

# SQL Cheat Sheet

In this guide, you'll find a useful cheat sheet that documents some of the more commonly used elements of SQL, and even a few of the less common. Hopefully, it will help developers – both beginner and experienced level – become more proficient in their understanding of the SQL language.

Use this as a quick reference during development, a learning aid, or even print it out and bind it if you'd prefer (whatever works!).

But before we get to the cheat sheet itself, for developers who may not be familiar with SQL, let's start with...

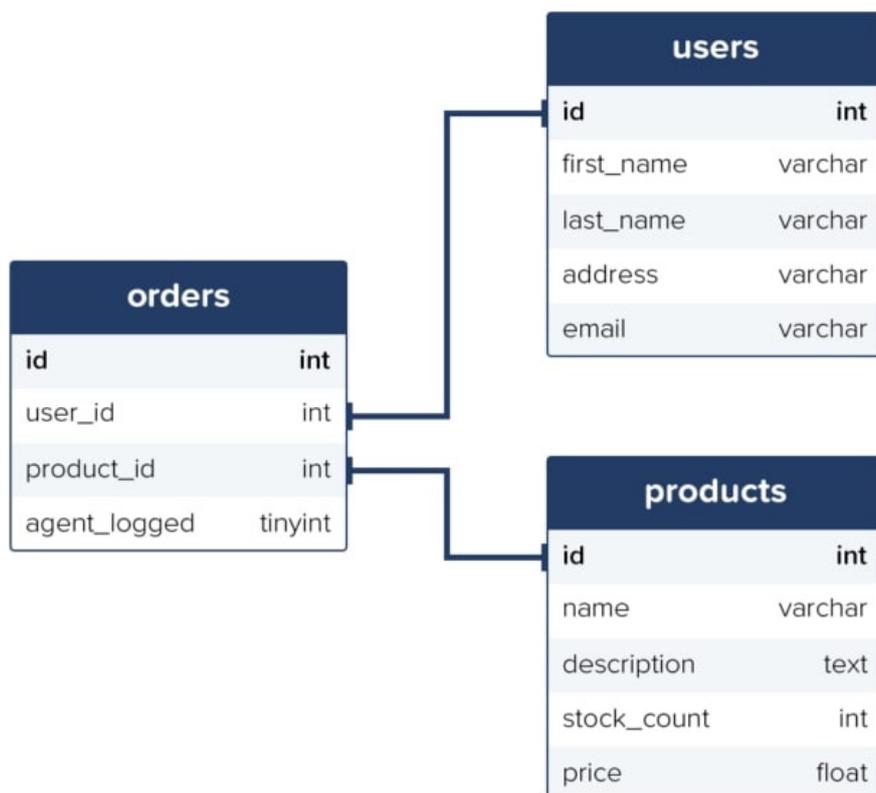
# Table of Contents

03	What is SQL
07	SQL vs MySQL
08	Installing MySQL
09	Using MySQL
11	Cheat Sheet
20	Comments
21	MySQL Data Types
25	Operators
27	Functions
36	Wildcard Characters
37	Keys
39	Indexes
40	Joins
42	View
43	Conclusions

# What is SQL

SQL stands for Structured Query Language. It's the language of choice on today's web for storing, manipulating and retrieving data within relational databases. Most, if not all of the websites you visit will use it in some way, including this one.

Here's what a basic relational database looks like. This example in particular stores e-commerce information, specifically the products on sale, the users who buy them, and records of these orders which link these 2 entities.



Using SQL, you are able to interact with the database by writing queries, which when executed, return any results which meet its criteria.

Here's an example query:-

```
SELECT * FROM users;
```

Using this SELECT statement, the query selects all data from all columns in the user's table. It would then return data like the below, which is typically called a results set:-

users				
id	first_name	last_name	address	email
1	Luke	Harrison	1640 Rivers...	luke@lukeh...
2	Heather	Reynolds	742 Evergr...	heza@hot...
3	Simon	Clarkson	7 Peterbou...	smr@yaho...
4	Claire	Simpson	15 Musgra...	claire@hot...
5	Oliver	Harrison	1640 Rivers...	oliver@ya...
6	James	Gilbert	598 Firshil...	kgill@appl...
7	Michael	Johnson	12 Redmire...	mj@yahoo...
8	Thomas	Smith	342 Brown...	t.smith@al...
9	Robyn	Gilbert	598 Firshil...	summer@d...
10	Bryony	Brown	165 South...	bryony@h...
11	Tester	Jester	123 Fake S...	test@luke...

If we were to replace the asterisk wildcard character (\*) with specific column names instead, only the data from these columns would be returned from the query.

```
SELECT first_name, last_name FROM users;
```

users	
first_name	last_name
Luke	Harrison
Heather	Reynolds
Simon	Clarkson
Claire	Simpson
Oliver	Harrison
James	Gilbert
Michael	Johnson
Thomas	Smith
Robyn	Gilbert
Bryony	Brown

We can add a bit of complexity to a standard SELECT statement by adding a WHERE clause, which allows you to filter what gets returned.

```
SELECT * FROM products WHERE stock_count <= 10 ORDER BY stock_count ASC;
```

This query would return all data from the products table with a stock\_count value of less than 10 in its results set. The use of the ORDER BY keyword means the results will be ordered using the stock\_count column, lowest values to highest.

products				
id	name	description	stock_count	price
192	Carton Do...	Whether y...	0	14.99
23	Cardboar...	Declutter...	1	3.49
3	SmartMo...	NULL	1	24.99
32	TripLast 33...	Cost effec...	4	16.50
875	A4 Storang...	Dimensio...	5	4.99
456	Pack of 50...	Date first a...	5	12.99
341	Set of 2 S...	5 year gua...	8	4.99
67	Large Car...	Need som...	10	12.99
196	10 X Plasti...	Pack of 10...	10	15.99
310	StorePac 5...	High qual...	10	9.99

Using the INSERT INTO statement, we can add new data to a table. Here's a basic example adding a new user to the users table:-

```
INSERT INTO users (first_name, last_name, address, email)
VALUES ('Tester', 'Jester', '123 Fake Street, Sheffield, United
Kingdom', 'test@lukeharrison.dev');
```

Then if you were to rerun the query to return all data from the user's table, the results set would look like this:

users				
id	first_name	last_name	address	email
1	Luke	Harrison	1640 Rivers...	luke@lukeh...
2	Heather	Reynolds	742 Evergr...	heza@hot...
3	Simon	Clarkson	7 Peterbou...	smr@yaho...
4	Claire	Simpson	15 Musgra...	claire@hot...
5	Oliver	Harrison	1640 Rivers...	oliver@ya...
6	James	Gilbert	598 Firshil...	jgill@appl...
7	Michael	Johnson	12 Redmire...	mj@yahoo...
8	Thomas	Smith	342 Brown...	t.smith@al...
9	Robyn	Gilbert	598 Firshil...	summer@d...
10	Bryony	Brown	165 South...	bryony@h...
11	Tester	Jester	123 Fake S...	test@luke...

Of course, these examples demonstrate only a very small selection of what the SQL language is capable of.

# SQL vs MySQL

You may have heard of [MySQL](#) before. It's important that you don't confuse this with SQL itself, as there's a clear difference.

**incorrect**  
**SQL === MySQL** ❌

**correct**  
**SQL = Language** ✅

**correct**  
**MySQL = System** ✅

SQL is the language. It outlines syntax that allows you to write queries that manage relational databases. Nothing more.

MySQL meanwhile is a database system that runs on a server. It implements the SQL language, allowing you to write queries using its syntax to manage MySQL databases.

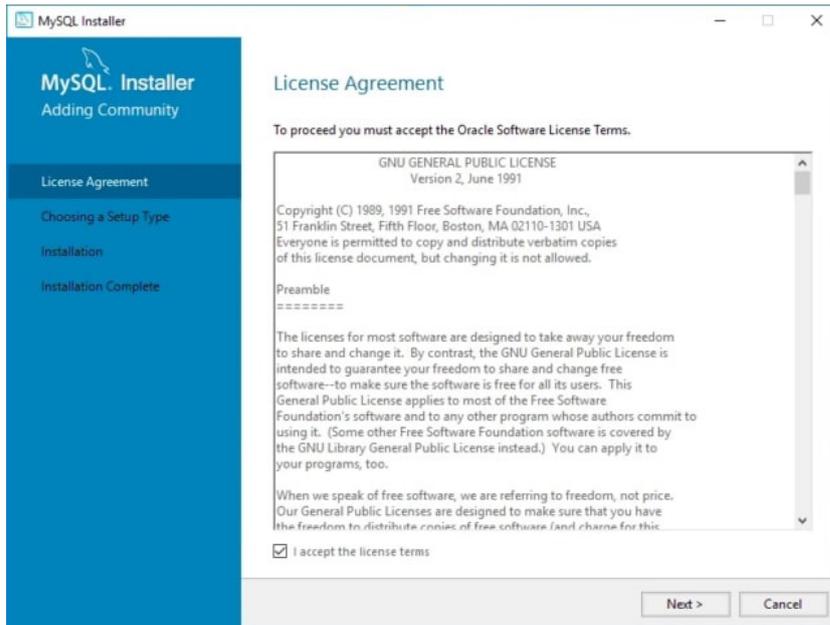
In addition to MySQL, there are other systems that implement SQL. Some of the more popular ones include:

- PostgreSQL
- SQLite
- Oracle Database
- Microsoft SQL Server

# Installing MySQL

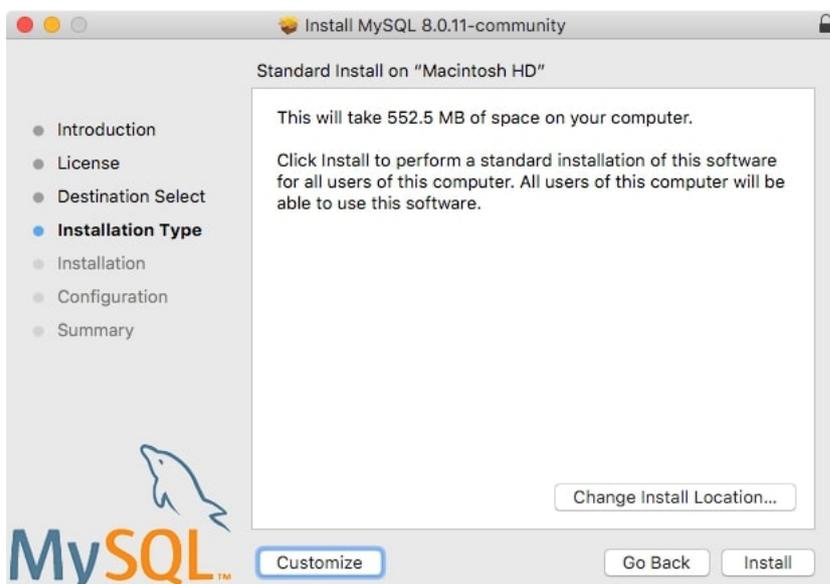
## Windows

The recommended way to install MySQL on Windows is by using the installer you can download from the [MySQL website](#).



## MacOS

On macOS, the recommended way to install MySQL is using native packages, which sounds a lot more complicated than it actually is. Essentially, it also involves just downloading an [installer](#).



Alternatively, if you prefer to use package managers such as [Homebrew](#), you can install MySQL like so:

```
brew install mysql
```

Whilst if you need to install the older MySQL version 5.7, which is still widely used today on the web, you can:

```
brew install mysql@5.7
```

## Using MySQL

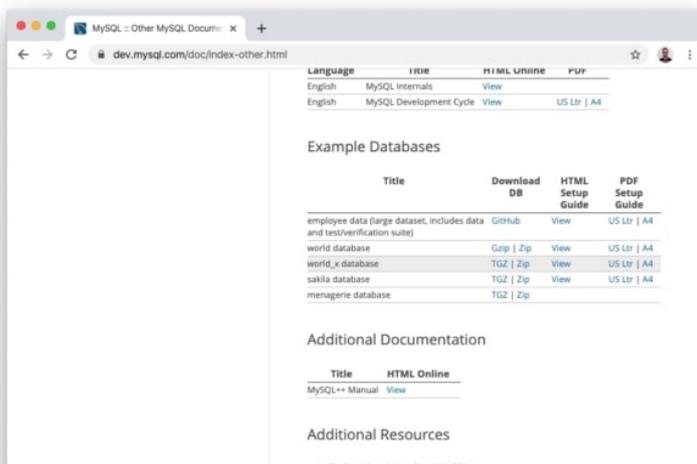
With MySQL now installed on your system, to get up and going as quickly as possible writing SQL queries, it's recommended that you use an SQL management application to make managing your databases a much simpler, easier process.

There are lots of apps to choose from which largely do the same job, so it's down to your own personal preference on which one to use:

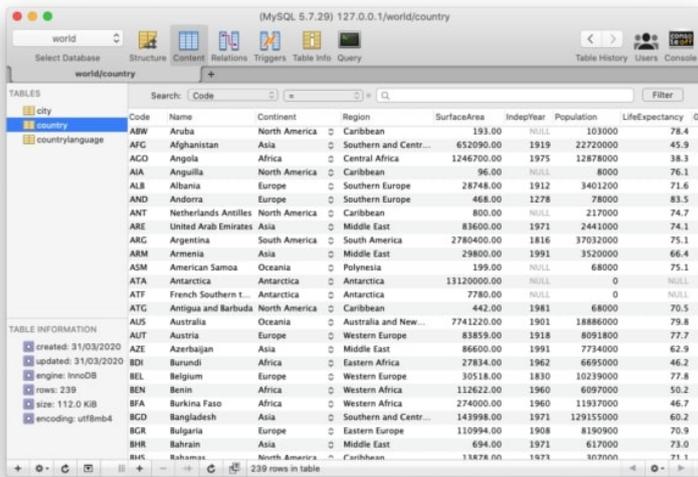
- [MySQL Workbench](#) is developed by Oracle, the owner of MySQL.
- [HeidiSQL](#) (Recommended Windows) is a free, open-source app for Windows. For macOS and Linux users, [Wine](#) is first required as a prerequisite.
- [phpMyAdmin](#) is a very popular alternative that operates in the web browser.
- [Sequel Pro](#) (Recommended macOS) is a macOS' only alternative and our favorite thanks to its clear and easy to use interface.

When you're ready to start writing your own SQL queries, rather than spending time creating your own database, consider importing dummy data instead.

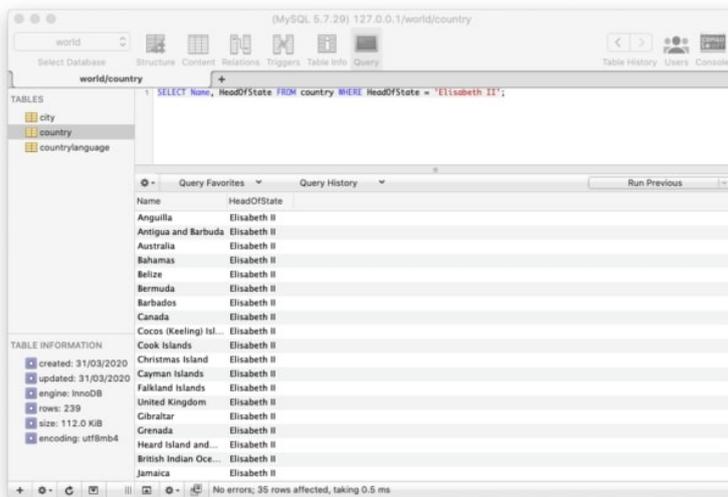
The MySQL website provides a number of [dummy databases](#) that you can download free of charge and then import into your SQL app.



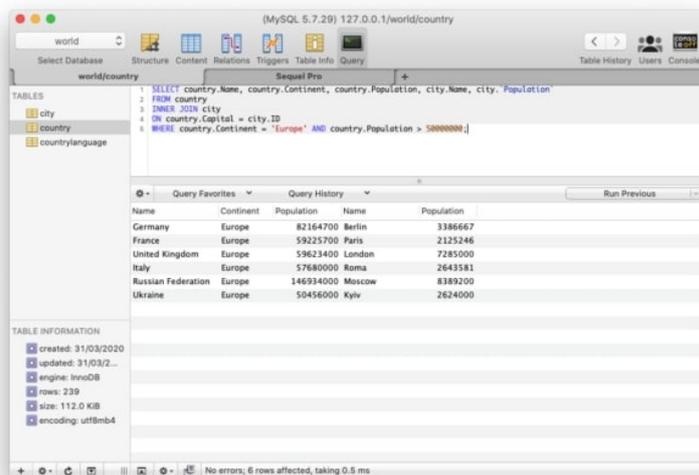
Our favorite of these is the world database, which provides some interesting data to practice writing SQL queries for. Here's a screenshot of its country table within Sequel Pro.



This example query returns all countries with Queen Elizabeth II as their head of state .



Whilst this one returns all European countries with a population of over 50million along with their capital city and its population.



# Cheat Sheet

## Keywords

A collection of keywords used in SQL statements, a description, and where appropriate an example. Some of the more advanced keywords have their own dedicated section later in the cheat sheet.

Where MySQL is mentioned next to an example, this means this example is only applicable to MySQL databases (as opposed to any other database system).

SQL Keywords	
Keyword	Description
<b>ADD</b>	<p>Adds a new column to an existing table.  <b>Example:</b> Adds a new column named 'email_address' to a table named 'users'.</p> <pre>ALTER TABLE users ADD email_address varchar(255);</pre>
<b>ADD CONSTRAINT</b>	<p>It creates a new constraint on an existing table, which is used to specify rules for any data in the table.  <b>Example:</b> Adds a new PRIMARY KEY constraint named 'user' on columns ID and SURNAME.</p> <pre>ALTER TABLE users ADD CONSTRAINT user PRIMARY KEY (ID, SURNAME);</pre>
<b>ALTER TABLE</b>	<p>Adds, deletes or edits columns in a table. It can also be used to add and delete constraints in a table, as per the above.  <b>Example:</b> Adds a new boolean column called 'approved' to a table named 'deals'.</p> <pre>ALTER TABLE deals ADD approved boolean;</pre> <p><b>Example 2:</b> Deletes the 'approved' column from the 'deals' table</p> <pre>ALTER TABLE deals DROP COLUMN approved;</pre>

SQL Keywords	
Keyword	Description
<b>ALTER COLUMN</b>	<p>Changes the data type of a table's column.  <b>Example:</b> In the 'users' table, make the column 'incept_date' into a 'datetime' type.</p> <pre>ALTER TABLE users ALTER COLUMN incept_date datetime;</pre>
<b>ALL</b>	<p>Returns true if all of the subquery values meet the passed condition.  <b>Example:</b> Returns the users with a higher number of tasks than the user with the highest number of tasks in the HR department (id 2)</p> <pre>SELECT first_name, surname, tasks_no FROM users WHERE tasks_no &gt; ALL (SELECT tasks FROM user WHERE department_id = 2);</pre>
<b>AND</b>	<p>Used to join separate conditions within a WHERE clause.  <b>Example:</b> Returns events located in London, United Kingdom</p> <pre>SELECT * FROM events WHERE host_country='United Kingdom' AND host_ city='London';</pre>
<b>ANY</b>	<p>Returns true if any of the subquery values meet the given condition.  <b>Example:</b> Returns products from the products table which have received orders - stored in the orders table - with a quantity of more than 5.</p> <pre>SELECT name FROM products WHERE productId = ANY (SELECT productId FROM orders WHERE quantity &gt; 5);</pre>
<b>AS</b>	<p>Renames a table or column with an alias value which only exists for the duration of the query.  <b>Example:</b> Aliases north_east_user_subscriptions column</p> <pre>SELECT north_east_user_subscriptions AS ne_subs FROM users WHERE ne_subs &gt; 5;</pre>
<b>ASC</b>	<p>Used with ORDER BY to return the data in ascending order.  <b>Example:</b> Apples, Bananas, Peaches, Raddish</p>

SQL Keywords	
Keyword	Description
<b>BETWEEN</b>	<p>Selects values within the given range.</p> <p><b>Example 1:</b> Selects stock with a quantity between 100 and 150.</p> <pre>SELECT * FROM stock WHERE quantity BETWEEN 100 AND 150;</pre> <p><b>Example 2:</b> Selects stock with a quantity NOT between 100 and 150. Alternatively, using the NOT keyword here reverses the logic and selects values outside the given range.</p> <pre>SELECT * FROM stock WHERE quantity NOT BETWEEN 100 AND 150;</pre>
<b>CASE</b>	<p>Change query output depending on conditions.</p> <p><b>Example:</b> Returns users and their subscriptions, along with a new column called activity_levels that makes a judgement based on the number of subscriptions.</p> <pre>SELECT first_name, surname, subscriptions CASE WHEN subscriptions &gt; 10 THEN 'Very active' WHEN Quantity BETWEEN 3 AND 10 THEN 'Active' ELSE 'Inactive' END AS activity_levels FROM users;</pre>
<b>CHECK</b>	<p>Adds a constraint that limits the value which can be added to a column.</p> <p><b>Example 1 (MySQL):</b> Makes sure any users added to the users table are 18 or over.</p> <pre>CREATE TABLE users ( first_name varchar(255), age int, CHECK (age&gt;=18) );</pre> <p><b>Example 2 (MySQL):</b> Adds a check after the table has already been created.</p> <pre>ALTER TABLE users ADD CHECK (age&gt;=18);</pre>

SQL Keywords	
Keyword	Description
<b>CREATE DATABASE</b>	<p>Creates a new database.  <b>Example:</b> Creates a new database named 'websitesetup'.</p> <pre>CREATE DATABASE websitesetup;</pre>
<b>CREATE TABLE</b>	<p>Creates a new table .  <b>Example:</b> Creates a new table called 'users' in the 'websitesetup' database.</p> <pre>CREATE TABLE users (   id int,   first_name varchar(255),   surname varchar(255),   address varchar(255),   contact_number int );</pre>
<b>DEFAULT</b>	<p>Sets a default value for a column;  <b>Example 1 (MySQL):</b> Creates a new table called Products which has a name column with a default value of 'Placeholder Name' and an available_from column with a default value of today's date.</p> <pre>CREATE TABLE products (   id int,   name varchar(255) DEFAULT 'Placeholder Name',   available_from date DEFAULT GETDATE() );</pre> <p><b>Example 2 (MySQL):</b> The same as above, but editing an existing table.</p> <pre>ALTER TABLE products ALTER name SET DEFAULT 'Placeholder Name', ALTER available_from SET DEFAULT GETDATE();</pre>
<b>DELETE</b>	<p>Delete data from a table.  <b>Example:</b> Removes a user with a user_id of 674.</p> <pre>DELETE FROM users WHERE user_id = 674;</pre>
<b>DESC</b>	<p>Used with ORDER BY to return the data in descending order.  <b>Example:</b> Raddish, Peaches, Bananas, Apples</p>

SQL Keywords	
Keyword	Description
<b>DROP COLUMN</b>	<p>Deletes a column from a table.  <b>Example:</b> Removes the first_name column from the users table.</p> <pre>ALTER TABLE users DROP COLUMN first_name</pre>
<b>DROP DATABASE</b>	<p>Deletes the entire database.  <b>Example:</b> Deletes a database named 'websitesetup'.</p> <pre>DROP DATABASE websitesetup;</pre>
<b>DROP DEFAULT</b>	<p>Removes a default value for a column.  <b>Example (MySQL):</b> Removes the default value from the 'name' column in the 'products' table.</p> <pre>ALTER TABLE products ALTER COLUMN name DROP DEFAULT;</pre>
<b>DROP TABLE</b>	<p>Deletes a table from a database.  <b>Example:</b> Removes the users table.</p> <pre>DROP TABLE users;</pre>
<b>EXISTS</b>	<p>Checks for the existence of any record within the subquery, returning true if one or more records are returned.  <b>Example:</b> Lists any dealerships with a deal finance percentage less than 10.</p> <pre>SELECT dealership_name FROM dealerships WHERE EXISTS (SELECT deal_name FROM deals WHERE dealership_id = deals.dealership_id AND finance_ percentage &lt; 10);</pre>
<b>FROM</b>	<p>Specifies which table to select or delete data from.  <b>Example:</b> Selects data from the users table.</p> <pre>SELECT area_manager FROM area_managers WHERE EXISTS (SELECT ProductName FROM Products WHERE area_manager_id = deals.area_manager_id AND Price &lt; 20);</pre>

SQL Keywords	
Keyword	Description
IN	<p>Used alongside a WHERE clause as a shorthand for multiple OR conditions. So instead of:</p> <pre>SELECT * FROM users WHERE country = 'USA' OR country = 'United Kingdom' OR country = 'Russia' OR country = 'Australia';</pre> <p>You can use:</p> <pre>SELECT * FROM users WHERE country IN ('USA', 'United Kingdom', 'Russia', 'Australia');</pre>
INSERT INTO	<p>Add new rows to a table. <b>Example:</b> Adds a new vehicle.</p> <pre>INSERT INTO cars (make, model, mileage, year) VALUES ('Audi', 'A3', 30000, 2016);</pre>
IS NULL	<p>Tests for empty (NULL) values. <b>Example:</b> Returns users that haven't given a contact number.</p> <pre>SELECT * FROM users WHERE contact_number IS NULL;</pre>
IS NOT NULL	<p>The reverse of NULL. Tests for values that aren't empty / NULL.</p>
LIKE	<p>Returns true if the operand value matches a pattern. <b>Example:</b> Returns true if the user's first_name ends with 'son'.</p> <pre>SELECT * FROM users WHERE first_name LIKE '%son';</pre>
NOT	<p>Returns true if a record DOESN'T meet the condition. <b>Example:</b> Returns true if the user's first_name doesn't end with 'son'.</p> <pre>SELECT * FROM users WHERE first_name NOT LIKE '%son';</pre>
OR	<p>Used alongside WHERE to include data when either condition is true. <b>Example:</b> Returns users that live in either Sheffield or Manchester.</p> <pre>SELECT * FROM users WHERE city = 'Sheffield' OR 'Manchester';</pre>

SQL Keywords	
Keyword	Description
<b>ORDER BY</b>	<p>Used to sort the result data in ascending (default) or descending order through the use of ASC or DESC keywords.  <b>Example:</b> Returns countries in alphabetical order.</p> <pre>SELECT * FROM countries ORDER BY name;</pre>
<b>ROWNUM</b>	<p>Returns results where the row number meets the passed condition.  <b>Example:</b> Returns the top 10 countries from the countries table.</p> <pre>SELECT * FROM countries WHERE ROWNUM &lt;= 10;</pre>
<b>SELECT</b>	<p>Used to select data from a database, which is then returned in a results set.  <b>Example 1:</b> Selects all columns from all users.</p> <pre>SELECT * FROM users;</pre> <p><b>Example 2:</b> Selects the first_name and surname columns from all users.xx</p> <pre>SELECT first_name, surname FROM users;</pre>
<b>SELECT DISTINCT</b>	<p>Sames as SELECT, except duplicate values are excluded.  <b>Example:</b> Creates a backup table using data from the users table.</p> <pre>SELECT * INTO usersBackup2020 FROM users;</pre>
<b>SELECT INTO</b>	<p>Copies data from one table and inserts it into another.  <b>Example:</b> Returns all countries from the users table, removing any duplicate values (which would be highly likely)</p> <pre>SELECT DISTINCT country from users;</pre>
<b>SELECT TOP</b>	<p>Allows you to return a set number of records to return from a table.  <b>Example:</b> Returns the top 3 cars from the cars table.</p> <pre>SELECT TOP 3 * FROM cars;</pre>

SQL Keywords	
Keyword	Description
SET	<p>Used alongside UPDATE to update existing data in a table. <b>Example:</b> Updates the value and quantity values for an order with an id of 642 in the orders table.</p> <pre>UPDATE orders SET value = 19.49, quantity = 2 WHERE id = 642;</pre>
SOME	Identical to ANY.
TOP	<p>Used alongside SELECT to return a set number of records from a table. <b>Example:</b> Returns the top 5 users from the users table.</p> <pre>SELECT TOP 5 * FROM users;</pre>
TRUNCATE TABLE	<p>Similar to DROP, but instead of deleting the table and its data, this deletes only the data. <b>Example:</b> Empties the sessions table, but leaves the table itself intact.</p> <pre>TRUNCATE TABLE sessions;</pre>
UNION	<p>Combines the results from 2 or more SELECT statements and returns only distinct values. <b>Example:</b> Returns the cities from the events and subscribers tables.</p> <pre>SELECT city FROM events UNION SELECT city from subscribers;</pre>
UNION ALL	The same as UNION, but includes duplicate values.

SQL Keywords	
Keyword	Description
UNIQUE	<p>This constraint ensures all values in a column are unique. <b>Example 1 (MySQL):</b> Adds a unique constraint to the id column when creating a new users table.</p> <pre>CREATE TABLE users ( id int NOT NULL, name varchar(255) NOT NULL, UNIQUE (id) );</pre> <p><b>Example 2 (MySQL):</b> Alters an existing column to add a UNIQUE constraint.</p> <pre>ALTER TABLE users ADD UNIQUE (id);</pre>
UPDATE	<p>Updates existing data in a table. <b>Example:</b> Updates the mileage and serviceDue values for a vehicle with an id of 45 in the cars table.</p> <pre>UPDATE cars SET mileage = 23500, serviceDue = 0 WHERE id = 45;</pre>
VALUES	<p>Used alongside the INSERT INTO keyword to add new values to a table. <b>Example:</b> Adds a new car to the cars table.</p> <pre>INSERT INTO cars (name, model, year) VALUES ('Ford', 'Fiesta', 2010);</pre>
WHERE	<p>Filters results to only include data which meets the given condition. <b>Example:</b> Returns orders with a quantity of more than 1 item.</p> <pre>SELECT * FROM orders WHERE quantity &gt; 1;</pre>

# Comments

Comments allow you to explain sections of your SQL statements, or to comment out code and prevent its execution.

In SQL, there are 2 types of comments, single line and multiline.

## Single Line Comments

Single line comments start with `--`. Any text after these 2 characters to the end of the line will be ignored.

```
-- My Select query  
SELECT * FROM users;
```

## Multiline Comments

Multiline comments start with `/*` and end with `*/`. They stretch across multiple lines until the closing characters have been found.

```
/*  
This is my select query.  
It grabs all rows of data from the users table  
*/  
SELECT * FROM users;  
  
/*  
This is another select query, which I don't want to execute yet  

```

# MySQL Data Types

When creating a new table or editing an existing one, you must specify the type of data that each column accepts.

In the below example, data passed to the `id` column must be an `int`, whilst the `first_name` column has a `VARCHAR` data type with a maximum of 255 characters.

```
CREATE TABLE users (  
    id int,  
    first_name varchar(255)  
);
```

## String Data Types

String Data Types	
Data Type	Description
<b>CHAR(size)</b>	Fixed length string which can contain letters, numbers and special characters. The size parameter sets the maximum string length, from 0 - 255 with a default of 1.
<b>VARCHAR(size)</b>	Variable length string similar to <code>CHAR()</code> , but with a maximum string length range from 0 to 65535.
<b>BINARY(size)</b>	Similar to <code>CHAR()</code> but stores binary byte strings.
<b>VARBINARY(size)</b>	Similar to <code>VARCHAR()</code> but for binary byte strings.
<b>TINYBLOB</b>	Holds Binary Large Objects (BLOBs) with a max length of 255 bytes.
<b>TINYTEXT</b>	Holds a string with a maximum length of 255 characters. Use <code>VARCHAR()</code> instead, as it's fetched much faster.
<b>TEXT(size)</b>	Holds a string with a maximum length of 65535 bytes. Again, better to use <code>VARCHAR()</code> .
<b>BLOB(size)</b>	Holds Binary Large Objects (BLOBs) with a max length of 65535 bytes.
<b>MEDIUMTEXT</b>	Holds a string with a maximum length of 16,777,215 characters.

String Data Types	
Data Type	Description
<b>MEDIUMBLOB</b>	Holds Binary Large Objects (BLOBs) with a max length of 16,777,215 bytes.
<b>LONGTEXT</b>	Holds a string with a maximum length of 4,294,967,295 characters.
<b>LOBLOB</b>	Holds Binary Large Objects (BLOBs) with a max length of 4,294,967,295 bytes.
<b>ENUM(a, b, c, etc...)</b>	<p>A string object that only has one value, which is chosen from a list of values which you define, up to a maximum of 65535 values. If a value is added which isn't on this list, it's replaced with a blank value instead. Think of ENUM being similar to HTML radio boxes in this regard.</p> <pre>CREATE TABLE tshirts (color ENUM('red', 'green', 'blue', 'yellow', 'purple'));</pre>
<b>SET(a, b, c, etc...)</b>	A string object that can have 0 or more values, which is chosen from a list of values which you define, up to a maximum of 64 values. Think of SET being similar to HTML checkboxes in this regard.

## Numeric Data Types

Numeric Data Types	
Data Type	Description
<b>BIT(size)</b>	A bit-value type with a default of 1. The allowed number of bits in a value is set via the size parameter, which can hold values from 1 to 64.
<b>TINYINT(size)</b>	A very small integer with a signed range of -128 to 127, and an unsigned range of 0 to 255. Here, the size parameter specifies the maximum allowed display width, which is 255.
<b>BOOL</b>	Essentially a quick way of setting the column to TINYINT with a size of 1. 0 is considered false, whilst 1 is considered true.
<b>BOOLEAN</b>	Same as BOOL.
<b>SMALLINT(size)</b>	A small integer with a signed range of -32768 to 32767, and an unsigned range from 0 to 65535. Here, the size parameter specifies the maximum allowed display width, which is 255.

Numeric Data Types	
Data Type	Description
<b>MEDIUMINT(size)</b>	A medium integer with a signed range of -8388608 to 8388607, and an unsigned range from 0 to 16777215. Here, the size parameter specifies the maximum allowed display width, which is 255.
<b>INT(size)</b>	A medium integer with a signed range of -2147483648 to 2147483647, and an unsigned range from 0 to 4294967295. Here, the size parameter specifies the maximum allowed display width, which is 255.
<b>INTEGER(size)</b>	Same as INT.
<b>BIGINT(size)</b>	A medium integer with a signed range of -9223372036854775808 to 9223372036854775807, and an unsigned range from 0 to 18446744073709551615. Here, the size parameter specifies the maximum allowed display width, which is 255.
<b>FLOAT(p)</b>	A floating point number value. If the precision (p) parameter is between 0 to 24, then the data type is set to <code>FLOAT()</code> , whilst if its from 25 to 53, the data type is set to <code>DOUBLE()</code> . This behaviour is to make the storage of values more efficient.
<b>DOUBLE(size, d)</b>	A floating point number value where the total digits are set by the size parameter, and the number of digits after the decimal point is set by the d parameter.
<b>DECIMAL(size, d)</b>	An exact fixed point number where the total number of digits is set by the size parameters, and the total number of digits after the decimal point is set by the d parameter.  For size, the maximum number is 65 and the default is 10, whilst for d, the maximum number is 30 and the default is 10.
<b>DEC(size, d)</b>	Same as DECIMAL.

## Date / Time Data Types

Date / Time Data Types	
Data Type	Description
<b>DATE</b>	A simple date in YYYY-MM-DD format, with a supported range from '1000-01-01' to '9999-12-31'.
<b>DATETIME(fsp)</b>	<p>A date time in YYYY-MM-DD hh:mm:ss format, with a supported range from '1000-01-01 00:00:00' to '9999-12-31 23:59:59'.</p> <p>By adding DEFAULT and ON UPDATE to the column definition, it automatically sets to the current date/time.</p>
<b>TIMESTAMP(fsp)</b>	<p>A Unix Timestamp, which is a value relative to the number of seconds since the Unix epoch ('1970-01-01 00:00:00' UTC). This has a supported range from '1970-01-01 00:00:01' UTC to '2038-01-09 03:14:07' UTC.</p> <p>By adding DEFAULT CURRENT_TIMESTAMP and ON UPDATE CURRENT_TIMESTAMP to the column definition, it automatically sets to current date/time.</p>
<b>TIME(fsp)</b>	A time in hh:mm:ss format, with a supported range from '-838:59:59' to '838:59:59'.
<b>YEAR</b>	A year, with a supported range of '1901' to '2155'.

# Operators

## Arithmetic Operators

Arithmetic Operators	
Operator	Description
+	Add
-	Subtract
*	Multiply
/	Divide
%	Modulo

## Bitwise Operator

Bitwise Operator	
Operator	Description
&	Bitwise AND
	Bitwise OR
^	Bitwise exclusive OR

## Comparison Operators

Comparison Operators	
Operator	Description
=	Equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
≠	Not equal to

## Compound Operators

Compound Operators	
Operator	Description
<code>+=</code>	Add equals
<code>-=</code>	Subtract equals
<code>*=</code>	Multiply equals
<code>/=</code>	Divide equals
<code>%=</code>	Modulo equals
<code>&amp;=</code>	Bitwise AND equals
<code>^-=</code>	Bitwise exclusive equals
<code> *=</code>	Bitwise OR equals

# Functions

## String Functions

String Functions	
Name	Description
ASCII	Returns the equivalent ASCII value for a specific character.
CHAR_LENGTH	Returns the character length of a string.
CHARACTER_LENGTH	Same as CHAR_LENGTH.
CONCAT	Adds expressions together, with a minimum of 2.
CONCAT_WS	Adds expressions together, but with a separator between each value.
FIELD	Returns an index value relative to the position of a value within a list of values.
FIND IN SET	Returns the position of a string in a list of strings.
FORMAT	When passed a number, returns that number formatted to include commas (eg 3,400,000).
INSERT	Allows you to insert one string into another at a certain point, for a certain number of characters.
INSTR	Returns the position of the first time one string appears within another.
LCASE	Convert a string to lowercase.
LEFT	Starting from the left, extract the given number of characters from a string and return them as another.
LENGTH	Returns the length of a string, but in bytes.
LOCATE	Returns the first occurrence of one string within another,
LOWER	Same as LCASE.
LPAD	Left pads one string with another, to a specific length.
LTRIM	Remove any leading spaces from the given string.

String Functions	
Name	Description
<b>MID</b>	Extracts one string from another, starting from any position.
<b>POSITION</b>	Returns the position of the first time one substring appears within another.
<b>REPEAT</b>	Allows you to repeat a string
<b>REPLACE</b>	Allows you to replace any instances of a substring within a string, with a new substring.
<b>REVERSE</b>	Reverses the string.
<b>RIGHT</b>	Starting from the right, extract the given number of characters from a string and return them as another.
<b>RPAD</b>	Right pads one string with another, to a specific length.
<b>RTRIM</b>	Removes any trailing spaces from the given string.
<b>SPACE</b>	Returns a string full of spaces equal to the amount you pass it.
<b>STRCMP</b>	Compares 2 strings for differences
<b>SUBSTR</b>	Extracts one substring from another, starting from any position.
<b>SUBSTRING</b>	Same as SUBSTR
<b>SUBSTRING_INDEX</b>	Returns a substring from a string before the passed substring is found the number of times equals to the passed number.
<b>TRIM</b>	Removes trailing and leading spaces from the given string. Same as if you were to run LTRIM and RTRIM together.
<b>UCASE</b>	Convert a string to uppercase.
<b>UPPER</b>	Same as UCASE.

## Numeric Functions

Numeric Functions	
Name	Description
<b>ABS</b>	Returns the absolute value of the given number.
<b>ACOS</b>	Returns the arc cosine of the given number.
<b>ASIN</b>	Returns the arc sine of the given number.
<b>ATAN</b>	Returns the arc tangent of one or 2 given numbers.
<b>ATAN2</b>	Return the arc tangent of 2 given numbers.
<b>AVG</b>	Returns the average value of the given expression.
<b>CEIL</b>	Returns the closest whole number (integer) upwards from a given decimal point number.
<b>CEILING</b>	Same as CEIL.
<b>COS</b>	Returns the cosine of a given number.
<b>COT</b>	Returns the cotangent of a given number.
<b>COUNT</b>	Returns the amount of records that are returned by a SELECT query.
<b>DEGREES</b>	Converts a radians value to degrees.
<b>DIV</b>	Allows you to divide integers.
<b>EXP</b>	Returns e to the power of the given number.
<b>FLOOR</b>	Returns the closest whole number (integer) downwards from a given decimal point number.
<b>GREATEST</b>	Returns the highest value in a list of arguments.
<b>LEAST</b>	Returns the smallest value in a list of arguments.
<b>LN</b>	Returns the natural logarithm of the given number
<b>LOG</b>	Returns the natural logarithm of the given number, or the logarithm of the given number to the given base
<b>LOG10</b>	Does the same as LOG, but to base 10.

Numeric Functions	
Name	Description
<b>LOG2</b>	Does the same as LOG, but to base 2.
<b>MAX</b>	Returns the highest value from a set of values.
<b>MIN</b>	Returns the lowest value from a set of values.
<b>MOD</b>	Returns the remainder of the given number divided by the other given number.
<b>PI</b>	Returns PI.
<b>POW</b>	Returns the value of the given number raised to the power of the other given number.
<b>POWER</b>	Same as POW.
<b>RADIANS</b>	Converts a degrees value to radians.
<b>RAND</b>	Returns a random number.
<b>ROUND</b>	Round the given number to the given amount of decimal places.
<b>SIGN</b>	Returns the sign of the given number.
<b>SIN</b>	Returns the sine of the given number.
<b>SQRT</b>	Returns the square root of the given number.
<b>SUM</b>	Returns the value of the given set of values combined.
<b>TAN</b>	Returns the tangent of the given number.
<b>TRUNCATE</b>	Returns a number truncated to the given number of decimal places.

## Date Functions

Numeric Functions	
Name	Description
<b>ADDDATE</b>	Add a date interval (eg: 10 DAY) to a date (eg: 20/01/20) and return the result (eg: 20/01/30).
<b>ADDTIME</b>	Add a time interval (eg: 02:00) to a time or datetime (05:00) and return the result (07:00).
<b>CURDATE</b>	Get the current date.
<b>CURRENT_DATE</b>	Same as CURDATE.
<b>CURRENT_TIME</b>	Get the current time.
<b>CURRENT_TIMESTAMP</b>	Get the current date and time.
<b>CURTIME</b>	Same as CURRENT_TIME.
<b>DATE</b>	Extracts the date from a datetime expression.
<b>DATEDIFF</b>	Returns the number of days between the 2 given dates.
<b>DATE_ADD</b>	Same as ADDDATE.
<b>DATE_FORMAT</b>	Formats the date to the given pattern.
<b>DATE_SUB</b>	Subtract a date interval (eg: 10 DAY) to a date (eg: 20/01/20) and return the result (eg: 20/01/10).
<b>DAY</b>	Returns the day for the given date.
<b>DAYNAME</b>	Returns the weekday name for the given date.
<b>DAYOFWEEK</b>	Returns the index for the weekday for the given date.
<b>DAYOFYEAR</b>	Returns the day of the year for the given date.
<b>EXTRACT</b>	Extract from the date the given part (eg MONTH for 20/01/20 = 01).
<b>FROM_DAYS</b>	Return the date from the given numeric date value.
<b>HOUR</b>	Return the hour from the given date.

Numeric Functions	
Name	Description
<b>LAST DAY</b>	Get the last day of the month for the given date.
<b>LOCALTIME</b>	Gets the current local date and time.
<b>LOCALTIMESTAMP</b>	Same as LOCALTIME.
<b>MAKEDATE</b>	Creates a date and returns it, based on the given year and number of days values.
<b>MAKETIME</b>	Creates a time and returns it, based on the given hour, minute and second values.
<b>MICROSECOND</b>	Returns the microsecond of a given time or datetime.
<b>MINUTE</b>	Returns the minute of the given time or datetime.
<b>MONTH</b>	Returns the month of the given date.
<b>MONTHNAME</b>	Returns the name of the month of the given date.
<b>NOW</b>	Same as LOCALTIME.
<b>PERIOD_ADD</b>	Adds the given number of months to the given period.
<b>PERIOD_DIFF</b>	Returns the difference between 2 given periods.
<b>QUARTER</b>	Returns the year quarter for the given date.
<b>SECOND</b>	Returns the second of a given time or datetime.
<b>SEC_TO_TIME</b>	Returns a time based on the given seconds.
<b>STR_TO_DATE</b>	Creates a date and returns it based on the given string and format.
<b>SUBDATE</b>	Same as DATE_SUB.
<b>SUBTIME</b>	Subtracts a time interval (eg: 02:00) to a time or datetime (05:00) and return the result (03:00).
<b>SYSDATE</b>	Same as LOCALTIME.
<b>TIME</b>	Returns the time from a given time or datetime.
<b>TIME_FORMAT</b>	Returns the given time in the given format.

Numeric Functions	
Name	Description
<b>TIME_TO_SEC</b>	Converts and returns a time into seconds.
<b>TIMEDIFF</b>	Returns the difference between 2 given time/datetime expressions.
<b>TIMESTAMP</b>	Returns the datetime value of the given date or datetime.
<b>TO_DAYS</b>	Returns the total number of days that have passed from '00-00-0000' to the given date.
<b>WEEK</b>	Returns the week number for the given date.
<b>WEEKDAY</b>	Returns the weekday number for the given date.
<b>WEEKOFYEAR</b>	Returns the week number for the given date.
<b>YEAR</b>	Returns the year from the given date.
<b>YEARWEEK</b>	Returns the year and week number for the given date.

## Misc Functions

Numeric Functions	
Name	Description
<b>IN</b>	Returns the given number in binary.
<b>BINARY</b>	Returns the given value as a binary string.
<b>CAST</b>	Convert one type into another.
<b>COALESCE</b>	From a list of values, return the first non-null value.
<b>CONNECTION_ID</b>	For the current connection, return the unique connection ID.
<b>CONV</b>	Convert the given number from one numeric base system into another.
<b>CONVERT</b>	Convert the given value into the given datatype or character set.
<b>CURRENT_USER</b>	Return the user and hostname which was used to authenticate with the server.
<b>DATABASE</b>	Get the name of the current database.
<b>GROUP BY</b>	<p>Used alongside aggregate functions (COUNT, MAX, MIN, SUM, AVG) to group the results.</p> <p><b>Example: Lists the number of users with active orders.</b></p> <pre>SELECT COUNT(user_id), active_orders FROM users GROUP BY active_orders;</pre> <p>It's used in the place of WHERE with aggregate functions.</p>
<b>HAVING</b>	<p><b>Example: Lists the number of users with active orders, but only include users with more than 3 active orders.</b></p> <pre>SELECT COUNT(user_id), active_orders FROM users GROUP BY active_orders HAVING COUNT(user_id) &gt; 3;</pre>
<b>IF</b>	If the condition is true return a value, otherwise return another value.
<b>IFNULL</b>	If the given expression equates to null, return the given value.

Numeric Functions	
Name	Description
<b>ISNULL</b>	If the expression is null, return 1, otherwise return 0.
<b>LAST_INSERT_ID</b>	For the last row which was added or updated in a table, return the auto increment ID.
<b>NULLIF</b>	Compares the 2 given expressions. If they are equal, NULL is returned, otherwise the first expression is returned.
<b>SESSION_USER</b>	Return the current user and hostnames.
<b>SYSTEM_USER</b>	Same as SESSION_USER.
<b>USER</b>	Same as SESSION_USER.
<b>VERSION</b>	Returns the current version of the MySQL powering the database.

# Wildcard Characters

In SQL, Wildcards are special characters used with the LIKE and NOT LIKE keywords which allow us to search data with sophisticated patterns much more efficiently

Wildcards	
Name	Description
%	<p>Equates to zero or more characters.</p> <p><b>Example 1:</b> Find all users with surnames ending in 'son'.</p> <pre>SELECT * FROM users WHERE surname LIKE '%son';</pre> <p><b>Example 2:</b> Find all users living in cities containing the pattern 'che'</p> <pre>SELECT * FROM users WHERE city LIKE '%che%';</pre>
_	<p>Equates to any single character.</p> <p><b>Example:</b> Find all users living in cities beginning with any 3 characters, followed by 'chester'.</p> <pre>SELECT * FROM users WHERE city LIKE '___chester';</pre>
[charlist]	<p>Equates to any single character in the list.</p> <p><b>Example 1:</b> Find all users with first names beginning with J, H or M.</p> <pre>SELECT * FROM users WHERE first_name LIKE '[jhm]%';</pre> <p><b>Example 2:</b> Find all users with first names beginning letters between A-L.</p> <pre>SELECT * FROM users WHERE first_name LIKE '[a-l]%';</pre> <p><b>Example 3:</b> Find all users with first names not ending with letters between n-s.</p> <pre>SELECT * FROM users WHERE first_name LIKE '%[!n-s]';</pre>

# Keys

In relational databases, there is a concept of primary and foreign keys. In SQL tables, these are included as constraints, where a table can have a primary key, a foreign key, or both.

## Primary Key

A primary key allows each record in a table to be uniquely identified. There can only be one primary key per table, and you can assign this constraint to any single or combination of columns. However, this means each value within this column(s) must be unique.

Typically in a table, the primary key is an ID column, and is usually paired with the AUTO\_INCREMENT keyword. This means the value increases automatically as new records are created.

## Example 1 (MySQL)

Create a new table and set the primary key to the ID column.

```
CREATE TABLE users (  
  id int NOT NULL AUTO_INCREMENT,  
  first_name varchar(255),  
  last_name varchar(255) NOT NULL,  
  address varchar(255),  
  email varchar(255),  
  PRIMARY KEY (id)  
);
```

## Example 2 (MySQL)

Alter an existing table and set the primary key to the first\_name column.

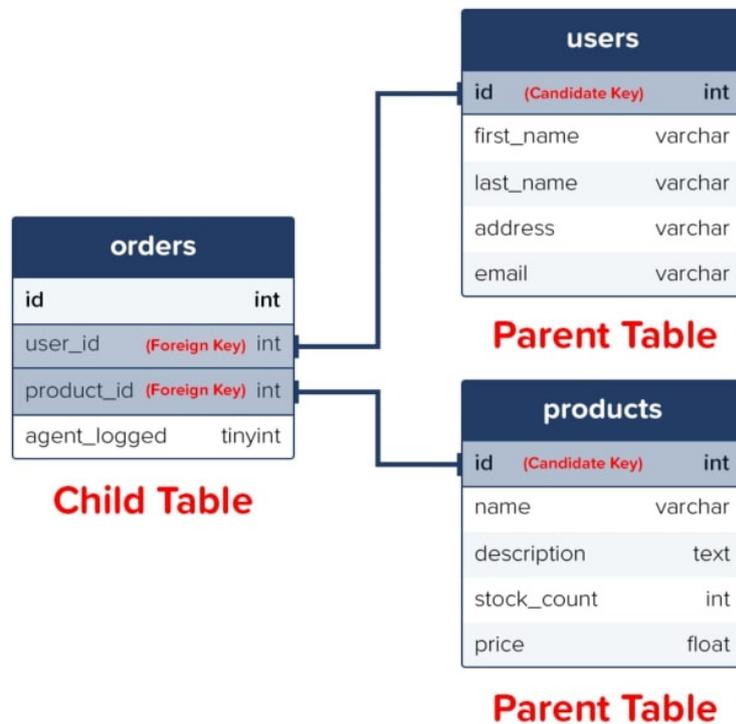
```
ALTER TABLE users  
ADD PRIMARY KEY (first_name);
```

## Foreign Key

A foreign key can be applied to one column or many and is used to link 2 tables together in a relational database.

As seen in the diagram below, the table containing the foreign key is called the child key, whilst the table which contains the referenced key, or candidate key, is called the parent table.

This essentially means that the column data is shared between 2 tables, as a foreign key also prevents invalid data from being inserted which isn't also present in the parent table.



### Example 1 (MySQL)

Create a new table and turn any columns that reference IDs in other tables into foreign keys.

```
CREATE TABLE orders (
  id int NOT NULL,
  user_id int,
  product_id int,
  PRIMARY KEY (id),
  FOREIGN KEY (user_id) REFERENCES users(id),
  FOREIGN KEY (product_id) REFERENCES products(id)
);
```

### Example 2 (MySQL)

Alter an existing table and create a foreign key.

```
ALTER TABLE orders
ADD FOREIGN KEY (user_id) REFERENCES users(id);
```

# Indexes

Indexes are attributes that can be assigned to columns that are frequently searched against to make data retrieval a quicker and more efficient process.

This doesn't mean each column should be made into an index though, as it takes longer for a column with an index to be updated than a column without. This is because when indexed columns are updated, the index itself must also be updated.

Wildcards	
Name	Description
<b>CREATE INDEX</b>	<p>Creates an index named 'idx_test' on the first_name and surname columns of the users table. In this instance, duplicate values are allowed.</p> <pre>CREATE INDEX idx_test ON users (first_name, surname);</pre>
<b>CREATE UNIQUE INDEX</b>	<p>Creates an index named 'idx_test' on the first_name and surname columns of the users table. In this instance, duplicate values are allowed.</p> <pre>CREATE UNIQUE INDEX idx_test ON users (first_name, surname);</pre>
<b>DROP INDEX</b>	<p>Creates an index named 'idx_test' on the first_name and surname columns of the users table. In this instance, duplicate values are allowed.</p> <pre>ALTER TABLE users DROP INDEX idx_test;</pre>

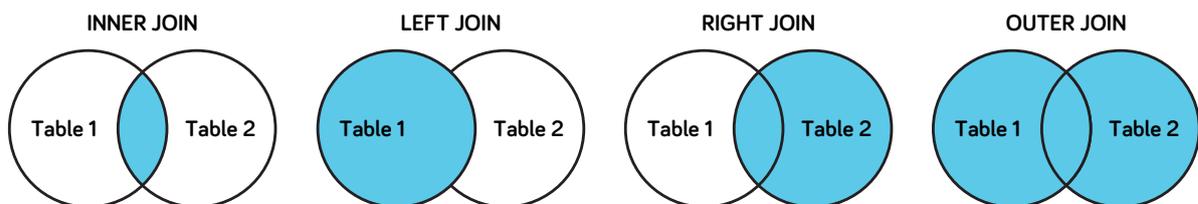
# Joins

In SQL, a JOIN clause is used to return a results set which combines data from multiple tables, based on a common column which is featured in both of them

There are a number of different joins available for you to use:

- Inner Join (Default): Returns any records which have matching values in both tables.
- Left Join: Returns all of the records from the first table, along with any matching records from the second table.
- Right Join: Returns all of the records from the second table, along with any matching records from the first.
- Full Join: Returns all records from both tables when there is a match.

A common way of visualising how joins work is like this:



In the following example, an inner join will be used to create a new unifying view combining the orders table and then 3 different tables

We'll replace the `user_id` and `product_id` with the `first_name` and `surname` columns of the user who placed the order, along with the name of the item which was purchased.

orders			
id	user_id	product_id	agent_logged
1	5	196	0
2	4	32	1
3	6	310	0
4	10	196	1
5	1	67	1
6	1	341	1
7	1	875	0
8	9	3	1
9	5	23	1
10	8	196	1

users				
id	first_name	last_name	address	email
1	Luke	Harrison	1640 Rivers...	luke@lukeh...
2	Heather	Reynolds	742 Evergr...	heza@hotmail...
3	Simon	Clarkson	7 Peterbou...	smr@yahoo...
4	Claire	Simpson	15 Musgra...	claire@hotmail...
5	Oliver	Harrison	1640 Rivers...	oliver@ya...
6	James	Gilbert	598 Firshil...	jjgill@appl...
7	Michael	Johnson	12 Redmire...	mj@yahoo...
8	Thomas	Smith	342 Brown...	t.smith@al...
9	Robyn	Gilbert	598 Firshil...	summer@id...
10	Bryony	Brown	165 South...	bryony@th...

products				
id	name	description	stock_count	price
192	Carton Do...	Whether y...	0	14.99
23	Cardboar...	Declutter...	1	3.49
3	SmartMo...	NULL	1	24.99
32	TripLast 33...	Cost effec...	4	16.50
875	A4 Storang...	Dimensio...	5	4.99
456	Pack of 50...	Date first a...	5	12.99
341	Set of 2 S...	5 year qua...	8	4.99
67	Large Car...	Need som...	10	12.99
196	10 X Plasti...	Pack of 10...	10	15.99
310	StorePac 5...	High qual...	10	9.99

```
SELECT orders.id, users.first_name, users.surname, products.name as 'product name'  
FROM orders  
INNER JOIN users on orders.user_id = users.id  
INNER JOIN products on orders.product_id = products.id;
```

Would return a results set which looks like:

Inner Join Result Set			
id	first_name	surname	product name
1	Oliver	Harrison	10 X Plasti...
2	Claire	Simpson	TripLast 33...
3	James	Gilbert	StorePac 5...
4	Bryony	Brown	10 X Plasti...
5	Luke	Harison	Large Car...
6	Luke	Harrison	Set of 2 S...
7	Luke	Harrison	A4 Storag...
8	Robyn	Gilbert	SmartMo...
9	Oliver	Harrison	Cardboar...
10	Thomas	Smith	10 X Plasti...

# View

A view is essentially a SQL results set that get stored in the database under a label, so you can return to it later, without having to rerun the query. These are especially useful when you have a costly SQL query which may be needed a number of times, so instead of running it over and over to generate the same results set, you can just do it once and save it as a view.

## Creating Views

To create a view, you can do so like this:

```
CREATE VIEW priority_users AS
SELECT * FROM users
WHERE country = 'United Kingdom';
```

Then in future, if you need to access the stored result set, you can do so like this:

```
SELECT * FROM [priority_users];
```

## Replacing Views

With the CREATE OR REPLACE command, a view can be updated.

```
CREATE OR REPLACE VIEW [priority_users] AS
SELECT * FROM users
WHERE country = 'United Kingdom' OR country='USA';
```

## Deleting Views

To delete a view, simply use the DROP VIEW command.

```
DROP VIEW priority_users;
```

# Conclusions

The majority of the websites on today's web use relational databases in some way. This makes SQL a valuable language to know, as it allows you to create more complex, functional websites and systems.

Make sure to bookmark this page, so in the future, if you're working with SQL and can't quite remember a specific operator, how to write a certain query, or are just confused about how joins work, then you'll have a cheat sheet on hand which is ready, willing and able to help.

