mathcal{W}_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } \mathcal{W}_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.
\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; e\{(1+t); (1+t^2)\} \notin \mathsf{LI}; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}
\Rightarrow dim(\mathcal{W}_1) = 2.
\forall p(t) \in \mathcal{W}_2 \Rightarrow \mathcal{W}_2 = [(-1+t)]
```

```
Exercício.2:(Respostas)
\mathcal{W}_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } \mathcal{W}_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.
\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; e\{(1+t); (1+t^2)\} \notin \mathsf{LI}; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}
\Rightarrow dim(\mathcal{W}_1) = 2.
\forall p(t) \in \mathcal{W}_2 \Rightarrow \mathcal{W}_2 = [(-1+t)] \in \{(-1+t)\} \notin \mathsf{LI};
```

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EXERCÍCIO.2:(RESPOSTAS)
\mathcal{W}_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } \mathcal{W}_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.
\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; e\{(1+t); (1+t^2)\} \notin \mathsf{LI}; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}
\Rightarrow dim(\mathcal{W}_1) = 2.
\forall p(t) \in \mathcal{W}_2 \Rightarrow \mathcal{W}_2 = [(-1+t)] \in \{(-1+t)\} \notin \mathsf{LI}; \Rightarrow \beta_{\mathcal{W}_2} = \{(-1+t)\}
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EXERCÍCIO.2:(RESPOSTAS)
\mathcal{W}_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } \mathcal{W}_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.
\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; e\{(1+t); (1+t^2)\} \notin LI; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}
\Rightarrow dim(\mathcal{W}_1) = 2.
\forall p(t) \in \mathcal{W}_2 \Rightarrow \mathcal{W}_2 = [(-1+t)] \in \{(-1+t)\} \notin \mathsf{LI}; \Rightarrow \beta_{\mathcal{W}_2} = \{(-1+t)\} \Rightarrow \dim(\mathcal{W}_2) = 1.
```

```
EXERCÍCIO.2:(RESPOSTAS)
\mathcal{W}_1 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 = a_1 + a_2 \} \text{ e } \mathcal{W}_2 = \{ p(t) \in \mathcal{P}_2(\mathbb{R}) | a_0 + a_1 = 0 \text{ e } a_2 = 0 \}.
\forall p(t) \in \mathcal{W}_1 \Rightarrow \mathcal{W}_1 = [(1+t); (1+t^2)]; e\{(1+t); (1+t^2)\} \notin LI; \Rightarrow \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}
\Rightarrow dim(\mathcal{W}_1) = 2.
\forall p(t) \in \mathcal{W}_2 \Rightarrow \mathcal{W}_2 = [(-1+t)] \in \{(-1+t)\} \notin \mathsf{LI}; \Rightarrow \beta_{\mathcal{W}_2} = \{(-1+t)\} \Rightarrow \dim(\mathcal{W}_2) = 1.
```

Base e Dimensão

Exercício.2:(Respostas)

EXERCÍCIO.2:(RESPOSTAS) 
$$W_1 = [(1+t); (1+t^2)]; e,$$

EXERCÍCIO.2:(RESPOSTAS) 
$$W_1 = [(1+t); (1+t^2)]; e, W_2 = [(-1+t)];$$

Base e Dimensão

EXERCÍCIO.2:(RESPOSTAS) 
$$W_1 = [(1+t); (1+t^2)]; e, W_2 = [(-1+t)];$$

Então,  $\forall p(t) \in (\mathcal{W}_1 \cap \mathcal{W}_2)$ 

EXERCÍCIO.2:(RESPOSTAS)
$$\mathcal{W}_1 = [(1+t); (1+t^2)]; \text{ e, } \mathcal{W}_2 = [(-1+t)];$$
Então,  $\forall p(t) \in (\mathcal{W}_1 \cap \mathcal{W}_2) \Rightarrow (\mathcal{W}_1 \cap \mathcal{W}_2) = \{0\}$ 

EXERCÍCIO.2:(RESPOSTAS) 
$$W_1 = [(1+t); (1+t^2)]; e, W_2 = [(-1+t)];$$

$$\mathsf{Ent\~ao}, \, \forall p(t) \in (\mathcal{W}_1 \cap \mathcal{W}_2) \Rightarrow (\mathcal{W}_1 \cap \mathcal{W}_2) = \{0\} \Rightarrow (\mathcal{W}_1 \cap \mathcal{W}_2) = [\emptyset] \Rightarrow \beta_{\mathcal{W}_1 \cap \mathcal{W}_2} = \emptyset$$

EXERCÍCIO.2:(RESPOSTAS) 
$$\mathcal{W}_1 = [(1+t); (1+t^2)]; \text{ e, } \mathcal{W}_2 = [(-1+t)];$$
 Então,  $\forall p(t) \in (\mathcal{W}_1 \cap \mathcal{W}_2) \Rightarrow (\mathcal{W}_1 \cap \mathcal{W}_2) = \{0\} \Rightarrow (\mathcal{W}_1 \cap \mathcal{W}_2) = [\emptyset] \Rightarrow \beta_{\mathcal{W}_1 \cap \mathcal{W}_2} = \emptyset \Rightarrow \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 0.$ 

EXERCÍCIO.2:(RESPOSTAS) 
$$\mathcal{W}_1 = [(1+t); (1+t^2)]; \text{ e, } \mathcal{W}_2 = [(-1+t)];$$
 Então,  $\forall p(t) \in (\mathcal{W}_1 \cap \mathcal{W}_2) \Rightarrow (\mathcal{W}_1 \cap \mathcal{W}_2) = \{0\} \Rightarrow (\mathcal{W}_1 \cap \mathcal{W}_2) = [\emptyset] \Rightarrow \beta_{\mathcal{W}_1 \cap \mathcal{W}_2} = \emptyset \Rightarrow \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 0.$ 

Base e Dimensão

Exercício.2:(Respostas)

EXERCÍCIO.2:(RESPOSTAS) 
$$dim(W_1 + W_2) =$$

EXERCÍCIO.2: (RESPOSTAS) 
$$dim(W_1 + W_2) = dim(W_1) + dim(W_2) - dim(W_1 \cap W_2) =$$

EXERCÍCIO.2:(RESPOSTAS) 
$$dim(\mathcal{W}_1 + \mathcal{W}_2) = dim(\mathcal{W}_1) + dim(\mathcal{W}_2) - dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 2 + 1 - 0$$

EXERCÍCIO.2:(RESPOSTAS) 
$$\dim(\mathcal{W}_1 + \mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1 \cap \mathcal{W}_2) = \ 2 + 1 - 0 = 3$$

EXERCÍCIO.2: (RESPOSTAS) 
$$dim(\mathcal{W}_1 + \mathcal{W}_2) = dim(\mathcal{W}_1) + dim(\mathcal{W}_2) - dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 2 + 1 - 0 = 3$$
 
$$\Rightarrow \beta_{\mathcal{W}_1 + \mathcal{W}_2} = \{e_1, e_2, e_3\}.$$

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EXERCÍCIO.2:(RESPOSTAS)
dim(\mathcal{W}_1 + \mathcal{W}_2) = dim(\mathcal{W}_1) + dim(\mathcal{W}_2) - dim(\mathcal{W}_1 \cap \mathcal{W}_2) = 2 + 1 - 0 = 3
\Rightarrow \beta_{W_1+W_2} = \{e_1, e_2, e_3\}.
E, como \mathcal{V} = \mathcal{P}_2(\mathbb{R}) = \mathcal{W}_1 + \mathcal{W}_2, temos que :
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EXERCÍCIO.2:(RESPOSTAS) 
$$\begin{aligned} & \dim(\mathcal{W}_1+\mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1\cap\mathcal{W}_2) = \ 2+1-0 = 3 \\ & \Rightarrow \beta_{\mathcal{W}_1+\mathcal{W}_2} = \{e_1,e_2,e_3\}. \\ & \mathsf{E}, \ \mathsf{como}\ \mathcal{V} = \mathcal{P}_2(\mathbb{R}) = \mathcal{W}_1 + \mathcal{W}_2, \ \mathsf{temos}\ \mathsf{que} : \end{aligned}$$

$$dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_2) = 3$$

EXERCÍCIO.2:(RESPOSTAS) 
$$\begin{aligned} & \dim(\mathcal{W}_1+\mathcal{W}_2) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_2) - \dim(\mathcal{W}_1\cap\mathcal{W}_2) = \ 2+1-0 = 3 \\ & \Rightarrow \beta_{\mathcal{W}_1+\mathcal{W}_2} = \{e_1,e_2,e_3\}. \\ & \mathsf{E}, \ \mathsf{como}\ \mathcal{V} = \mathcal{P}_2(\mathbb{R}) = \mathcal{W}_1 + \mathcal{W}_2, \ \mathsf{temos}\ \mathsf{que} : \end{aligned}$$

$$dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_2) = 3$$

Base e Dimensão

Exercício.2:(Respostas)

EXERCÍCIO.2:(RESPOSTAS)  
$$\beta_{W_1} = \{(1+t); (1+t^2)\}; e,$$

EXERCÍCIO.2:(RESPOSTAS)  

$$\beta_{W_1} = \{(1+t); (1+t^2)\}; \text{ e, } \beta_{W_2} = \{(-1+t)\};$$

```
EXERCÍCIO.2:(RESPOSTAS)
\beta_{W_1} = \{(1+t); (1+t^2)\}; \text{ e, } \beta_{W_2} = \{(-1+t)\};
\mathcal{W}_3 = ? um subespço de \mathcal{V} tal que \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 onde, \mathcal{W}_3 \neq \mathcal{W}_2.
```

```
EXERCÍCIO.2:(RESPOSTAS)
\beta_{W_1} = \{(1+t); (1+t^2)\}; \text{ e, } \beta_{W_2} = \{(-1+t)\};
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Então. \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 se, e somente se.
```

```
EXERCÍCIO.2:(RESPOSTAS)
\beta_{W_1} = \{(1+t); (1+t^2)\}; \text{ e, } \beta_{W_2} = \{(-1+t)\};
\mathcal{W}_3 = ? um subespoo de \mathcal{V} tal que \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 onde, \mathcal{W}_3 \neq \mathcal{W}_2.
Então. \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 se, e somente se.
  (i) V = W_1 + W_3:
```

```
EXERCÍCIO.2:(RESPOSTAS)
\beta_{W_2} = \{(1+t); (1+t^2)\}; \text{ e. } \beta_{W_2} = \{(-1+t)\};
\mathcal{W}_3 = ? um subespoo de \mathcal{V} tal que \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 onde, \mathcal{W}_3 \neq \mathcal{W}_2.
Então. \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 se, e somente se.
  (i) V = W_1 + W_3:
        \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3).
```

```
EXERCÍCIO.2:(RESPOSTAS)
\beta_{W_2} = \{(1+t); (1+t^2)\}; \text{ e. } \beta_{W_2} = \{(-1+t)\};
\mathcal{W}_3 = ? um subespoo de \mathcal{V} tal que \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 onde, \mathcal{W}_3 \neq \mathcal{W}_2.
Então. \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 se, e somente se.
  (i) V = W_1 + W_3:
        \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3).
 (ii) W_1 \cap W_3 = \{0\};
```

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EXERCÍCIO.2: (RESPOSTAS) \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}; \text{ e, } \beta_{\mathcal{W}_2} = \{(-1+t)\}; \mathcal{W}_3 = ? \text{ um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_2. Então, \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 \text{ se, e somente se,} (i) \mathcal{V} = \mathcal{W}_1 + \mathcal{W}_3; \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3). (ii) \mathcal{W}_1 \cap \mathcal{W}_3 = \{0\}; \Rightarrow \dim(\mathcal{W}_1 \cap \mathcal{W}_3) = 0.
```

```
EXERCÍCIO.2: (RESPOSTAS) \beta_{\mathcal{W}_1} = \{(1+t); (1+t^2)\}; \text{ e, } \beta_{\mathcal{W}_2} = \{(-1+t)\}; \mathcal{W}_3 = ? \text{ um subespço de } \mathcal{V} \text{ tal que } \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 \text{ onde, } \mathcal{W}_3 \neq \mathcal{W}_2. Então, \mathcal{V} = \mathcal{W}_1 \oplus \mathcal{W}_3 \text{ se, e somente se,} (i) \mathcal{V} = \mathcal{W}_1 + \mathcal{W}_3; \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3). (ii) \mathcal{W}_1 \cap \mathcal{W}_3 = \{0\}; \Rightarrow \dim(\mathcal{W}_1 \cap \mathcal{W}_3) = 0.
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Base e Dimensão

EXERCÍCIO.2:(RESPOSTAS)

Base e Dimensão

Exercício.2:(Respostas) Por (i) e (ii), temos

Base e Dimensão

EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  $dim(V) = dim(W_1 + W_3)$ 

Base e Dimensão

EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  $dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1) + dim(\mathcal{W}_3)$ 

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EXERCÍCIO.2:(RESPOSTAS)
Por (i) e (ii), temos
dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1) + dim(\mathcal{W}_3)
\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_1)
```

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\begin{split} &\operatorname{EXERC\'iCIO.2:}(\operatorname{RESPOSTAS})\\ &\operatorname{Por}\;(i)\;e\;(ii),\; \operatorname{temos}\\ &\mathit{dim}(\mathcal{V}) = \mathit{dim}(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \mathit{dim}(\mathcal{V}) = \mathit{dim}(\mathcal{W}_1) + \mathit{dim}(\mathcal{W}_3)\\ &\Rightarrow \mathit{dim}(\mathcal{W}_3) = \mathit{dim}(\mathcal{V}) - \mathit{dim}(\mathcal{W}_1) \Rightarrow \mathit{dim}(\mathcal{W}_3) = 3 - 2 = 1 \end{split}
```

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\begin{split} &\operatorname{EXERC\'iCIO.2:}(\operatorname{RESPOSTAS})\\ &\operatorname{Por}\;(i)\;e\;(ii),\; temos\\ &\mathit{dim}(\mathcal{V}) = \mathit{dim}(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \mathit{dim}(\mathcal{V}) = \mathit{dim}(\mathcal{W}_1) + \mathit{dim}(\mathcal{W}_3)\\ &\Rightarrow \mathit{dim}(\mathcal{W}_3) = \mathit{dim}(\mathcal{V}) - \mathit{dim}(\mathcal{W}_1) \Rightarrow \mathit{dim}(\mathcal{W}_3) = 3 - 2 = 1\;. \end{split}
```

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EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3.
```

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EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que \underline{\text{complete}} \ \beta_{\mathcal{W}_1}
```

```
EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que \underline{\text{complete}} \ \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}:
```

```
EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que \underline{\text{complete}} \ \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\};
```

```
EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que complete \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}; podemos por exemplo, tomar u = t:
```

•  $u = t \notin \mathcal{W}_1$ :

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EXERCÍCIO.2:(RESPOSTAS)
Por (i) e (ii), temos dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1) + dim(\mathcal{W}_3) \Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_1) \Rightarrow dim(\mathcal{W}_3) = 3 - 2 = 1 . Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3.
Porém, tem que ser um vetor u \in \mathcal{V} que complete \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}; podemos por exemplo, tomar u = t:
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Base e Dimensão

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EXERCÍCIO. 2: (RESPOSTAS) Por (i) e (ii), temos \begin{aligned} &\dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ &\Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ . \end{aligned} Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que <u>complete</u> \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}; podemos por exemplo, tomar u = t:
```

•  $u = t \notin \mathcal{W}_1$ :  $\lambda_1(1+t) + \lambda_2(1+t^2) + \lambda_3(t) = 0 + 0t + 0t^2$ 

Base e Dimensão

# EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos $dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1) + dim(\mathcal{W}_3)$ $\Rightarrow dim(\mathcal{W}_3) = dim(\mathcal{V}) - dim(\mathcal{W}_1) \Rightarrow dim(\mathcal{W}_3) = 3 - 2 = 1 .$ Então, temos que obter um vetor $u \in \mathcal{V}$ para gerar $\mathcal{W}_3$ . Porém, tem que ser um vetor $u \in \mathcal{V}$ que complete $\beta_{\mathcal{W}_1}$ formando uma base para $\mathcal{V}$ : $\beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}$ ; podemos por exemplo, tomar u = t:

•  $u = t \notin \mathcal{W}_1$ :  $\lambda_1(1+t) + \lambda_2(1+t^2) + \lambda_3(t) = 0 + 0t + 0t^2$  $\Rightarrow \lambda_1 + \lambda_2 = 0$ 

Base e Dimensão

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EXERCÍCIO. 2: (RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que complete \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}; podemos por exemplo, tomar u = t:
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•  $u = t \notin \mathcal{W}_1$ :  $\lambda_1(1+t) + \lambda_2(1+t^2) + \lambda_3(t) = 0 + 0t + 0t^2$  $\Rightarrow \lambda_1 + \lambda_2 = 0$ ;  $\lambda_1 + \lambda_3 = 0$ ;

Base e Dimensão

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EXERCÍCIO. 2: (RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que complete \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}; podemos por exemplo, tomar u = t:
```

•  $u = t \notin \mathcal{W}_1$ :  $\lambda_1(1+t) + \lambda_2(1+t^2) + \lambda_3(t) = 0 + 0t + 0t^2$  $\Rightarrow \lambda_1 + \lambda_2 = 0$ ;  $\lambda_1 + \lambda_3 = 0$ ;  $\lambda_2 = 0$ 

Base e Dimensão

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EXERCÍCIO.2:(RESPOSTAS) Por (i) e (ii), temos  \dim(\mathcal{V}) = \dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \dim(\mathcal{V}) = \dim(\mathcal{W}_1) + \dim(\mathcal{W}_3) \\ \Rightarrow \dim(\mathcal{W}_3) = \dim(\mathcal{V}) - \dim(\mathcal{W}_1) \Rightarrow \dim(\mathcal{W}_3) = 3 - 2 = 1 \ .  Então, temos que obter um vetor u \in \mathcal{V} para gerar \mathcal{W}_3. Porém, tem que ser um vetor u \in \mathcal{V} que complete \beta_{\mathcal{W}_1} formando uma base para \mathcal{V}: \beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}; podemos por exemplo, tomar u = t:
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#### Exercício.2:(respostas)

$$\textit{dim}(\mathcal{V}) = \textit{dim}(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \textit{dim}(\mathcal{V}) = \textit{dim}(\mathcal{W}_1) + \textit{dim}(\mathcal{W}_3)$$

$$\Rightarrow \text{dim}(\mathcal{W}_3) = \text{dim}(\mathcal{V}) - \text{dim}(\mathcal{W}_1) \Rightarrow \text{dim}(\mathcal{W}_3) = 3 - 2 = 1 \ .$$

Então, temos que obter um vetor  $u \in \mathcal{V}$  para gerar  $\mathcal{W}_3$ .

$$\beta_{\mathcal{V}} = \beta_{\mathcal{W}_1} \cup \{u\}$$
; podemos por exemplo, tomar  $u = t$ :

• 
$$u = t \notin \mathcal{W}_1$$
:  $\lambda_1(1+t) + \lambda_2(1+t^2) + \lambda_3(t) = 0 + 0t + 0t^2$   
 $\Rightarrow \lambda_1 + \lambda_2 = 0; \lambda_1 + \lambda_3 = 0; \lambda_2 = 0 \Rightarrow \lambda_1 = \lambda_2 = \lambda_3 = 0 \Rightarrow \{1+t; 1+t^2; t\} \text{ \'e LI.}$ 

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#### Exercício.2:(respostas)

Por (i) e (ii), temos

$$\textit{dim}(\mathcal{V}) = \textit{dim}(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \textit{dim}(\mathcal{V}) = \textit{dim}(\mathcal{W}_1) + \textit{dim}(\mathcal{W}_3)$$

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Então, temos que obter um vetor  $u \in \mathcal{V}$  para gerar  $\mathcal{W}_3$ .

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- $u = t \notin \mathcal{W}_2$ :

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#### Exercício.2:(respostas)

Por (i) e (ii), temos

$$\textit{dim}(\mathcal{V}) = \textit{dim}(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow \textit{dim}(\mathcal{V}) = \textit{dim}(\mathcal{W}_1) + \textit{dim}(\mathcal{W}_3)$$

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- $u = t \notin \mathcal{W}_2$ :  $\lambda_1(-1+t) + \lambda_2(t) = 0 + 0t + 0t^2$

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#### EXERCÍCIO.2:(RESPOSTAS)

Por (i) e (ii), temos

$$dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1) + dim(\mathcal{W}_3)$$
  
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#### Exercício.2:(respostas)

Por (i) e (ii), temos

$$dim(V) = dim(W_1 + W_3) \Rightarrow dim(V) = dim(W_1) + dim(W_3)$$
  
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Base e Dimensão

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$$dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1) + dim(\mathcal{W}_3)$$
  
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- $u = t \notin \mathcal{W}_2$ :  $\lambda_1(-1+t) + \lambda_2(t) = 0 + 0t + 0t^2$  $\Rightarrow -\lambda_1 = 0$ ;  $\lambda_1 + \lambda_2 = 0$ ;  $0 = 0 \Rightarrow \lambda_1 = \lambda_2 = 0 \Rightarrow \{-1+t; t\}$  é LI.

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$$\Rightarrow \beta_{\mathcal{W}_3} = \{t\} = \{e_2\} \Rightarrow \beta_{\mathcal{V}} = \{(1+t); (1+t^2); t\}$$

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#### Exercício.2:(respostas)

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- $u = t \notin \mathcal{W}_2$ :  $\lambda_1(-1+t) + \lambda_2(t) = 0 + 0t + 0t^2$  $\Rightarrow -\lambda_1 = 0; \lambda_1 + \lambda_2 = 0; 0 = 0 \Rightarrow \lambda_1 = \lambda_2 = 0 \Rightarrow \{-1+t; t\} \notin \mathsf{LI}.$

$$\Rightarrow \beta_{\mathcal{W}_3} = \{t\} = \{e_2\} \Rightarrow \beta_{\mathcal{V}} = \{(1+t); (1+t^2); t\} = \{e_1 + e_2; e_1 + e_3; e_2\}.$$

Base e Dimensão

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$$dim(\mathcal{V}) = dim(\mathcal{W}_1 + \mathcal{W}_3) \Rightarrow dim(\mathcal{V}) = dim(\mathcal{W}_1) + dim(\mathcal{W}_3)$$
  
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- $u = t \notin \mathcal{W}_2$ :  $\lambda_1(-1+t) + \lambda_2(t) = 0 + 0t + 0t^2$  $\Rightarrow -\lambda_1 = 0$ ;  $\lambda_1 + \lambda_2 = 0$ ;  $0 = 0 \Rightarrow \lambda_1 = \lambda_2 = 0 \Rightarrow \{-1 + t; t\}$  é LI.

$$\Rightarrow \beta_{W_3} = \{t\} = \{e_2\} \Rightarrow \beta_{V} = \{(1+t); (1+t^2); t\} = \{e_1 + e_2; e_1 + e_3; e_2\}.$$
  
Agora,  $\forall p(t) \in W_3 \Rightarrow p(t) = \lambda.t$ 

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$$\Rightarrow \beta_{W_3} = \{t\} = \{e_2\} \Rightarrow \beta_{V} = \{(1+t); (1+t^2); t\} = \{e_1 + e_2; e_1 + e_3; e_2\}.$$
Agora.  $\forall p(t) \in W_3 \Rightarrow p(t) = \lambda.t \Rightarrow W_3 = \{p(t) \in \mathcal{P}_2(\mathbb{R}) \mid a_0 = a_2 = 0\}.$