Database Security Lab

These 5 experiments cover all **major areas of database security**:

1. Access control
2. Injection attacks
3. Auditing
4. Encryption
5. Role-based access control

1. User Management with GRANT and REVOKE

Objective: To study database access control using user roles and privileges.

a) Create Users

```
CREATE USER 'student1'@'localhost' IDENTIFIED BY 'pass123';
CREATE USER 'student2'@'localhost' IDENTIFIED BY 'pass123';
```

b) Grant Privileges

```
GRANT ALL PRIVILEGES ON labdb.* TO 'student1'@'localhost';
GRANT SELECT, INSERT ON labdb.* TO 'student2'@'localhost';
```

c) Revoke Privilege

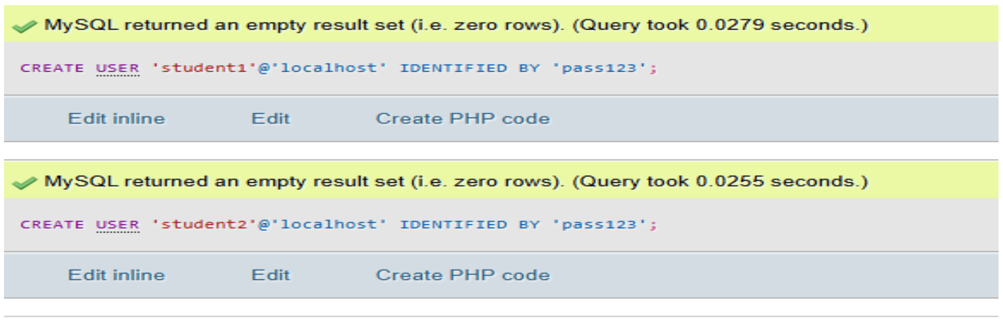
```
REVOKE INSERT ON labdb.* FROM 'student2'@'localhost';
```

d) Verify

```
SHOW GRANTS FOR 'student1'@'localhost';
SHOW GRANTS FOR 'student2'@'localhost';
```

Output:

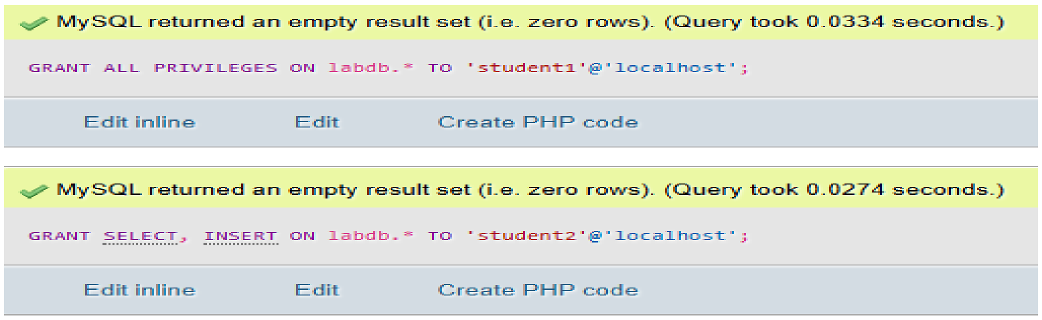
a)



```
✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0279 seconds.)
CREATE USER 'student1'@'localhost' IDENTIFIED BY 'pass123';
```

```
✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0255 seconds.)
CREATE USER 'student2'@'localhost' IDENTIFIED BY 'pass123';
```

b)



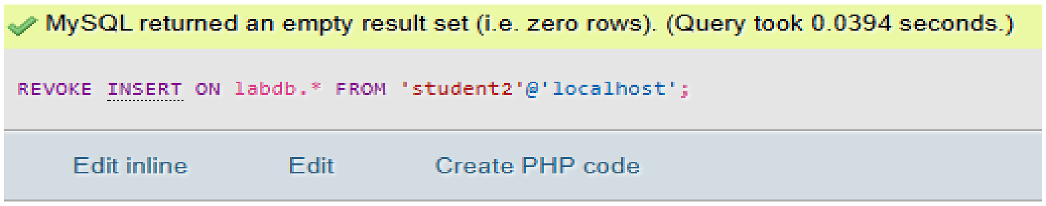
✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0334 seconds.)

```
GRANT ALL PRIVILEGES ON labdb.* TO 'student1'@'localhost';
```

✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0274 seconds.)

```
GRANT SELECT, INSERT ON labdb.* TO 'student2'@'localhost';
```

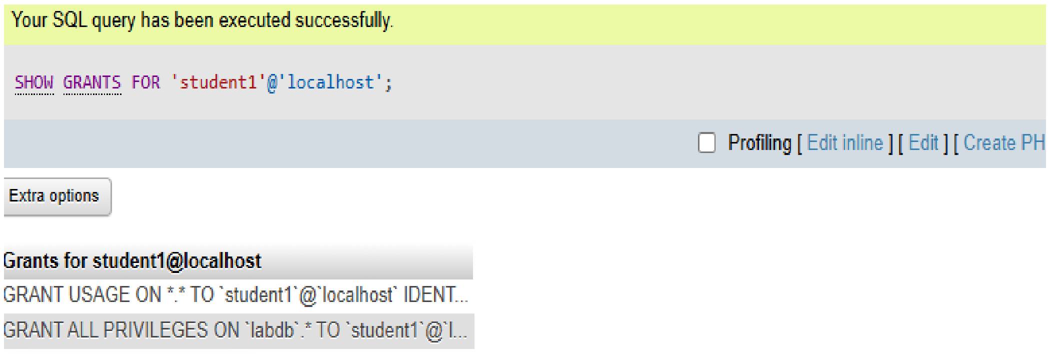
c)



✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0394 seconds.)

```
REVOKE INSERT ON labdb.* FROM 'student2'@'localhost';
```

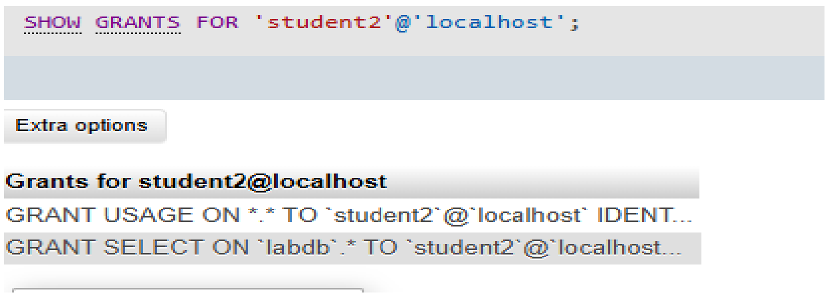
d)



Your SQL query has been executed successfully.

```
SHOW GRANTS FOR 'student1'@'localhost';
```

Grants for student1@localhost
GRANT USAGE ON *.* TO \`student1\`@\`localhost\` IDENT...
GRANT ALL PRIVILEGES ON \`labdb\`.* TO \`student1\`@\`l...



```
SHOW GRANTS FOR 'student2'@'localhost';
```

Grants for student2@localhost
GRANT USAGE ON *.* TO \`student2\`@\`localhost\` IDENT...
GRANT SELECT ON \`labdb\`.* TO \`student2\`@\`localhost...

2. Experiment SQL Injection Demonstration

Objective: To demonstrate SQL injection and its prevention.

```
CREATE DATABASE labdb;
USE labdb;

CREATE TABLE users (
id INT AUTO_INCREMENT PRIMARY KEY,
username VARCHAR(50),
password VARCHAR(50)
);

INSERT INTO users (username, password) VALUES
('admin', 'admin123'),
('student', 'stud123');
```

Injection Example:

Input:

Username: admin

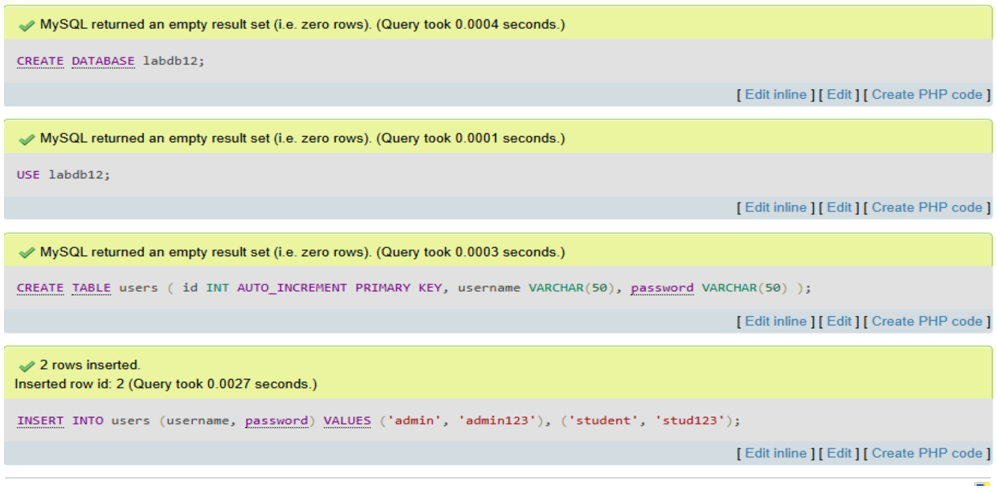
Password: ' OR '1'='1

Query becomes:

```
SELECT * FROM users WHERE username='admin' AND password='' OR '1'='1';
```

Bypasses authentication.

Prevention: Use prepared statements (parameterized queries)



```
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0004 seconds.)
CREATE DATABASE labdb12;
[ Edit inline ] [ Edit ] [ Create PHP code ]

MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)
USE labdb12;
[ Edit inline ] [ Edit ] [ Create PHP code ]

MySQL returned an empty result set (i.e. zero rows). (Query took 0.0003 seconds.)
CREATE TABLE users ( id INT AUTO_INCREMENT PRIMARY KEY, username VARCHAR(50), password VARCHAR(50) );
[ Edit inline ] [ Edit ] [ Create PHP code ]

2 rows inserted.
Inserted row id: 2 (Query took 0.0027 seconds.)
INSERT INTO users (username, password) VALUES ('admin', 'admin123'), ('student', 'stud123');
[ Edit inline ] [ Edit ] [ Create PHP code ]
```

3. Experiment Database Auditing

Objective: To enable logging and track changes to the database.

Procedure:

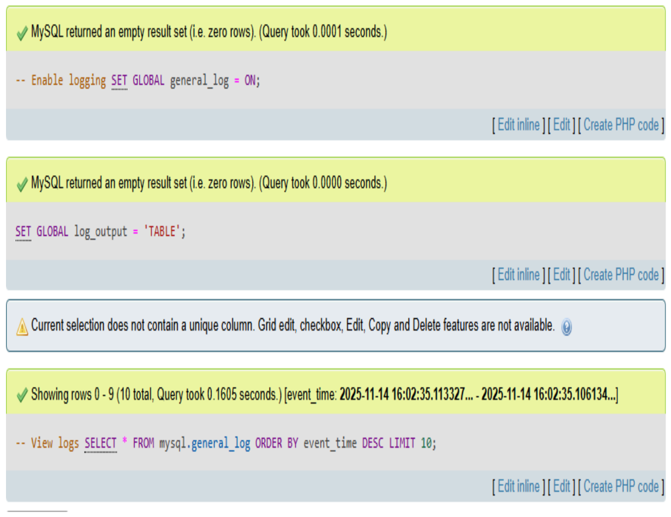
-- Enable general log (MySQL)

```
SET GLOBAL general_log = 'ON';
SET GLOBAL general_log_output = 'TABLE';
```

-- View logged queries

```
SELECT * FROM mysql.general_log ORDER BY event_time DESC LIMIT 10;
```

Output:



```
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)
-- Enable logging SET GLOBAL general_log = ON;
```

[Edit inline] [Edit] [Create PHP code]

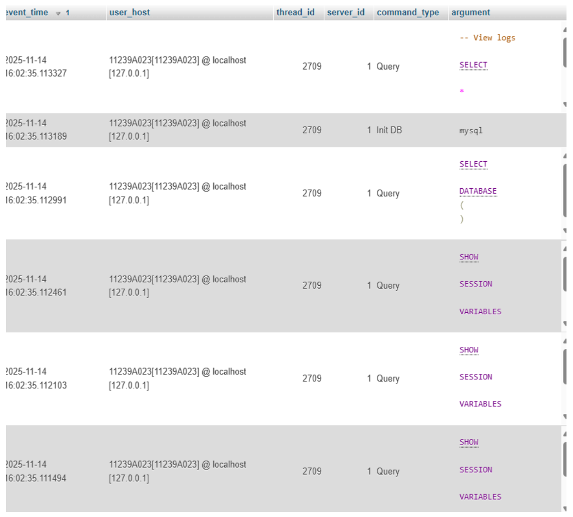
```
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0000 seconds.)
SET GLOBAL log_output = 'TABLE';
```

[Edit inline] [Edit] [Create PHP code]

Current selection does not contain a unique column. Grid edit, checkbox, Edit, Copy and Delete features are not available.

```
Showing rows 0 - 9 (10 total, Query took 0.1605 seconds.) [event_time: 2025-11-14 16:02:35.113327... - 2025-11-14 16:02:35.106134...]
-- View logs SELECT * FROM mysql.general_log ORDER BY event_time DESC LIMIT 10;
```

[Edit inline] [Edit] [Create PHP code]



event_time	user_host	thread_id	server_id	command_type	argument
2025-11-14 16:02:35.113327	11239A023[11239A023] @ localhost [127.0.0.1]	2709	1	Query	-- View logs SELECT *
2025-11-14 16:02:35.113189	11239A023[11239A023] @ localhost [127.0.0.1]	2709	1	Init DB	mysql
2025-11-14 16:02:35.112991	11239A023[11239A023] @ localhost [127.0.0.1]	2709	1	Query	SELECT DATABASE ( )
2025-11-14 16:02:35.112461	11239A023[11239A023] @ localhost [127.0.0.1]	2709	1	Query	SHOW SESSION VARIABLES
2025-11-14 16:02:35.112103	11239A023[11239A023] @ localhost [127.0.0.1]	2709	1	Query	SHOW SESSION VARIABLES
2025-11-14 16:02:35.111494	11239A023[11239A023] @ localhost [127.0.0.1]	2709	1	Query	SHOW SESSION VARIABLES

4. Experiment 4: Encryption in Database

Objective: To secure data using encryption functions.

a) CREATE TABLE secure_data (

id INT AUTO_INCREMENT PRIMARY KEY,
secret VARBINARY(255)
);

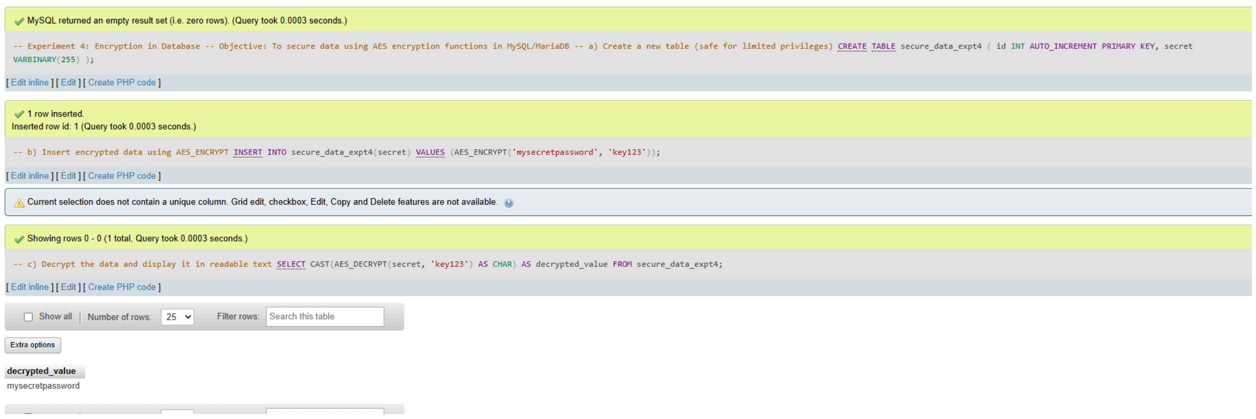
b) Insert encrypted data (AES)

INSERT INTO secure_data(secret) VALUES (AES_ENCRYPT('mysecretpassword', 'key123'));

c) Decrypt data

SELECT AES_DECRYPT(secret, 'key123') AS decrypted_value FROM secure_data;

Output:



✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0003 seconds.)

```
-- Experiment 4: Encryption in Database -- Objective: To secure data using AES encryption functions in MySQL/MariaDB -- a) Create a new table (safe for limited privileges) CREATE TABLE secure_data_expt4 ( id INT AUTO_INCREMENT PRIMARY KEY, secret
VARBINARY(255) );
```

[Edit inline] [Edit] [Create PHP code]

✓ 1 row inserted.
Inserted row id: 1 (Query took 0.0003 seconds.)

```
-- b) Insert encrypted data using AES_ENCRYPT INSERT INTO secure_data_expt4(secret) VALUES (AES_ENCRYPT('mysecretpassword', 'key123'));
```

[Edit inline] [Edit] [Create PHP code]

⚠ Current selection does not contain a unique column. Grid edit, checkbox, Edit, Copy and Delete features are not available.

✓ Showing rows 0 - 0 (1 total, Query took 0.0003 seconds.)

```
-- c) Decrypt the data and display it in readable text SELECT CAST(AES_DECRYPT(secret, 'key123') AS CHAR) AS decrypted_value FROM secure_data_expt4;
```

[Edit inline] [Edit] [Create PHP code]

decrypted_value
mysecretpassword

5: Role-Based Access Control (RBAC)

Objective: To implement RBAC in a database.

Procedure:

a) Create a role

```
CREATE ROLE 'manager';
```

b) Assign privileges to role

```
GRANT SELECT, UPDATE ON labdb.* TO 'manager';
```

c) Create user and assign role

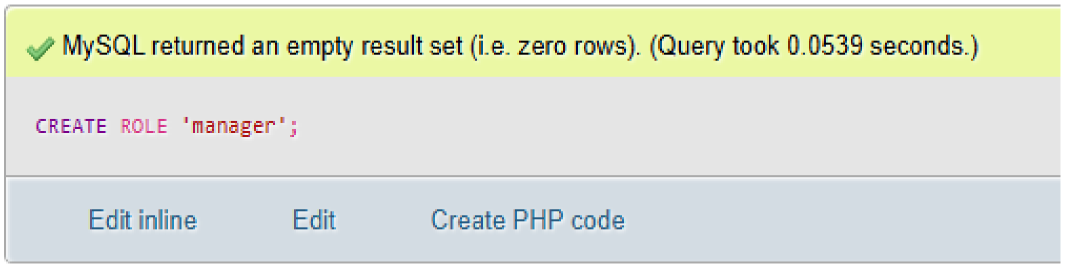
```
CREATE USER 'alice'@'localhost' IDENTIFIED BY 'alice123';
GRANT 'manager' TO 'alice'@'localhost';
```

d) Verify

```
SHOW GRANTS FOR 'alice'@'localhost';
```

Output:

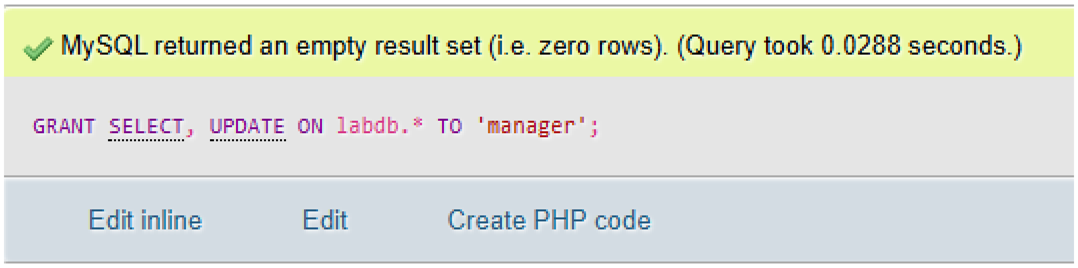
a)



✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0539 seconds.)

```
CREATE ROLE 'manager';
```

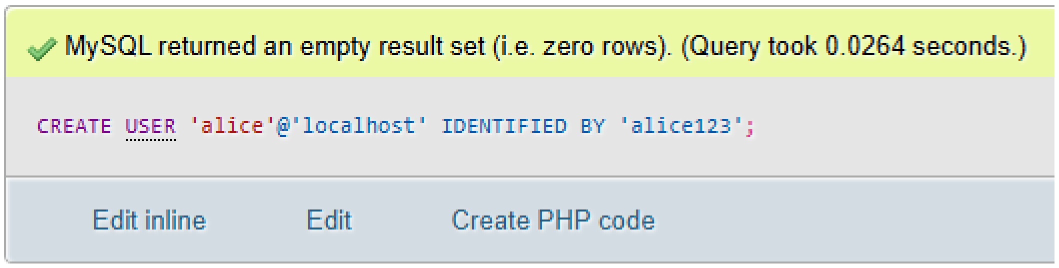
b)



✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0288 seconds.)

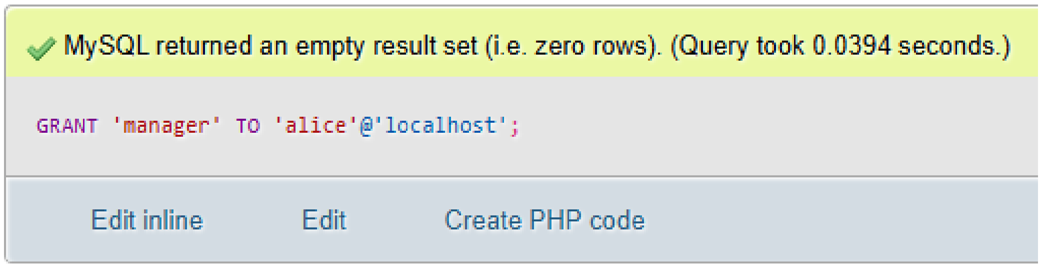
```
GRANT SELECT, UPDATE ON labdb.* TO 'manager';
```

c)



✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0264 seconds.)

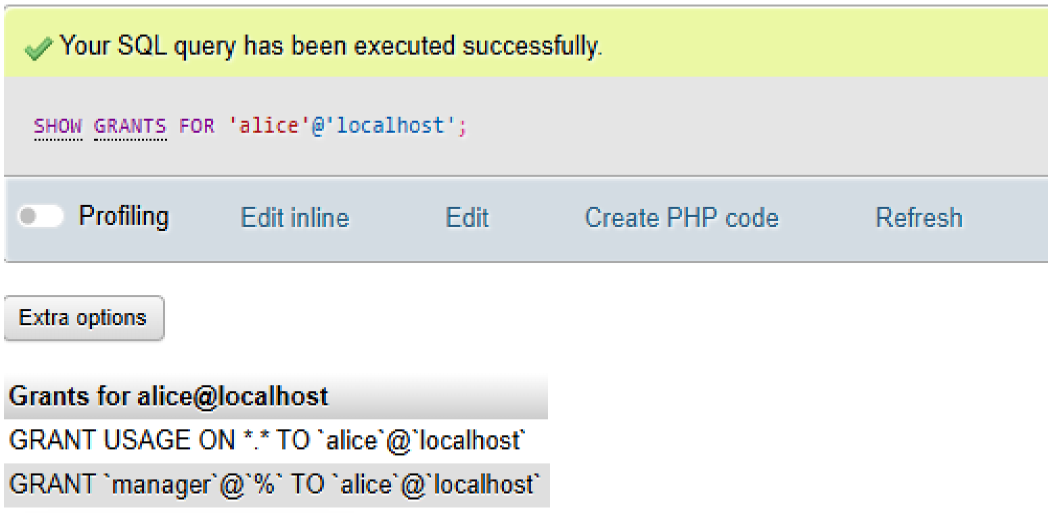
```
CREATE USER 'alice'@'localhost' IDENTIFIED BY 'alice123';
```



✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0394 seconds.)

```
GRANT 'manager' TO 'alice'@'localhost';
```

d)



✓ Your SQL query has been executed successfully.

```
SHOW GRANTS FOR 'alice'@'localhost';
```

Grants for alice@localhost
GRANT USAGE ON *.* TO \`alice\`@\`localhost\`
GRANT \`manager\`@\`%\` TO \`alice\`@\`localhost\`