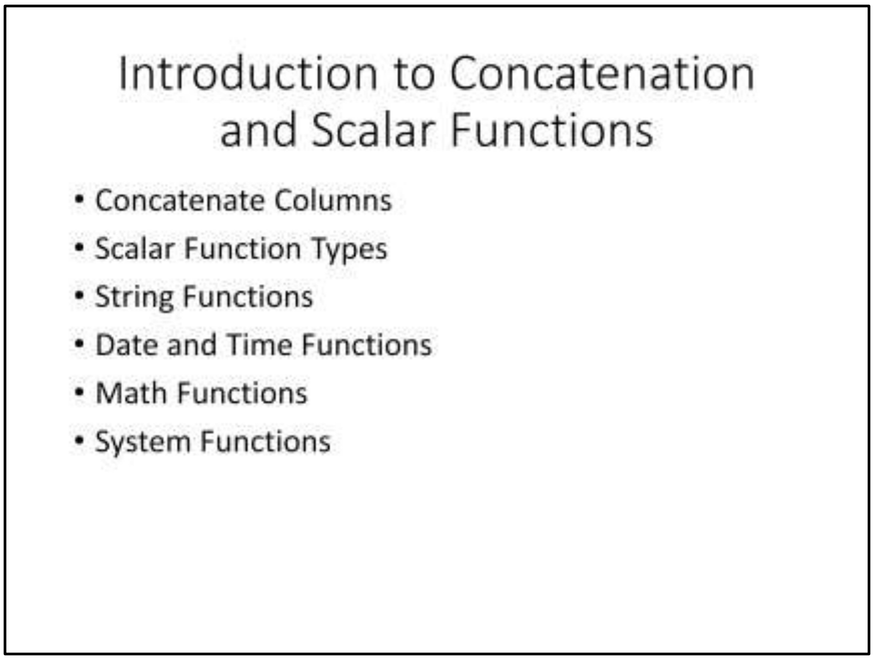
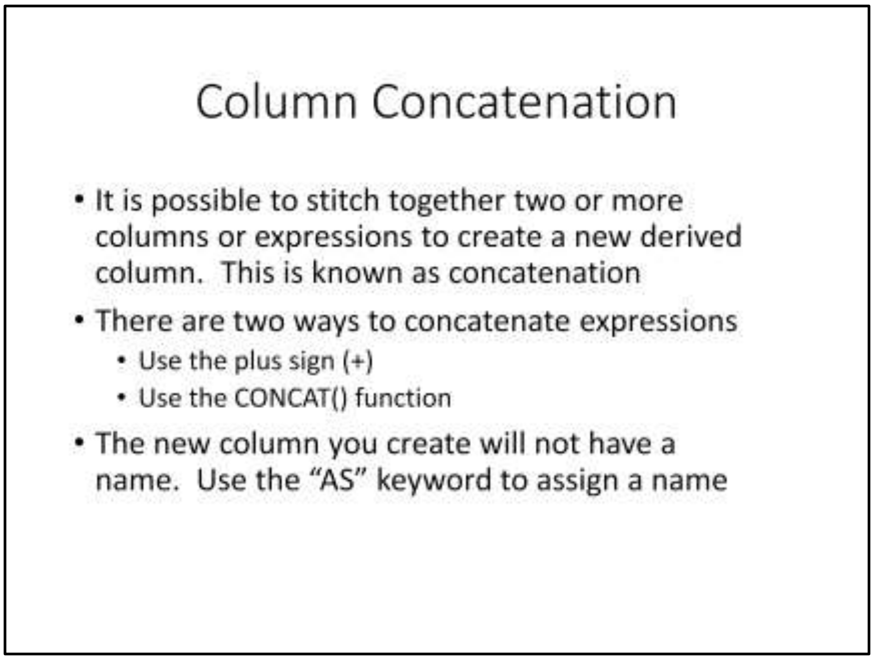


## Introduction to Concatenation and Scalar Functions

- Concatenate Columns
- Scalar Function Types
- String Functions
- Date and Time Functions
- Math Functions
- System Functions

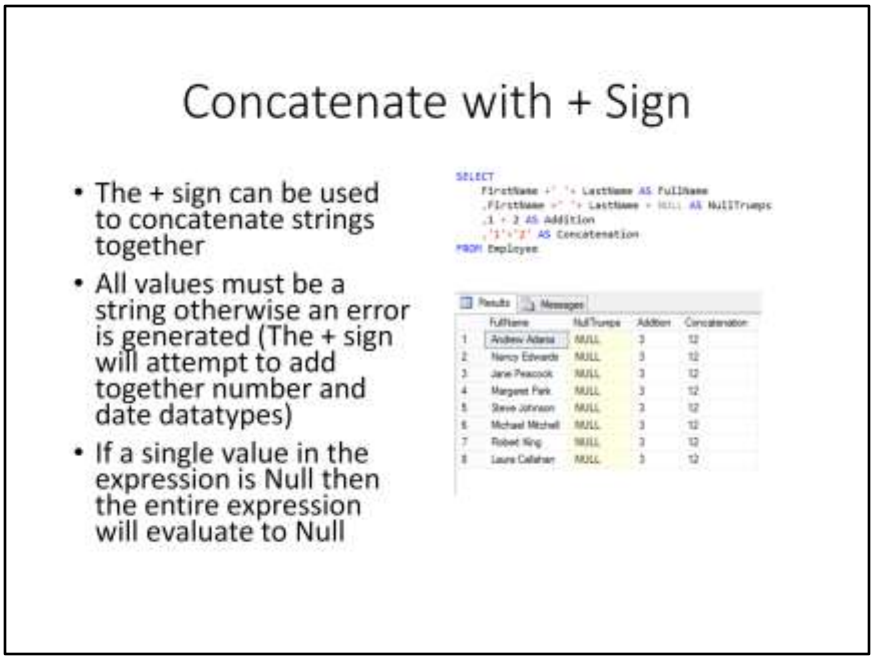
This presentation will be on concatenation and scalar functions. Concatenation and functions are used extensively to modify column data results. I will talk about concatenation and the types of available scalar functions.



## Column Concatenation

- It is possible to stitch together two or more columns or expressions to create a new derived column. This is known as concatenation
- There are two ways to concatenate expressions
  - Use the plus sign (+)
  - Use the CONCAT() function
- The new column you create will not have a name. Use the "AS" keyword to assign a name

Oftentimes you may want to display multiple pieces of data in a single column. Combining these pieces together is known as concatenation. SQL Server has two methods for concatenating expressions. One is the plus sign, and the other is the concatenation function. Concatenated expressions do not have a name assigned by default. You assign a name to a concatenated expression in the same way you would assign a name to a column, by using the AS keyword.



## Concatenate with + Sign

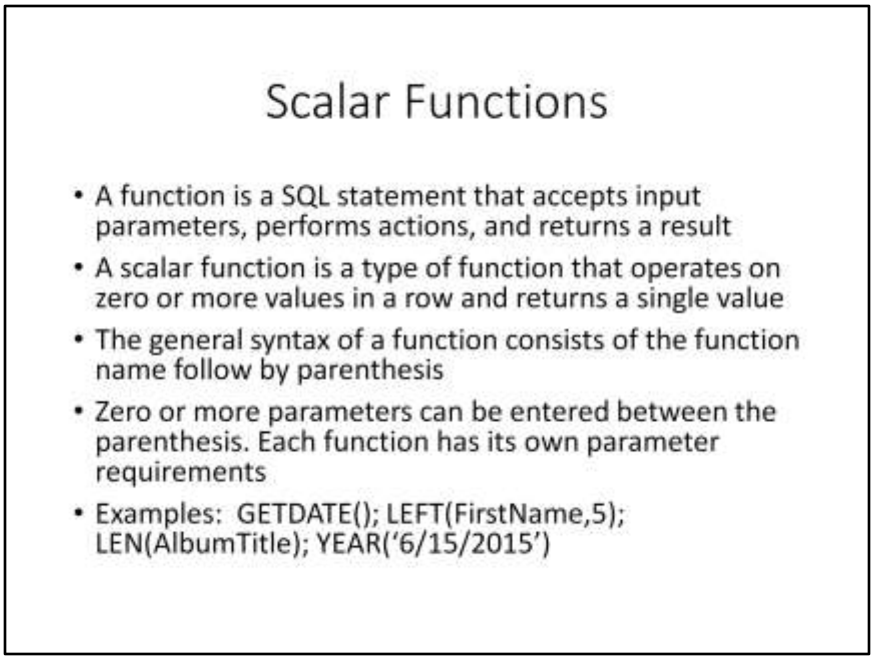
- The + sign can be used to concatenate strings together
- All values must be a string otherwise an error is generated (The + sign will attempt to add together number and date datatypes)
- If a single value in the expression is Null then the entire expression will evaluate to Null

```
SELECT
    FirstName +' '+ LastName AS FullName
    ,FirstName +' '+ LastName + NULL AS NullTrumps
    ,1 + 2 AS Addition
    ,'1'+'2' AS Concatenation
FROM Employee
```

Results | Messages

|  | FullName | NullTrumps | Addition | Concatenation |
|---|---|---|---|---|
| 1 | Andrew Adams | NULL | 3 | 12 |
| 2 | Nancy Edwards | NULL | 3 | 12 |
| 3 | Jane Peacock | NULL | 3 | 12 |
| 4 | Margaret Park | NULL | 3 | 12 |
| 5 | Steve Johnson | NULL | 3 | 12 |
| 6 | Michael Mitchell | NULL | 3 | 12 |
| 7 | Robert King | NULL | 3 | 12 |
| 8 | Laura Callahan | NULL | 3 | 12 |

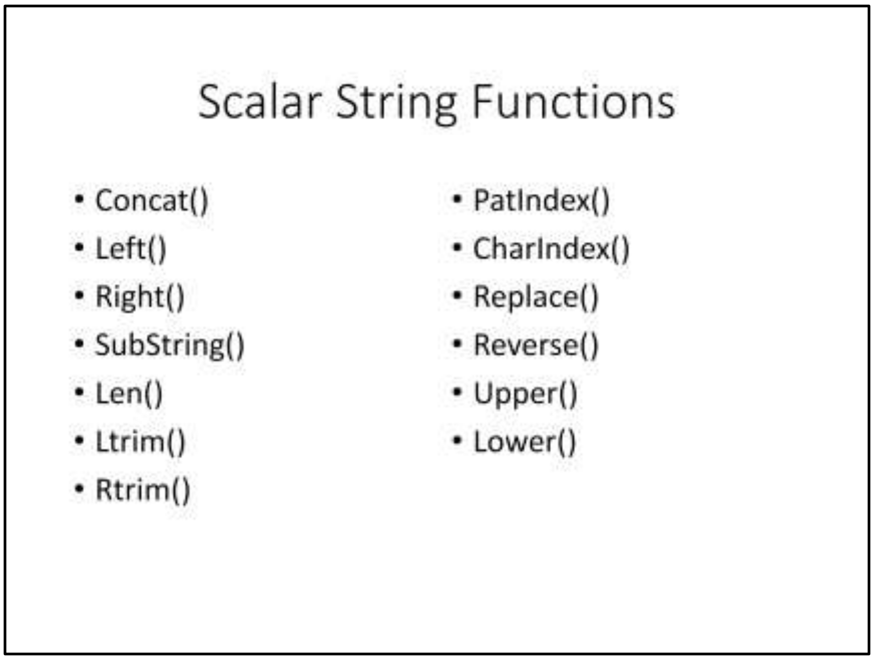
You can concatenate two strings together by using the plus sign. It is important all values you are concatenating be of the string datatype. Otherwise SQL will attempt math addition and an error may result instead. You can change a datatype by using the CAST or CONVERT functions. I will cover these functions later I the presentation. Also it is important to remember that any values in the expression that are null will force the entire expression to return a null value.



## Scalar Functions

- A function is a SQL statement that accepts input parameters, performs actions, and returns a result
- A scalar function is a type of function that operates on zero or more values in a row and returns a single value
- The general syntax of a function consists of the function name follow by parenthesis
- Zero or more parameters can be entered between the parenthesis. Each function has its own parameter requirements
- Examples: GETDATE(); LEFT(FirstName,5); LEN(AlbumTitle); YEAR('6/15/2015')

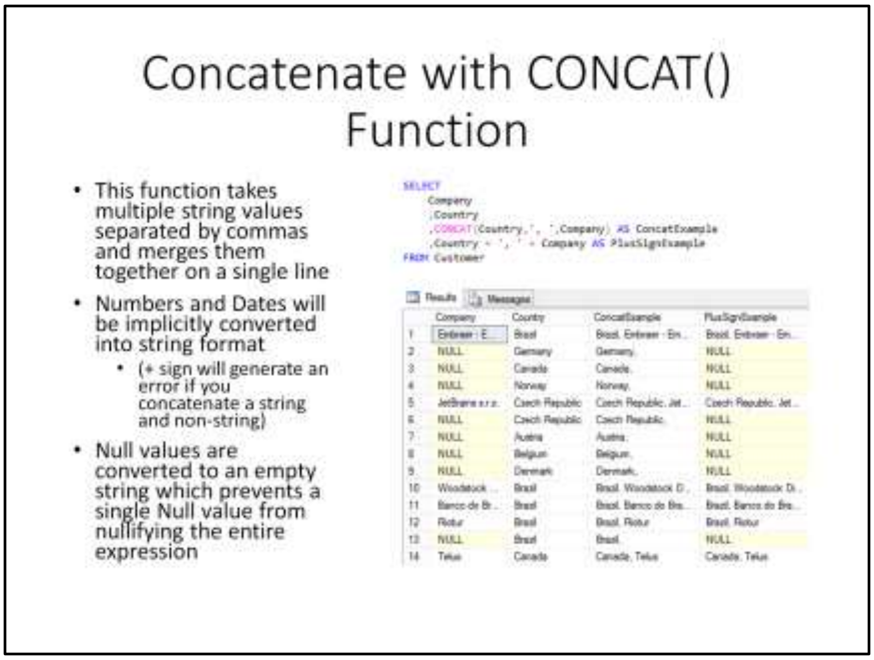
There are several types of functions in SQL Server. Scalar functions are generally used against a column in a single row of data. That means for every row in a result set, the function will be applied. The syntax of a function consists of the function name and zero or more parameters enclosed in parenthesis. Parameters can be columns as well as hard coded data. Hardcoded strings and dates need to be enclosed in single quotes. It is also possible to nest parameters inside one another.



## Scalar String Functions

- Concat()
- Left()
- Right()
- SubString()
- Len()
- Ltrim()
- Rtrim()
- PatIndex()
- CharIndex()
- Replace()
- Reverse()
- Upper()
- Lower()

String functions are functions that manipulate string data such as the char and varchar datatypes. They can be very useful in formatting data to your reporting needs. I will discuss the functions on this slide which are some of the more popular functions, but it is not an exhaustive list.



## Concatenate with CONCAT() Function

- This function takes multiple string values separated by commas and merges them together on a single line
- Numbers and Dates will be implicitly converted into string format
  - (+ sign will generate an error if you concatenate a string and non-string)
- Null values are converted to an empty string which prevents a single Null value from nullifying the entire expression

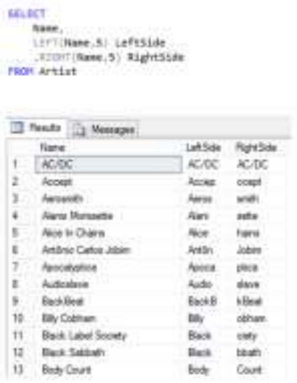
```sql
SELECT
    Company
    ,Country
    ,CONCAT(Country,', ',Company) AS ConcatExample
    ,Country + ', ' + Company AS PlusSignExample
FROM Customer
```

| | Company | Country | ConcatExample | PlusSignExample |
|---|---|---|---|---|
| 1 | Embraer - E... | Brazil | Brazil, Embraer - Em... | Brazil, Embraer - Em... |
| 2 | NULL | Germany | Germany, | NULL |
| 3 | NULL | Canada | Canada, | NULL |
| 4 | NULL | Norway | Norway, | NULL |
| 5 | JetBrains s.r.o. | Czech Republic | Czech Republic, Jet... | Czech Republic, Jet... |
| 6 | NULL | Czech Republic | Czech Republic, | NULL |
| 7 | NULL | Austria | Austria, | NULL |
| 8 | NULL | Belgium | Belgium, | NULL |
| 9 | NULL | Denmark | Denmark, | NULL |
| 10 | Woodstock ... | Brazil | Brazil, Woodstock D... | Brazil, Woodstock D... |
| 11 | Banco do Br... | Brazil | Brazil, Banco do Bra... | Brazil, Banco do Bra... |
| 12 | Riotur | Brazil | Brazil, Riotur | Brazil, Riotur |
| 13 | NULL | Brazil | Brazil, | NULL |
| 14 | Telus | Canada | Canada, Telus | Canada, Telus |

The CONCAT function is another way to concatenate multiple strings together. Each string is entered between the parenthesis and separated by commas. Hardcoded string values need to be enclosed in single quotes. The CONCAT function has an advantage over the plus sign in that it will implicitly convert numbers and dates into string values. Also Nulls will be converted to an empty string which prevents the entire expression from retuning null.

## Left() and Right()

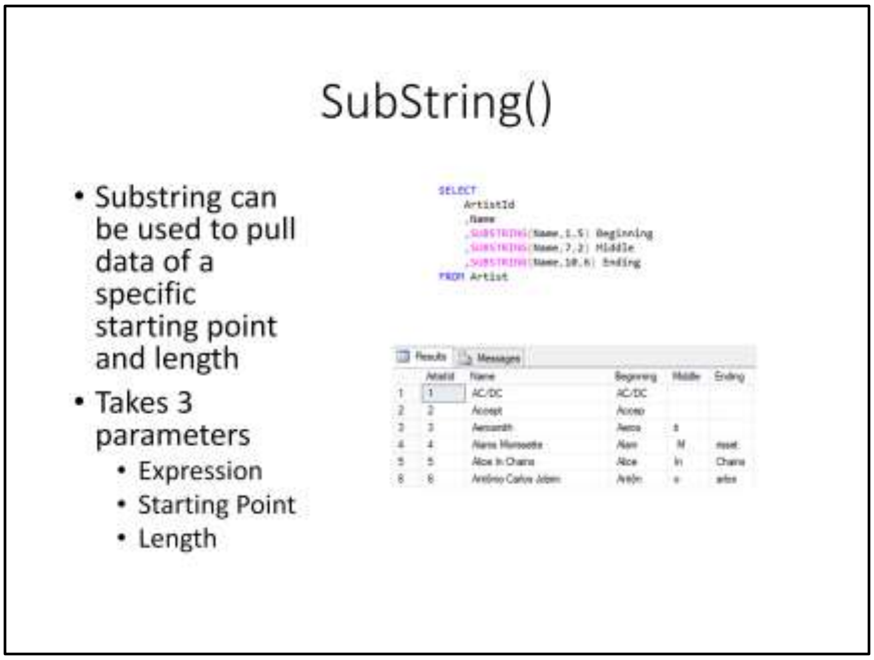
- Functions return a set number of characters starting from the Left or Right of an expression
- Takes 2 parameters
  - Expression
  - Length



```
SELECT
    Name,
    LEFT(Name,5) LeftSide
    ,RIGHT(Name,5) RightSide
FROM Artist
```

|  | Name | LeftSide | RightSide |
|---|---|---|---|
| 1 | AC/DC | AC/DC | AC/DC |
| 2 | Accept | Accep | ccept |
| 3 | Aerosmith | Aeros | smith |
| 4 | Alanis Morissette | Alani | sette |
| 5 | Alice In Chains | Alice | hains |
| 6 | Antônio Carlos Jobim | Antôn | Jobim |
| 7 | Apocalyptica | Apoca | ptica |
| 8 | Audioslave | Audio | slave |
| 9 | BackBeat | BackB | kBeat |
| 10 | Billy Cobham | Billy | obham |
| 11 | Black Label Society | Black | ciety |
| 12 | Black Sabbath | Black | bbath |
| 13 | Body Count | Body | Count |

The LEFT and RIGHT functions are used to grab a specified number of characters from the left or right side of a string value. They both take 2 parameters. The first parameter is the string you're pulling from, and the second is an integer of the number of characters you wish to pull. If the integer is larger than the number of characters in the string then the entire string is returned.



## SubString()

- Substring can be used to pull data of a specific starting point and length
- Takes 3 parameters
  - Expression
  - Starting Point
  - Length

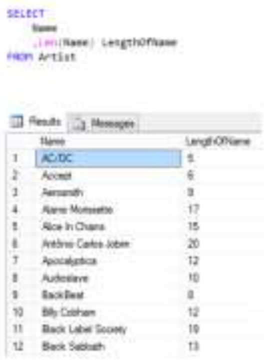
```
SELECT
    ArtistId
    ,Name
    ,SUBSTRING(Name,1,5) Beginning
    ,SUBSTRING(Name,7,2) Middle
    ,SUBSTRING(Name,10,6) Ending
FROM Artist
```

| | ArtistId | Name | Beginning | Middle | Ending |
|---|---|---|---|---|---|
| 1 | 1 | AC/DC | AC/DC | | |
| 2 | 2 | Accept | Accep | | |
| 3 | 3 | Aerosmith | Aeros | it | |
| 4 | 4 | Alanis Morissette | Alani | M | risset |
| 5 | 5 | Alice In Chains | Alice | In | Chains |
| 6 | 6 | Antônio Carlos Jobim | Antôn | o | arlos |

The SUBSTRING function is similar to the LEFT function except you can specify a starting point within the string. The SUBSTRING function takes 3 parameters. The first parameter is the string you're pulling from, the second is an integer identifying the starting position, and the third is an integer specifying how many characters after the starting point to return. SUBSTRING is useful for extracting data from the middle of a string.

## Len()

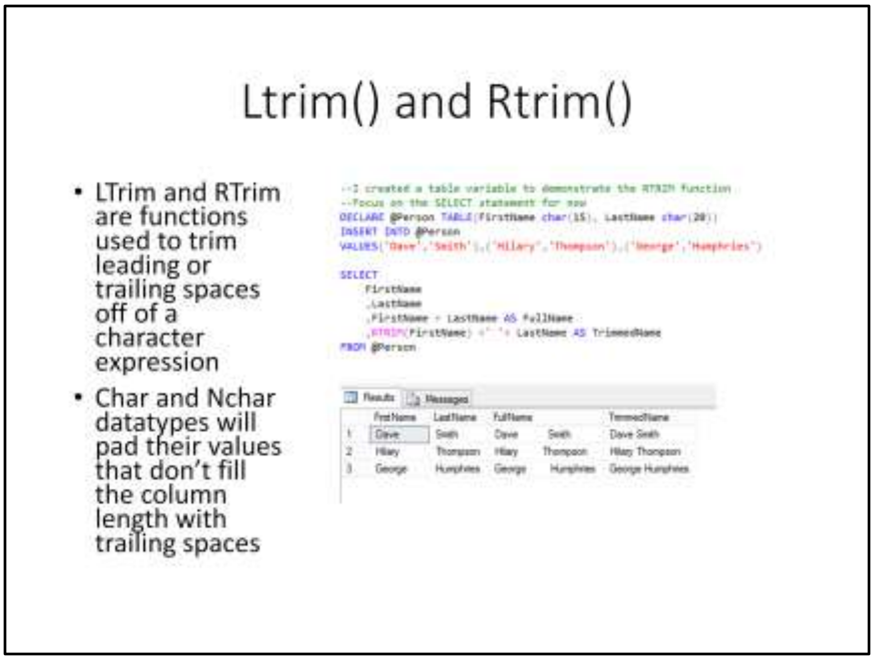
- The Len function returns the number of characters present in a string
- Takes a single expression parameter
- Spaces are counted as a character



```
SELECT
    Name
    ,Len(Name) LengthOfName
FROM Artist
```

|  | Name | LengthOfName |
|---|---|---|
| 1 | AC/DC | 5 |
| 2 | Accept | 6 |
| 3 | Aerosmith | 9 |
| 4 | Alanis Morissette | 17 |
| 5 | Alice In Chains | 15 |
| 6 | Antônio Carlos Jobim | 20 |
| 7 | Apocalyptica | 12 |
| 8 | Audioslave | 10 |
| 9 | BackBeat | 8 |
| 10 | Billy Cobham | 12 |
| 11 | Black Label Society | 19 |
| 12 | Black Sabbath | 13 |

The length or LEN function returns the length of a string. It takes a string parameter as its only input and returns an integer. While useful on its own, the length function is often used with other functions like substring where the starting position can vary.



## Ltrim() and Rtrim()

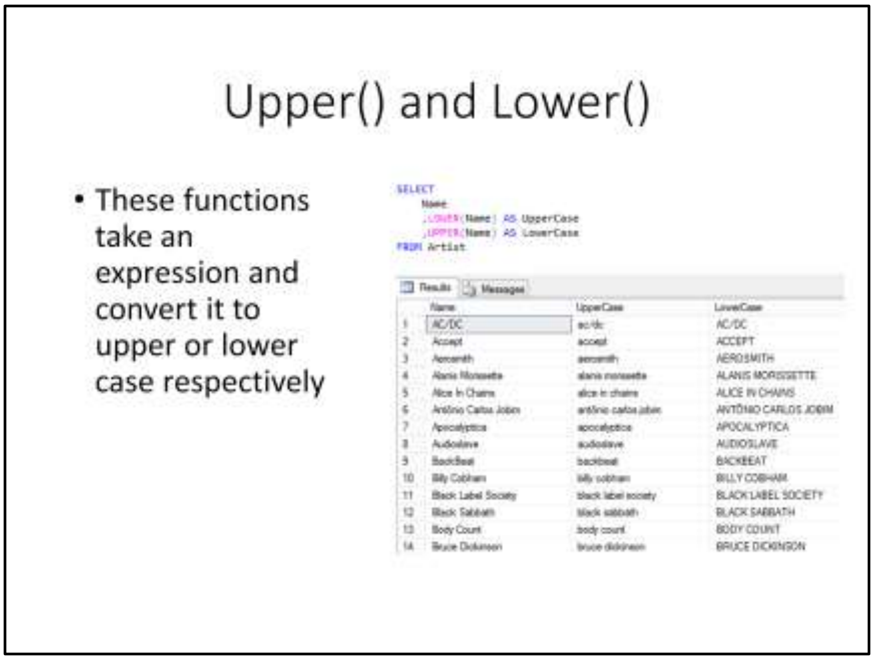
- LTrim and RTrim are functions used to trim leading or trailing spaces off of a character expression
- Char and Nchar datatypes will pad their values that don't fill the column length with trailing spaces

```
--I created a table variable to demonstrate the RTRIM function
--Focus on the SELECT statement for now
DECLARE @Person TABLE(FirstName char(15), LastName char(20))
INSERT INTO @Person
VALUES('Dave','Smith'),('Hilary','Thompson'),('George','Humphries')

SELECT
    FirstName
    ,LastName
    ,FirstName + LastName AS FullName
    ,RTRIM(FirstName) +' '+ LastName AS TrimmedName
FROM @Person
```

```
Results   Messages
     FirstName  LastName   FullName                  TrimmedName
1    Dave       Smith      Dave       Smith          Dave Smith
2    Hilary     Thompson   Hilary     Thompson       Hilary Thompson
3    George     Humphries  George     Humphries      George Humphries
```

The left trim and right trim functions are used to remove leading or trailing spaces from a string.  These extra spaces usually occur with fixed width datatypes such char and nchar.



## Upper() and Lower()

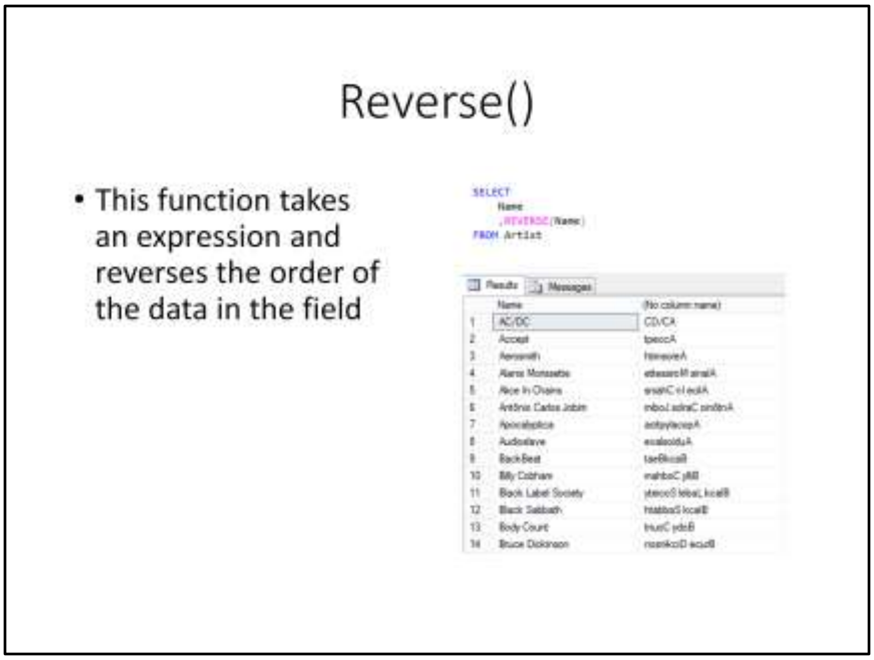
- These functions take an expression and convert it to upper or lower case respectively

```
SELECT
    Name
    ,LOWER(Name) AS UpperCase
    ,UPPER(Name) AS LowerCase
FROM Artist
```

Results | Messages

```
    Name                  UpperCase             LowerCase
1   AC/DC                 ac/dc                 AC/DC
2   Accept                accept                ACCEPT
3   Aerosmith             aerosmith             AEROSMITH
4   Alanis Morissette     alanis morissette     ALANIS MORISSETTE
5   Alice In Chains       alice in chains       ALICE IN CHAINS
6   Antônio Carlos Jobim  antônio carlos jobim  ANTÔNIO CARLOS JOBIM
7   Apocalyptica          apocalyptica          APOCALYPTICA
8   Audioslave            audioslave            AUDIOSLAVE
9   BackBeat              backbeat              BACKBEAT
10  Billy Cobham          billy cobham          BILLY COBHAM
11  Black Label Society   black label society   BLACK LABEL SOCIETY
12  Black Sabbath         black sabbath         BLACK SABBATH
13  Body Count            body count            BODY COUNT
14  Bruce Dickinson       bruce dickinson       BRUCE DICKINSON
```

The UPPER and LOWER functions are pretty straight forward.  They take a string expression and return it in uppercase or lowercase form.



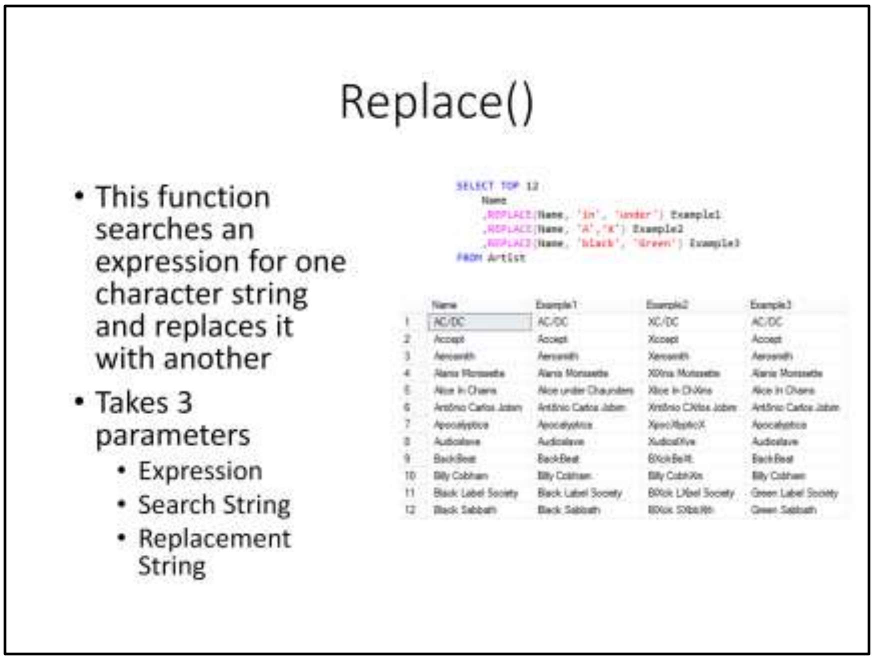
## Reverse()

- This function takes an expression and reverses the order of the data in the field

```
SELECT
    Name
    ,REVERSE(Name)
FROM Artist
```

```
    Name                    (No column name)
1   AC/DC                   CD/CA
2   Accept                  tpeccA
3   Aerosmith               htimsoreA
4   Alanis Morissette       ettessiroM sinalA
5   Alice In Chains         sniahC nI ecilA
6   Antônio Carlos Jobim    miboJ solraC oinôtnA
7   Apocalyptica            acitpylacopA
8   Audioslave              evalsoiduA
9   BackBeat                taeBkcaB
10  Billy Cobham            mahboC ylliB
11  Black Label Society     yteicoS lebaL kcalB
12  Black Sabbath           htabbaS kcalB
13  Body Count              tnuoC ydoB
14  Bruce Dickinson         nosnikciD ecurB
```

The REVERSE function takes a single string input and reverses the order of the string. This can be useful when applying other functions to characters at the end of a string.



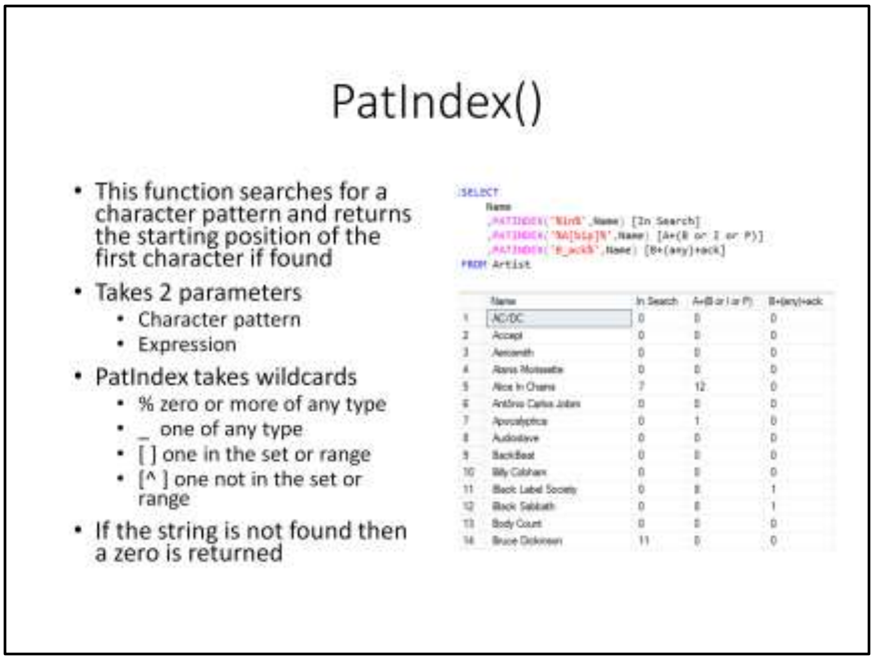
## Replace()

- This function searches an expression for one character string and replaces it with another
- Takes 3 parameters
  - Expression
  - Search String
  - Replacement String

```
SELECT TOP 12
    Name
    ,REPLACE(Name, 'in', 'under') Example1
    ,REPLACE(Name, 'A','X') Example2
    ,REPLACE(Name, 'black', 'Green') Example3
FROM Artist
```

| | Name | Example1 | Example2 | Example3 |
|---|---|---|---|---|
| 1 | AC/DC | AC/DC | XC/DC | AC/DC |
| 2 | Accept | Accept | Xccept | Accept |
| 3 | Aerosmith | Aerosmith | Xerosmith | Aerosmith |
| 4 | Alanis Morissette | Alanis Morissette | XlXnis Morissette | Alanis Morissette |
| 5 | Alice In Chains | Alice under Chaunders | Xlice In ChXins | Alice In Chains |
| 6 | Antônio Carlos Jobim | Antônio Carlos Jobim | Xntônio CXrlos Jobim | Antônio Carlos Jobim |
| 7 | Apocalyptica | Apocalyptica | XpocXlypticX | Apocalyptica |
| 8 | Audioslave | Audioslave | XudioslXve | Audioslave |
| 9 | BackBeat | BackBeat | BXckBeXt | BackBeat |
| 10 | Billy Cobham | Billy Cobham | Billy CobhXm | Billy Cobham |
| 11 | Black Label Society | Black Label Society | BlXck LXbel Society | Green Label Society |
| 12 | Black Sabbath | Black Sabbath | BlXck SXbbXth | Green Sabbath |

The replace function is used to search an expression for a certain character string and replace it with another character string. This is very similar to the find and replace tools in Microsoft Office. The function takes 3 parameters, the expression to search, the string to search for, and the string to replace. All found instances in an expression will be replaced.



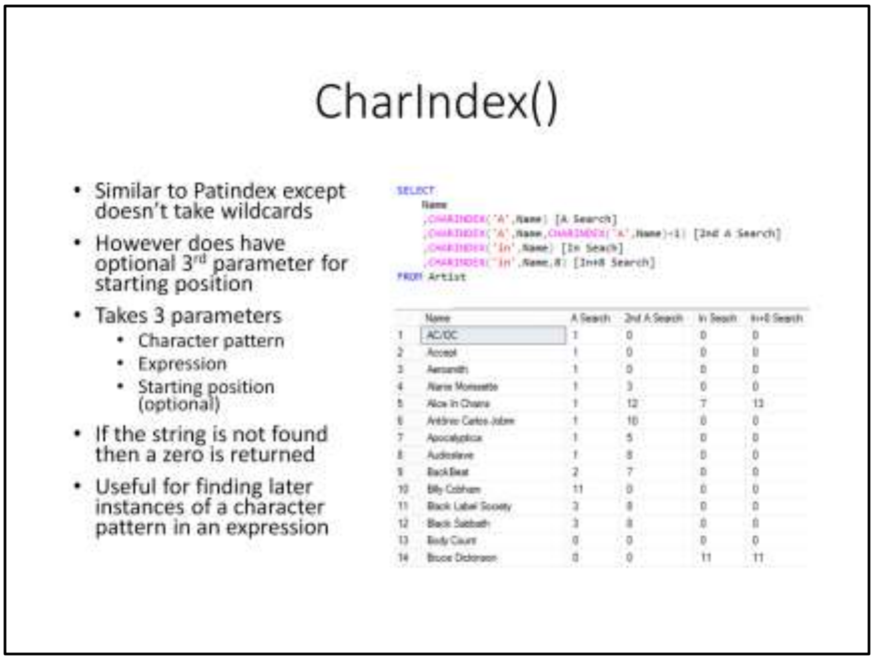
## PatIndex()

- This function searches for a character pattern and returns the starting position of the first character if found
- Takes 2 parameters
  - Character pattern
  - Expression
- PatIndex takes wildcards
  - % zero or more of any type
  - _ one of any type
  - [ ] one in the set or range
  - [^ ] one not in the set or range
- If the string is not found then a zero is returned

```
SELECT
    Name
    ,PATINDEX('%in%',Name) [In Search]
    ,PATINDEX('%A[bip]%',Name) [A+(B or I or P)]
    ,PATINDEX('B_ack%',Name) [B+(any)+ack]
FROM Artist
```

| | Name | In Search | A+(B or I or P) | B+(any)+ack |
|---|---|---|---|---|
| 1 | AC/DC | 0 | 0 | 0 |
| 2 | Accept | 0 | 0 | 0 |
| 3 | Aerosmith | 0 | 0 | 0 |
| 4 | Alanis Morissette | 0 | 0 | 0 |
| 5 | Alice In Chains | 7 | 12 | 0 |
| 6 | Antônio Carlos Jobim | 0 | 0 | 0 |
| 7 | Apocalyptica | 0 | 1 | 0 |
| 8 | Audioslave | 0 | 0 | 0 |
| 9 | BackBeat | 0 | 0 | 0 |
| 10 | Billy Cobham | 0 | 0 | 0 |
| 11 | Black Label Society | 0 | 0 | 1 |
| 12 | Black Sabbath | 0 | 0 | 1 |
| 13 | Body Count | 0 | 0 | 0 |
| 14 | Bruce Dickinson | 11 | 0 | 0 |

The PATINDEX function searches an expression for a character string pattern and returns the starting position for the first found instance of that expression. PATINDEX takes 2 parameters, the character pattern to search for, and the expression to search on. You can use wildcard characters in the character pattern. These are the same wildcards allowable in a LIKE clause. If no matches are found then a zero is returned.



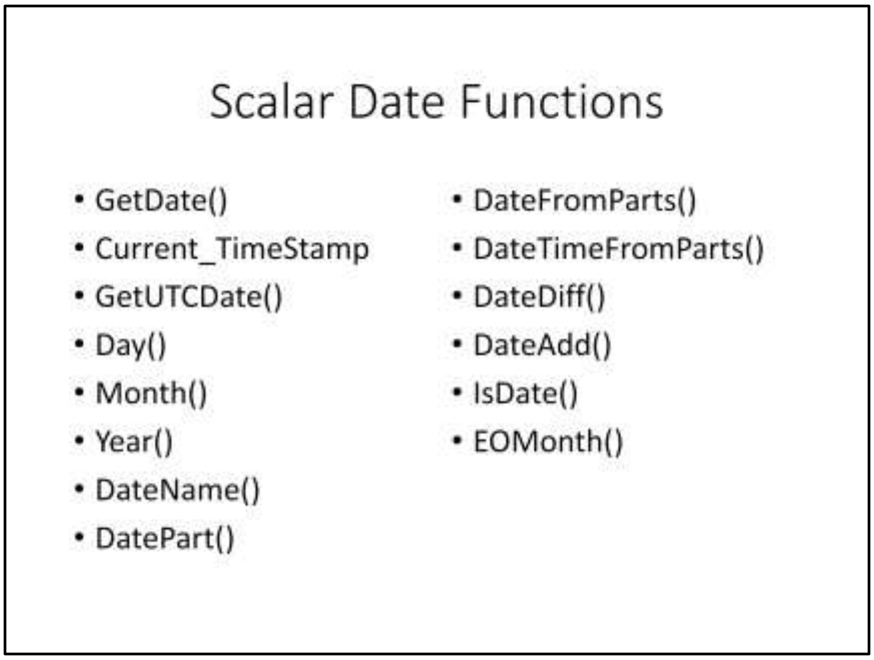
## CharIndex()

- Similar to Patindex except doesn't take wildcards
- However does have optional 3rd parameter for starting position
- Takes 3 parameters
  - Character pattern
  - Expression
  - Starting position (optional)
- If the string is not found then a zero is returned
- Useful for finding later instances of a character pattern in an expression

```sql
SELECT
    Name
    ,CHARINDEX('A',Name) [A Search]
    ,CHARINDEX('A',Name,CHARINDEX('A',Name)+1) [2nd A Search]
    ,CHARINDEX('In',Name) [In Seach]
    ,CHARINDEX('In',Name,8) [In+8 Search]
FROM Artist
```

| | Name | A Search | 2nd A Search | In Seach | In+8 Search |
|---|---|---|---|---|---|
| 1 | AC/DC | 1 | 0 | 0 | 0 |
| 2 | Accept | 1 | 0 | 0 | 0 |
| 3 | Aerosmith | 1 | 0 | 0 | 0 |
| 4 | Alanis Morissette | 1 | 3 | 0 | 0 |
| 5 | Alice In Chains | 1 | 12 | 7 | 13 |
| 6 | Antônio Carlos Jobim | 1 | 10 | 0 | 0 |
| 7 | Apocalyptica | 1 | 5 | 0 | 0 |
| 8 | Audioslave | 1 | 8 | 0 | 0 |
| 9 | BackBeat | 2 | 7 | 0 | 0 |
| 10 | Billy Cobham | 11 | 0 | 0 | 0 |
| 11 | Black Label Society | 3 | 8 | 0 | 0 |
| 12 | Black Sabbath | 3 | 8 | 0 | 0 |
| 13 | Body Count | 0 | 0 | 0 | 0 |
| 14 | Bruce Dickinson | 0 | 0 | 11 | 11 |

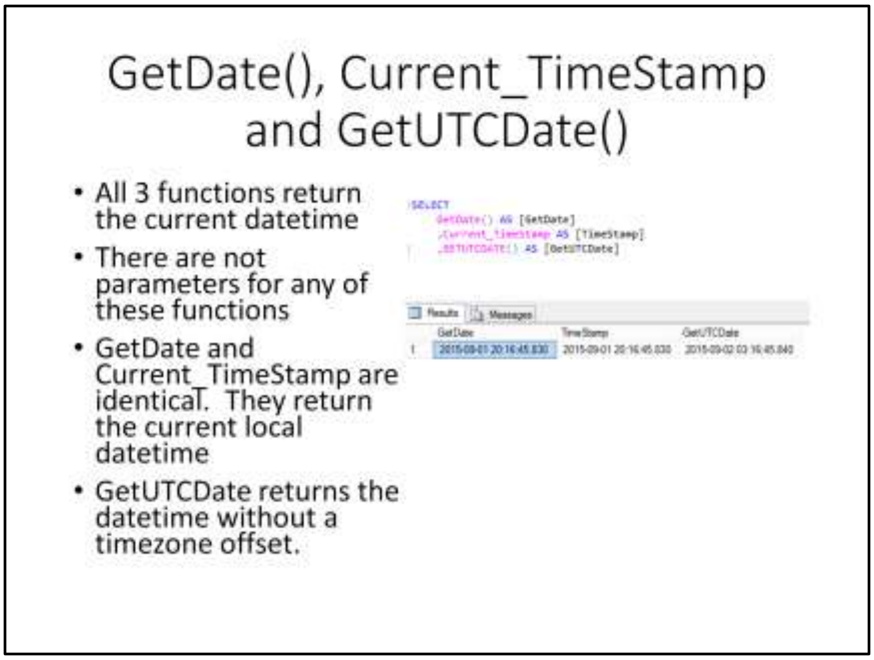
The CHARINDEX function is similar to PATINDEX function but with a couple of differences. First CHARINDEX does not allow wildcards in the search pattern. Second CHARINDEX has an optional 3rd parameter. You can enter an integer for the 3rd parameter to specify the starting position in the expression.



## Scalar Date Functions

- GetDate()
- Current_TimeStamp
- GetUTCDate()
- Day()
- Month()
- Year()
- DateName()
- DatePart()
- DateFromParts()
- DateTimeFromParts()
- DateDiff()
- DateAdd()
- IsDate()
- EOMonth()

Date functions are used to manipulate date and datetime data.  There are quite a few date functions I will discuss, but this is not an exhaustive list.



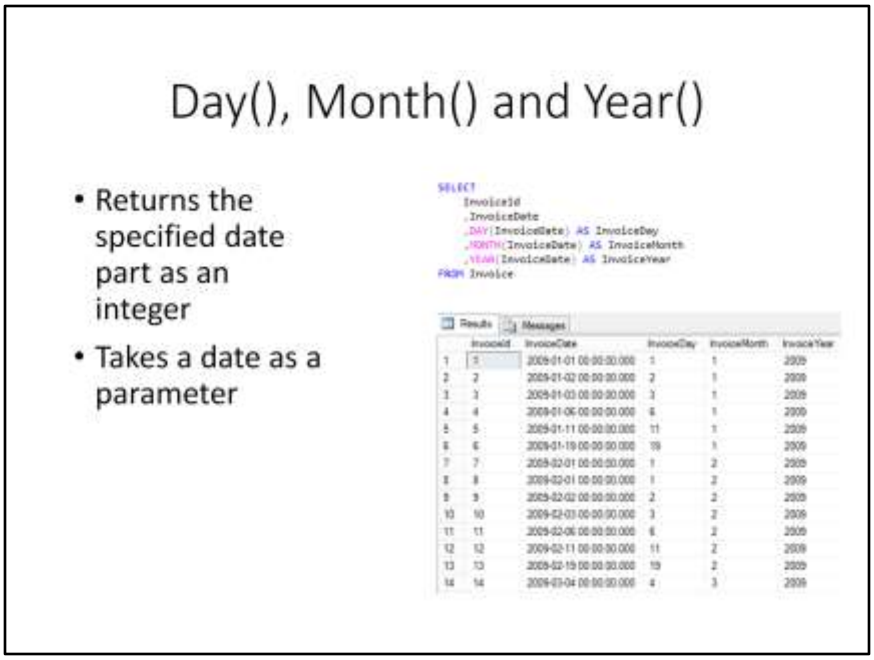
## GetDate(), Current_TimeStamp and GetUTCDate()

- All 3 functions return the current datetime
- There are not parameters for any of these functions
- GetDate and Current_TimeStamp are identical. They return the current local datetime
- GetUTCDate returns the datetime without a timezone offset.

```
SELECT
    GetDate() AS [GetDate]
    ,Current_timeStamp AS [TimeStamp]
    ,GETUTCDATE() AS [GetUTCDate]
```

```
   GetDate                  TimeStamp                GetUTCDate
1  2015-09-01 20:16:45.830  2015-09-01 20:16:45.830  2015-09-02 03:16:45.840
```

The GETDATE, CURRENT_TIMESTAMP and GETUTCDATE all return the current date and time at the time the query executed. GETDATE and CURRENT_TIMESTAMP are identical. They both return the current local date and time. For example my SQL Server is in the Pacific time zone so that is the time returned. GETUTCDATE on the other hand returns the Coordinated Universal Time formerly known as Greenwich Mean Time. None of these functions take any parameters.



## Day(), Month() and Year()

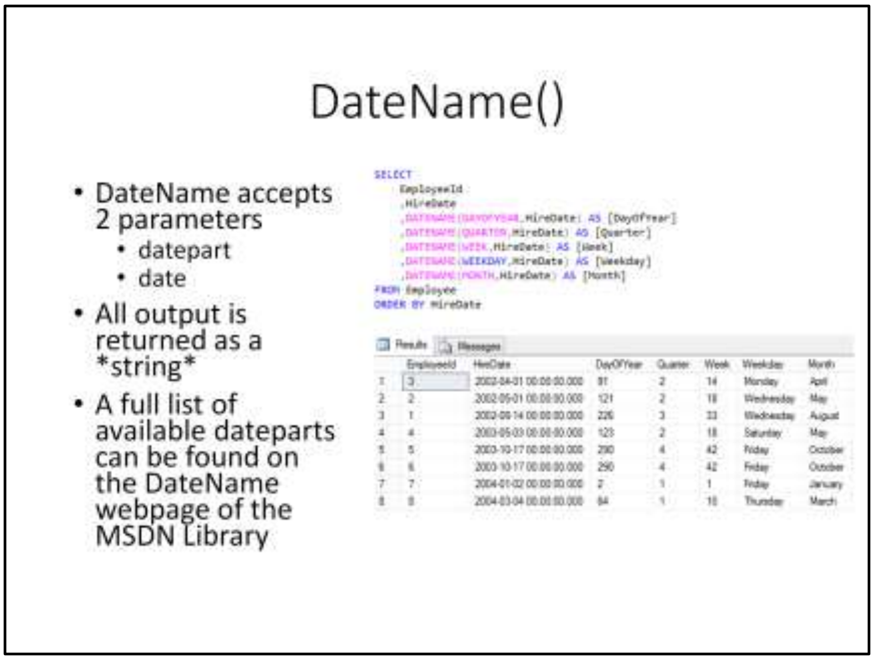
- Returns the specified date part as an integer
- Takes a date as a parameter

```
SELECT
    InvoiceId
    ,InvoiceDate
    ,DAY(InvoiceDate) AS InvoiceDay
    ,MONTH(InvoiceDate) AS InvoiceMonth
    ,YEAR(InvoiceDate) AS InvoiceYear
FROM Invoice
```

Results | Messages

| | InvoiceId | InvoiceDate | InvoiceDay | InvoiceMonth | InvoiceYear |
|---|---|---|---|---|---|
| 1 | 1 | 2009-01-01 00:00:00.000 | 1 | 1 | 2009 |
| 2 | 2 | 2009-01-02 00:00:00.000 | 2 | 1 | 2009 |
| 3 | 3 | 2009-01-03 00:00:00.000 | 3 | 1 | 2009 |
| 4 | 4 | 2009-01-06 00:00:00.000 | 6 | 1 | 2009 |
| 5 | 5 | 2009-01-11 00:00:00.000 | 11 | 1 | 2009 |
| 6 | 6 | 2009-01-19 00:00:00.000 | 19 | 1 | 2009 |
| 7 | 7 | 2009-02-01 00:00:00.000 | 1 | 2 | 2009 |
| 8 | 8 | 2009-02-01 00:00:00.000 | 1 | 2 | 2009 |
| 9 | 9 | 2009-02-02 00:00:00.000 | 2 | 2 | 2009 |
| 10 | 10 | 2009-02-03 00:00:00.000 | 3 | 2 | 2009 |
| 11 | 11 | 2009-02-06 00:00:00.000 | 6 | 2 | 2009 |
| 12 | 12 | 2009-02-11 00:00:00.000 | 11 | 2 | 2009 |
| 13 | 13 | 2009-02-19 00:00:00.000 | 19 | 2 | 2009 |
| 14 | 14 | 2009-03-04 00:00:00.000 | 4 | 3 | 2009 |

The DAY, MONTH and YEAR functions take a date as a parameter and returns only that specified component of the date. In the example all the invoice dates occurred in 2009 so the YEAR function returns just 2009 as an integer.



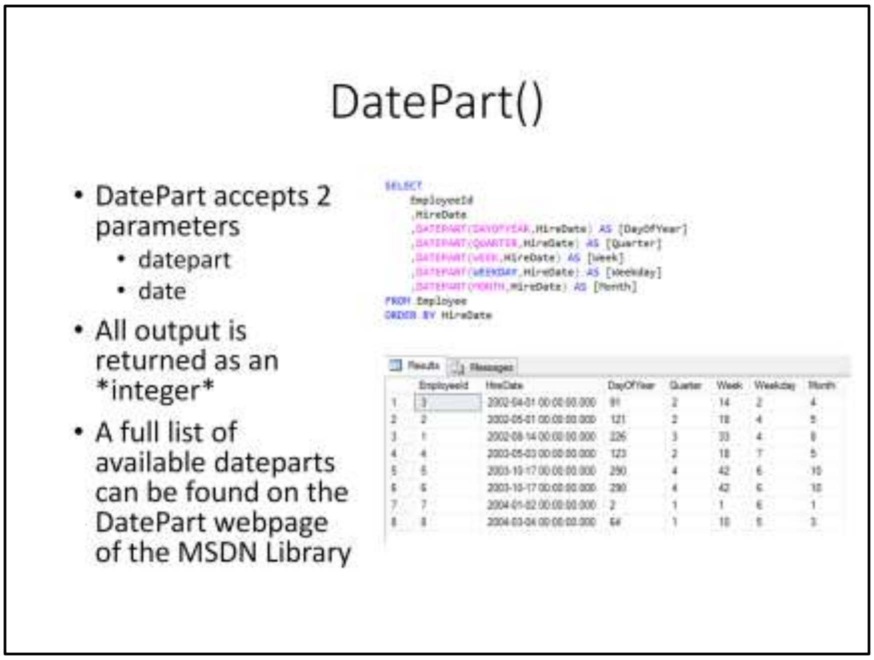
## DateName()

- DateName accepts 2 parameters
  - datepart
  - date
- All output is returned as a *string*
- A full list of available dateparts can be found on the DateName webpage of the MSDN Library

```sql
SELECT
    EmployeeId
    ,HireDate
    ,DATENAME(DAYOFYEAR,HireDate) AS [DayOfYear]
    ,DATENAME(QUARTER,HireDate) AS [Quarter]
    ,DATENAME(WEEK,HireDate) AS [Week]
    ,DATENAME(WEEKDAY,HireDate) AS [Weekday]
    ,DATENAME(MONTH,HireDate) AS [Month]
FROM Employee
ORDER BY HireDate
```

```
     EmployeeId  HireDate                 DayOfYear  Quarter  Week  Weekday    Month
1    3           2002-04-01 00:00:00.000  91         2        14    Monday     April
2    2           2002-05-01 00:00:00.000  121        2        18    Wednesday  May
3    1           2002-08-14 00:00:00.000  226        3        33    Wednesday  August
4    4           2003-05-03 00:00:00.000  123        2        18    Saturday   May
5    5           2003-10-17 00:00:00.000  290        4        42    Friday     October
6    6           2003-10-17 00:00:00.000  290        4        42    Friday     October
7    7           2004-01-02 00:00:00.000  2          1        1     Friday     January
8    8           2004-03-04 00:00:00.000  64         1        10    Thursday   March
```

The DATENAME function is used to return a specified part of a date as a string. The function takes 2 parameters, the first is the datepart to return and the second is the date itself. There are quite a few options to select from for the datepart parameter including weekday, month, quarter and week. Where possible datename will spell out the name of the datepart and all results are returned as a string.



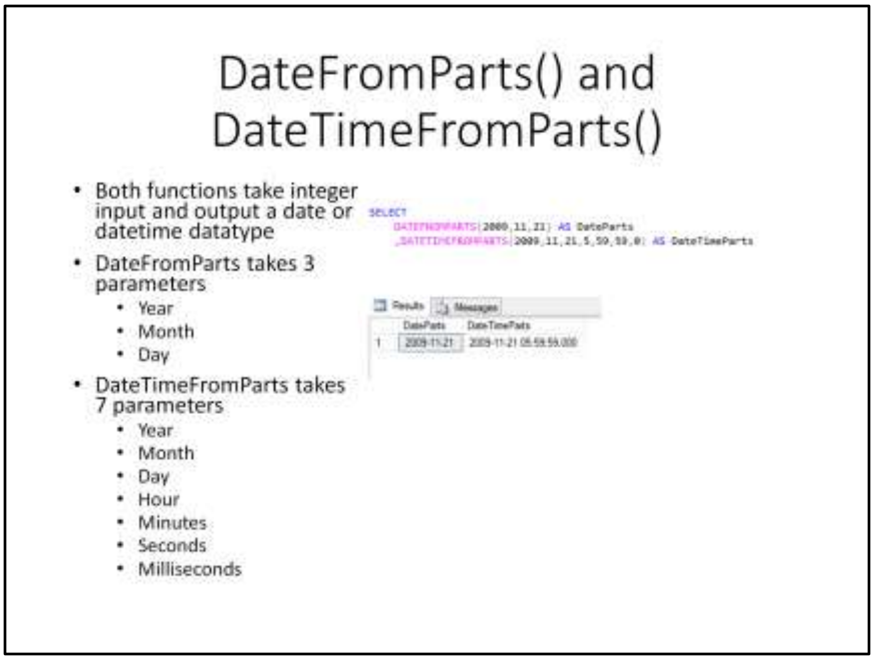
## DatePart()

- DatePart accepts 2 parameters
  - datepart
  - date
- All output is returned as an *integer*
- A full list of available dateparts can be found on the DatePart webpage of the MSDN Library

```
SELECT
    EmployeeId
    ,HireDate
    ,DATEPART(DAYOFYEAR,HireDate) AS [DayOfYear]
    ,DATEPART(QUARTER,HireDate) AS [Quarter]
    ,DATEPART(WEEK,HireDate) AS [Week]
    ,DATEPART(WEEKDAY,HireDate) AS [Weekday]
    ,DATEPART(MONTH,HireDate) AS [Month]
FROM Employee
ORDER BY HireDate
```

```
   EmployeeId  HireDate                 DayOfYear  Quarter  Week  Weekday  Month
1  3           2002-04-01 00:00:00.000  91         2        14    2        4
2  2           2002-05-01 00:00:00.000  121        2        18    4        5
3  1           2002-08-14 00:00:00.000  226        3        33    4        8
4  4           2003-05-03 00:00:00.000  123        2        18    7        5
5  5           2003-10-17 00:00:00.000  290        4        42    6        10
6  6           2003-10-17 00:00:00.000  290        4        42    6        10
7  7           2004-01-02 00:00:00.000  2          1        1     6        1
8  8           2004-03-04 00:00:00.000  64         1        10    5        3
```

The DATEPART function is very similar to DATENAME. It takes the same number of parameters and returns similar results. The only difference being that all output is returned as an integer. A full list of datepart options can be found in the Microsoft MSDN library.



## DateFromParts() and DateTimeFromParts()

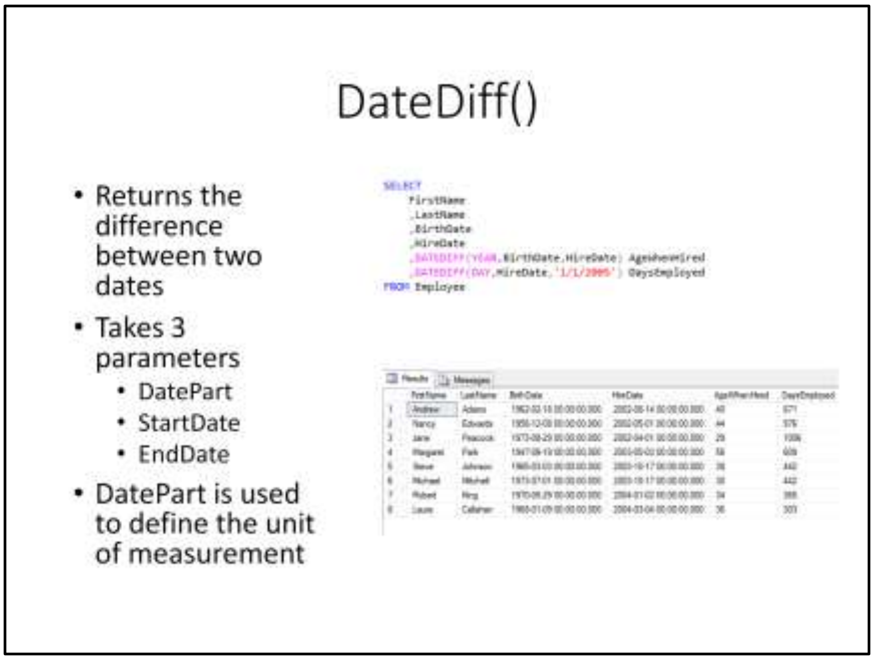
- Both functions take integer input and output a date or datetime datatype
- DateFromParts takes 3 parameters
  - Year
  - Month
  - Day
- DateTimeFromParts takes 7 parameters
  - Year
  - Month
  - Day
  - Hour
  - Minutes
  - Seconds
  - Milliseconds

```
SELECT
     DATEFROMPARTS(2009,11,21) AS DateParts
     ,DATETIMEFROMPARTS(2009,11,21,5,59,59,0) AS DateTimeParts
```

Results
Messages

```
   DateParts    DateTimeParts
1  2009-11-21   2009-11-21 05:59:59.000
```

DATEFROMPARTS and DATETIMEFROMPARTS are two functions that take integers in the form of date parts and outputs a full date or datetime datatype. DATEFROMPARTS takes the year, month and day as parameters while DATETIMEFROMPARTS takes an additional 4 parameters for hours, minutes, seconds, and milliseconds.



## DateDiff()

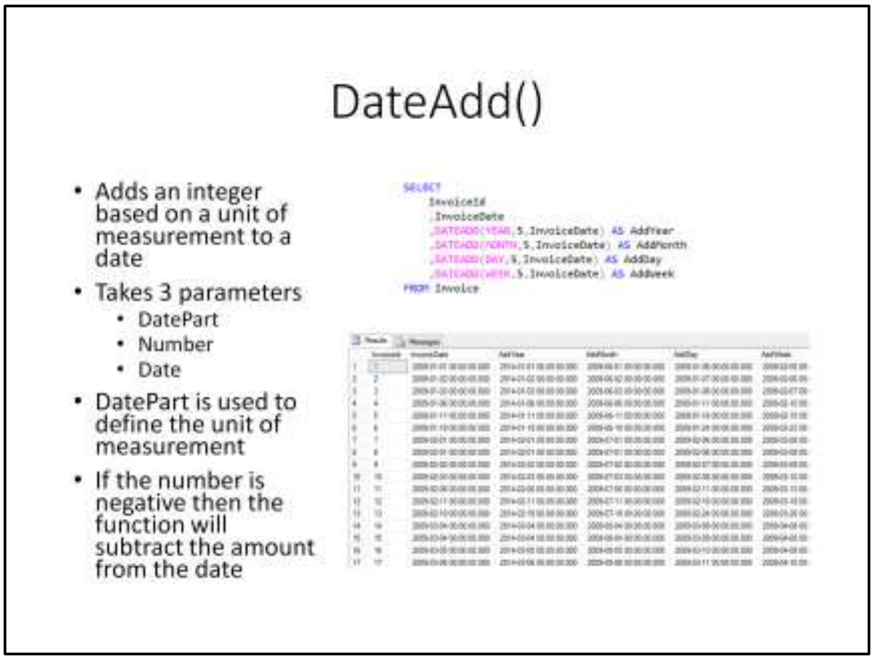
- Returns the difference between two dates
- Takes 3 parameters
  - DatePart
  - StartDate
  - EndDate
- DatePart is used to define the unit of measurement

```
SELECT
    FirstName
    ,LastName
    ,BirthDate
    ,HireDate
    ,DATEDIFF(YEAR,BirthDate,HireDate) AgeWhenHired
    ,DATEDIFF(DAY,HireDate,'1/1/2005') DaysEmployed
FROM Employee
```

Results | Messages

| | FirstName | LastName | BirthDate | HireDate | AgeWhenHired | DaysEmployed |
|---|---|---|---|---|---|---|
| 1 | Andrew | Adams | 1962-02-18 00:00:00.000 | 2002-08-14 00:00:00.000 | 40 | 871 |
| 2 | Nancy | Edwards | 1958-12-08 00:00:00.000 | 2002-05-01 00:00:00.000 | 44 | 976 |
| 3 | Jane | Peacock | 1973-08-29 00:00:00.000 | 2002-04-01 00:00:00.000 | 29 | 1006 |
| 4 | Margaret | Park | 1947-09-19 00:00:00.000 | 2003-05-03 00:00:00.000 | 56 | 609 |
| 5 | Steve | Johnson | 1965-03-03 00:00:00.000 | 2003-10-17 00:00:00.000 | 38 | 442 |
| 6 | Michael | Mitchell | 1973-07-01 00:00:00.000 | 2003-10-17 00:00:00.000 | 30 | 442 |
| 7 | Robert | King | 1970-05-29 00:00:00.000 | 2004-01-02 00:00:00.000 | 34 | 365 |
| 8 | Laura | Callahan | 1968-01-09 00:00:00.000 | 2004-03-04 00:00:00.000 | 36 | 303 |

The date difference or DATEDIFF function returns the difference between 2 dates base on the specified unit on measurement.  It takes 3 parameters, first is the unit of measurement such as day or year, second is the startdate, and third is the enddate.



## DateAdd()

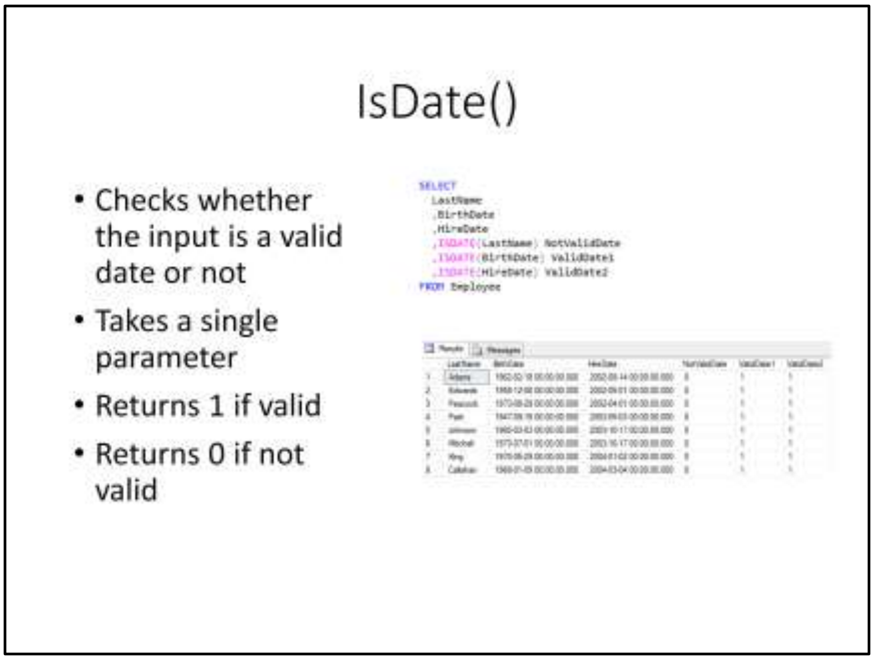
- Adds an integer based on a unit of measurement to a date
- Takes 3 parameters
  - DatePart
  - Number
  - Date
- DatePart is used to define the unit of measurement
- If the number is negative then the function will subtract the amount from the date

```sql
SELECT
    InvoiceId
    ,InvoiceDate
    ,DATEADD(YEAR,5,InvoiceDate) AS AddYear
    ,DATEADD(MONTH,5,InvoiceDate) AS AddMonth
    ,DATEADD(DAY,5,InvoiceDate) AS AddDay
    ,DATEADD(WEEK,5,InvoiceDate) AS AddWeek
FROM Invoice
```

Results | Messages

|  | InvoiceId | InvoiceDate | AddYear | AddMonth | AddDay | AddWeek |
|---|---|---|---|---|---|---|
| 1 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 2 | 2 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 3 | 3 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 4 | 4 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 5 | 5 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 6 | 6 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 7 | 7 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 8 | 8 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 9 | 9 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 10 | 10 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 11 | 11 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 12 | 12 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 13 | 13 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 14 | 14 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 15 | 15 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 16 | 16 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 17 | 17 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

DATEADD is a function used to add a specified quantity of a unit of measurement to a date. The function takes 3 parameters. The first is the unit of measurement, the second is the number or quantity as an integer, and the third is the date being added to. There isn't a date subtraction equivalent. Instead you can use DATEADD with a negative number to subtract from the date.



## IsDate()

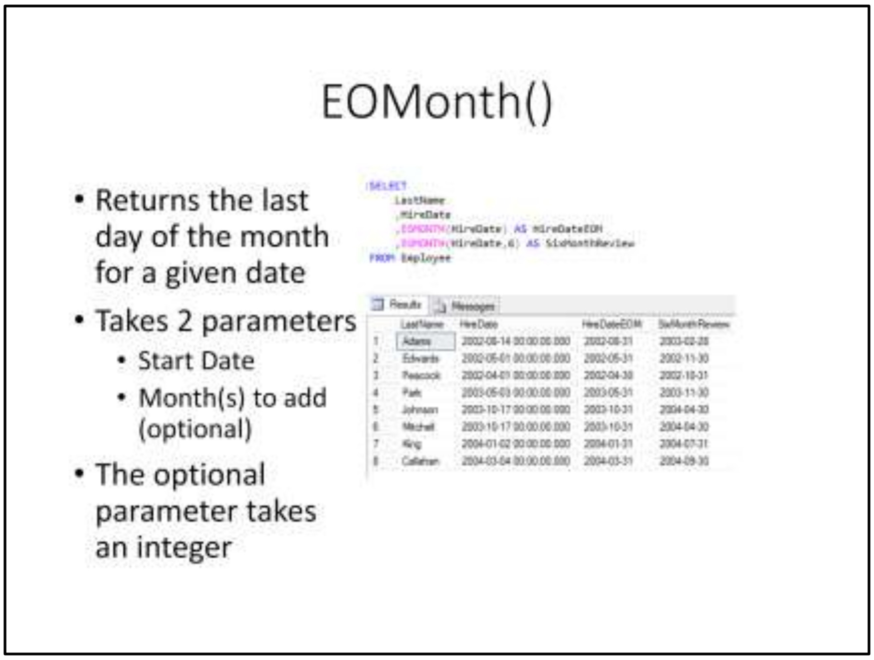
- Checks whether the input is a valid date or not
- Takes a single parameter
- Returns 1 if valid
- Returns 0 if not valid

```
SELECT
  LastName
  ,BirthDate
  ,HireDate
  ,ISDATE(LastName) NotValidDate
  ,ISDATE(BirthDate) ValidDate1
  ,ISDATE(HireDate) ValidDate2
FROM Employee
```

Results | Messages

```
   LastName  BirthDate                HireDate                 NotValidDate  ValidDate1  ValidDate2
1  Adams     1962-02-18 00:00:00.000  2002-08-14 00:00:00.000  0             1           1
2  Edwards   1958-12-08 00:00:00.000  2002-05-01 00:00:00.000  0             1           1
3  Peacock   1973-08-29 00:00:00.000  2002-04-01 00:00:00.000  0             1           1
4  Park      1947-09-19 00:00:00.000  2003-05-03 00:00:00.000  0             1           1
5  Johnson   1965-03-03 00:00:00.000  2003-10-17 00:00:00.000  0             1           1
6  Mitchell  1973-07-01 00:00:00.000  2003-10-17 00:00:00.000  0             1           1
7  King      1970-05-29 00:00:00.000  2004-01-02 00:00:00.000  0             1           1
8  Callahan  1968-01-09 00:00:00.000  2004-03-04 00:00:00.000  0             1           1
```

The ISDATE function is used to check whether a string is a valid date or not. If valid the functions output will equal 1, otherwise the output will equal 0. ISDATE is useful for filtering out bad dates in a text field.



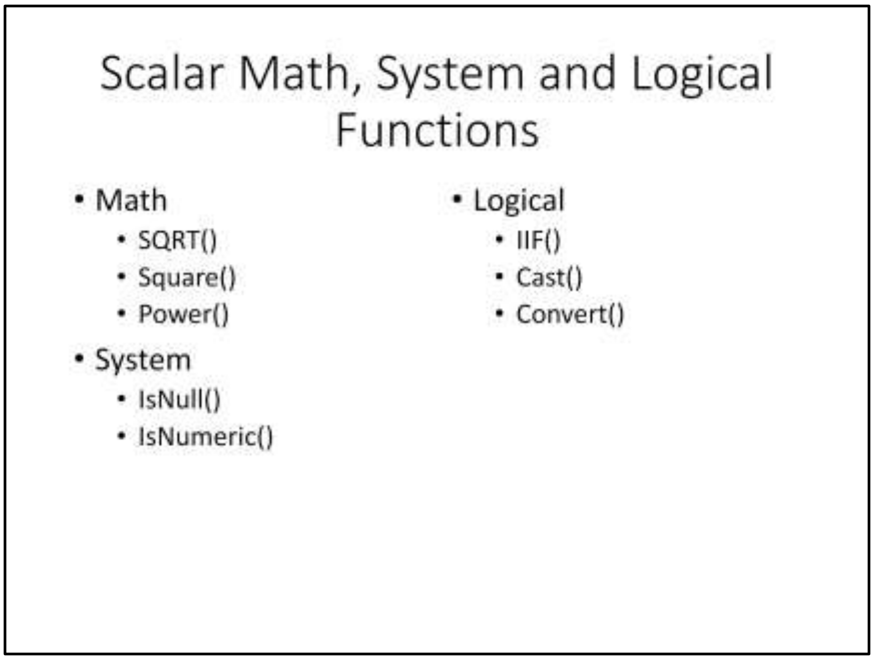
## EOMonth()

- Returns the last day of the month for a given date
- Takes 2 parameters
  - Start Date
  - Month(s) to add (optional)
- The optional parameter takes an integer

```
SELECT
    LastName
    ,HireDate
    ,EOMONTH(HireDate) AS HireDateEOM
    ,EOMONTH(HireDate,6) AS SixMonthReview
FROM Employee
```

```
   LastName   HireDate                  HireDateEOM   SixMonthReview
1  Adams      2002-08-14 00:00:00.000   2002-08-31    2003-02-28
2  Edwards    2002-05-01 00:00:00.000   2002-05-31    2002-11-30
3  Peacock    2002-04-01 00:00:00.000   2002-04-30    2002-10-31
4  Park       2003-05-03 00:00:00.000   2003-05-31    2003-11-30
5  Johnson    2003-10-17 00:00:00.000   2003-10-31    2004-04-30
6  Mitchell   2003-10-17 00:00:00.000   2003-10-31    2004-04-30
7  King       2004-01-02 00:00:00.000   2004-01-31    2004-07-31
8  Callahan   2004-03-04 00:00:00.000   2004-03-31    2004-09-30
```

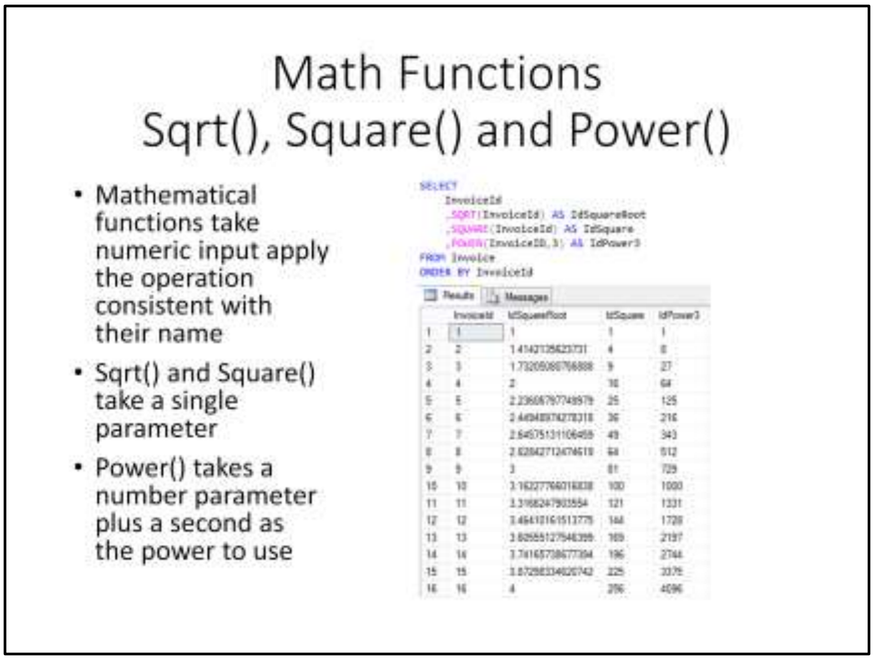
The end of month or EOMONTH function takes a date and returns the last day of the month for that given date.  The first parameter is the date to search against.  The second parameter is optional and allows the user to specify a certain number of months to add to the start date.  This function is useful when you want to find the last day of a month dynamically.



## Scalar Math, System and Logical Functions

- Math
  - SQRT()
  - Square()
  - Power()
- System
  - IsNull()
  - IsNumeric()
- Logical
  - IIF()
  - Cast()
  - Convert()

The rest of this presentation will cover some of the scalar function types in math, systems and logic. As stated previously this is not an exhaustive list. Go to Microsoft's online MSDN library to view all available built in functions.



## Math Functions
## Sqrt(), Square() and Power()

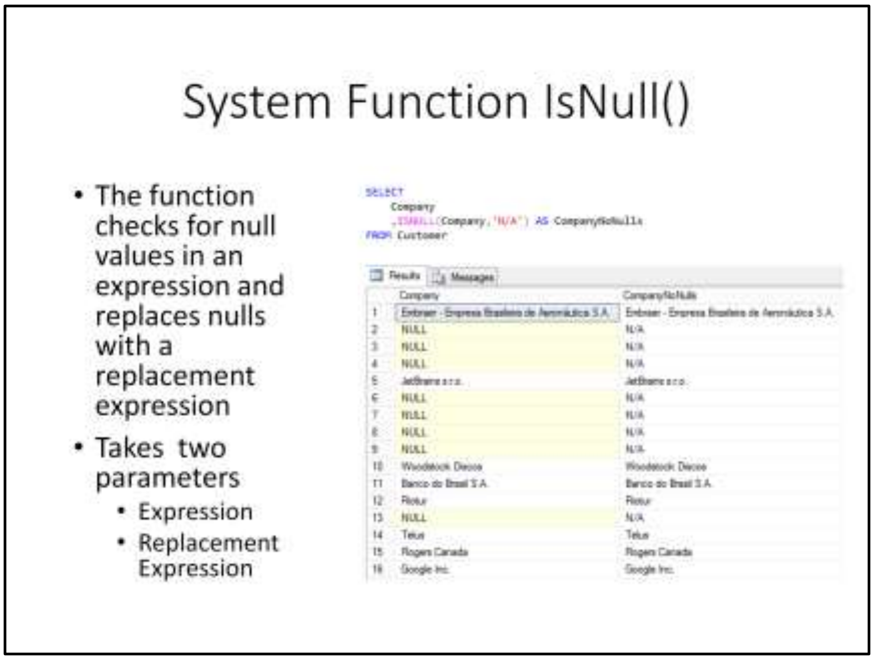
- Mathematical functions take numeric input apply the operation consistent with their name
- Sqrt() and Square() take a single parameter
- Power() takes a number parameter plus a second as the power to use

```
SELECT
    InvoiceId
    ,SQRT(InvoiceId) AS IdSquareRoot
    ,SQUARE(InvoiceId) AS IdSquare
    ,POWER(InvoiceID,3) AS IdPower3
FROM Invoice
ORDER BY InvoiceId
```

Results | Messages

|  | InvoiceId | IdSquareRoot | IdSquare | IdPower3 |
|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 1.4142135623731 | 4 | 8 |
| 3 | 3 | 1.73205080756888 | 9 | 27 |
| 4 | 4 | 2 | 16 | 64 |
| 5 | 5 | 2.23606797749979 | 25 | 125 |
| 6 | 6 | 2.44948974278318 | 36 | 216 |
| 7 | 7 | 2.64575131106459 | 49 | 343 |
| 8 | 8 | 2.82842712474619 | 64 | 512 |
| 9 | 9 | 3 | 81 | 729 |
| 10 | 10 | 3.16227766016838 | 100 | 1000 |
| 11 | 11 | 3.3166247903554 | 121 | 1331 |
| 12 | 12 | 3.46410161513775 | 144 | 1728 |
| 13 | 13 | 3.60555127546399 | 169 | 2197 |
| 14 | 14 | 3.74165738677394 | 196 | 2744 |
| 15 | 15 | 3.87298334620742 | 225 | 3375 |
| 16 | 16 | 4 | 256 | 4096 |

The math functions are pretty straight forward in that they take a number and apply their specified math operator to that number.  Most math expressions take a single parameter, but there are some like the POWER function that require additional input.



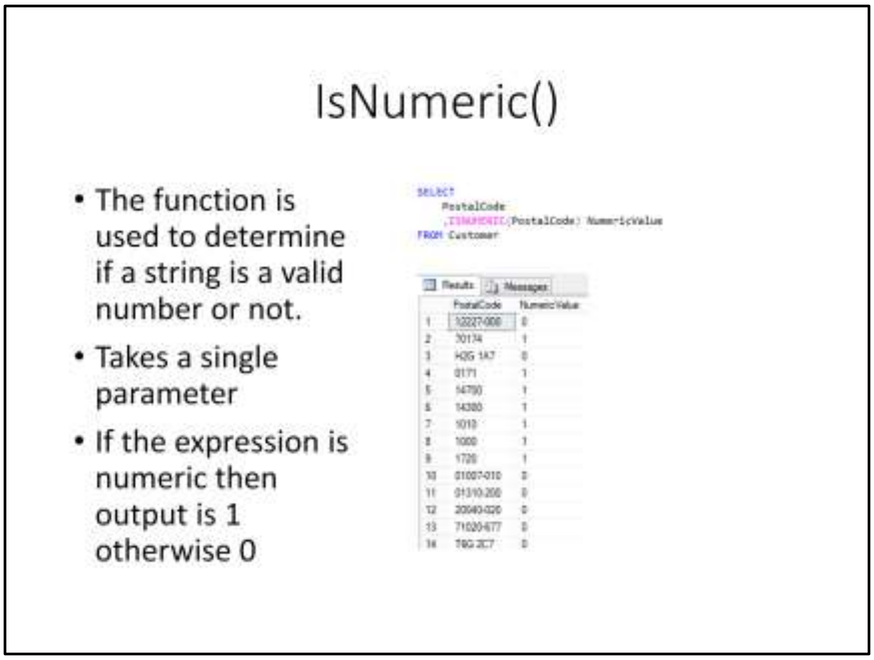
## System Function IsNull()

- The function checks for null values in an expression and replaces nulls with a replacement expression
- Takes two parameters
  - Expression
  - Replacement Expression

```
SELECT
    Company
    ,ISNULL(Company,'N/A') AS CompanyNoNulls
FROM Customer
```

| | Company | CompanyNoNulls |
|---|---|---|
| 1 | Embraer - Empresa Brasileira de Aeronáutica S.A. | Embraer - Empresa Brasileira de Aeronáutica S.A. |
| 2 | NULL | N/A |
| 3 | NULL | N/A |
| 4 | NULL | N/A |
| 5 | JetBrains s.r.o. | JetBrains s.r.o. |
| 6 | NULL | N/A |
| 7 | NULL | N/A |
| 8 | NULL | N/A |
| 9 | NULL | N/A |
| 10 | Woodstock Discos | Woodstock Discos |
| 11 | Banco do Brasil S.A. | Banco do Brasil S.A. |
| 12 | Riotur | Riotur |
| 13 | NULL | N/A |
| 14 | Telus | Telus |
| 15 | Rogers Canada | Rogers Canada |
| 16 | Google Inc. | Google Inc. |

The ISNULL function is used to search for null values in an expression. When it finds a null then it replaces the null with a second specified value. This function takes two parameters. The first is the expression to search against and the second is the replacement expression to use when a null value is found.



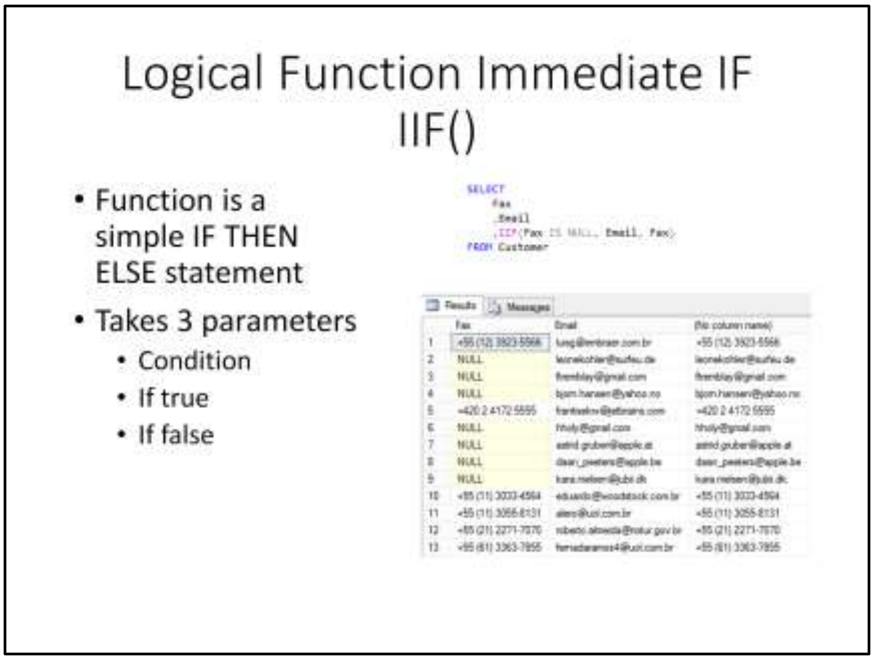
## IsNumeric()

- The function is used to determine if a string is a valid number or not.
- Takes a single parameter
- If the expression is numeric then output is 1 otherwise 0

```
SELECT
    PostalCode
    ,ISNUMERIC(PostalCode) NumericValue
FROM Customer
```

```
Results | Messages
    PostalCode   NumericValue
1   12227-000    0
2   70174        1
3   H2G 1A7      0
4   0171         1
5   14750        1
6   14380        1
7   1010         1
8   1000         1
9   1720         1
10  01007-010    0
11  01310-200    0
12  20040-020    0
13  71020-677    0
14  T8G 2C7      0
```

The ISNUMERIC function is used to determine whether an expression is a valid number or not. If the expression is numeric then the function will return the number one as output. If the expression is not numeric then a zero is returned.



## Logical Function Immediate IF IIF()

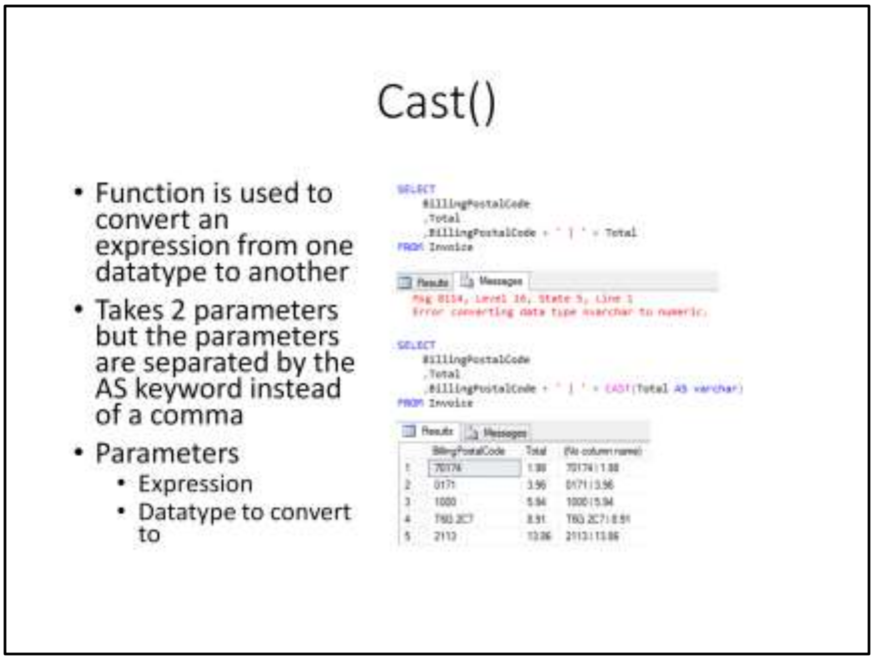
- Function is a simple IF THEN ELSE statement
- Takes 3 parameters
  - Condition
  - If true
  - If false

```
SELECT
    Fax
    ,Email
    ,IIF(Fax IS NULL, Email, Fax)
FROM Customer
```

Results | Messages

| | Fax | Email | (No column name) |
|---|---|---|---|
| 1 | +55 (12) 3923-5566 | luisg@embraer.com.br | +55 (12) 3923-5566 |
| 2 | NULL | leonekohler@surfeu.de | leonekohler@surfeu.de |
| 3 | NULL | ftremblay@gmail.com | ftremblay@gmail.com |
| 4 | NULL | bjorn.hansen@yahoo.no | bjorn.hansen@yahoo.no |
| 5 | +420 2 4172 5555 | frantisekw@jetbrains.com | +420 2 4172 5555 |
| 6 | NULL | hholy@gmail.com | hholy@gmail.com |
| 7 | NULL | astrid.gruber@apple.at | astrid.gruber@apple.at |
| 8 | NULL | daan_peeters@apple.be | daan_peeters@apple.be |
| 9 | NULL | kara.nielsen@jubii.dk | kara.nielsen@jubii.dk |
| 10 | +55 (11) 3033-4564 | eduardo@woodstock.com.br | +55 (11) 3033-4564 |
| 11 | +55 (11) 3055-8131 | alero@uol.com.br | +55 (11) 3055-8131 |
| 12 | +55 (21) 2271-7070 | roberto.almeida@riotur.gov.br | +55 (21) 2271-7070 |
| 13 | +55 (61) 3363-7855 | fernadaramos4@uol.com.br | +55 (61) 3363-7855 |

The immediate if or IIF function is an abbreviated if then else statement. It takes 3 parameters. The first parameter is a condition to check against. The second parameter is the result to return if the condition resolves to true. The third parameter is the result to return if the condition resolves to false. In the example I am checking the Fax column for Null values. If I find a null then the email is returned. Otherwise the fax number is returned.



## Cast()

- Function is used to convert an expression from one datatype to another
- Takes 2 parameters but the parameters are separated by the AS keyword instead of a comma
- Parameters
  - Expression
  - Datatype to convert to

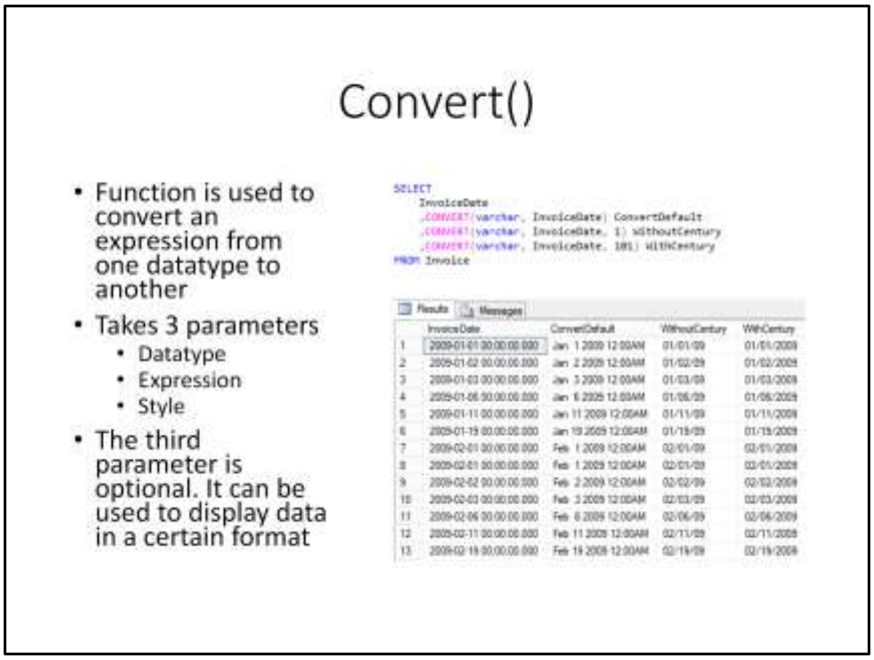
```
SELECT
    BillingPostalCode
    ,Total
    ,BillingPostalCode + ' | ' + Total
FROM Invoice
```

```
Msg 8114, Level 16, State 5, Line 1
Error converting data type nvarchar to numeric.
```

```
SELECT
    BillingPostalCode
    ,Total
    ,BillingPostalCode + ' | ' + CAST(Total AS varchar)
FROM Invoice
```

```
   BillingPostalCode  Total  (No column name)
1  70174              1.98   70174 | 1.98
2  0171               3.96   0171 | 3.96
3  1000               5.94   1000 | 5.94
4  T6G 2C7            8.91   T6G 2C7 | 8.91
5  2113               13.86  2113 | 13.86
```

The CAST function is used to convert an expression from one datatype to another. Datatype conversions are sometimes necessary when comparing or concatenating columns of different datatypes. CAST takes 2 parameters but its syntax is different from other functions in that it uses the AS keyword instead of a comma to separate the parameters. The first parameter is the expression and the second is the datatype to which it will be changed.



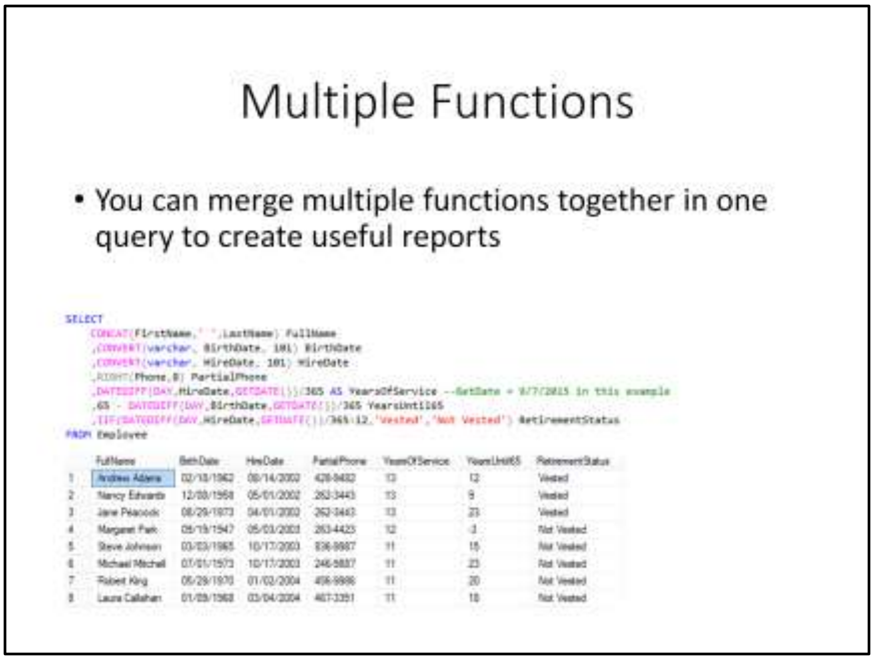
## Convert()

- Function is used to convert an expression from one datatype to another
- Takes 3 parameters
  - Datatype
  - Expression
  - Style
- The third parameter is optional. It can be used to display data in a certain format

```sql
SELECT
    InvoiceDate
    ,CONVERT(varchar, InvoiceDate) ConvertDefault
    ,CONVERT(varchar, InvoiceDate, 1) WithoutCentury
    ,CONVERT(varchar, InvoiceDate, 101) WithCentury
FROM Invoice
```

```
    InvoiceDate              ConvertDefault        WithoutCentury   WithCentury
1   2009-01-01 00:00:00.000  Jan  1 2009 12:00AM   01/01/09         01/01/2009
2   2009-01-02 00:00:00.000  Jan  2 2009 12:00AM   01/02/09         01/02/2009
3   2009-01-03 00:00:00.000  Jan  3 2009 12:00AM   01/03/09         01/03/2009
4   2009-01-06 00:00:00.000  Jan  6 2009 12:00AM   01/06/09         01/06/2009
5   2009-01-11 00:00:00.000  Jan 11 2009 12:00AM   01/11/09         01/11/2009
6   2009-01-19 00:00:00.000  Jan 19 2009 12:00AM   01/19/09         01/19/2009
7   2009-02-01 00:00:00.000  Feb  1 2009 12:00AM   02/01/09         02/01/2009
8   2009-02-01 00:00:00.000  Feb  1 2009 12:00AM   02/01/09         02/01/2009
9   2009-02-02 00:00:00.000  Feb  2 2009 12:00AM   02/02/09         02/02/2009
10  2009-02-03 00:00:00.000  Feb  3 2009 12:00AM   02/03/09         02/03/2009
11  2009-02-06 00:00:00.000  Feb  6 2009 12:00AM   02/06/09         02/06/2009
12  2009-02-11 00:00:00.000  Feb 11 2009 12:00AM   02/11/09         02/11/2009
13  2009-02-19 00:00:00.000  Feb 19 2009 12:00AM   02/19/09         02/19/2009
```

The CONVERT function is very similar to the CAST function except it has a 3rd optional parameter that allows you to determine the style of the data returned. The 3rd style parameter takes an integer that corresponds to an output mask for the data. This function is most practical when it's needed to represent a date in certain format. The available output masks can be found in the CONVERT documentation in the MSDN library. Note that CONVERT is a Microsoft specific function that may not work in other SQL server engines.



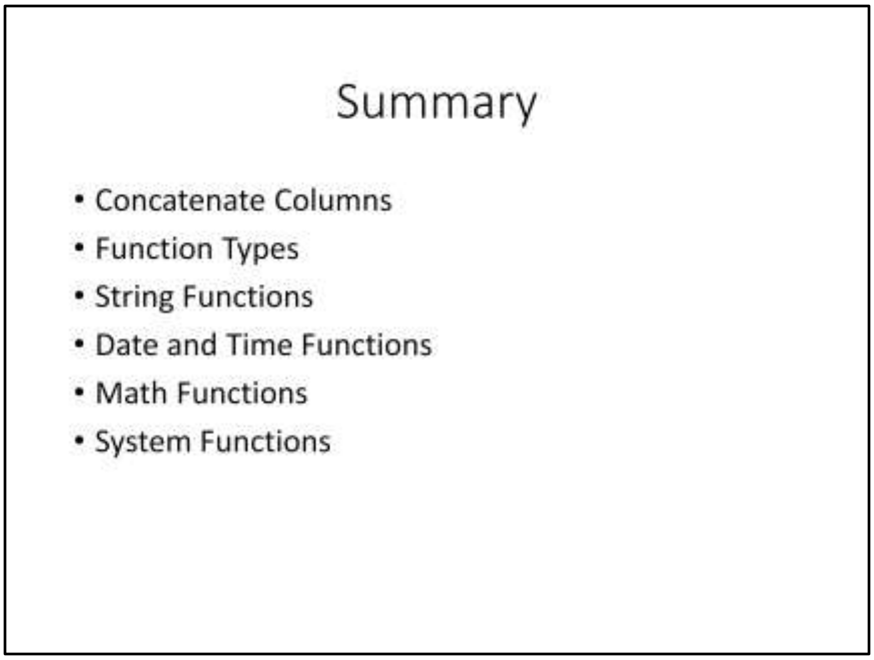
## Multiple Functions

- You can merge multiple functions together in one query to create useful reports

```
SELECT
    CONCAT(FirstName,' ',LastName) FullName
    ,CONVERT(varchar, BirthDate, 101) BirthDate
    ,CONVERT(varchar, HireDate, 101) HireDate
    ,RIGHT(Phone,8) PartialPhone
    ,DATEDIFF(DAY,HireDate,GETDATE())/365 AS YearsOfService --GetDate = 9/7/2015 in this example
    ,65 - DATEDIFF(DAY,BirthDate,GETDATE())/365 YearsUntil65
    ,IIF(DATEDIFF(DAY,HireDate,GETDATE())/365>12,'Vested','Not Vested') RetirementStatus
FROM Employee
```

| | FullName | BirthDate | HireDate | PartialPhone | YearsOfService | YearsUntil65 | RetirementStatus |
|---|---|---|---|---|---|---|---|
| 1 | Andrew Adams | 02/18/1962 | 08/14/2002 | 428-9432 | 13 | 12 | Vested |
| 2 | Nancy Edwards | 12/08/1958 | 05/01/2002 | 262-3443 | 13 | 9 | Vested |
| 3 | Jane Peacock | 08/29/1973 | 04/01/2002 | 262-3443 | 13 | 23 | Vested |
| 4 | Margaret Park | 09/19/1947 | 05/03/2003 | 263-4423 | 12 | -3 | Not Vested |
| 5 | Steve Johnson | 03/03/1965 | 10/17/2003 | 836-9987 | 11 | 15 | Not Vested |
| 6 | Michael Mitchell | 07/01/1973 | 10/17/2003 | 246-5887 | 11 | 23 | Not Vested |
| 7 | Robert King | 05/29/1970 | 01/02/2004 | 456-9986 | 11 | 20 | Not Vested |
| 8 | Laura Callahan | 01/09/1968 | 03/04/2004 | 467-3351 | 11 | 18 | Not Vested |

You can create powerful reports by using the built in functions available to you in SQL Server. Once you are familiar with what a function does, you can combine it with other functions to produce information out of data. Being comfortable with functions is essential to writing useful queries in SQL Server. In the example I am using string, date and logic functions to generate a report on an employee's retirement status.



## Summary

- Concatenate Columns
- Function Types
- String Functions
- Date and Time Functions
- Math Functions
- System Functions

This concludes the presentation on concatenation and scalar functions.