

Introduction and tutorial for MySQL

Ian Donaldson

MVB-INF 4410/9410

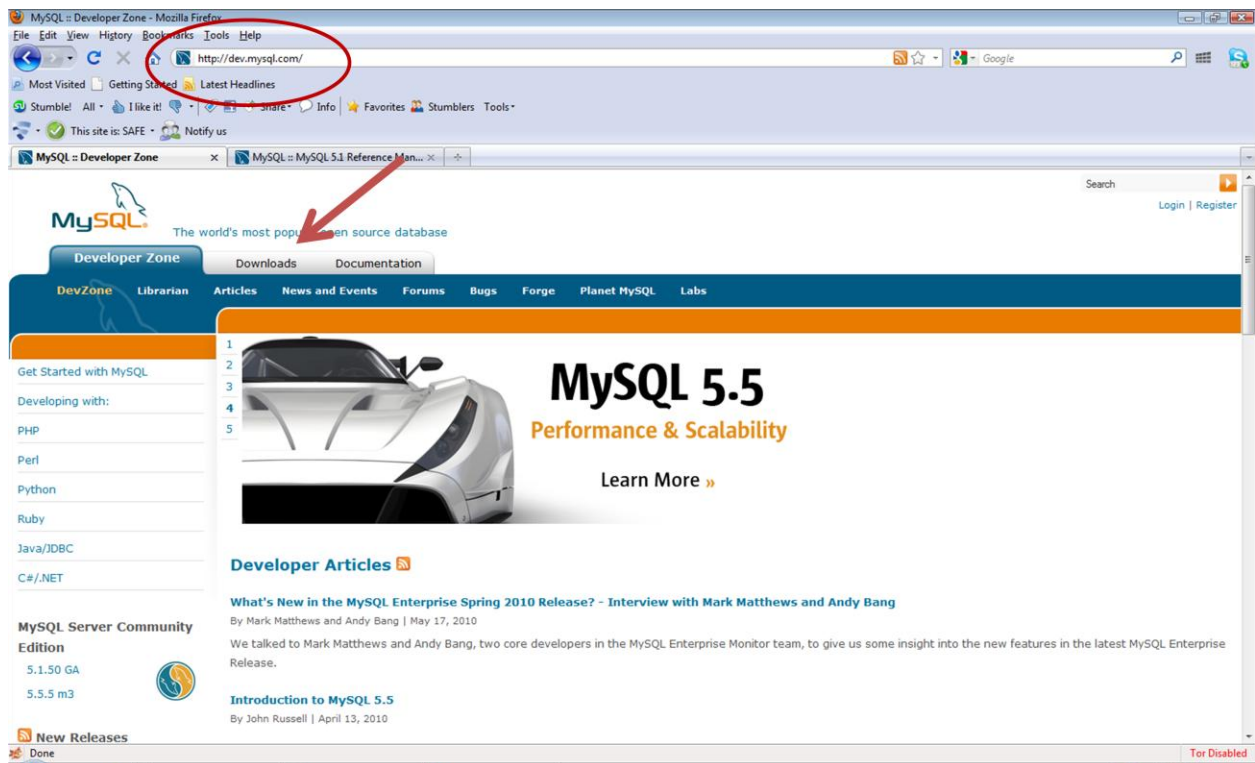
Tuesday, September 7, 2010

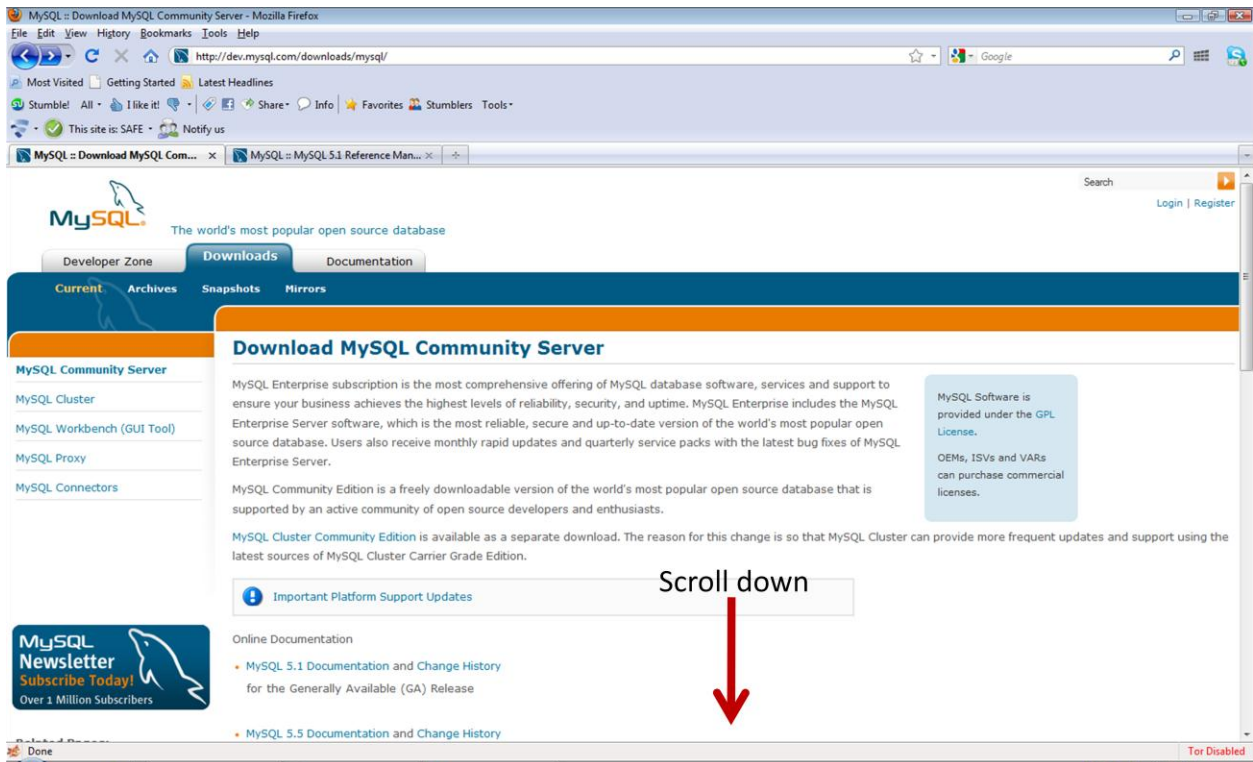
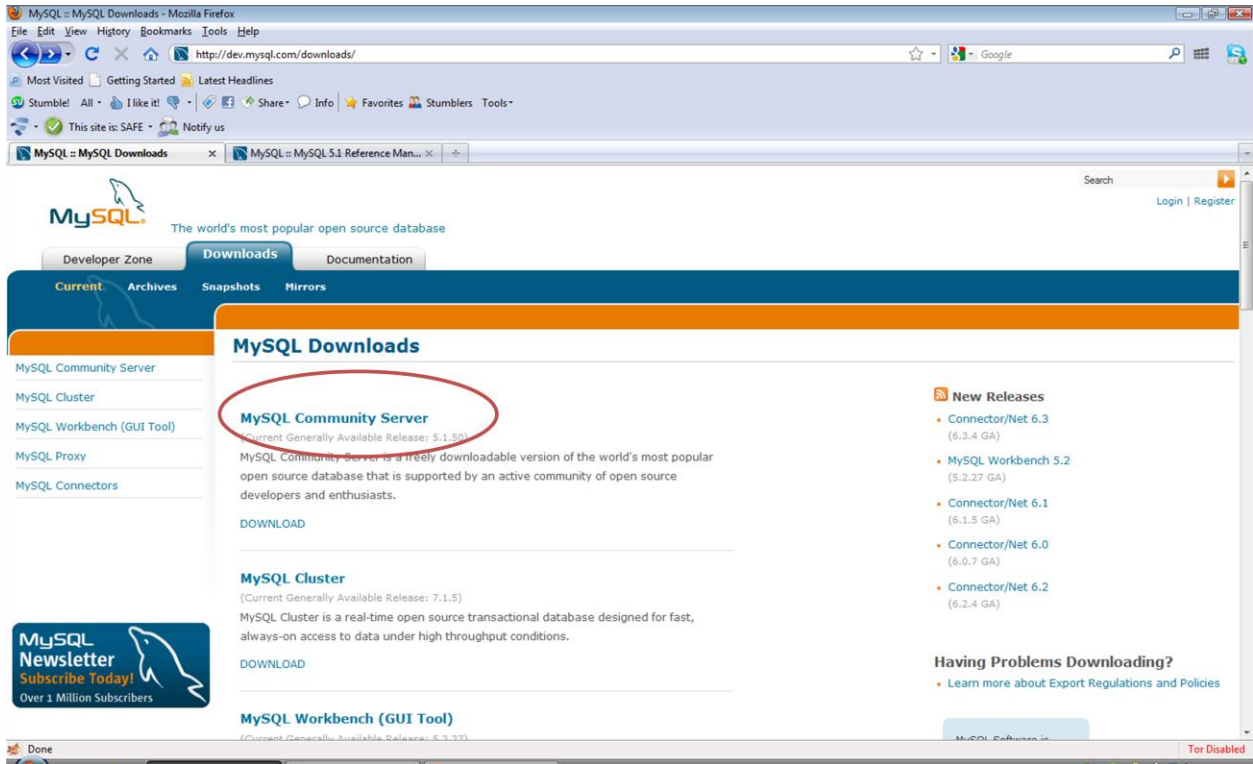
This tutorial shows a path to installing the MySQL database engine and to the associated tutorial in section 3 of the manual.

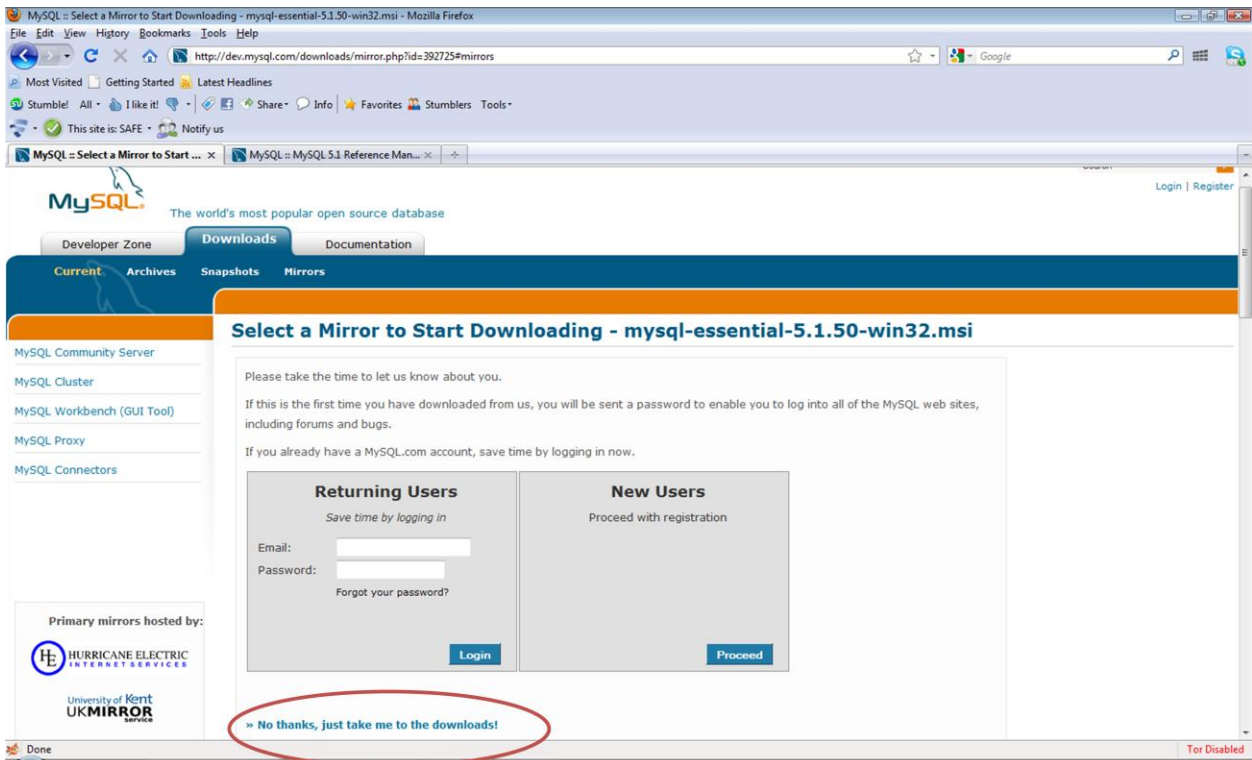
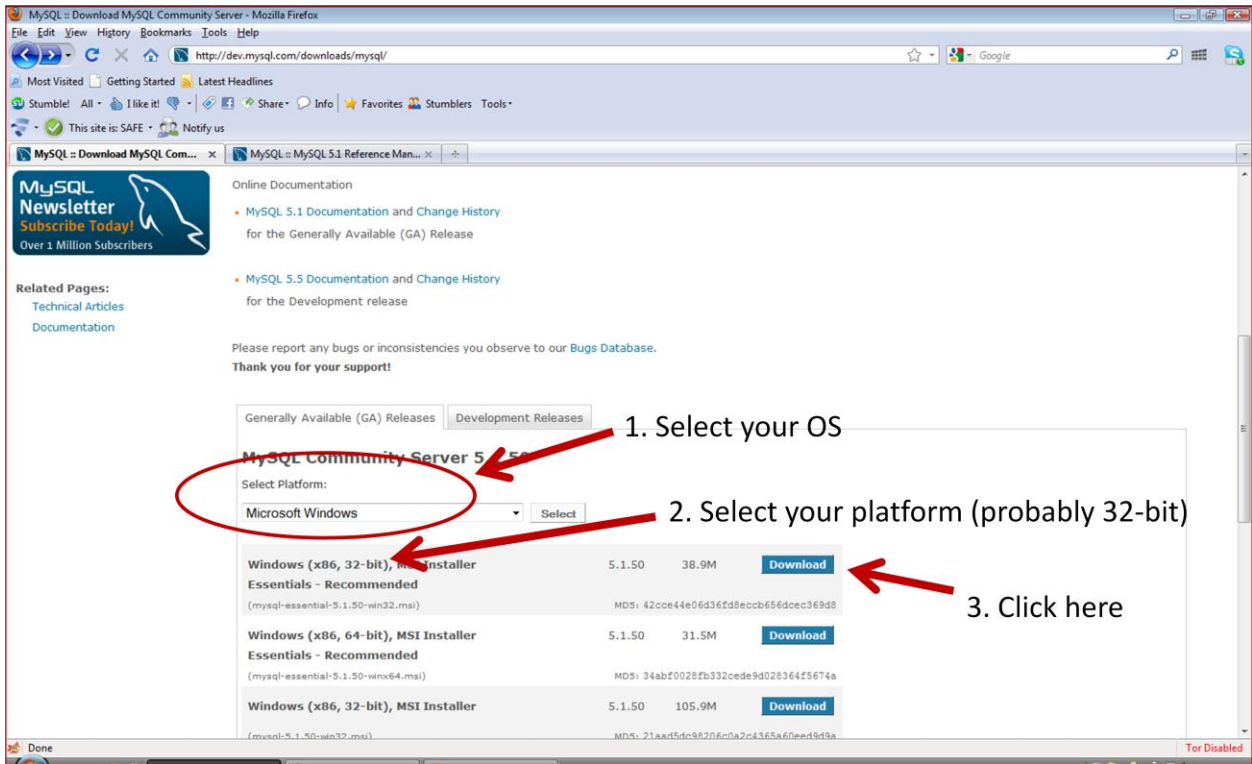
Start at <http://dev.mysql.com> for the installation

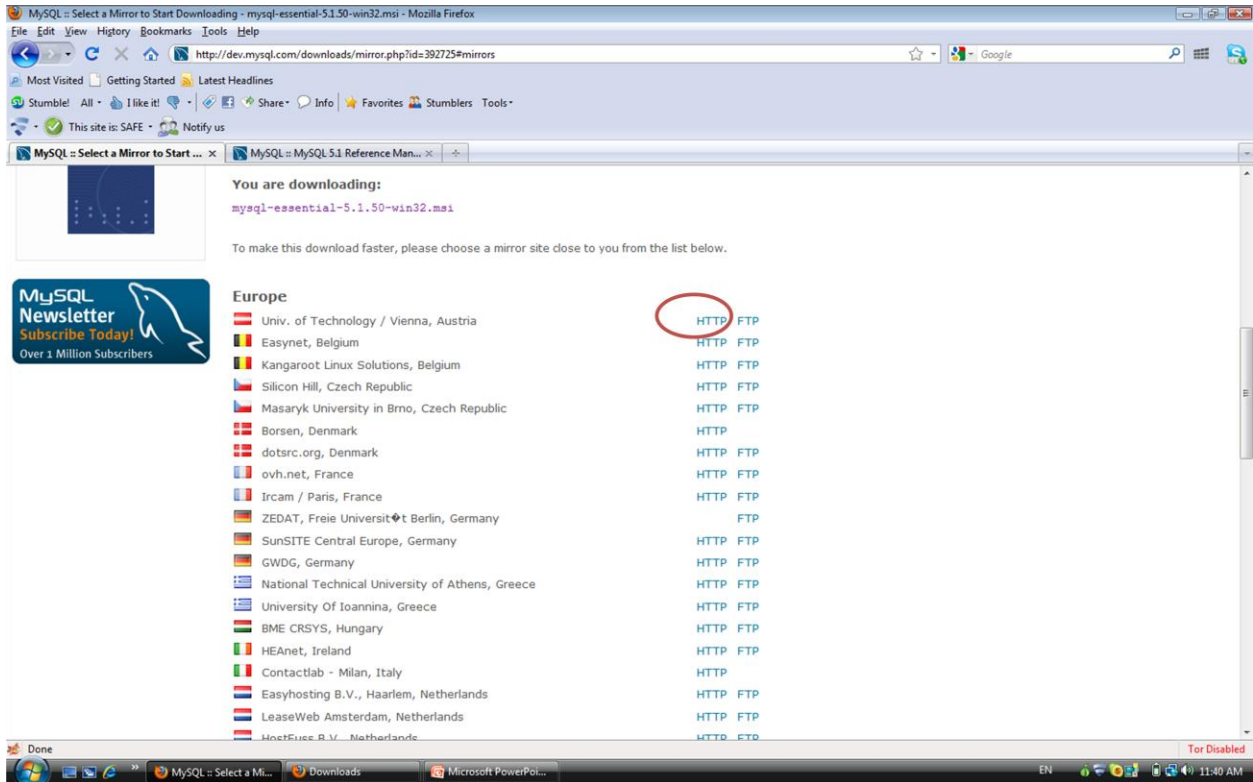
After completing the installation, make your way through the tutorial in sections 3.1 to 3.5 of the manual found at :

<http://dev.mysql.com/doc/refman/5.1/en/index.html>

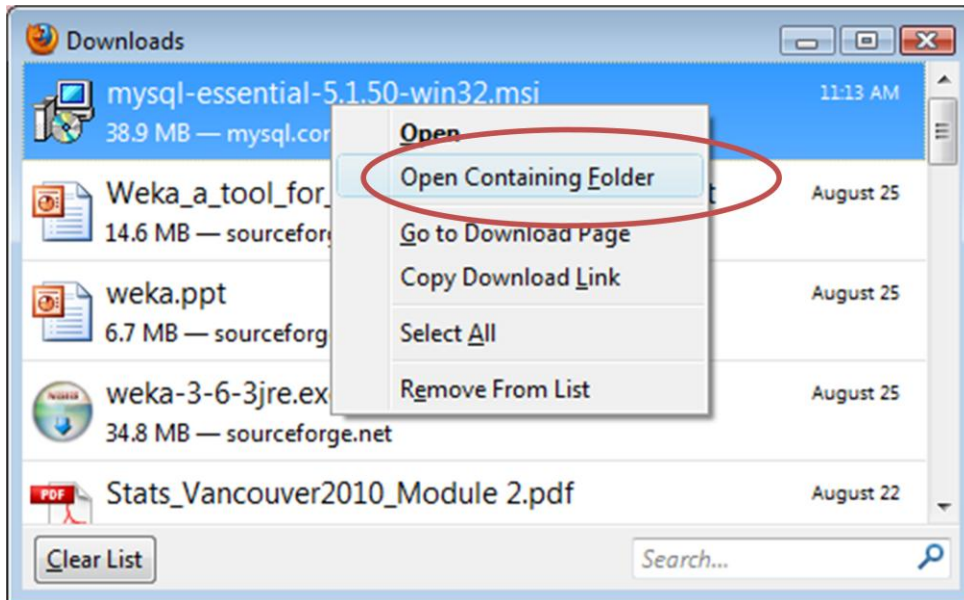




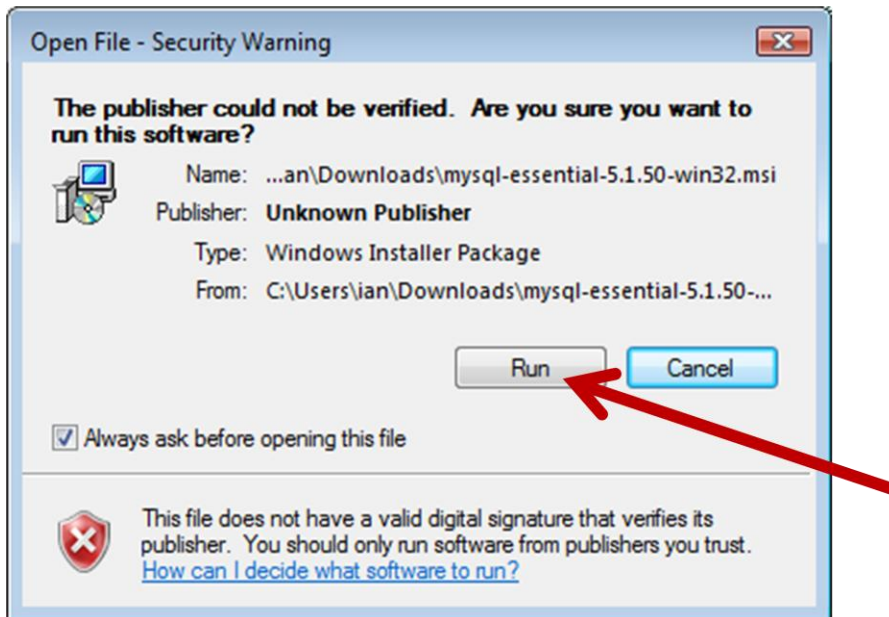




When the download finishes, find it and run it.

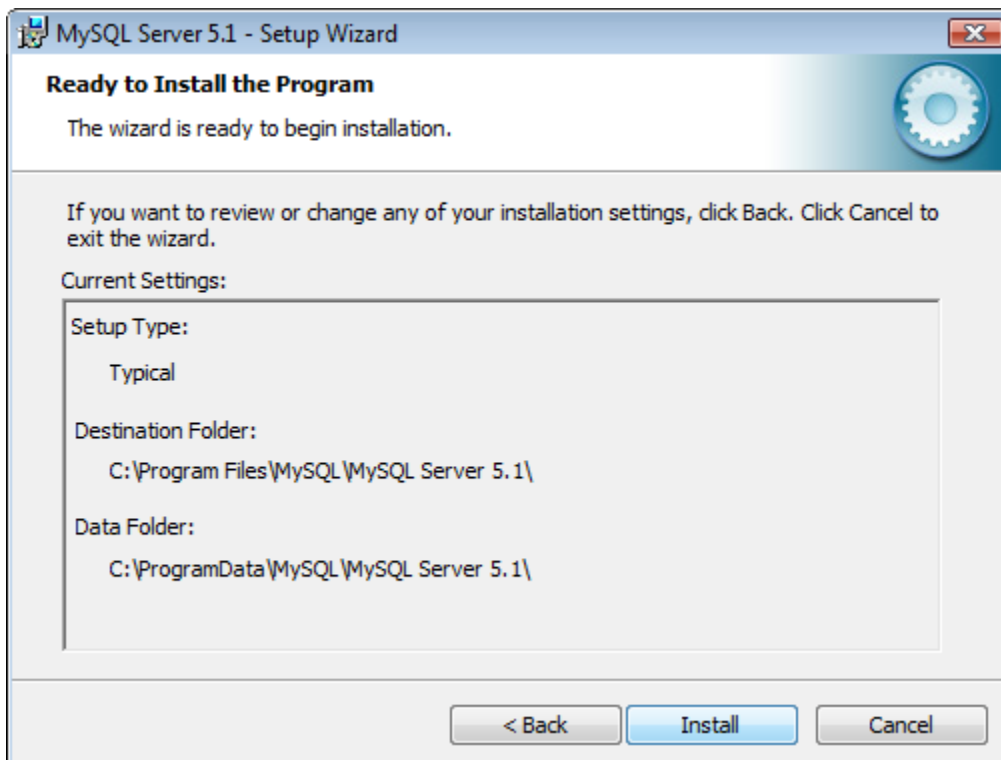
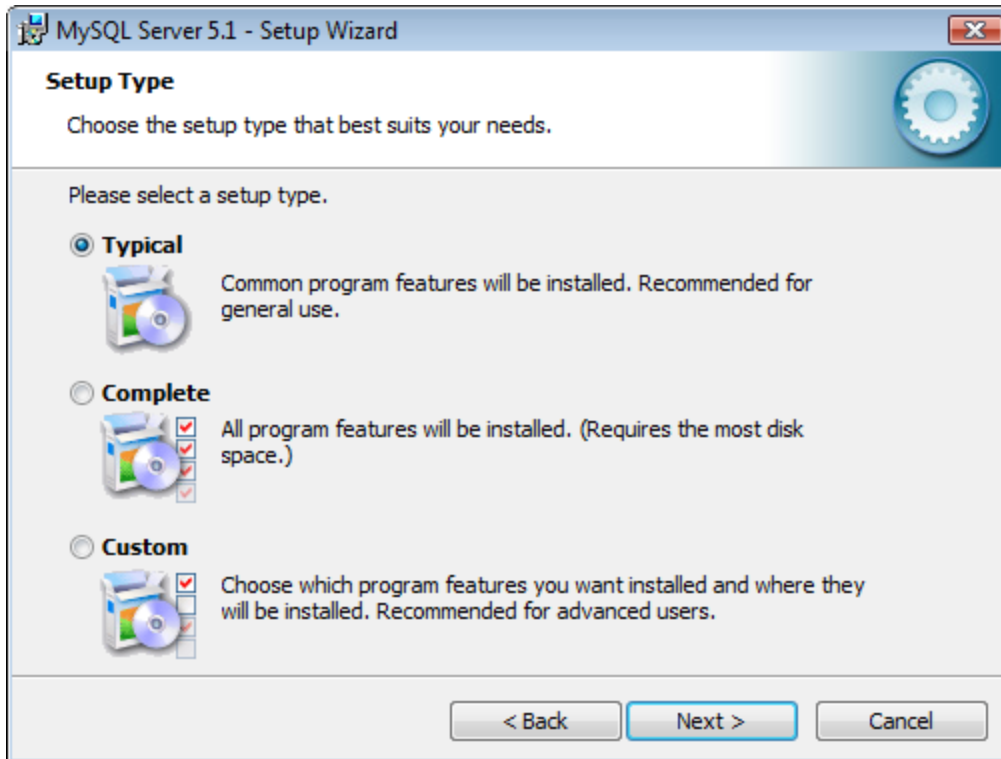


You must have administrative privileges to install software.

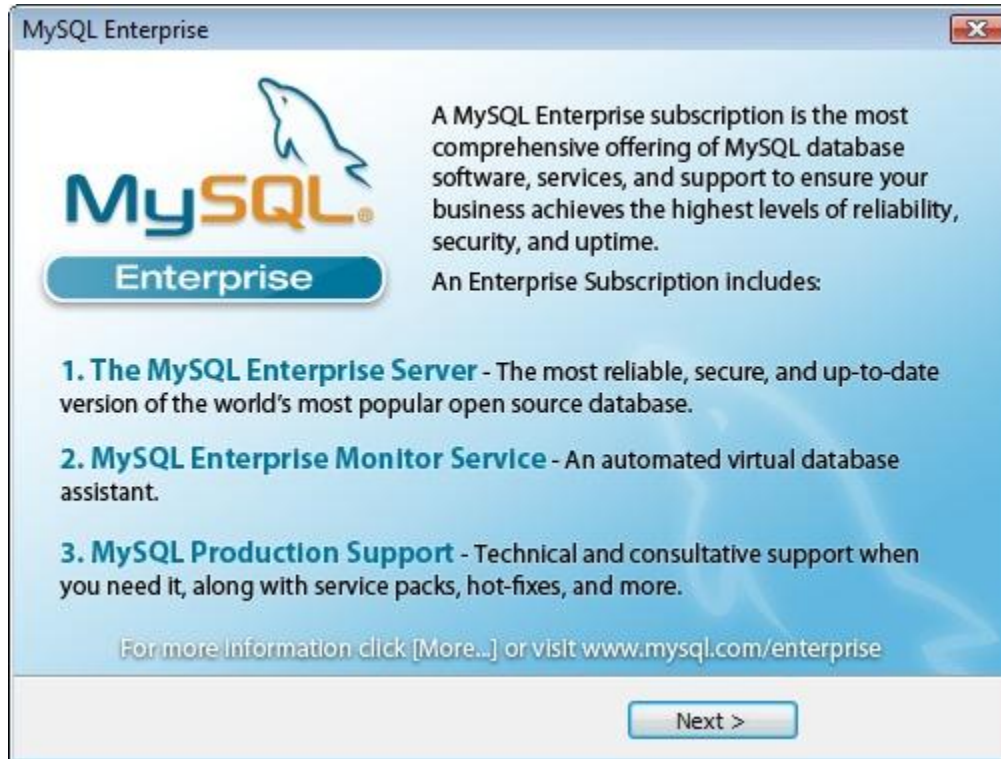


Then, just follow the default options...like this

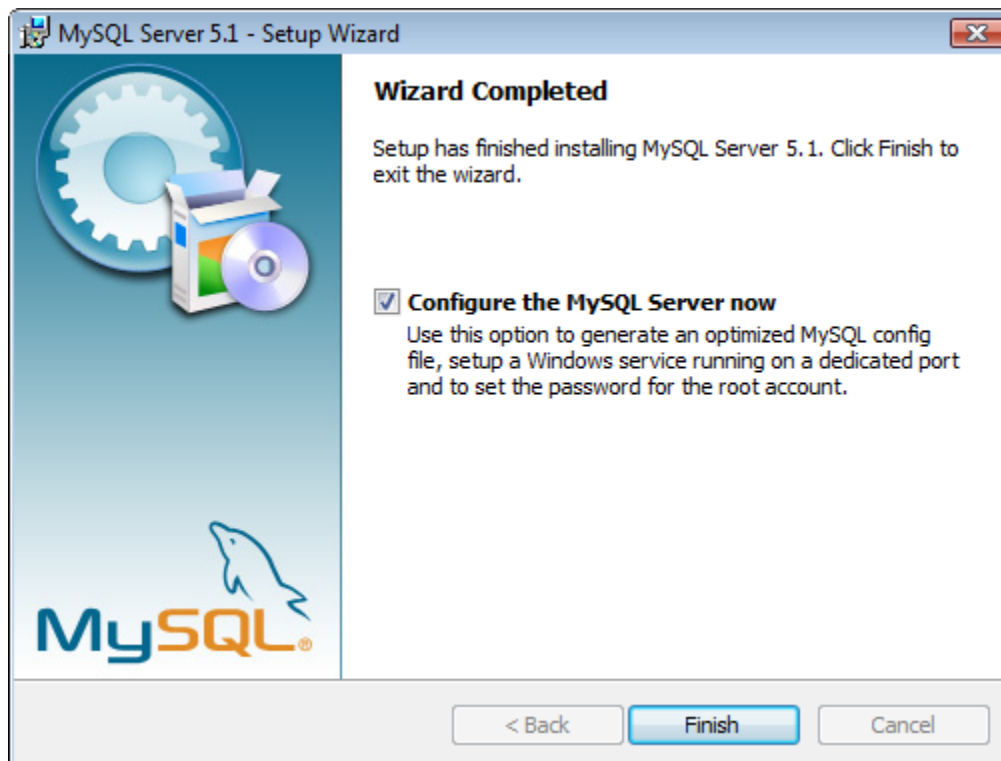


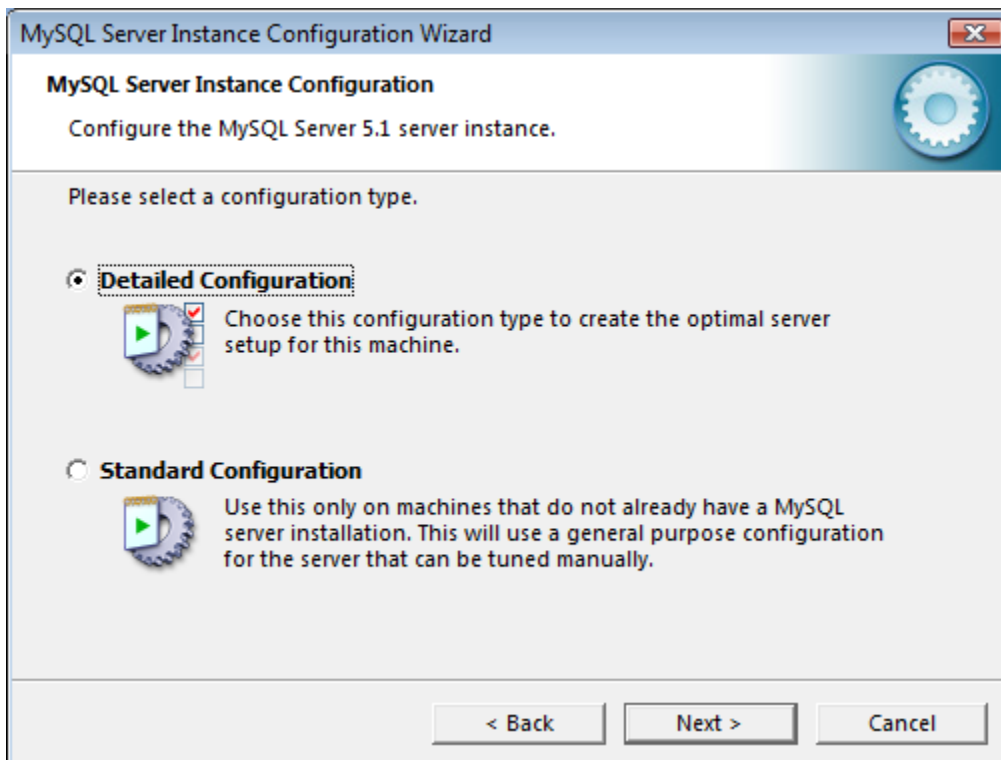
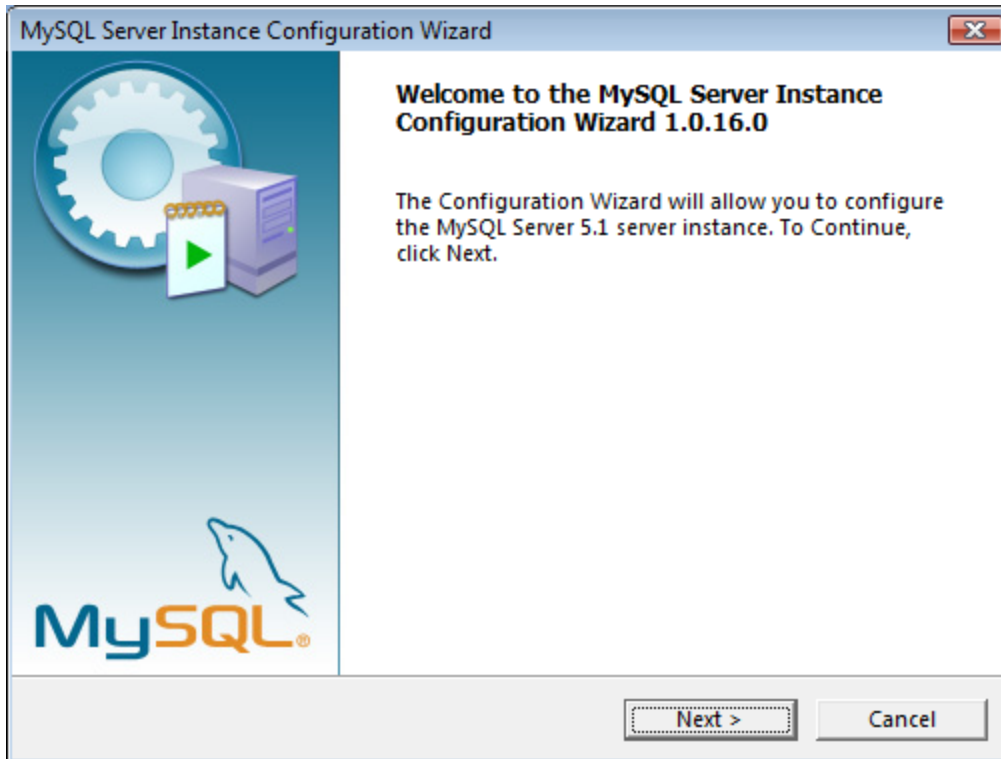


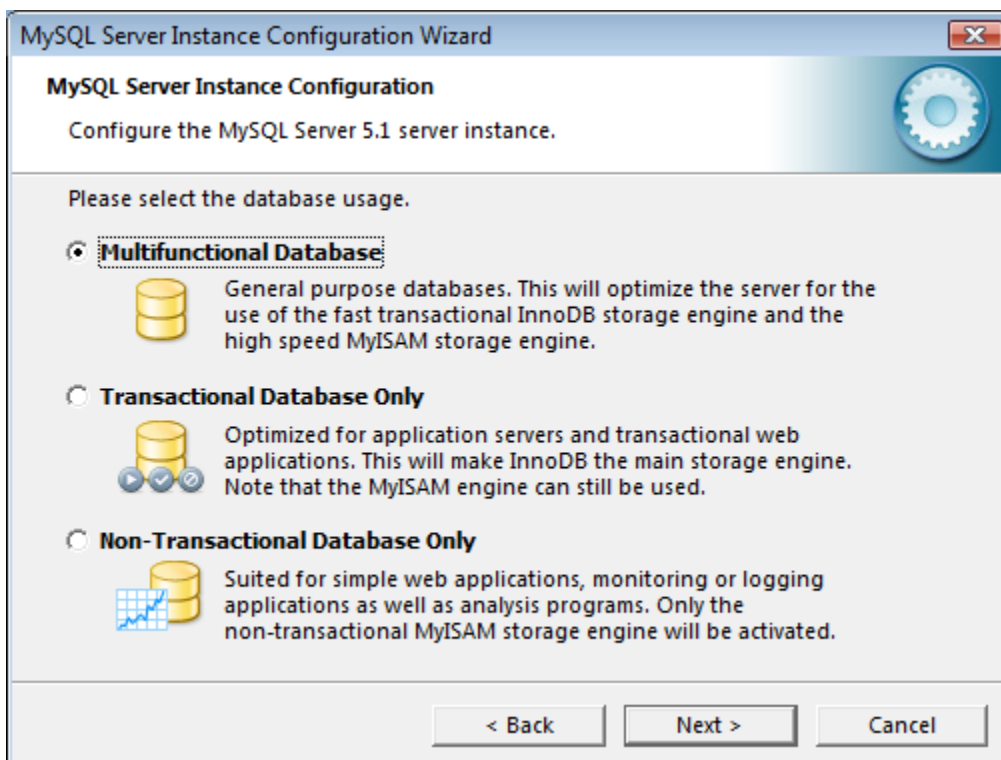
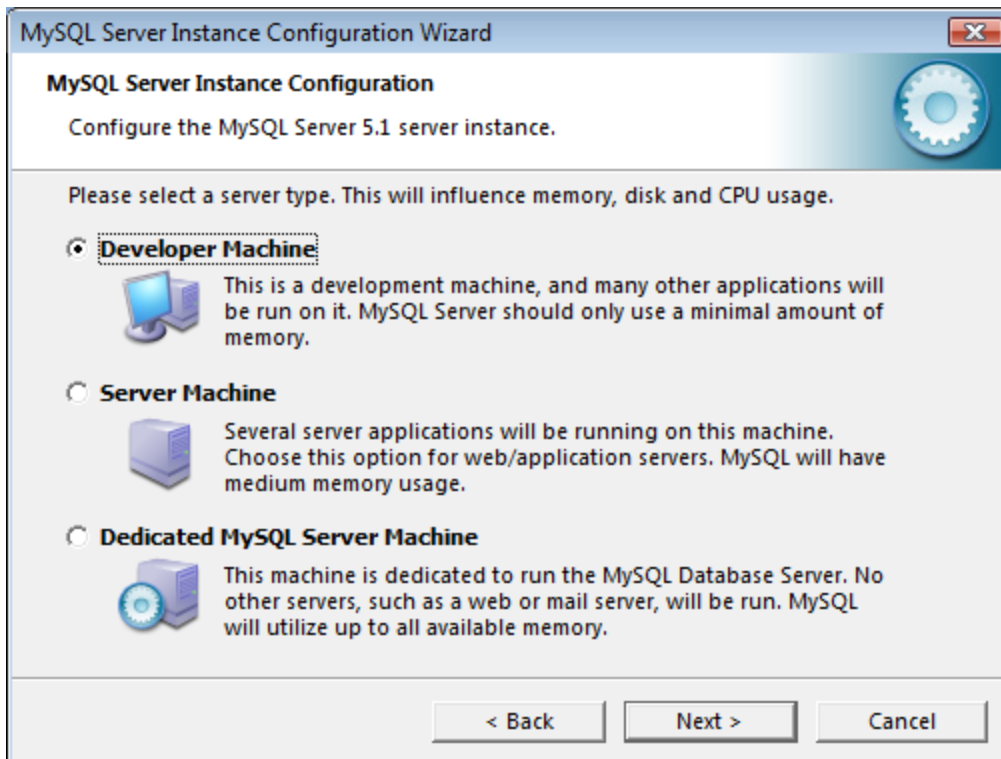
You can skip through the adverts...



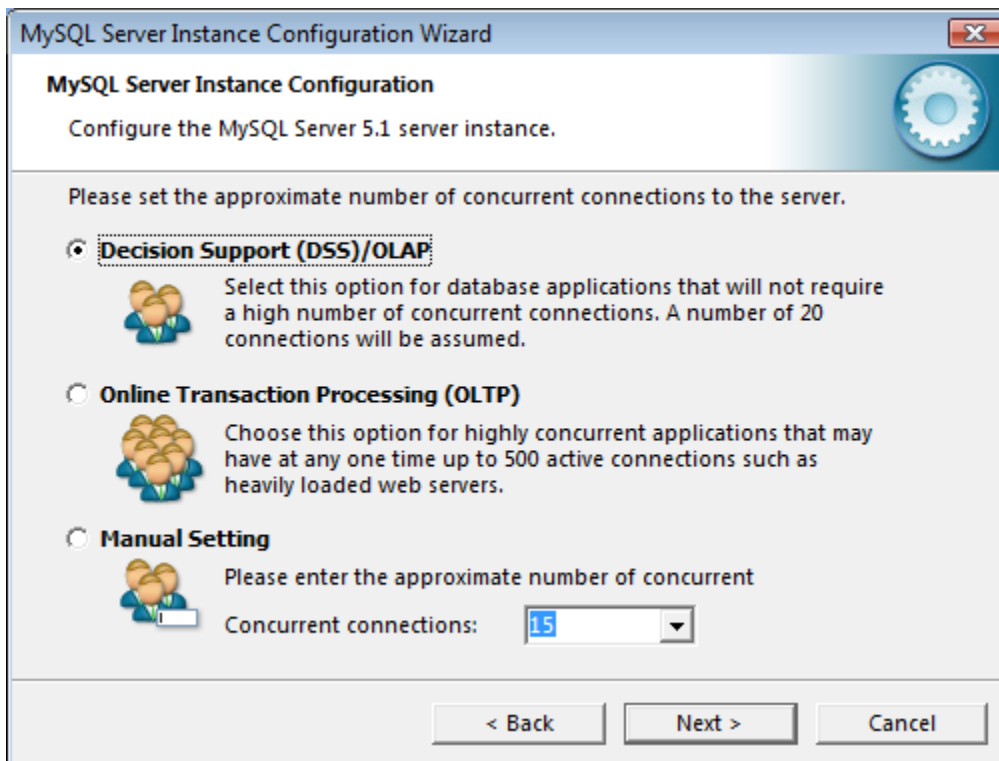
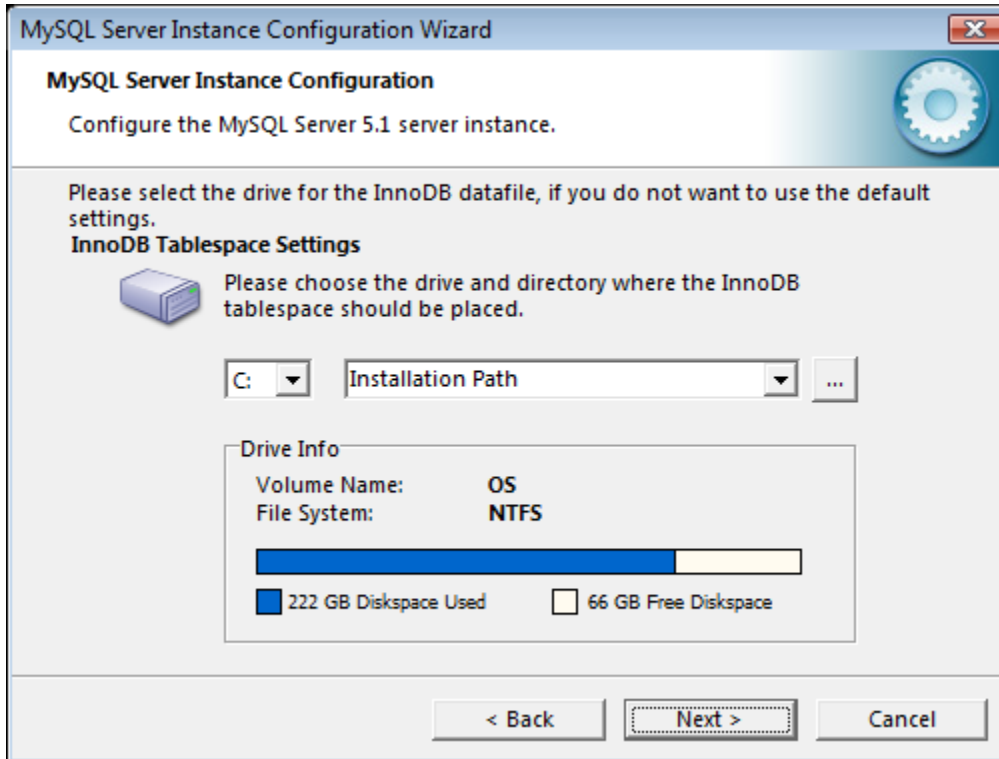
Click on finish

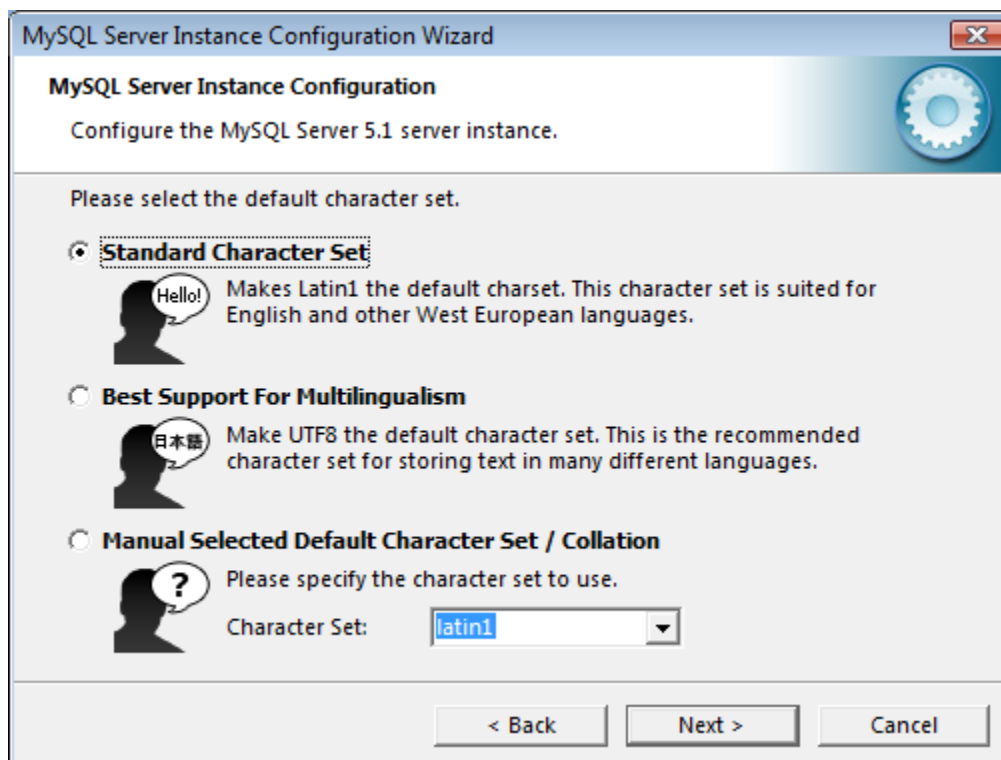
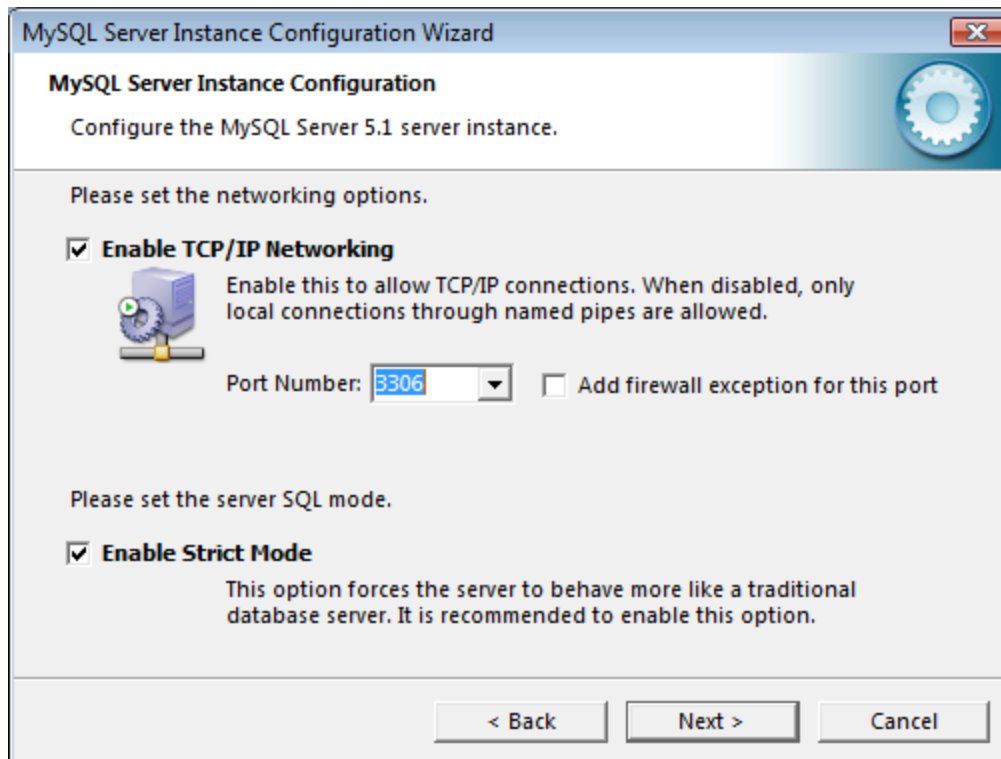


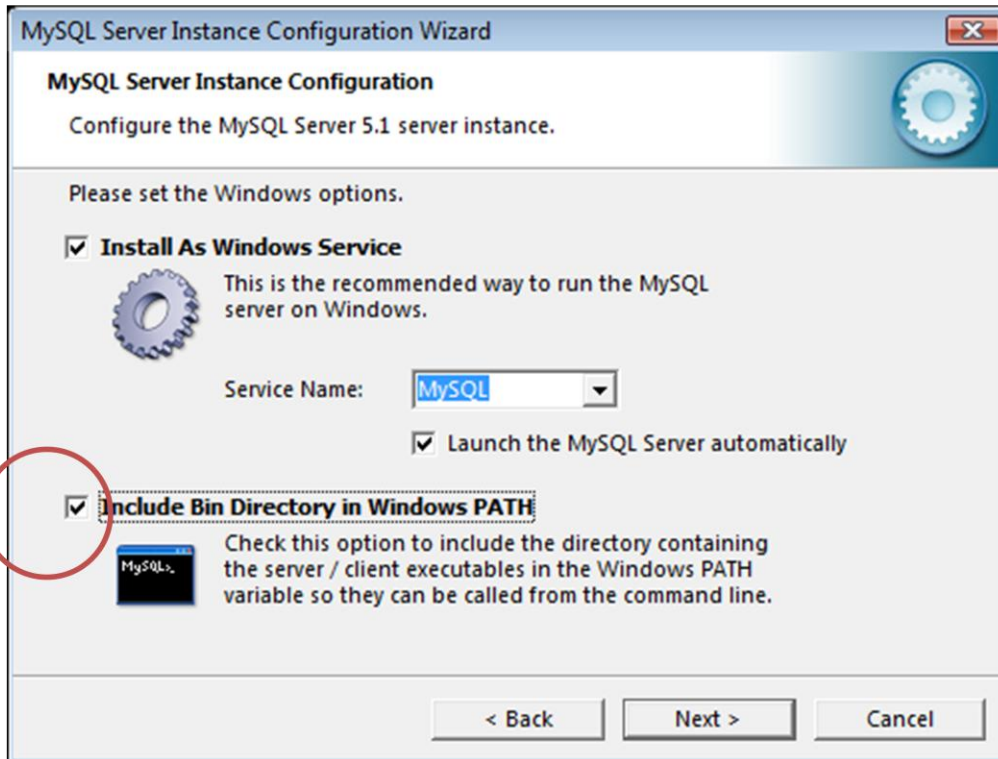




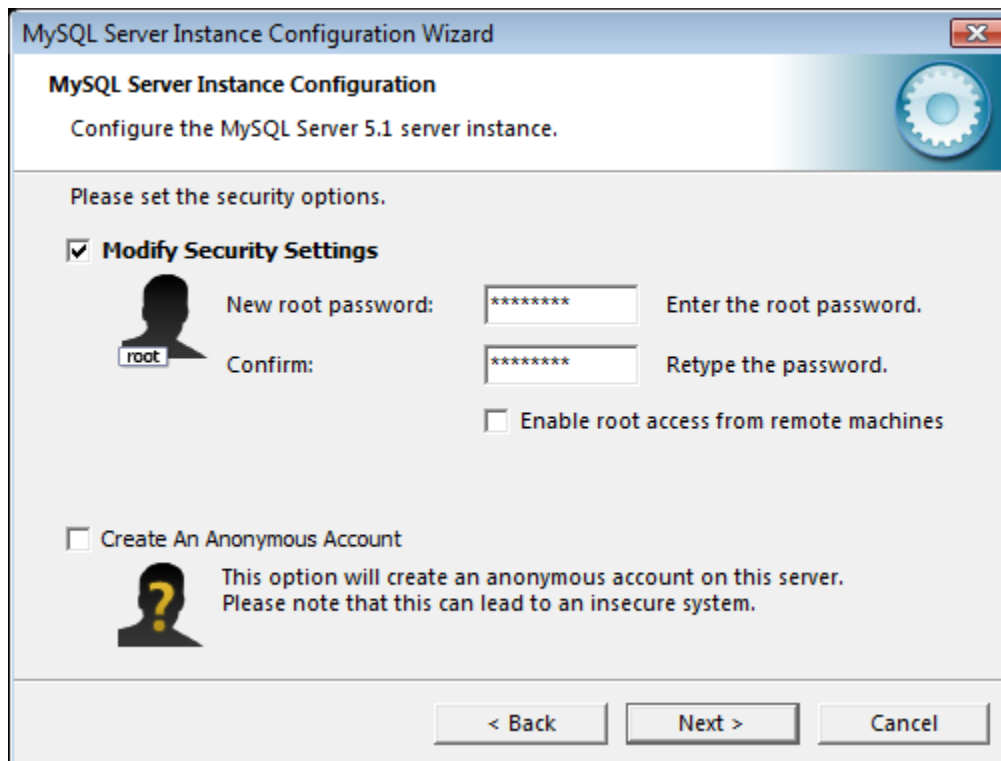
Accept default setting – somewhere where you have permissions to write to

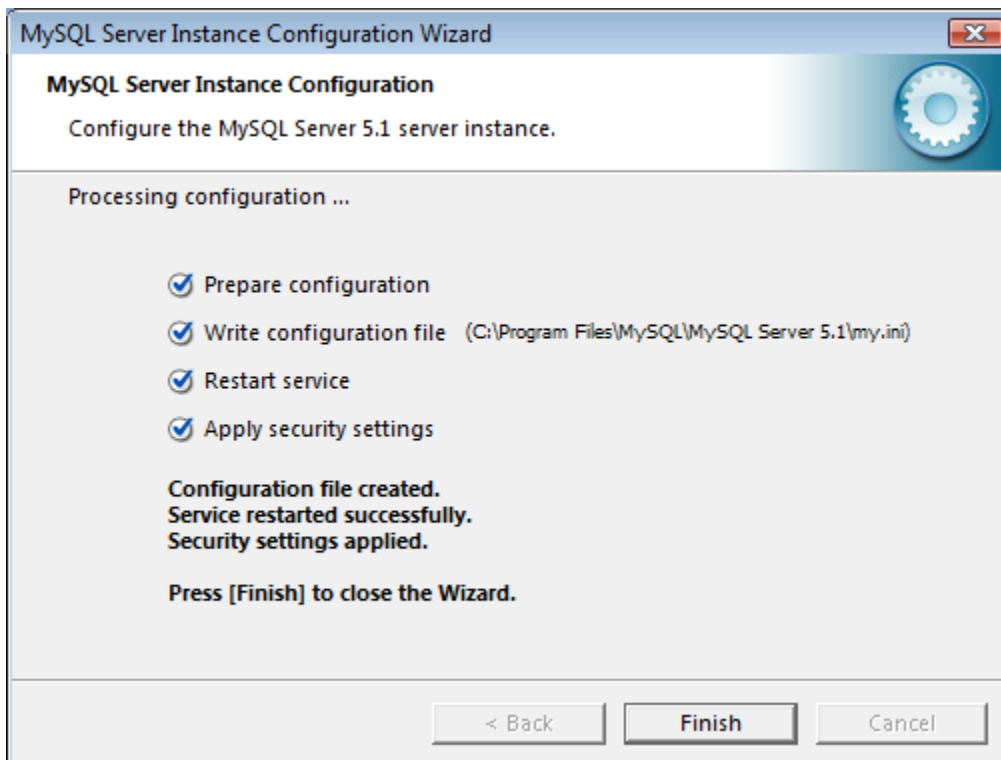
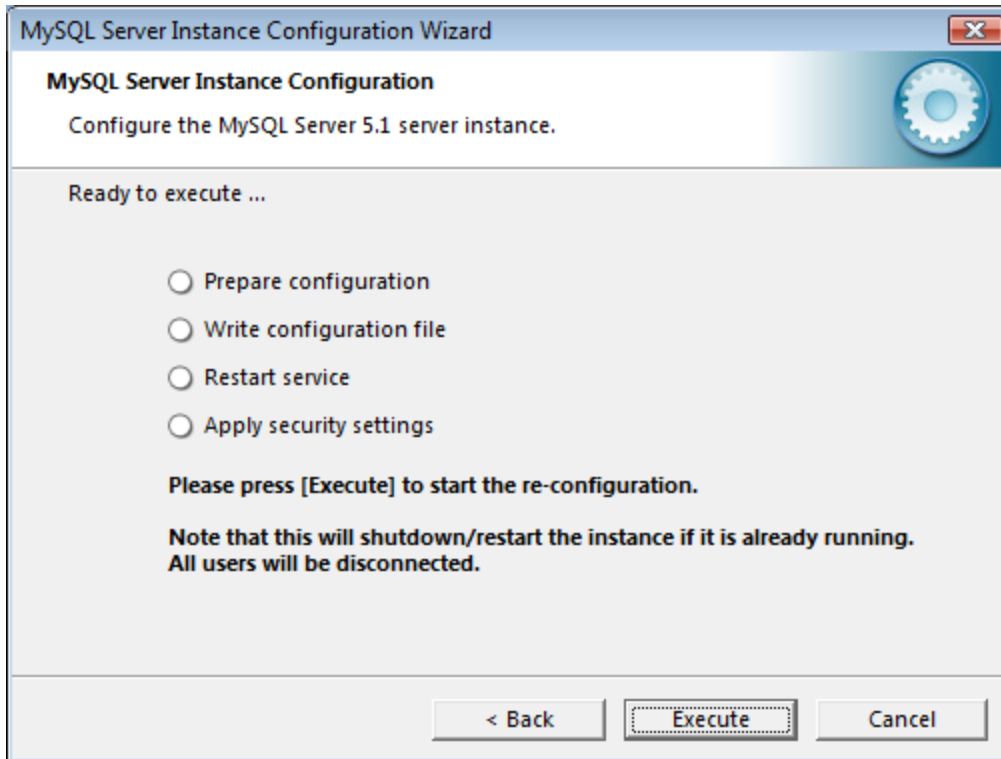






Enter a password of your choice (and remember it)

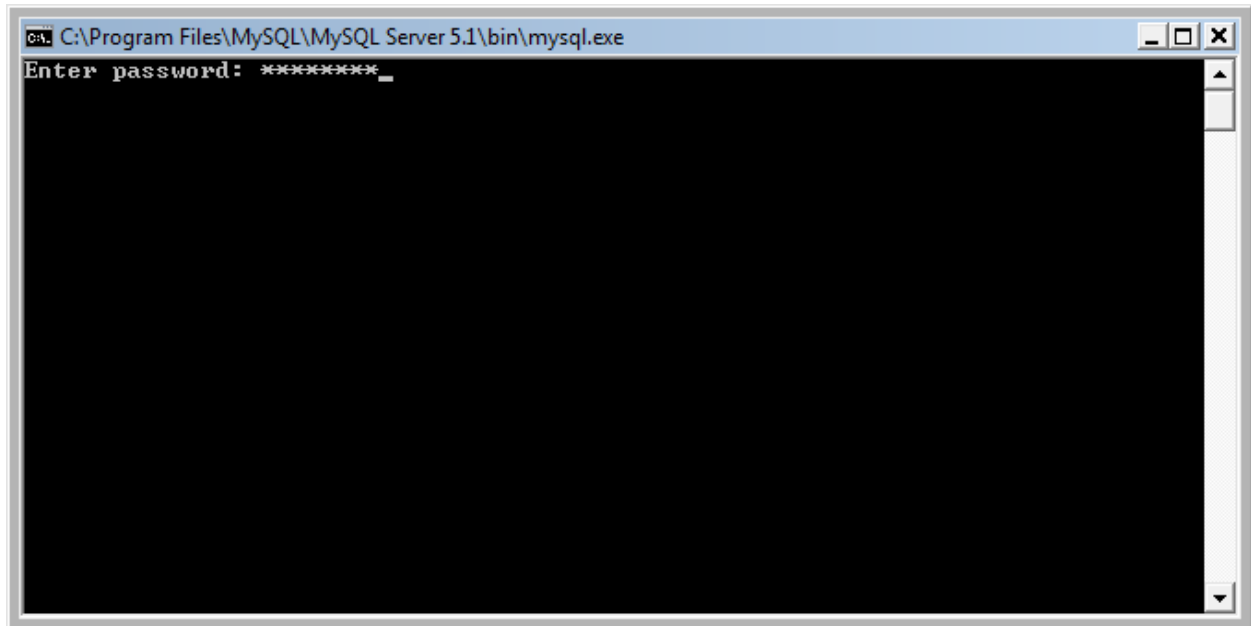




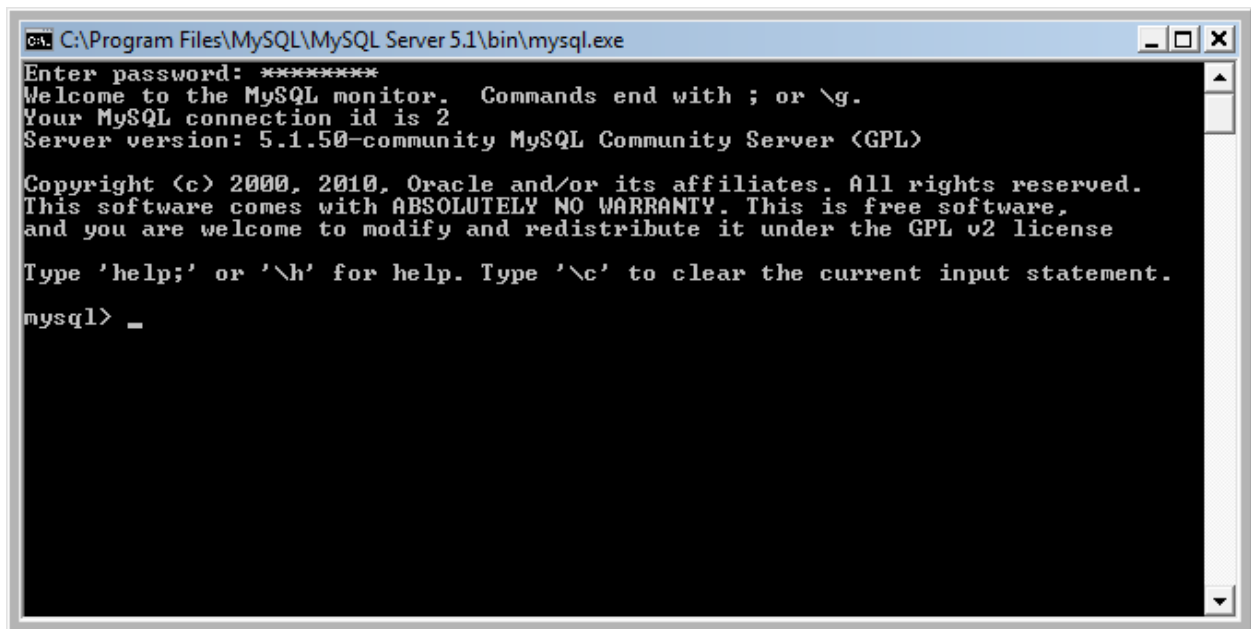
Start the MySQL command line client:



Enter the password you chose above



```
C:\Program Files\MySQL\MySQL Server 5.1\bin>mysql.exe
Enter password: *****_
```



```
C:\Program Files\MySQL\MySQL Server 5.1\bin>mysql.exe
Enter password: *****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 2
Server version: 5.1.50-community MySQL Community Server (GPL)

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Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
mysql> _
```

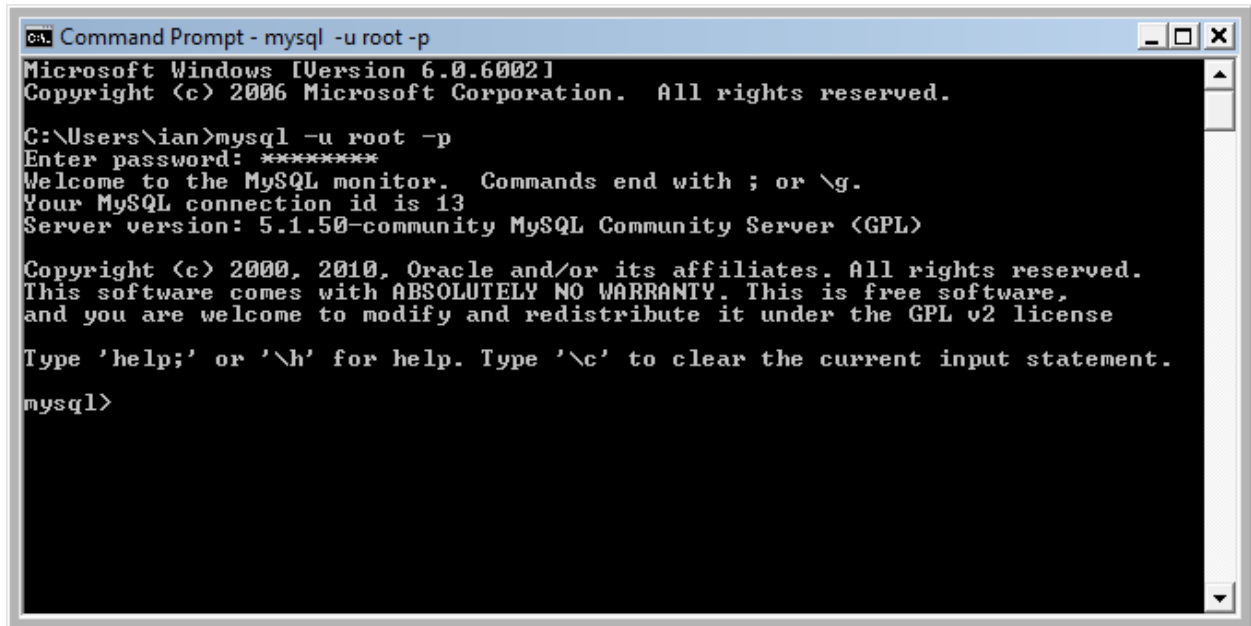
An alternative to the above way of connecting to mysql...

Open a dos command prompt and type...

```
mysql -u root -p
```

Then enter your password

You are the root user (controller) of the MySQL instance you just set up



```
Command Prompt - mysql -u root -p
Microsoft Windows [Version 6.0.6002]
Copyright (c) 2006 Microsoft Corporation. All rights reserved.

C:\Users\ian>mysql -u root -p
Enter password: *****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 13
Server version: 5.1.50-community MySQL Community Server (GPL)

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Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
mysql>
```

Now you're ready to start the tutorialbut first you need to go get it from <http://dev.mysql.doc>.

The screenshot shows the MySQL Documentation website in a Mozilla Firefox browser. The address bar contains <http://dev.mysql.com/doc/>. The page title is "MySQL Documentation: MySQL Reference Manuals". The navigation bar includes "Developer Zone", "Downloads", and "Documentation" (highlighted with a red arrow). The main content area is titled "MySQL Documentation: MySQL Reference Manuals" and contains a table of links for various MySQL versions and formats. A red arrow points to the "View" link in the table for MySQL v5.0.

MySQL Reference Manual (for GA releases)

| MySQL Version | HTML Online | HTML Page/chapter | HTML Single page | Eclipse Doc Plugin | PDF | CHM | Man Pages | RPM |
|---|----------------------|---------------------------|---------------------------|---------------------------|-----------------------------|---------------------|---------------------------|----------------------------|
| English v5.0 | View | TGZ Zip | TGZ Zip | TGZ Zip | US Ltr A4 | CHM | TGZ Zip | HTML PDF |
| English v5.1 (includes MySQL Cluster NDB 6.X/7.X) | View | TGZ Zip | TGZ Zip | TGZ Zip | US Ltr A4 | CHM | TGZ Zip | HTML PDF |

MySQL Reference Manual (for development releases)

| MySQL Version | HTML Online | HTML Page/chapter | HTML Single page | Eclipse Doc Plugin | PDF | CHM | Man Pages | RPM |
|-------------------------------------|----------------------|---------------------------|---------------------------|---------------------------|-----------------------------|---------------------|---------------------------|----------------------------|
| English MySQL Reference Manual v5.5 | View | TGZ Zip | TGZ Zip | TGZ Zip | US Ltr A4 | CHM | TGZ Zip | HTML PDF |
| English MySQL Reference Manual v5.6 | View | TGZ Zip | TGZ Zip | TGZ Zip | US Ltr A4 | CHM | TGZ Zip | HTML PDF |
| English InnoDB Plugin v1.0 | View | TGZ Zip | TGZ Zip | TGZ Zip | US Ltr A4 | | | |
| English InnoDB v1.1 | View | TGZ Zip | TGZ Zip | TGZ Zip | US Ltr A4 | | | |

MySQL Reference Manual (other releases and translations)

MySQL 5.1 Reference Manual - Mozilla Firefox
http://dev.mysql.com/doc/refman/5.1/en/index.html

MySQL
The world's most popular open source database

Developer Zone Downloads Documentation

MySQL Manual MySQL Workbench Expert Guides Topic Guides MySQL Cluster Other Docs MySQL Uni About Archives

MySQL 5.1 Reference Manual

Including MySQL Cluster NDB 6.X/7.X Reference Guide

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Preface, Notes, Licenses >

Section Navigation [Toggle]

- MySQL 5.1 Reference Manual
 - Preface, Notes, Licenses
 - 1 General Information
 - 2 Installing and Upgrading MySQL
 - 3 Tutorial
 - 4 MySQL Programs
 - 5 MySQL Server Administration
 - 6 Backup and Recovery
 - 7 Optimization
 - 8 Language Structure
 - 9 Internationalization and Localization
 - 10 Data Types
 - 11 Functions and Operators
 - 12 SQL Statement Syntax
 - 13 Storage Engines
 - 14 High Availability and Scalability
 - 15 MySQL Enterprise Monitor
 - 16 Replication
 - 17 MySQL Cluster NDB 6.X/7.X

Go to the tutorial

MySQL 5.1 Reference Manual :: 3 Tutorial - Mozilla Firefox
http://dev.mysql.com/doc/refman/5.1/en/tutorial.html

MySQL Manual MySQL Workbench Expert Guides Topic Guides MySQL Cluster Other Docs MySQL Uni About Archives

Chapter 3. Tutorial

Table of Contents [+/-]

- [3.1. Connecting to and Disconnecting from the Server](#)
- [3.2. Entering Queries](#)
- [3.3. Creating and Using a Database](#) [+/-]
- [3.4. Getting Information About Databases and Tables](#)
- [3.5. Using `mysql` in Batch Mode](#)
- [3.6. Examples of Common Queries](#) [+/-]
- [3.7. Queries from the Twin Project](#) [+/-]
- [3.8. Using MySQL with Apache](#)

This chapter provides a tutorial introduction to MySQL by showing how to use the `mysql` client program to create and use a simple database. `mysql` (sometimes referred to as the "terminal monitor" or just "monitor") is an interactive program that enables you to connect to a MySQL server, run queries, and view the results. `mysql` may also be used in batch mode: you place your queries in a file beforehand, then tell `mysql` to execute the contents of the file. Both ways of using `mysql` are covered here.

To see a list of options provided by `mysql`, invoke it with the `--help` option:

```
shell> mysql --help
```

This chapter assumes that `mysql` is installed on your machine and that a MySQL server is available to which you can connect. If this is not true, contact your MySQL administrator. (If you are the administrator, you need to consult the relevant portions of this manual, such as [Chapter 5, MySQL Server Administration](#).)

< 2.15.3 Problems Using the Perl DBI/DBD Interface

3.1 Connecting to and Disconnecting from the Server >

Section Navigation [Toggle]

- Preface, Notes, Licenses
- 1 General Information
- 2 Installing and Upgrading MySQL
- 3 Tutorial
 - 3.1 Connecting to and Disconnecting from the Server
 - 3.2 Entering Queries
 - 3.3 Creating and Using a Database
 - 3.4 Getting Information About Databases and Tables
 - 3.5 Using `mysql` in Batch Mode
 - 3.6 Examples of Common Queries
 - 3.7 Queries from the Twin Project
 - 3.8 Using MySQL with Apache
- 4 MySQL Programs
- 5 MySQL Server Administration
- 6 Backup and Recovery
- 7 Optimization
- 8 Language Structure

Then click here

MySQL 5.1 Reference Manual :: 3.1 Connecting to and Disconnecting from the Server

3.1. Connecting to and Disconnecting from the Server

To connect to the server, you will usually need to provide a MySQL user name when you invoke `mysql` and, most likely, a password. If the server runs on a machine other than the one where you log in, you will also need to specify a host name. Contact your administrator to find out what connection parameters you should use to connect (that is, what host, user name, and password to use). Once to connect like this:

```
shell> mysql -h host -u user -p
Enter password: *****
host and user represent the host name where your MySQL server is running and the user name of your MySQL account. Substitute appropriate values for your setup. The ***** represents your password, enter it when mysql displays the Enter password: prompt.
```

If that works, you should see some introductory information followed by a `mysql>` prompt:

```
shell> mysql -h host -u user -p
Enter password: *****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 25338 to server version: 5.1.51-standard

Type 'help;' or '\h' for help. Type '\c' to clear the buffer.

mysql>
```

The `mysql>` prompt tells you that `mysql` is ready for you to enter commands.

**You already did this
Your user name was "root"**

**You should already see
this and be able to
continue with section 3.2**

Follow the tutorial up to at least 3.6.

1. Use Programmers Notepad to make text files:

A few notes that will help during the tutorial follow.

Section 3.3.3 describes problems with line endings that differ on different platforms.

You can avoid these problems (on windows) by using Programmer’s Notepad to open, create and edit text files.

The program deals with large files really well (a common occurrence in bioinformatics)

And gives you full control over visualizing and changing the line endings that are used.

See the tools menu and select line endings.

Programmer’s notepad is freely downloadable from <http://www.pnotepad.org/>

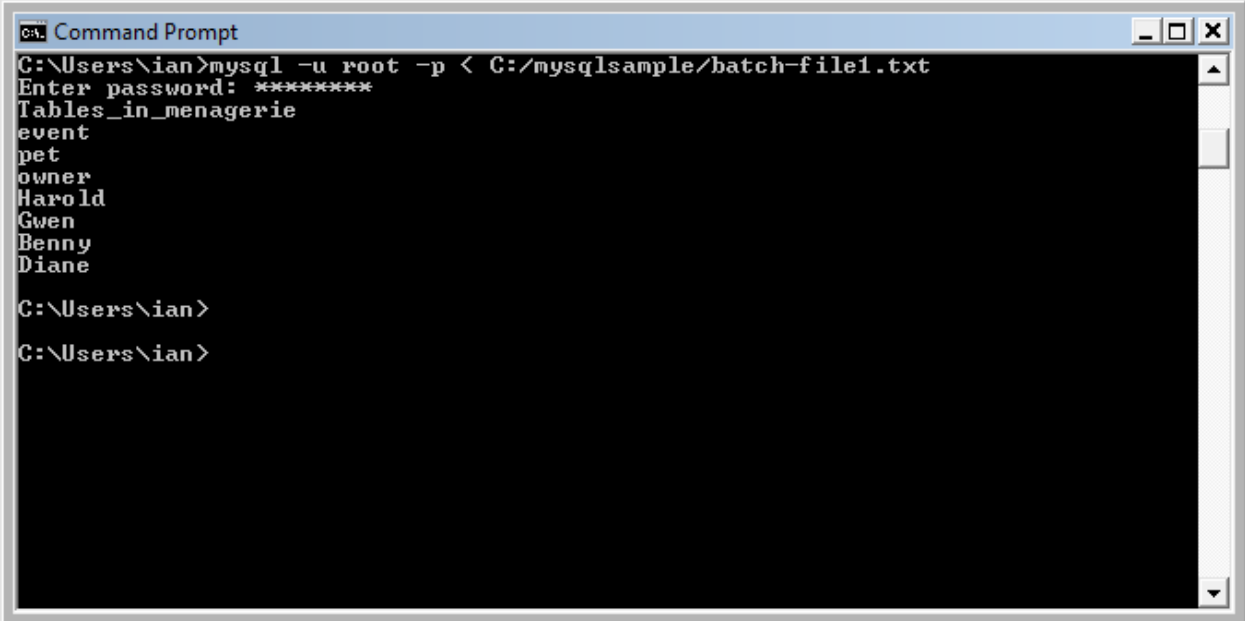
2. Running sql commands from a batch file.

I have a file at C:/mysqlsample.batch-file1.txt

With the following content:

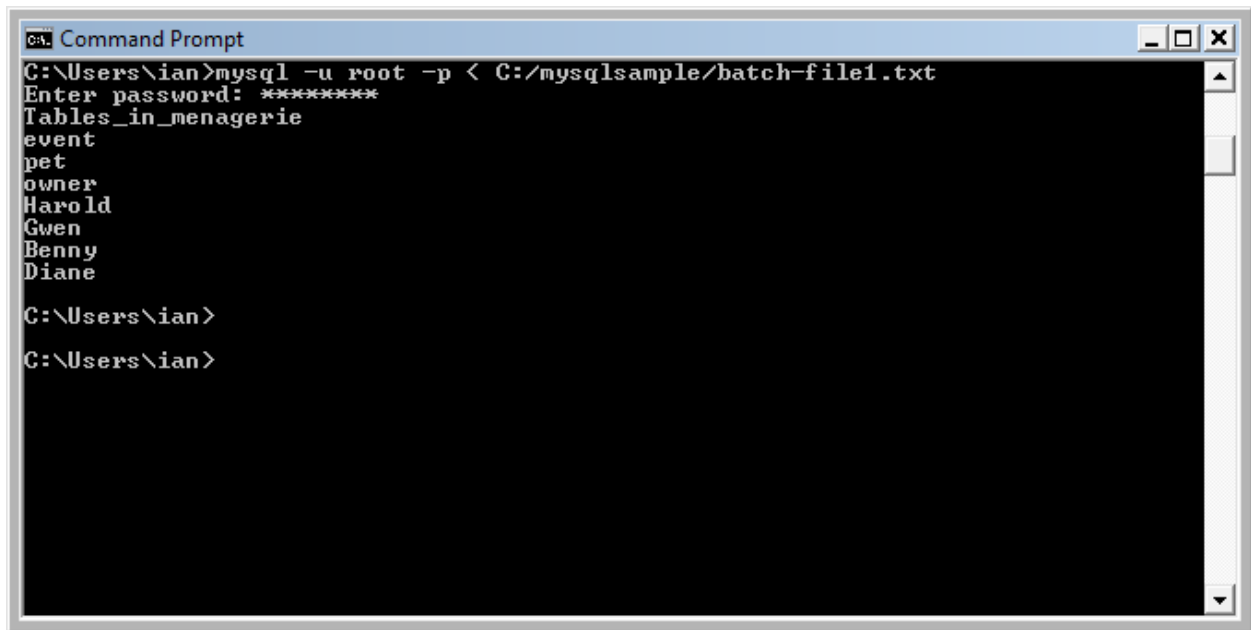
```
USE menagerie  
SHOW TABLES;  
SELECT DISTINCT owner FROM pet;
```

Then i can do the following to run from a cmd prompt:



```
C:\Users\ian>mysql -u root -p < C:/mysqlsample/batch-file1.txt  
Enter password: *****  
Tables_in_menagerie  
event  
pet  
owner  
Harold  
Gwen  
Benny  
Diane  
  
C:\Users\ian>  
C:\Users\ian>
```

Or I can use this syntax...

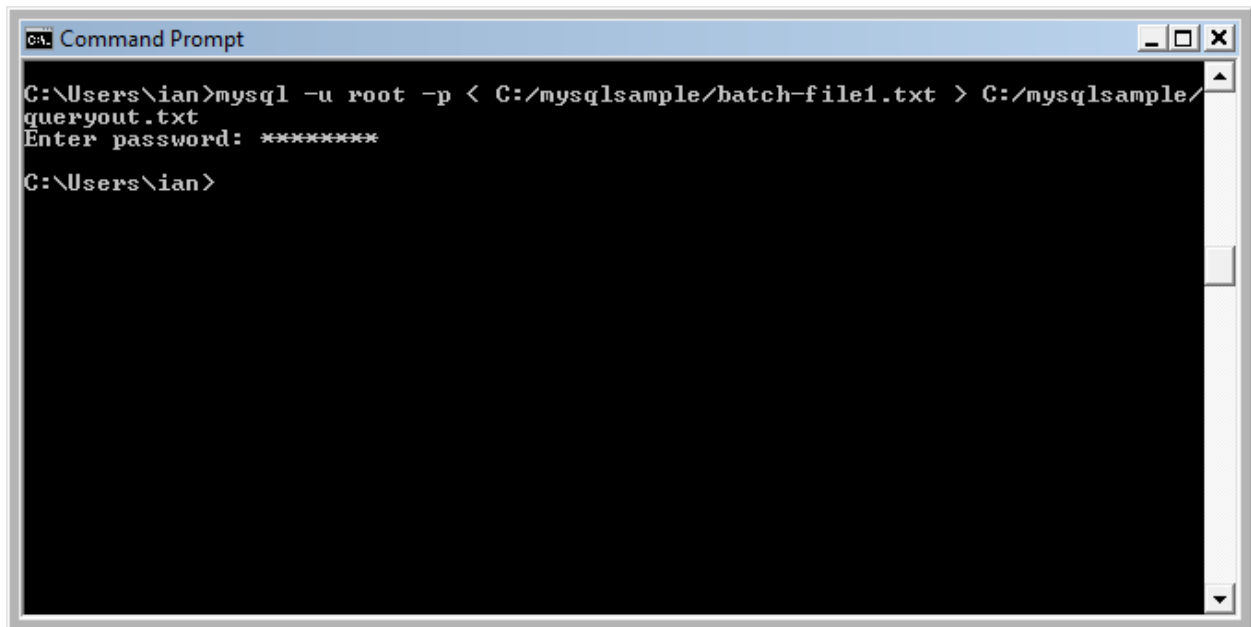


```
C:\Users\ian>mysql -u root -p < C:/mysqlsample/batch-file1.txt
Enter password: *****
Tables_in_menagerie
event
pet
owner
Harold
Gwen
Benny
Diane

C:\Users\ian>
C:\Users\ian>
```

See <http://dev.mysql.com/doc/refman/5.1/en/batch-mode.html> for more on this.

Try sending your query results to an output file like this:



```
C:\Users\ian>mysql -u root -p < C:/mysqlsample/batch-file1.txt > C:/mysqlsample/
queryout.txt
Enter password: *****

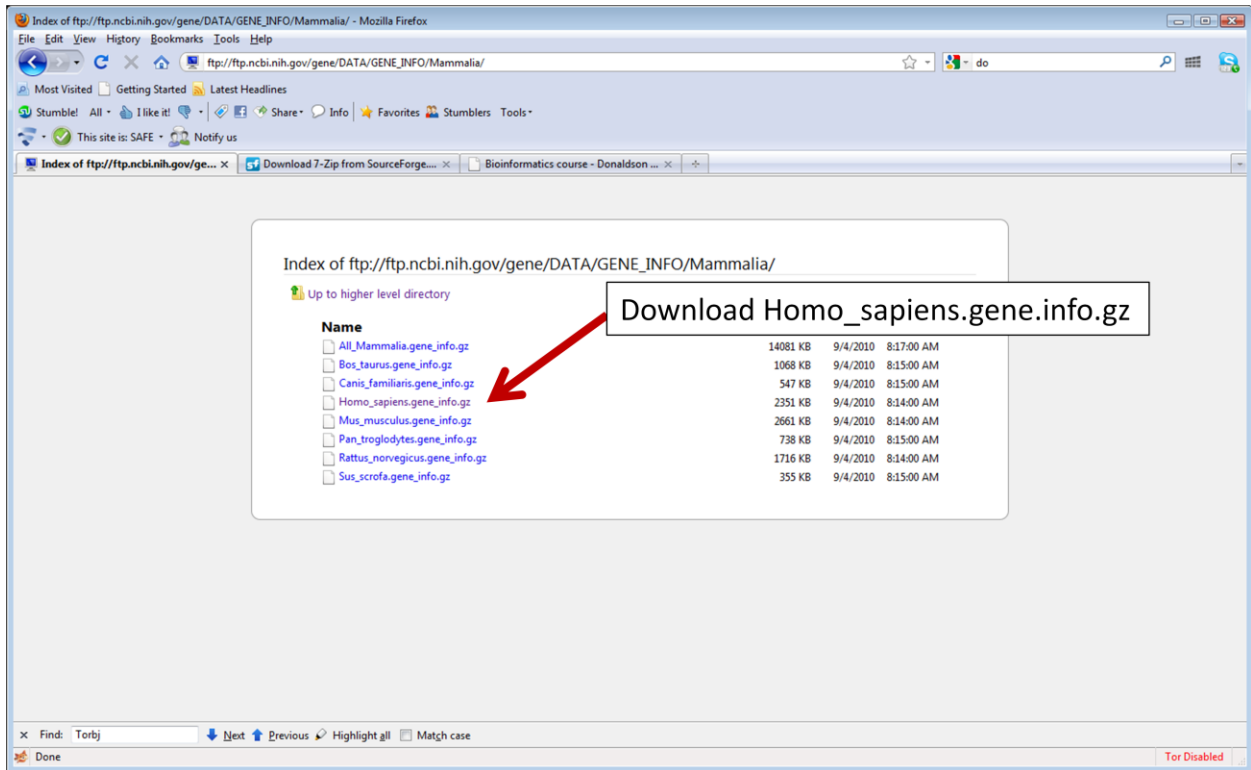
C:\Users\ian>
```

The file should be a simple tab-delimited file – perfect for importing into R or excel

Details at <http://dev.mysql.com/doc/refman/5.1/en/batch-mode.html>

After you have finished the MySQL tutorial, we will download a file from NCBI's Entrez Gene database. Point your browser at

ftp://ftp.ncbi.nih.gov/gene/DATA/GENE_INFO/Mammalia/



The .gz file extension means the file is compressed (using the GNU Zip algorithm)

You'll need some way of decompressing it so you can open it and look at it.

Windows users can use 7-zip (free).

Windows users can install this if they don't already have something that will handle .gz files

Welcome to the 7-Zip Home!

7-Zip is a file archiver with a high compression ratio.

Download 7-Zip 4.65 (2009-02-03) for Windows:

| Link | Type | Windows | Size |
|--------------------------|------|---------|------|
| Download | .exe | 32-bit | 1 MB |
| Download | .msi | x64 | 1 MB |

Download 7-Zip 9.15 beta (2010-06-20) for Windows:

| Link | Type | Windows | Size |
|--------------------------|------|---------|------|
| Download | .exe | 32-bit | 1 MB |
| Download | .msi | x64 | 1 MB |

The download links above redirect you to download pages on SourceForge.net

License

7-Zip is **open source** software. Most of the source code is under the **GNU LGPL** license. The unRAR code is under a mixed license: GNU LGPL + unRAR restrictions. Check license information here: [7-Zip license](#).

You can use 7-Zip on any computer, including a computer in a commercial organization. You don't need to register or pay for 7-Zip.

The main features of 7-Zip

- High compression ratio in new [7z format](#) with **LZMA** compression
- Supported formats:
 - Packing / unpacking: 7z, ZIP, GZIP, BZIP2 and TAR
 - Unpacking only: ARJ, CAB, CHM, CPIO, DEB, DMG, HFS, ISO, LZH, LZMA,

After decompressing it, the file will be called

Homo_sapiens.gene.info

It is a text file. If you change the name of the file to

Homo_sapiens.gene.info.txt

You'll be able to open it and view it with a text editor. It's big so I suggest Windows users try Programmers Notepad to open it (wordpad and notepad will work but very slowly).

The format of the file is described two levels up in

<ftp://ftp.ncbi.nih.gov/gene/README>

See section I. DATA directory , GENE_INFO subdirectory .

Read this section, then think how you would create a database (call it Gene) with one table that Reflects the columns described in the README.

You will need to use a SQL script to create the database and the table.

The beginning of the gene_info table description looks like this:

```
=====
gene_info                                recalculated daily
-----

    tab-delimited

    one line per GeneID

    Column header line is the first line in the file.

    Note: subsets of gene_info are available in the DATA/GENE_INFO
          directory (described later)
-----

tax_id:

    the unique identifier provided by NCBI Taxonomy

    for the species or strain/isolate

GeneID:

    the unique identifier for a gene

....
```

So the first two columns are called tax_id and GeneID. You can tell that they are both integers by looking at the text file you opened.

You haven't learned in the tutorial how to specify columns that hold integers.

You could read more about how to do this at:

<http://dev.mysql.com/doc/refman/5.1/en/creating-tables.html>

<http://dev.mysql.com/doc/refman/5.1/en/data-types.html>

<http://dev.mysql.com/doc/refman/5.1/en/create-table.html>

But here is the step by step answer for you:

Use these commands to create and use the database:

```
CREATE DATABASE gene;
```

```
use gene;
```

Use this SQL statement to create the geneinfo table.

```
CREATE TABLE geneinfo(  
    taxid INT DEFAULT -1,  
    geneid INT DEFAULT -1,  
    symbol VARCHAR(100) DEFAULT 'NA',  
    locustag VARCHAR(100) DEFAULT 'NA',  
    synonym VARCHAR(1024) DEFAULT 'NA',  
    dbxref VARCHAR(4096) DEFAULT 'NA',  
    chromosome VARCHAR(100) DEFAULT 'NA',  
    map VARCHAR(100) DEFAULT -1,  
    description VARCHAR(4096) DEFAULT 'NA',  
    type VARCHAR(100) DEFAULT 'NA',  
    nomsymbol VARCHAR(100) DEFAULT 'NA',  
    nomname VARCHAR(512) DEFAULT 'NA',  
    nomstat VARCHAR(10) DEFAULT 'NA',  
    otherdesc VARCHAR(4096) DEFAULT 'NA',  
    moddate VARCHAR(8),  
    rowid INT PRIMARY KEY AUTO_INCREMENT,  
    index igeneinfo_geneid (geneid),  
    index igeneinfo_symbol (symbol),  
    index igeneinfo_tax (taxid),  
    index igeneinfo_synonym (synonym(50))  
);
```

Then use a SQL statement like this one to load the "Homo_sapiens.gene_info.txt" file into the geneinfo table you just created.

```
load data local infile  
'C:/Users/you_user_name/mysqlwsl/Homo_sapiens.gene_info.txt' into table  
geneinfo fields terminated by '\t';
```

This last loading operation will return a warning message. Messages from the last SQL statement can be viewed using the following statement:

```
show warnings limit 10;
```

"limit 10" was added to this statement because there were so many warnings. What happens if you remove "limit 10"?

You should view a sample of the imported table to spot-check that you got what you expected.

```
select * from geneinfo limit 1;
```

This is a bit cumbersome to look at because there are so many columns. Try modifying the above statement to view a few columns at a time.

If you want to remove the table and re-import the data, you can use this statement.

```
drop table geneinfo;
```

Exercise

Go through the following and try to answer the questions. If you get stuck, there are hints and other useful commands below.

You can also spot-check the table to see if it meets expectations.

This is a table for genes from Homo sapiens (taxon id 9606). How many distinct taxon ids are there in the table? Is human the only one or are there exceptions and what are they.

You can find more info on a given taxon identifiers at <http://www.ncbi.nlm.nih.gov/taxonomy>

How many rows are in the table? Does this match the number of rows in the text file you imported? Hint: look in the bottom left hand corner of programmers notepad for the number of lines.

How many distinct gene identifiers are there? Does this make sense?

What are the distinct chromosomes on which these genes exist? Do these make sense? Look at a few examples that don't make sense.

What are the distinct gene types that are represented in the file?

What are these types? Hint: look at the README.

How many protein-coding genes are there?

How would you make a table of just those genes that encode proteins?

Take a look at some entries in the "synonyms" column. What is going on here?

Some genes have multiple synonyms and they are listed together in this one column with pipes "|" separating them. Look some of these cases up in Entrez Gene to see the symbols there.

Synonyms are an example of denormalized data (multiple pieces of info concatenated into the same column).

End of exercise.

Hints and useful commands for the exercise:

```
select distinct taxid from geneinfo;  
select count(*) from geneinfo;  
select count(distinct geneid) from geneinfo;  
select distinct chromosome from geneinfo;  
select * from geneinfo where chromosome = 'Un' limit 1;
```

<http://www.ncbi.nlm.nih.gov/gene?term=26581>

```
select distinct type from geneinfo;  
SELECT type, COUNT(*) FROM geneinfo GROUP BY type;  
create table some_new_table_name as (select ....);  
create table proteinGenes as (select * from geneinfo where type='protein-  
coding');  
select geneid, synonyms from geneinfo limit 100;
```

Commands you used during the MySQL tutorial:

In case you forget the syntax and need examples you can cut and paste then modify.
You might consider making your own file of examples.

```
shell> mysql -h host -u user -p  
CREATE DATABASE menagerie;  
SHOW DATABASES;  
USE menagerie  
SHOW TABLES;  
CREATE TABLE pet (name VARCHAR(20), owner VARCHAR(20), species VARCHAR(20), sex  
CHAR(1), birth DATE, death DATE);  
DESCRIBE pet;  
LOAD DATA LOCAL INFILE '/path/pet.txt' INTO TABLE pet;
```

```
LOAD DATA LOCAL INFILE '/path/pet.txt' INTO TABLE pet
```

```
-> LINES TERMINATED BY '\r\n';
```

```
INSERT INTO pet
```

```
-> VALUES ('Puffball','Diane','hamster','f','1999-03-30',NULL);
```

The SELECT statement

```
SELECT what_to_select
```

```
FROM which_table
```

```
WHERE conditions_to_satisfy;
```

```
SELECT * FROM pet;
```

Correcting mistakes in the db

```
DELETE FROM pet;
```

```
UPDATE pet SET birth = '1989-08-31' WHERE name = 'Bowser';
```

```
SELECT * FROM pet WHERE name = 'Bowser';
```

```
SELECT * FROM pet WHERE species = 'dog' AND sex = 'f';
```

```
SELECT name, birth FROM pet;
```

```
SELECT owner FROM pet;
```

```
SELECT DISTINCT owner FROM pet;
```

```
SELECT name, species, birth FROM pet
```

```
-> WHERE species = 'dog' OR species = 'cat';
```

```
SELECT name, birth FROM pet ORDER BY birth;
```

```
SELECT name, birth FROM pet ORDER BY birth DESC;
```

```
SELECT name, species, birth FROM pet ORDER BY species, birth DESC;
```

```
SELECT name, birth, CURDATE(), (YEAR(CURDATE())-YEAR(birth)) -  
(RIGHT(CURDATE(),5)<RIGHT(birth,5)) AS age FROM pet;
```

```
SELECT name, birth, death,
```

```
-> (YEAR(death)-YEAR(birth)) - (RIGHT(death,5)<RIGHT(birth,5))
```

```
-> AS age
```

```
-> FROM pet WHERE death IS NOT NULL ORDER BY age;
```

```
SELECT name, birth, MONTH(birth) FROM pet;
```

```
SELECT name, birth FROM pet WHERE MONTH(birth) = 5;
```

```
SELECT name, birth FROM pet
```

```
-> WHERE MONTH(birth) = MONTH(DATE_ADD(CURDATE(),INTERVAL 1 MONTH));
```

```
SELECT 1 IS NULL, 1 IS NOT NULL;
```

```
SELECT 0 IS NULL, 0 IS NOT NULL, '' IS NULL, '' IS NOT NULL;
```

Pattern matching

```
SELECT * FROM pet WHERE name LIKE 'b%';
```

```
SELECT * FROM pet WHERE name LIKE '%fy';
```

```
SELECT * FROM pet WHERE name LIKE '%w%';
```

```
SELECT * FROM pet WHERE name LIKE '_____';
```

http://dev.mysql.com/doc/refman/5.1/en/regexp.html#operator_regexp

```
SELECT * FROM pet WHERE name REGEXP '^b';
```

```
SELECT * FROM pet WHERE name REGEXP '^.....$';
```

```
SELECT * FROM pet WHERE name REGEXP '^.{5}$';
```

counting rows

```
SELECT COUNT(*) FROM pet;
```

```
SELECT owner, COUNT(*) FROM pet GROUP BY owner;
```

```
SELECT species, COUNT(*) FROM pet GROUP BY species;
```

```
SELECT species, sex, COUNT(*) FROM pet GROUP BY species, sex;
```

```
mysql> SELECT species, sex, COUNT(*) FROM pet
```

```
-> WHERE species = 'dog' OR species = 'cat'
```

```
-> GROUP BY species, sex;
```

inner joins

SELECT pet.name,

-> (YEAR(date)-YEAR(birth)) - (RIGHT(date,5)<RIGHT(birth,5)) AS age,

-> remark

-> FROM pet INNER JOIN event

-> ON pet.name = event.name

-> WHERE event.type = 'litter';

mysql> SELECT p1.name, p1.sex, p2.name, p2.sex, p1.species

-> FROM pet AS p1 INNER JOIN pet AS p2

-> ON p1.species = p2.species AND p1.sex = 'f' AND p2.sex = 'm';

using mysql in batch mode

mysql -u root -p < some_batch_script.txt > some_result_script.txt

some common queries

SELECT MAX(article) AS article FROM shop;

SELECT article, dealer, price

FROM shop

WHERE price=(SELECT MAX(price) FROM shop);

left join

```
SELECT s1.article, s1.dealer, s1.price
FROM shop s1
LEFT JOIN shop s2 ON s1.price < s2.price
WHERE s2.article IS NULL;
```

max of column per group

```
SELECT article, dealer, price
FROM shop
ORDER BY price DESC
LIMIT 1;
```

```
SELECT article, MAX(price) AS price
FROM shop
GROUP BY article;
```

user variables begin with @

```
mysql> SELECT @min_price:=MIN(price),@max_price:=MAX(price) FROM shop;
mysql> SELECT * FROM shop WHERE price=@min_price OR price=@max_price;
```

union


```
SELECT field1_index, field2_index
    FROM test_table WHERE field1_index = '1'
UNION
SELECT field1_index, field2_index
    FROM test_table WHERE field2_index = '1';
```

auto increment

```
CREATE TABLE animals (
    id MEDIUMINT NOT NULL AUTO_INCREMENT,
    name CHAR(30) NOT NULL,
    PRIMARY KEY (id)
);
```