Nullable, First and Follow

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Esta é a gramática livre de contexto!

```
E → T E'
E' → + T E'
E' → - T E'
E' → F T'
T' → * F T'
T' → / F T'
T' → id
F → num
F → ( E )
```

Acertando a gramática

Símbolo inicial: E Novo símbolo inicial: S

Acertando a gramática

Símbolo inicial: E Novo símbolo inicial: S

Nova regra de produção: S →E \$

NT	Nullable	First	Follow

Tabela de símbolos anuláveis, conjuntos first e conjuntos follow

NT	Nullable	First	Follow
S			
E'			
Т			
T'			
F			
Е			

Tabela de símbolos anuláveis, conjuntos first e conjuntos follow

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
Е	×		

Encontrando os símbolos não terminais anuláveis Inicialmente nenhum símbolo não terminal é anulável

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
Е	×		

```
E \rightarrow T \quad E'
E' \rightarrow + \quad T \quad E'
E' \rightarrow - \quad T \quad E'
E' \rightarrow - \quad T \quad E'
E' \rightarrow F \quad T'
T' \rightarrow F \quad T'
T' \rightarrow / \quad F \quad T'
T' \rightarrow f \quad T'
```

NT	Nullable	First	Follow
S	×		
E'	×		
T	×		
T'	×		
F	×		
Е	×		

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
Е	×		

```
E \rightarrow T \quad E'
E' \rightarrow + \quad T \quad E'
E' \rightarrow - \quad T \quad E'
E' \rightarrow - \quad T \quad E'
T' \rightarrow F \quad T'
T' \rightarrow * \quad F \quad T'
T' \rightarrow / \quad F \quad T'
T' \rightarrow f \quad \to id
F \rightarrow num
F \rightarrow ( E )
```

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
E	×		

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
E	×		

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
E	×		

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
Е	×		

```
S \rightarrow E \quad S
E \rightarrow T \quad E'
E' \rightarrow + \quad T \quad E'
E' \rightarrow - \quad T \quad E'
E' \rightarrow T \quad F \quad T'
T' \rightarrow * \quad F \quad T'
T' \rightarrow / \quad F \quad T'
T' \rightarrow F \quad T'
T' \rightarrow F \quad T'
T' \rightarrow F \quad T'
T \rightarrow G' \quad F \quad T'
T' \rightarrow G'
```

NT	Nullable	First	Follow
S	×		
E'	×		
Т	×		
T'	×		
F	×		
E	×		

```
S \rightarrow E \qquad S
E \rightarrow T \qquad E'
E' \rightarrow + \qquad T \qquad E
E' \rightarrow - \qquad T \qquad E
E' \rightarrow T
T \rightarrow F \qquad T'
T' \rightarrow * \qquad F \qquad T
T' \rightarrow / \qquad F \qquad T
T' \rightarrow d
F \rightarrow num
```

NT	Nullable	First	Follow
S	×		
E'	× V		
Т	×		
T'	×		
F	×		
E	×		

Lado direito da regra é vazio

```
S \rightarrow E \qquad S
E \rightarrow T \qquad E'
E' \rightarrow + \qquad T \qquad E
E' \rightarrow - \qquad T \qquad E'
T \rightarrow F \qquad T'
T' \rightarrow * \qquad F \qquad T'
T' \rightarrow f \qquad T'
T' \rightarrow f \qquad T'
F \rightarrow id
F \rightarrow num
```

NT	Nullable	First	Follow
S	×		
E'	× ✓		
Т	×		
T'	× ✓		
F	×		
E	×		

Lado direito da regra é vazio

NT	Nullable	First	Follow
S	×		
E'	× ✓		
Т	×		
T'	× ✓		
F	×		
E	×		

Lado direito da regra não é anulável

NT	Nullable	First	Follow
S	×		
E'	× ✓		
Т	×		
T'	× ✓		
F	×		
E	×		

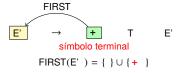
Lado direito da regra não é anulável

NT	Nullable	First	Follow
S	×		
E'	× ✓		
Т	×		
T'	× ✓		
F	×		
E	×		

Encontrando os conjuntos first

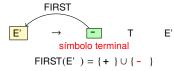
Inicialmente são vazios

NT	Nullable	First	Follow
S	×		
E'	× ✓	+	
T	×		
T'	× ✓		
F	×		
Е	×		





NT	Nullable	First	Follow
S	×		
E'	× ✓	+ -	
Т	×		
T'	× ✓		
F	×		
Е	×		

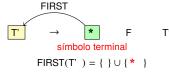


Nullable	First	Follow
×		
× ✓	+ -	
×		
× ✓		
×		
×		
	× × ✓ × × ✓ ×	× √ + - × × √ × √

 $\begin{array}{c} {\sf E'} \to \\ {\sf O} \ {\sf lado} \ {\sf direito} \ {\sf da} \ {\sf regra} \ {\sf \'e} \ \\ {\sf Logo} \ {\sf a} \ {\sf regra} \ {\sf \'e} \ {\sf inútil} \end{array}$

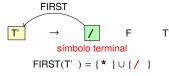


NT	Nullable	First	Follow
S	×		
E'	× ✓	+ -	
T	×		
T'	× ✓	*	
F	×		
Е	×		





NT	Nullable	First	Follow
S	×		
E'	× ✓	+ -	
Т	×		
T'	× ✓	* /	
F	×		
Е	×		



NT	Nullable	First	Follow
S	×		
E'	× ✓	+ -	
Т	×		
T'	× ✓	* /	
F	×		
Е	×		

 $\begin{array}{c} {\rm T'} \, \to \\ {\rm O\,lado\,\, direito\,\, da\,\, regra\,\, \acute{e}} \, \epsilon \\ {\rm Logo\,\, a\,\, regra\,\, \acute{e}\,\, inútil} \end{array}$

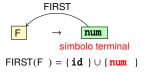


NT	Nullable	First	Follow
S	×		
E'	× ✓	+ -	
T	×		
T'	× ✓	* /	
F	×	id	
Е	×		

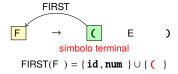


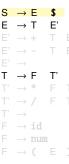


NT	Nullable	First	Follow
S	×		
E'	× ✓	+ -	
T	×		
T'	× ✓	* /	
F	×	id num	
Е	×		
E	×		

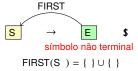


NT	Nullable	First		Follow
S	×			
E'	× ✓	+ -		
T	×			
T'	× ✓	* /		
F	×	id num	(
Е	×			





NT	Nullable	First	Follow
S	×		
E'	× ✓	+ -	
Т	×		
T'	× ✓	* /	
F	×	id num (
Е	×		



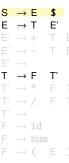


NT	Nullable	First		Follow
S	×			
E'	× ✓	+ -		
Т	×			
T'	× ✓	* /		
F	×	id num	(
Е	×			

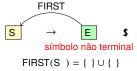


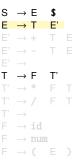
NT	Nullable	First		Follow
S	×			
E'	× ✓	+ -		
Т	×	id num	(
T'	× ✓	* /		
F	×	id num	(
Е	×			
				•





NT	Nullable	First		Follow
S	×			
E'	× ✓	+ -		
T	×	id num	(
T'	× ✓	* /		
F	×	id num	(
Е	×			

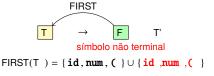




NT	Nullable	First			Follow
S	×				
E'	× ✓	+ -			
Т	×	id	num	(
T'	× ✓	* /			
F	×	id	num	(
E	×	id	num	(



NT	Nullable	First		Follow
S	×			
E'	× ✓	+ -		
Т	×	id num	(
T'	× ✓	* /		
F	×	id num	(
Е	×	id num	(





NT	Nullable	First			Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(



NT	Nullable	First	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(
T'	× ✓	*	/		
F	×	id	num	(
E	×	id	num	(



NT	Nullable	First			Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(
					•



NT	Nullable	First		Follow
S	×	id n	ium (
E'	× ✓	+ -		
Т	×	id n	ium (
T'	× ✓	* /		
F	×	id r	ium (
Е	×	id n	ium (



NT	Nullable	First	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(
T'	× ✓	*	/		
F	×	id	num	(
E	×	id	num	(



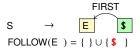
NT	Nullable	First			Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(
					•



NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
T	×	id	num	(
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(

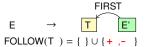
NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
T	×	id	num	(
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(

NT	Nullable	First		Follow
S	×	id num	ı (
E'	× ✓	+ -		
Т	×	id num	ı (
T'	× ✓	* /		
F	×	id num	ı (
Е	×	id num	ı (\$
		•		•





Nullable	Firs	t		Follow
×	id	num	(
× √	+	-		
×	id	num	(+ -
× ✓	*	/		
×	id	num	(
×	id	num	(\$
	× × ✓ × × ✓ × × ✓	X	× √	X

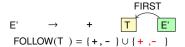


NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
T	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(\$

 $\mathsf{E} \quad \rightarrow \quad \mathsf{T} \quad \boxed{\mathsf{E}'}$



NT	Nullable	First		Follow
S	×	id 1	num (
E'	× ✓	+ -		
Т	×	id 1	num (+ -
T'	× ✓	* /		
F	×	id 1	num (
Е	×	id 1	num (\$

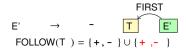


NT	Nullable	First	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
T	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(\$





NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(
E	×	id	num	(\$



NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
T	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(\$



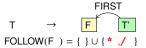
```
S \rightarrow E \qquad S
E \rightarrow T \qquad E'
E' \rightarrow + \qquad T \qquad E'
E' \rightarrow - \qquad T \qquad E'
E' \rightarrow T'
T' \rightarrow F \qquad T'
T' \rightarrow / \qquad F \qquad T'
```

NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(
Е	×	id	num	(\$

E' →
Nenhum símbolo não terminal no lado direito da regra
Regra inútil



NT	Nullable	First		Follow
S	×	id num	(
E'	× ✓	+ -		
Т	×	id num	(+ -
T'	× ✓	* /		
F	×	id num	(* /
E	×	id num	(\$

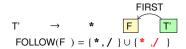


```
E \rightarrow T \quad E'
E' \rightarrow + \quad T \quad E'
E' \rightarrow - \quad T \quad E'
E' \rightarrow F \quad T'
T' \rightarrow F \quad T'
T' \rightarrow / \quad F \quad T'
T' \rightarrow
```

NT	Nullable	First			Follow
S	×	id	num	(
E'	× ✓	+ -	-		
T	×	id	num	(+ -
T'	× ✓	* /	/		
F	×	id	num	(* /
Е	×	id	num	(\$

 $T \rightarrow F \overline{T'}$

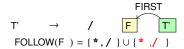
NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(+ -
T'	× √	*	/		
F	×	id	num	(* /
Е	×	id	num	(\$



NT	Nullable	First		Follow
S	×	id	num (
E'	× ✓	+ -		
Т	×	id	num (+ -
T'	× ✓	* /	,	
F	×	id	num (* /
E	×	id	num (\$

 $T' \rightarrow * F \overline{T'}$

NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(* /
Е	×	id	num	(\$
					1



NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(* /
Е	×	id	num	(\$

 $T' \rightarrow / F \overline{T'}$

```
E \rightarrow T \quad E'
E' \rightarrow + \quad T \quad E'
E' \rightarrow - \quad T \quad E'
E' \rightarrow - \quad T \quad E'
T' \rightarrow F \quad T'
T' \rightarrow * \quad F \quad T'
T' \rightarrow / \quad F \quad T'
T' \rightarrow f \quad
```

NT	Nullable	Firs	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
Т	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(* /
Е	×	id	num	(\$

T' →
Nenhum símbolo não terminal no lado direito da regra
Regra inútil

 $F \rightarrow (E)$

NT	Nullable	First	t		Follow
S	×	id	num	(
E'	× ✓	+	-		
T	×	id	num	(+ -
T'	× ✓	*	/		
F	×	id	num	(* /
Е	×	id	num	(\$

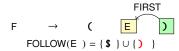
F →id Nenhum símbolo não terminal no lado direito da regra Regra inútil

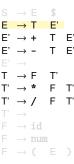
```
E \rightarrow T \quad E'
E' \rightarrow + \quad T \quad E
E' \rightarrow - \quad T \quad E
E' \rightarrow - \quad T
T \rightarrow F \quad T'
T' \rightarrow * \quad F \quad T'
T' \rightarrow / \quad F \quad T'
T' \rightarrow f \quad T'
T'
```

NT	Nullable	Firs	t		Follov	V
S	×	id	num	(
E'	× ✓	+	-			
Т	×	id	num	(+ -	-
T'	× ✓	*	/			
F	×	id	num	(*	/
Е	×	id	num	(\$	

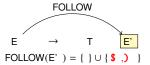
F →**num** Nenhum símbolo não terminal no lado direito da regra Regra inútil

NT	Nullable	Firs	t		Fol	llow	
S	×	id	num	(
E'	× ✓	+	-				
Т	×	id	num	(+	-	
T'	× ✓	*	/				
F	×	id	num	(*	/	
E	×	id	num	(\$)	



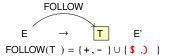


NT	Nullable	Firs	t		Fol	low		
S	×	id	num	(
E'	× ✓	+	-		\$)		
Т	×	id	num	(+	-		
T'	× ✓	*	/					
F	×	id	num	(*	/		
Е	×	id	num	(\$)		



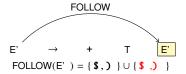


NT	Nullable	Firs	t		Fol	low		
S	×	id	num	(
E'	× ✓	+	-		\$)		
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/					
F	×	id	num	(*	/		
Е	×	id	num	(\$)		
	•	•						

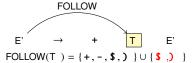




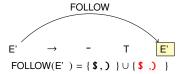
NT	Nullable	Firs	t		Fol	low		
S	×	id	num	(
E'	× ✓	+	-		\$)		
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/					
F	×	id	num	(*	/		
Е	×	id	num	(\$)		



NT	Nullable	Firs	t		Fol	low		
S	×	id	num	(
E'	× ✓	+	-		\$)		
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/					
F	×	id	num	(*	/		
Е	×	id	num	(\$)		

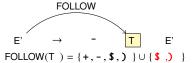


NT	Nullable	Firs	t		Fol	low		
S	×	id	num	(
E'	× ✓	+	-		\$)		
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/					
F	×	id	num	(*	/		
Е	×	id	num	(\$)		

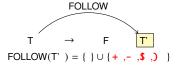


```
S \rightarrow E \qquad S
E \rightarrow T \qquad E'
E' \rightarrow + \qquad T \qquad E
E' \rightarrow - \qquad T \qquad E
E' \rightarrow - \qquad T \qquad F \qquad T'
T' \rightarrow F \qquad T'
T' \rightarrow / \qquad F \qquad T
T' \rightarrow id
F \rightarrow id
F \rightarrow num
```

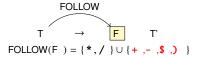
NT	Nullable	Firs	t		Fol	low		
S	×	id	num	(
E'	× ✓	+	-		\$)		
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/					
F	×	id	num	(*	/		
Е	×	id	num	(\$)		



NT	Nullable	Firs	t		Fol	low		
S	×	id	num	(
E'	× ✓	+	-		\$)		
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/		
Е	X	id	num	(\$)		

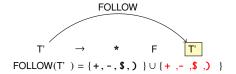


NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

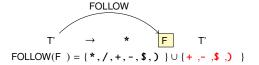


```
S \rightarrow E \qquad S
E \rightarrow T \qquad E'
E' \rightarrow + \qquad T \qquad E'
E' \rightarrow - \qquad T \qquad E'
E' \rightarrow - \qquad T \qquad F \qquad T'
T' \rightarrow f \qquad T'
```

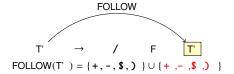
NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			



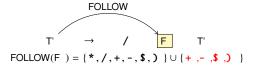
		t		· O.	low				
×	id	num	(
× √	+	-		\$)				
×	id	num	(+	-	\$)		
× √	*	/		+	-	\$)		
×	id	num	(*		+	-	\$)
×	id	num	(\$)				
>	× √ × × × × × × × × × × × × × × × × × ×	× √ + × id × √ * × id	× √ + - × id num × √ * / × id num	× √ + - × id num (× √ * / × id num (X	X	<pre> x \ / + -</pre>	x \ / + -	<pre>x \ / + -</pre>



NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× √	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× √	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

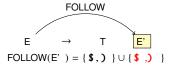


NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			



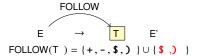


NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			



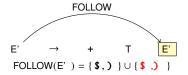


NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			
	•	•							

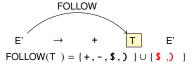




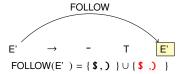
NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			



NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

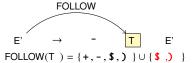


NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			



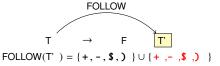
```
S \rightarrow E \qquad S
E \rightarrow T \qquad E'
E' \rightarrow + \qquad T \qquad E
E' \rightarrow - \qquad T \qquad E
E' \rightarrow - \qquad T \qquad F \qquad T'
T' \rightarrow F \qquad T'
T' \rightarrow / \qquad F \qquad T
T' \rightarrow id
F \rightarrow id
F \rightarrow num
```

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

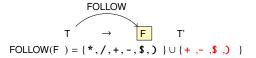


 $S \rightarrow E \qquad S$ $E \rightarrow T \qquad E'$ $E' \rightarrow + \qquad T \qquad E$ $E' \rightarrow - \qquad T \qquad E$ $T \rightarrow F \qquad T'$ $T' \rightarrow * \qquad F \qquad T'$ $T' \rightarrow / \qquad F \qquad T'$ $T' \rightarrow d$ $F \rightarrow num$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

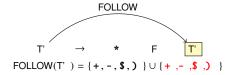


NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

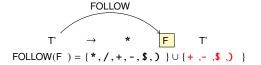


```
S \rightarrow E \qquad S
E \rightarrow T \qquad E'
E' \rightarrow + \qquad T \qquad E'
E' \rightarrow - \qquad T \qquad E'
E' \rightarrow - \qquad T \qquad F \qquad T'
T' \rightarrow f \qquad T'
```

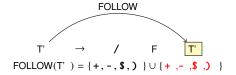
NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× √	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× √	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			



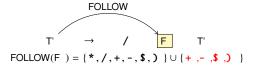
		t		· O.	low				
×	id	num	(
× ✓	+	-		\$)				
×	id	num	(+	-	\$)		
× √	*	/		+	-	\$)		
×	id	num	(*		+	-	\$)
×	id	num	(\$)				
>	× √ × × × × × × × × × × × × × × × × × ×	× √ + × id × √ * × id	× √ + - × id num × √ * / × id num	× √ + - × id num (× √ * / × id num (X	X	× \(\sqrt{ + - } \) × \(\text{id num (+ - } \) × \(\sqrt{ * / } \) × \(\text{id num (* / + } \)	<pre>x \ / + -</pre>	<pre>x \ / + -</pre>



NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			



NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			



NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$ ()	*	+	-	/	id	num
S								
E'								
Т								
T'								
F								
Е								

Construção da tabela LL(1)

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$ ()	*	+	-	/	id	num
S								
E'								
Т								
T'								
F								
E								

 $FIRST(E \$) = \{ \} \cup \{ id num (\} \}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$ ())	*	+	-	/	id	num
S	E \$							E \$	E \$
E'									
Т									
T'									
F									
Е									

$$S \rightarrow E$$
 \$ id num (

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$ ()	*	+	-	/	id	nu	m
S	Е	\$					Е	\$ Е	\$
E'									
Т									
T'									
F									
Е									

 $FIRST(T E') = \{ \} \cup \{ id num (\} \}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$ ()	*	+	-	/	id	num
S	Е	\$						E \$	E \$
E'									
Т									
T'									
F									
Е	Т	E'						T E'	T E'

$$E \rightarrow T E'$$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$ ()	*	+	-	/			nu	m
S	Е	\$						Е	\$	Е	\$
E'											
Т											
T'											
F											
Е	Т	E'						Т	E'	Т	E'

$$\mathsf{FIRST}(+ \mathsf{T} \mathsf{E}') = \{ \} \cup \{+ \}$$

NT	Nullable	Firs	t	Fol	low				
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$ ()	*	+	-	/	id		nu	m
S	Е	\$						Е	\$	Е	\$
E'					+ T E'						
Т											
T'											
F											
Е	Т	E'						Т	E'	Т	E'

$$E' \rightarrow + T E'$$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$ ()	*	+	-	/	id		nu	m
S	Е	\$						Е	\$	Е	\$
E'					+ T E'						
Т											
T'											
F											
Е	Т	E'						Т	E'	Т	E'

$$\mathsf{FIRST}(\mathsf{-}\ \mathsf{T}\ \mathsf{E'}\,) = \{\ \} \cup \{\mathsf{-}\ \}$$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$ ()	*	+	-	/	id		nu	m
S	Е	\$						Е	\$	Е	\$
E'					+ T E'	- T E'					
Т											
T'											
F											
Ε	Т	E'						Т	E'	Т	E'

 $\mathsf{E'} \ \to \ \mathsf{-} \ \mathsf{T} \ \mathsf{E'}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*	+	-	/	id		nu	m
S		Е	\$						Е	\$	Е	\$
E'	€			ϵ		+ T E'	- T E'					
Т												
T'												
F												
Е		Т	E'						Т	E'	Т	E'



NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*	+			-			/	id		nu	m
S		Е	\$										Е	\$	Е	\$
E'	ϵ			ϵ		+	Т	E'	-	Т	E'					
Т																
T'																
F																
Е		Т	E'										Т	E'	Т	E'

 $FIRST(F T') = \{ \} \cup \{ id num (\} \}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*	+	-	/	id	ļ.	nu	m
S		Е	\$						Е	\$	Е	\$
E'	ϵ			ϵ		+ T E'	- T E'					
Т		F	T'						F	T'	F	T'
T'												
F												
Е		Т	E'						Т	E'	Т	E'

 $T \rightarrow F T'$ id num (

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$	()	*	+	-	/	id		nu	m
S		Е	\$						Е	\$	Е	\$
E'	ϵ			ϵ		+ T E'	- T E'					
Т		F	T'						F	T'	F	T'
T'												
F												
Е		Т	E'						Т	E'	Т	E'

 $FIRST(* F T') = \{ \} \cup \{ * \}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*	+	-	/	id	l	nu	m
S		Е	\$						E	\$	Е	\$
E'	ϵ			ϵ		+ T E'	- T E'					
Т		F	T'						F	T'	F	T'
T'					* F T'							
F												
Ε		Т	E'						T	E'	Т	E'

T' → * F T'

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*			+			-			/	id		nu	m
S		Е	\$												Е	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	-	Т	E'					
Т		F	T'												F	T'	F	T'
T'					*	F	T'											
F																		
E		Т	E'												Т	E'	Т	E'

 $\mathsf{FIRST}(\textit{\textbf{/}} \mathsf{F} \mathsf{T}') = \{\ \} \cup \{\textit{\textbf{/}}\ \}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*			+			-			/	id	l	nu	m
S		Е	\$												Е	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	-	Т	E'					
Т		F	T'												F	T'	F	T'
T'					*	F	T'							/ F T'				
F																		
Ε		Т	E'												T	E'	Т	E'

$$T' \rightarrow / F T'$$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

\$	()	*			+			-			/			id	l	nu	m
	Е	\$														Е	\$	Е	\$
ϵ			ϵ				+	Т	E'	-	Т	E'							
	F	T'														F	T'	F	T'
ϵ			ϵ	*	F	T'	ϵ			ϵ			/	F	T'				
	Т	E'														Т	E'	Т	E'
		ε F	ε F Τ'	ε ε ε ε	Ε \$ ε F Τ' ε *	Ε\$ ε Ε Γ' Ε * F	E \$ ε F Τ' ε * F Τ'	E \$	E \$	E \$	E\$ ε + T Ε' F Τ' ε * F Τ' ε ε	E\$	E \$	E \$	E \$	E \$	\$ () * + - / 10 E \$ E ε ε + ΤΕ' - ΤΕ' F Τ' ε * F Τ' ε ε / F Τ'	E \$ Ε \$	\$ () * + - / 1d nu E \$ E E \$ E F T' E * F T' &

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$	()	*			+			-			/		id		nu	m
S		Е	\$													E	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	-	Τ	E'						
Т		F	T'													F	T'	F	T'
T'	ϵ			ϵ	*	F	T'	ϵ			ϵ			/ F	T'				
F																			
Е		Т	E'													Т	E'	Т	E'

 $\mathsf{FIRST}(\mathbf{id}) = \{ \} \cup \{ \mathbf{id} \}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*			+			-			/		id	l	nu	m
S		Е	\$													E	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	T-	Т	E'						
Т		F	T'													F	T'	F	T'
T'	ϵ			ϵ	*	F	T'	ϵ			ϵ			/ F	T'				
F																id			
Е		Т	E'													Т	E'	Т	E'

$$\begin{array}{ccc} \mathsf{F} & \to & \text{id} \\ & & \text{id} \end{array}$$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$	()	*			+			-			/			id		nu	m
S		Е	\$														Е	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	-	Т	E'							
Т		F	T'														F	T'	F	T'
T'	ϵ			ϵ	*	F	T'	ϵ			ϵ			7	F :	T'				
F																	id			
Е		Т	E'														Т	E'	Т	E'

 $\mathsf{FIRST}(\mathbf{num}\) = \{\ \} \cup \{\ \mathbf{num}\ \}$

S	\rightarrow	Ε	\$	
Ε	\rightarrow	Т	E'	
E'	\rightarrow	+	Τ	E
E'	\rightarrow	-	Τ	E
E'	\rightarrow			
		F	T'	
T'	\rightarrow	*	F	T
T'	\rightarrow	/	F	T
T'	\rightarrow			
F	\rightarrow	id		
F	\rightarrow	num		
F	\rightarrow	(F	٦

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*			+			-			/		id	ļ	nu	m
S		Е	\$													E	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	-	Т	E'						
Т		F	T'													F	T'	F	T'
T'	ϵ			ϵ	*	F	T'	ϵ			ϵ			/	F T'				
F																id	L	nu	m
Е		Т	E'													Т	E'	Т	E'

 $\mathsf{F} \quad o \quad \mathbf{num} \\ \qquad \qquad \mathbf{num}$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
T	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
Е	×	id	num	(\$)			

	\$	()	*			+			-			/			id	l	nu	m
S		Е	\$														E	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	T-	Т	E'							
Т		F	T'														F	T'	F	T'
T'	ϵ			ϵ	*	F	T'	ϵ			ϵ			7	F	T'				
F																	id	l	nu	m
Е		Т	E'														Т	E'	Т	E'

$$FIRST((E)) = \{ \} \cup \{ (\} \}$$

NT	Nullable	Firs	t		Fol	low			
S	×	id	num	(
E'	× ✓	+	-		\$)			
Т	×	id	num	(+	-	\$)	
T'	× ✓	*	/		+	-	\$)	
F	×	id	num	(*	/	+	-	\$)
E	×	id	num	(\$)			

	\$	()	*			+			-			/		id	Į.	nu	m
S		Е	\$													Е	\$	Е	\$
E'	ϵ			ϵ				+	Т	E'	-	Т	E'						
Т		F	T'													F	T'	F	T'
T'	ϵ			ϵ	*	F	T'	ϵ			ϵ			/	F T'				
F		(E)													id	L	nu	m
E		Т	E'													Т	E'	Т	E'

$$\mathsf{F} \ \rightarrow \ (\ \mathsf{E} \)$$