

Databases

RDS - Relational Database Service

AWS RDS

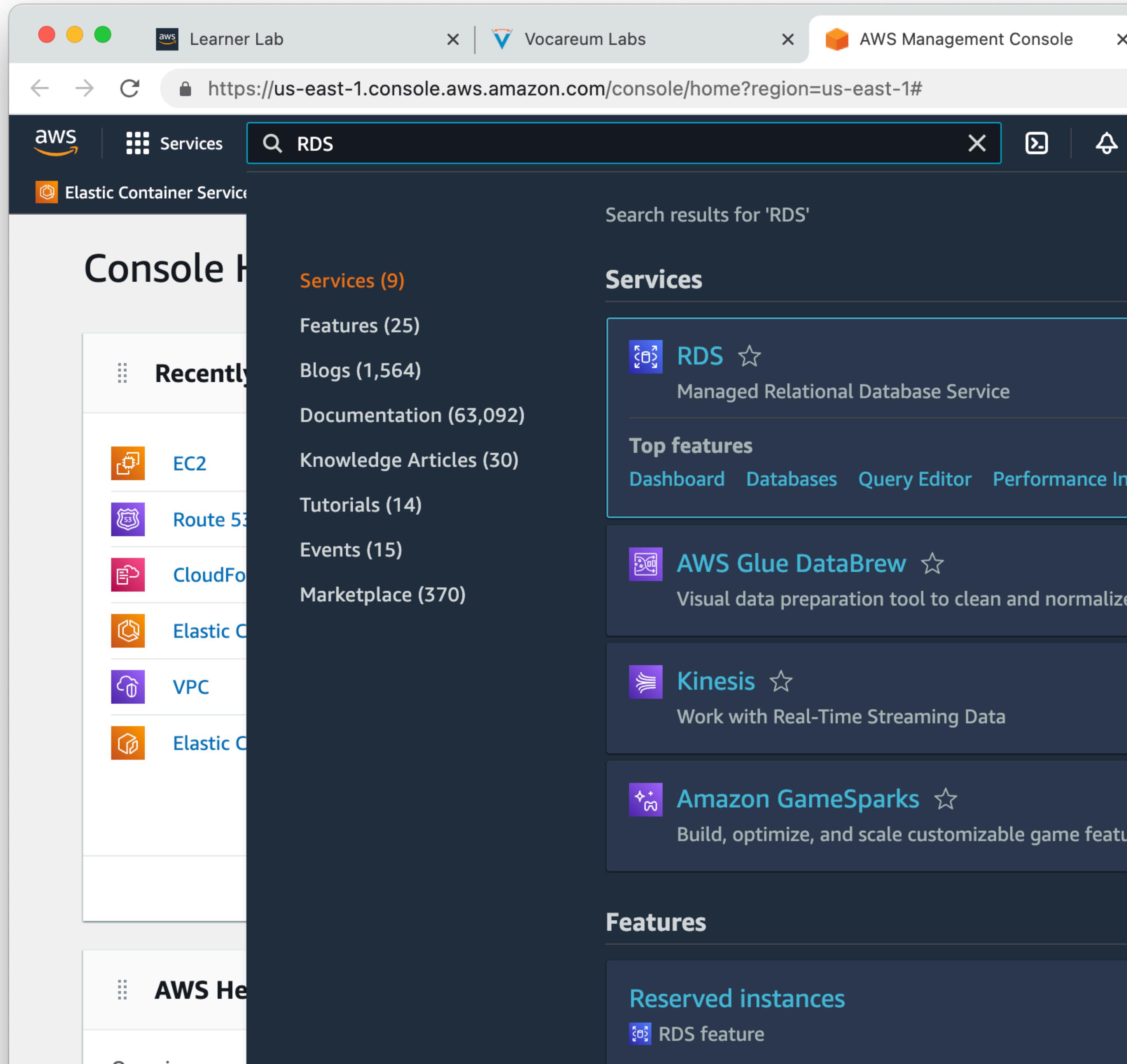
Managed Database Service

- RDS (Relational Database Server) is Amazon's SQL offering
- Of course, you can always run your own database server, on an instance anywhere...
 - <https://www.mysql.com/>
- But why go to all that trouble?

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- Search for RDS in the top search bar.
- Click on RDS in the Services results.



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- From the dashboard, you may see a “Create Database” button in an announcement.
- If not, click on “Databases” in the left sidebar.
- Click “Create Database”

The screenshot shows the AWS RDS Management Console dashboard. At the top, there's a navigation bar with tabs for Elastic Container Service, Elastic Container Registry, CloudFormation, VPC, and EC2. Below the navigation bar is a sidebar titled "Amazon RDS" with links to Dashboard, Databases, Query Editor, Performance insights, Snapshots, Automated backups, Reserved instances, Proxies, Subnet groups, Parameter groups, and Option groups. To the right of the sidebar, there's a main content area. It features a callout box with an info icon and text about the new Amazon RDS Multi-AZ deployment option for MySQL and PostgreSQL. It includes a "Create database" button and a link to "Restore Multi-AZ DB Cluster from Snapshot". Below this, there's a section titled "Resources" with information about DB Instances (0/40), Allocated storage (0 TB/100 TB), and links to Increase DB instances limit and Parameter groups (0). A "Refresh" button is also present.

The screenshot shows the "Databases" page within the AWS RDS Management Console. The left sidebar has a "Databases" link highlighted. The main content area shows a table with columns for DB identifier, Role, Engine, Region & AZ, Size, and Status. A search bar at the top says "Filter by databases". A "Create database" button is located at the bottom right of the table. The status bar at the bottom indicates "No instances found".

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- Select “Standard Create.” We have to turn off some features which aren’t allowed in AWS Academy.
- Select MySQL
- Leave the Edition and version as default.
 - MySQL Community
 - Version 8.0.x

The screenshot shows the AWS RDS Management Console interface for creating a new database. At the top, there are three tabs: 'Learner Lab', 'Vocareum Labs', and 'RDS Management Console'. The 'RDS Management Console' tab is active, with the URL <https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#launch-dbinstance:gdb=false;s3-import=false> visible. The main content area is titled 'Create database' and has a sub-section 'Choose a database creation method'. It offers two options: 'Standard create' (selected) and 'Easy create'. Below this, the 'Engine options' section is shown, with 'MySQL' selected (radio button is checked). Other engine options available are Amazon Aurora, PostgreSQL, Oracle, and MariaDB. Under 'Edition', 'MySQL Community' is selected. At the bottom of the page, there are links for 'Feedback' and 'Unified Settings'.

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- Make sure to select “Free tier”

The screenshot shows the AWS RDS "Launch AWS Academy Learner" wizard. The URL is https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#launch-dbinstance:.

Engine version: MySQL 8.0.35

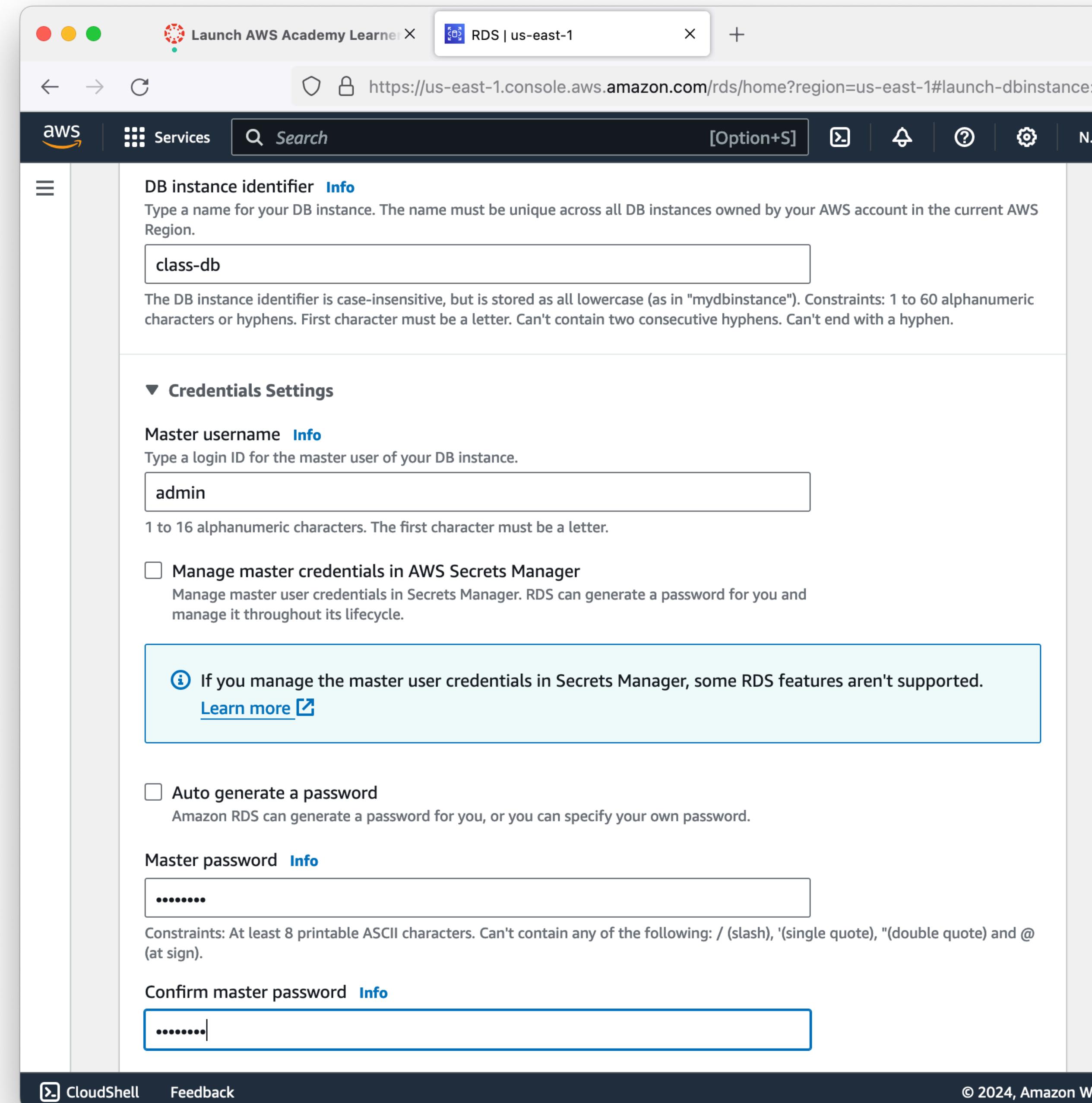
Templates: Choose a sample template to meet your use case. The "Free tier" option is selected.

Availability and durability: Deployment options: Single DB instance (not supported for Multi-AZ DB cluster snapshot) and Multi-AZ DB instance (not supported for Multi-AZ DB cluster snapshot).

AWS RDS

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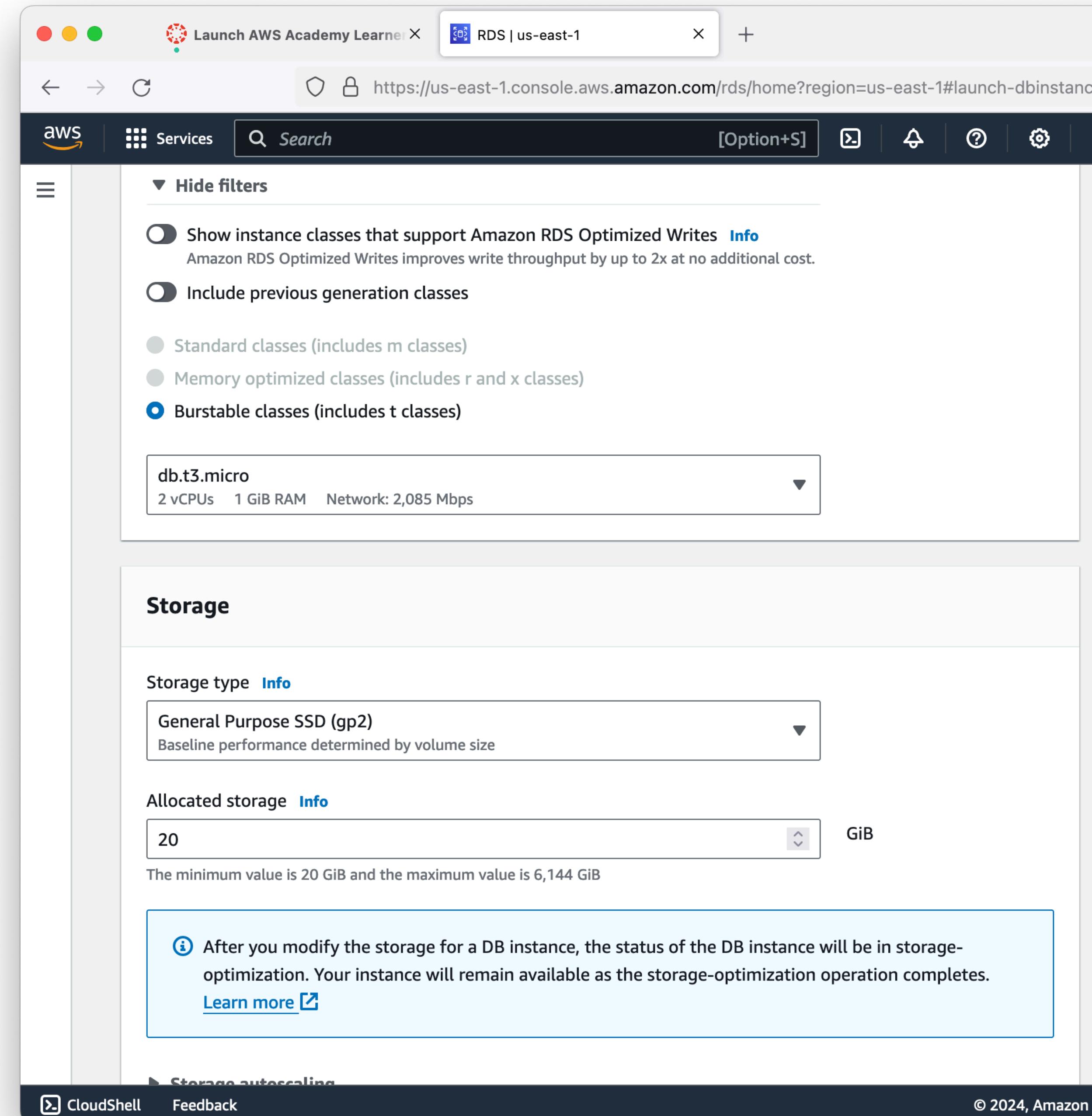
- Set a name for your DB Instance.
This only shows up in the AWS console, it's not used for connecting to the database
- Choose a good password, and keep it somewhere safe and memorable.
 - If you forget it, you can reset this later.



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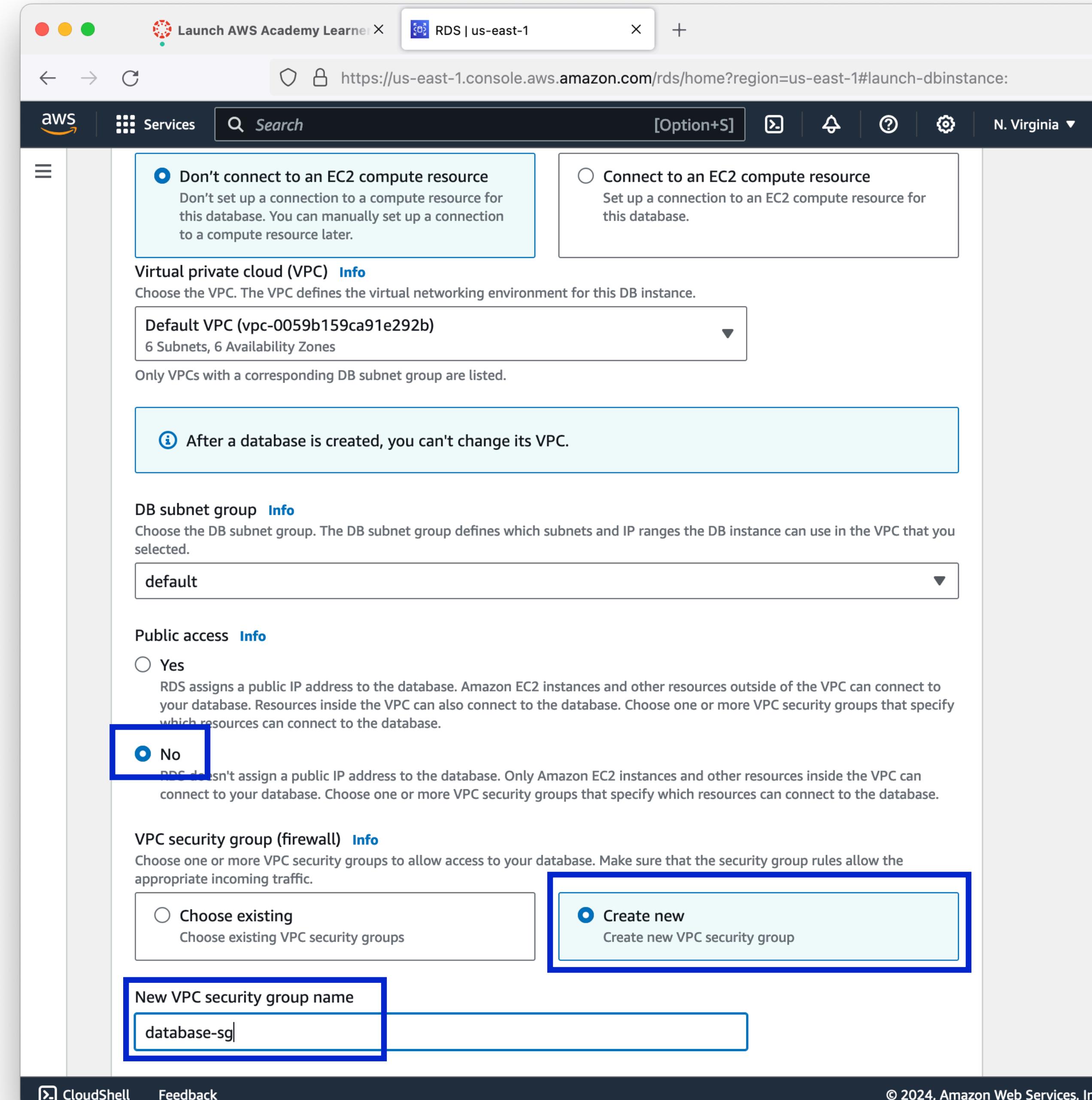
- Change the instance class to db.t3.micro
- Change the Allocated storage to the smallest allowed: 20 GiB
- Un-check “Enable storage autoscaling”
 - We won’t use anywhere near that much space.



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- Don't connect to an EC2 resource (we'll configure that ourselves)
- Make sure you have “No” selected for Public access.
- Create a new security group
- Name your security group “database-sg”
 - If you delete this RDS instance and create a new one later, you can re-use this VPC security group



AWS RDS

Managed Database Service

- Leave “Password authentication” selected

The screenshot shows the AWS RDS "Launch AWS Academy Learner" configuration page. The "Database authentication" section is expanded, showing three options: "Password authentication" (selected), "Password and IAM database authentication", and "Password and Kerberos authentication". The "Monitoring" section has an unchecked checkbox for "Enable Enhanced Monitoring". The "Additional configuration" section contains a link to "Database options, encryption turned on, backup turned on, backtrack turned off, maintenance, CloudWatch Logs, delete protection turned off". The "Estimated monthly costs" section states that the Amazon RDS Free Tier is available for 12 months and lists free resources: 750 hrs of Amazon RDS in a Single-AZ db.t2.micro, db.t3.micro or db.t4g.micro Instance, and 20 GB of General Purpose Storage (SSD). The top navigation bar includes tabs for "Services" and "Search", and the bottom footer includes "CloudShell" and "Feedback" buttons.

Launch AWS Academy Learner X RDS | us-east-1 +

https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#launch-dbinstance:

aws Services Search [Option+S] N. Virginia ▾

Database authentication

Database authentication options [Info](#)

Password authentication
Authenticates using database passwords.

Password and IAM database authentication
Authenticates using the database password and user credentials through AWS IAM users and roles.

Password and Kerberos authentication
Choose a directory in which you want to allow authorized users to authenticate with this DB instance using Kerberos Authentication.

Monitoring

Enable Enhanced Monitoring
Enabling Enhanced Monitoring metrics are useful when you want to see how different processes or threads use the CPU.

▶ Additional configuration

Database options, encryption turned on, backup turned on, backtrack turned off, maintenance, CloudWatch Logs, delete protection turned off.

Estimated monthly costs

The Amazon RDS Free Tier is available to you for 12 months. Each calendar month, the free tier will allow you to use the Amazon RDS resources listed below for free:

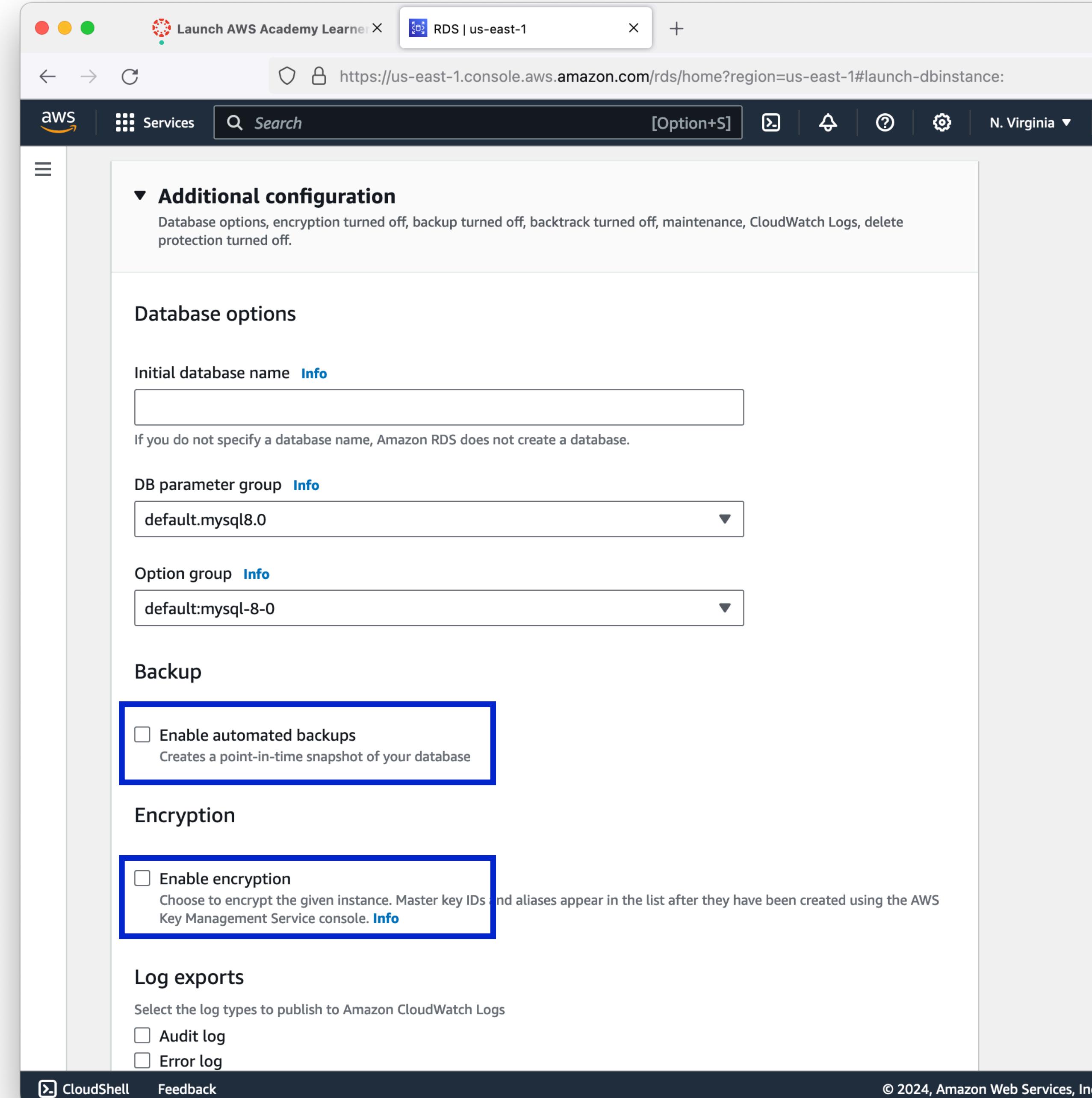
- 750 hrs of Amazon RDS in a Single-AZ db.t2.micro, db.t3.micro or db.t4g.micro Instance.
- 20 GB of General Purpose Storage (SSD).

CloudShell Feedback © 2024, Amazon Web Services, Inc.

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- Expand “Additional configuration”
- Disable automated backups
 - Automated backups are usually the correct default for things, but we really want to minimize costs for the class, and daily backups really add up!
- Disable encryption
 - Usually a good idea, keep it simple for class.



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- Click “Create database”

The screenshot shows the 'Create database' wizard in the AWS RDS console. The top navigation bar includes tabs for 'Launch AWS Academy Learner' and 'RDS | us-east-1'. The URL is https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#launch-dbinstance:.

Maintenance window (Info):
Select the period you want pending modifications or maintenance applied to the database by Amazon RDS.
 Choose a window
 No preference

Deletion protection
 Enable deletion protection
Protects the database from being deleted accidentally. While this option is enabled, you can't delete the database.

Estimated monthly costs
The Amazon RDS Free Tier is available to you for 12 months. Each calendar month, the free tier will allow you to use the Amazon RDS resources listed below for free:

- 750 hrs of Amazon RDS in a Single-AZ db.t2.micro, db.t3.micro or db.t4g.micro Instance.
- 20 GB of General Purpose Storage (SSD).
- 20 GB for automated backup storage and any user-initiated DB Snapshots.

[Learn more about AWS Free Tier.](#)

When your free usage expires or if your application use exceeds the free usage tiers, you simply pay standard, pay-as-you-go service rates as described in the [Amazon RDS Pricing page](#).

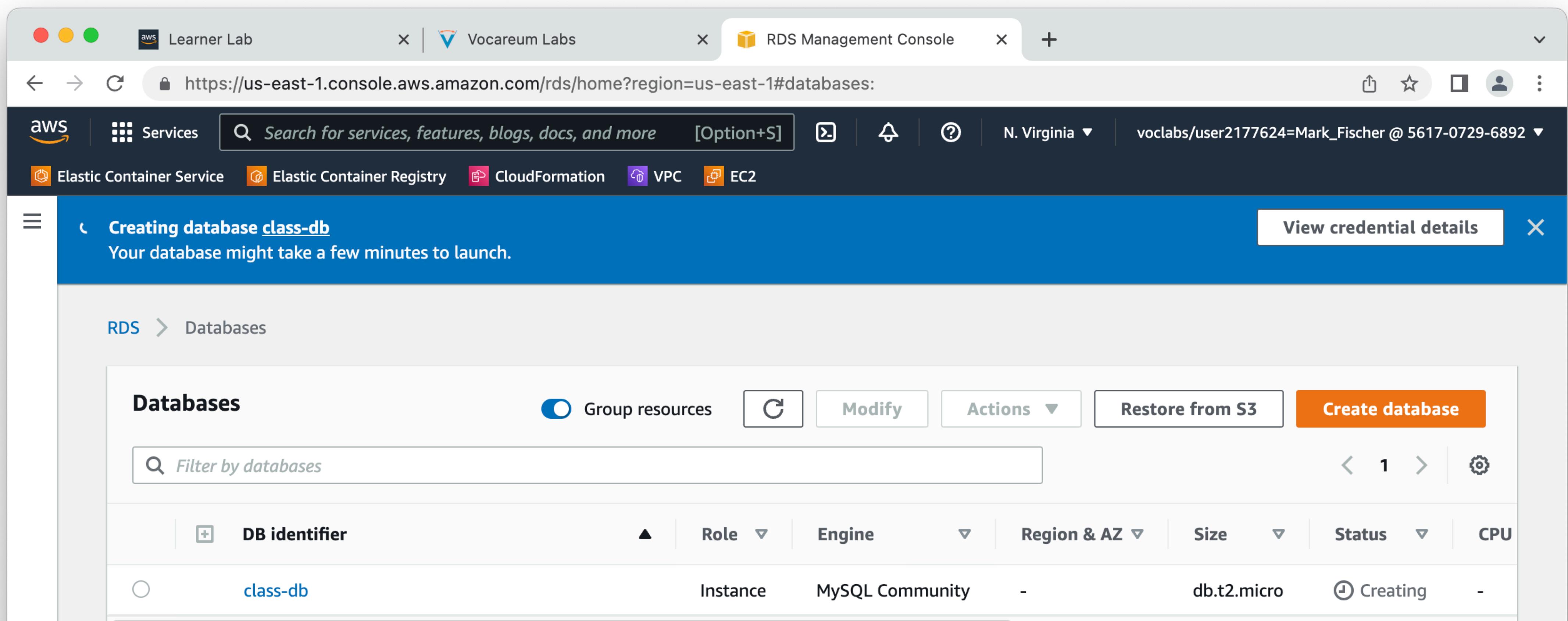
Important: You are responsible for ensuring that you have all of the necessary rights for any third-party products or services that you use with AWS services.

Buttons at the bottom: Cancel (grayed out) and Create database (orange button).

AWS RDS

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- Your database may take several minutes to be ready for use. The cloud is not instant 😛



AWS RDS

Managed Database Service

- Dark Patterns:
 - AWS now tries to up-sell you when creating things
 - Can only “hide” for 30 days!
 - You can avoid this by deploying resources through automation

Launch AWS Academy Learner X Databases | RDS | us-east-1 +

https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#databases: [Option+S] N. Virginia View credential d

Creating database class-db
Your database might take a few minutes to launch.

Suggested add-ons for class-db

Simplify the configuration of the following suggested add-ons by using settings from your new database.

 Create an ElastiCache cluster from RDS using your DB settings - new

You can save up to 55% in cost and gain up to 80x faster read performance using ElastiCache with RDS for MySQL (vs. RDS for MySQL alone).

[Learn more ↗](#) [Create ElastiCache cluster](#)

 Use RDS Proxy

Using a proxy allows your applications to pool and share database connections to help them scale. A proxy simplifies connection management and makes applications more resilient to database failures.

[Learn more ↗](#) [Create proxy](#)

 You can hide these suggestions so they don't appear after database creation. All these actions can be taken from the database list page or database details page.

Hide add-ons for 30 days [Close](#)

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AWS RDS

Managed Database Service

- Eventually your RDS instance will complete. This may take 5 minutes or more.
- Click on your database name to get details on it.

The screenshot shows a web browser window with three tabs: "Learner Lab", "Vocareum Labs", and "RDS Management Console". The "RDS Management Console" tab is active, displaying the URL <https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#databases>. The main content area is titled "Databases" and shows a table with one row. The row contains the following data:

DB identifier	Role	Engine	Region & AZ	Size	Status	CPU
class-db	MySQL Community	us-east-1b	db.t2.micro	Available		

A green banner at the top of the page reads "Successfully created database class-db". There is a "View connection details" button next to the banner.

AWS RDS

- You will need to copy down the Endpoint domain name. This is how you will connect to your database from a server.

The screenshot shows the AWS RDS console for the 'class-db' database in the 'us-east-1' region. The 'Connectivity & security' tab is selected, highlighting the 'Endpoint' field which contains the value 'class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com'. This endpoint URL is highlighted with a blue box.

Endpoint & port	Networking	Security
Endpoint class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com	Availability Zone us-east-1f VPC vpc-0059b159ca91e292b	VPC security groups database-sg (sg-025e5e60516cdacf1) Active
Port 3306	Subnet group default- vpc-0059b159ca91e292b	Publicly accessible No
	Subnets	Certificate authority Info rds-ca-rsa2048-g1

AWS RDS

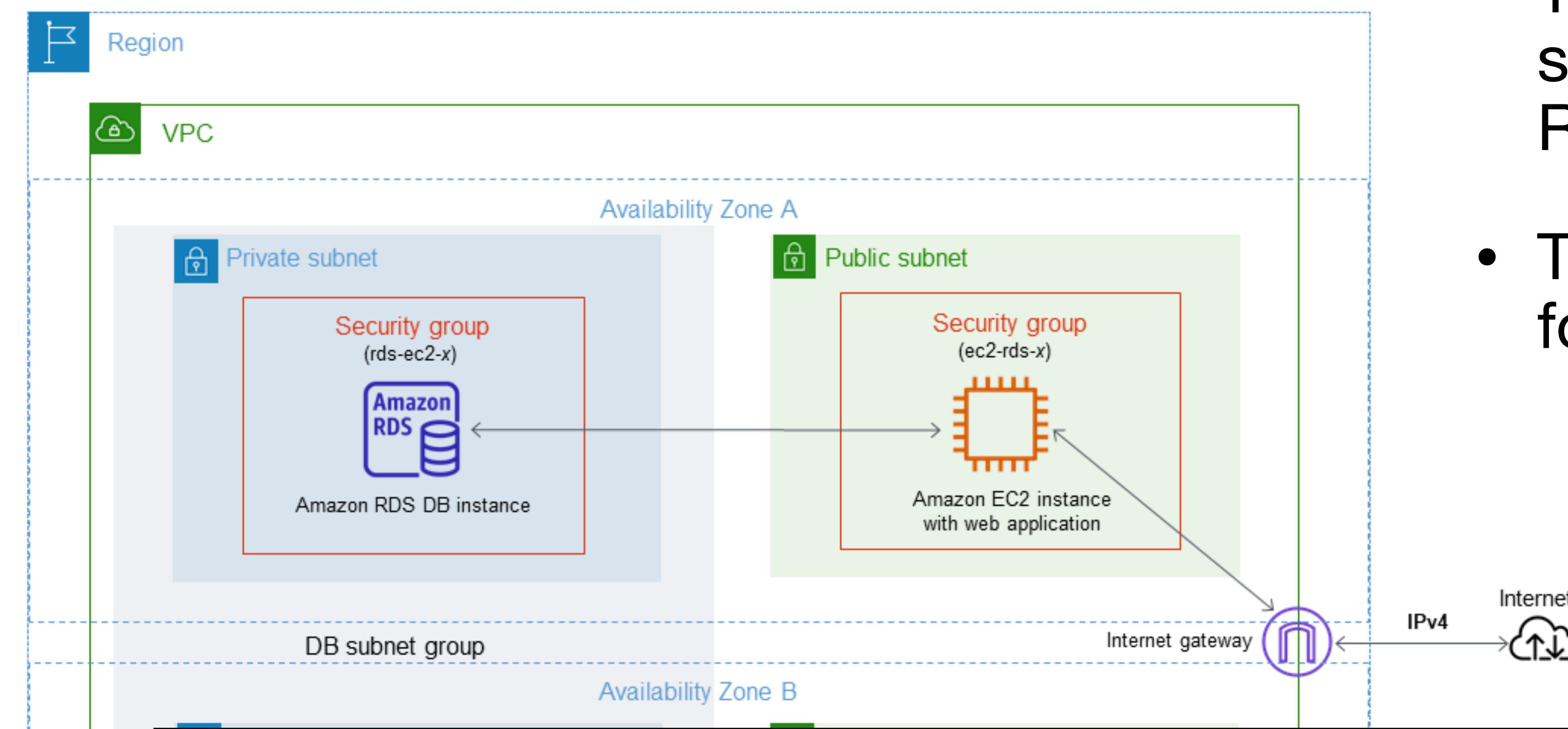
Security Groups

- Our new RDS instance does NOT have a public IP address
 - Because RDS is a fully managed service, you cannot ssh into it
 - With no Public IP you cannot connect to it directly from your laptop
- Our new RDS instance has a private IP address, and is listening on port 3306
 - We need to give our EC2 instance access

AWS RDS

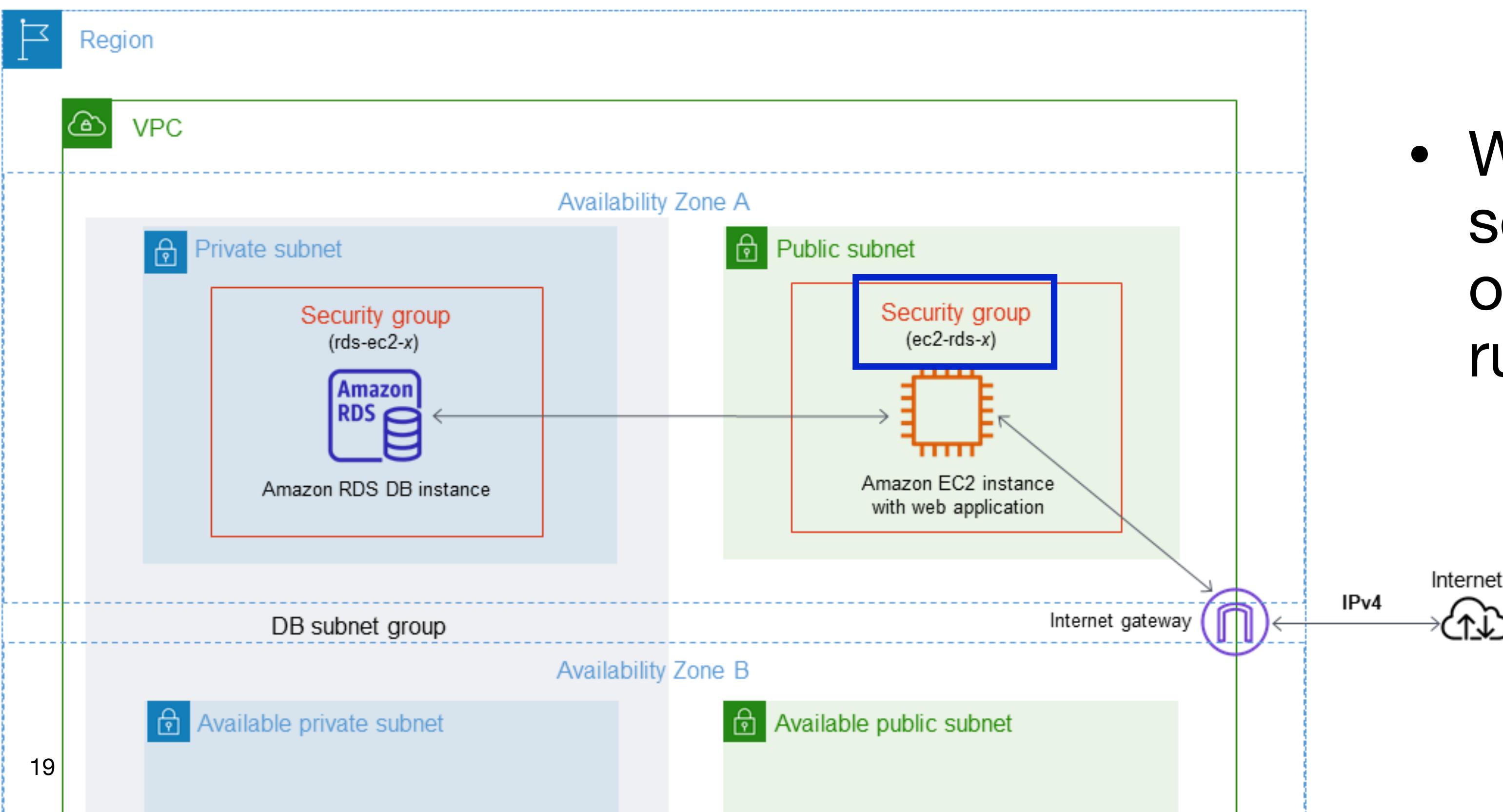
Security Groups

- With no public access, we must allow our EC2 instance access to the RDS instance
- This is done by allowing the security group attached to the RDS instance
- This is a very common pattern for cloud applications



AWS RDS

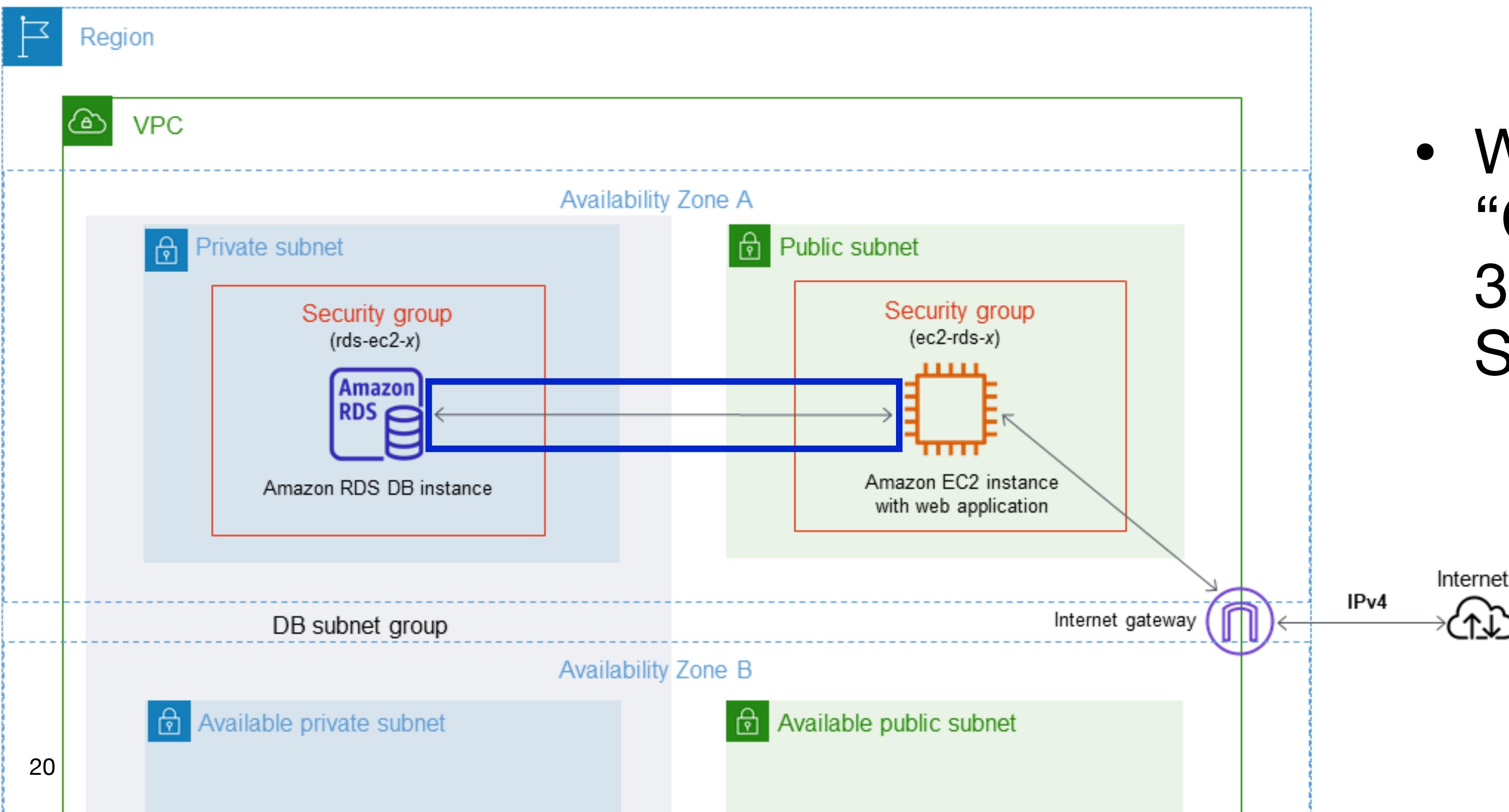
Security Groups



- We'll do this by adding the security group ID attached to our EC2 instance to the ingress rules of the RDS security group

AWS RDS

Security Groups

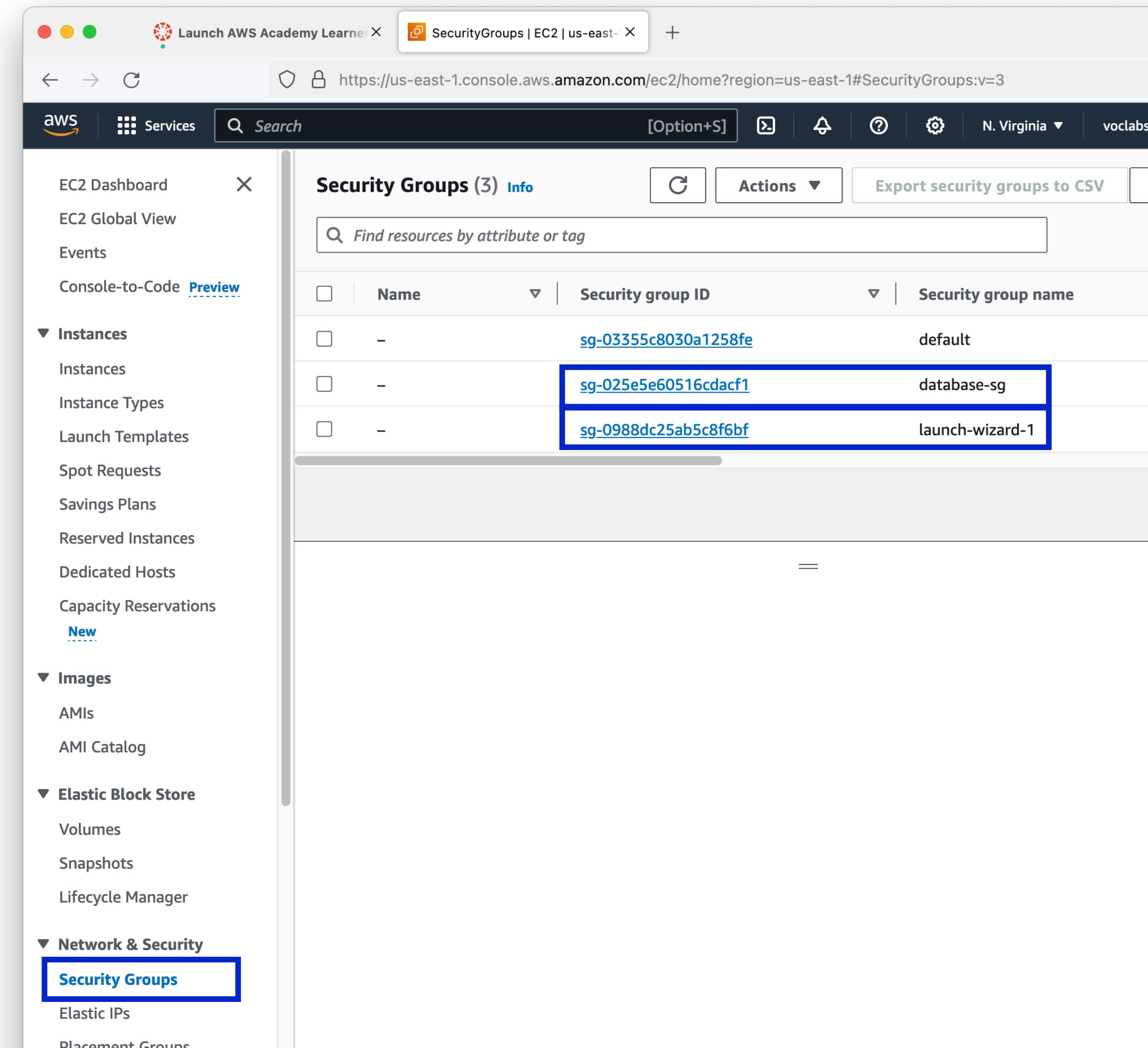


- We want to add a rule that says, “Connections to the DB [port 3306] are allowed from the EC2 Security Group.”

AWS RDS

Security Groups

- In the EC2 console, select “Security Groups” from the left sidebar
- the launch-wizard-1 SG is the one attached to our EC2 instance
- The database-sg SG is attached to our database



AWS RDS

Security Groups

- We need to update the database security group, so select that one
- Then click “Edit inbound rules”

The screenshot shows the AWS EC2 Security Groups page. On the left, a sidebar lists various services: EC2 Dashboard, EC2 Global View, Events, Console-to-Code (Preview), Instances (with sub-options: Instances, Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Capacity Reservations, New), Images (AMIs, AMI Catalog), Elastic Block Store (Volumes, Snapshots, Lifecycle Manager), and Network & Security (Security Groups, Elastic IPs, Placement Groups). The 'Security Groups' option under Network & Security is selected.

The main content area displays 'Security Groups (1/3)'. It shows three entries:

Name	Security group ID	Security group name	VPC ID
-	sg-03355c8030a1258fe	default	vpc-0059b159ca91e2
<input checked="" type="checkbox"/>	sg-025e5e60516cdacf1	database-sg	vpc-0059b159ca91e2
-	sg-0988dc25ab5c8f6bf	launch-wizard-1	vpc-0059b159ca91e2

Below this, a modal window is open for the 'sg-025e5e60516cdacf1 - database-sg' security group. The 'Inbound rules' tab is selected, showing one rule:

Name	Security group rule...	IP version	Type	Protocol
-	sgr-056c4eb649bb670...	IPv4	MySQL/Aurora	TCP

AWS RDS Security Groups

- Add a new rule
- Select MySQL/Aurora for the rule type
- For the source, click in the input field, and scroll down until you find the “launch-wizard-1” security group
- Click “Save rules”

The screenshot shows the AWS EC2 console with the URL <https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#ModifyInboundSecurityGroupRules:securityGroupID>. The page title is "Edit inbound rules" for the security group "sg-025e5e60516cdacf1 - database-sg". The main content area displays the "Inbound rules" table with one existing rule and a button to "Add rule". The rule table columns are: Security group rule ID, Type, Protocol, Port range, Source, and Description - optional. The first rule has a Type of "MySQL/Aurora", Protocol of "TCP", Port range of "3306", and a Source of "67.1.149.77/32". The "Source" field is highlighted with a blue border. To the right of the table is a sidebar with sections for "Security Groups" (listing "database-sg | sg-025e5e60516cdacf1", "default | sg-03355c8030a1258fe", and "launch-wizard-1 | sg-0988dc25ab5c8f6bf"), "Prefix lists" (listing "com.amazonaws.us-east-1.dynamodb | pl-02cd2c6b" and "com.amazonaws.us-east-1.ipv6.route53-healthchecks | pl-05c0959a59362110e"), and other AWS links.

Security group rule ID	Type <small>Info</small>	Protocol	Port range	Source <small>Info</small>	Description - optional <small>Info</small>
sgr-056c4eb649bb67044	MySQL/Aurora	TCP	3306	Cu... <input type="button" value="Delete"/>	<input type="text" value="67.1.149.77/32"/> <input type="button" value="Delete"/>
-	MySQL/Aurora	TCP	3306	Cu... <input type="button" value="Delete"/>	<input type="text" value="::/48"/> <input type="text" value="::/64"/> <input type="button" value="Delete"/>

Add rule

Security Groups

- database-sg | sg-025e5e60516cdacf1
- default | sg-03355c8030a1258fe
- launch-wizard-1 | sg-0988dc25ab5c8f6bf

Prefix lists

- com.amazonaws.us-east-1.dynamodb | pl-02cd2c6b
- com.amazonaws.us-east-1.ipv6.route53-healthchecks | pl-05c0959a59362110e

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ECS → RDS

Connecting at last

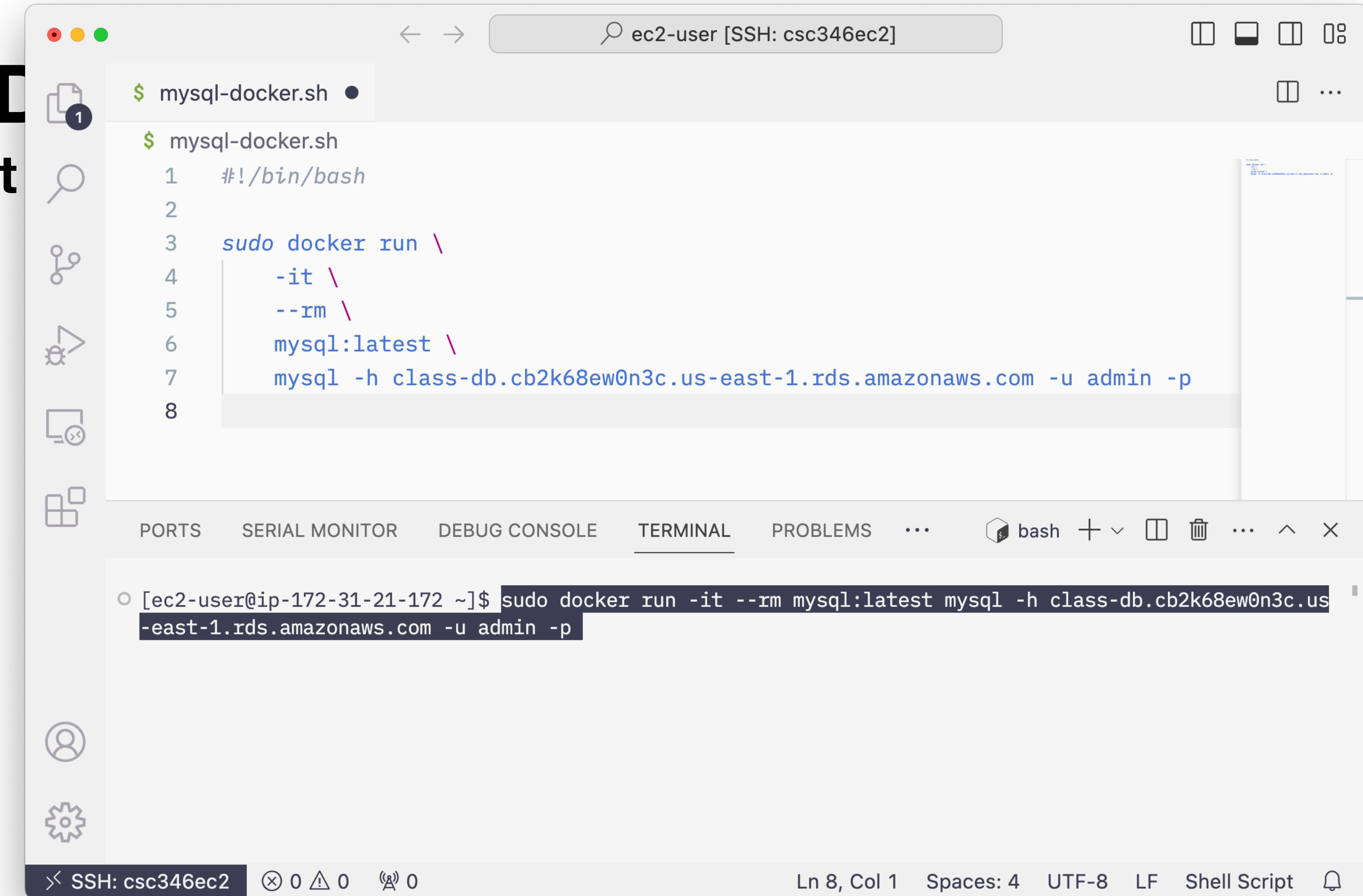
- Connect to your EC2 instance using your method of choice
- We need the mysql client software
- Docker!
- Use the hostname for your RDS instance, and the password you wrote down for the admin user (you did write down the password, right?)

```
sudo docker run -it --rm mysql:latest mysql -h class-db...rds.amazonaws.com -u admin -p
```

ECS → RDS

Connecting at

- Docker lets us run programs without installing them permanently



The screenshot shows a terminal window titled "ec2-user [SSH: csc346ec2]" with the following content:

```
$ mysql-docker.sh
$ mysql-docker.sh
1  #!/bin/bash
2
3  sudo docker run \
4      -it \
5      --rm \
6      mysql:latest \
7      mysql -h class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com -u admin -p
```

The terminal tab bar includes: PORTS, SERIAL MONITOR, DEBUG CONSOLE, TERMINAL (selected), PROBLEMS, and a set of icons for bash, plus, minus, close, etc.

In the terminal pane, a command is shown:

```
[ec2-user@ip-172-31-21-172 ~]$ sudo docker run -it --rm mysql:latest mysql -h class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com -u admin -p
```

The status bar at the bottom indicates: SSH: csc346ec2, 0 errors, 0 warnings, 0 info, Line 8, Col 1, Spaces: 4, UTF-8, LF, Shell Script, and a bell icon.

ECS → RDS

Connecting at

- Docker lets us run programs without installing them permanently

The screenshot shows a terminal window titled "ec2-user [SSH: csc346ec2]" with the following content:

```
$ mysql-docker.sh
$ mysql-docker.sh
1  #!/bin/bash
2
3  sudo docker run \
4      -it \
5      --rm \
6      mysql:latest \
7      mysql -h class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com -u admin -p
8
```

The terminal is connected to a MySQL monitor. The output is:

```
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 30
Server version: 8.0.35 Source distribution

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affiliates. Other names may be trademarks of their respective
owners.

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

mysql>
```

The status bar at the bottom indicates "SSH: csc346ec2" and "Ln 8, Col 1".

ECS → RDS

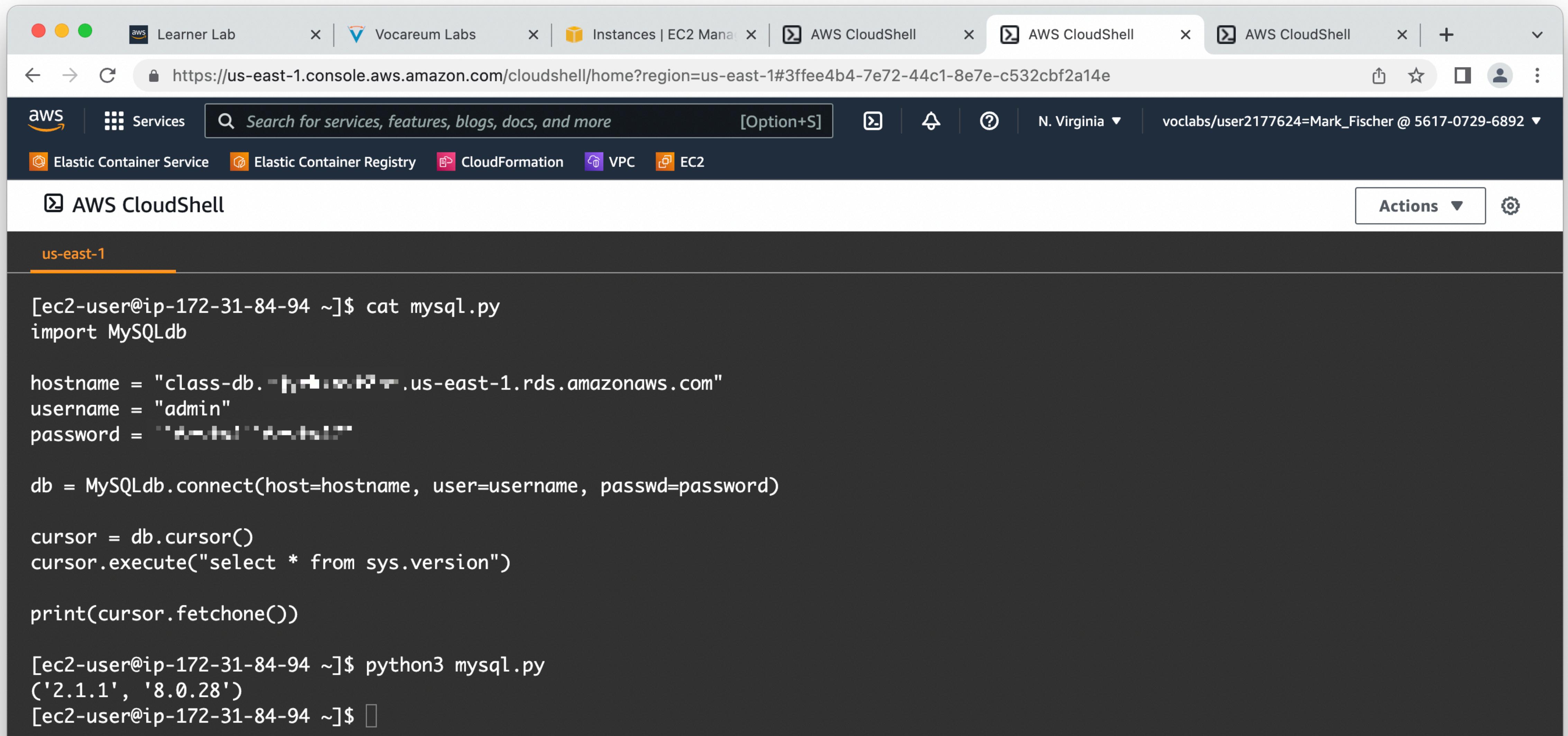
Connecting from python

```
sudo yum install mariadb105-devel gcc python3.11-devel python3.11-pip  
sudo pip3.11 install mysqlclient
```

- Now we can use the MySQLdb module within python on our EC2 instance.

ECS → RDS

Connecting from python



The screenshot shows a macOS desktop with several open tabs in a browser window. The active tab is titled "AWS CloudShell" and contains a terminal session. The terminal is running on an EC2 instance in the us-east-1 region. The user has pasted and run a Python script named "mysql.py" which connects to a MySQL database on an RDS instance. The output shows the version of the MySQL client.

```
[ec2-user@ip-172-31-84-94 ~]$ cat mysql.py
import MySQLdb

hostname = "class-db..us-east-1.rds.amazonaws.com"
username = "admin"
password = ""

db = MySQLdb.connect(host=hostname, user=username, passwd=password)

cursor = db.cursor()
cursor.execute("select * from sys.version")

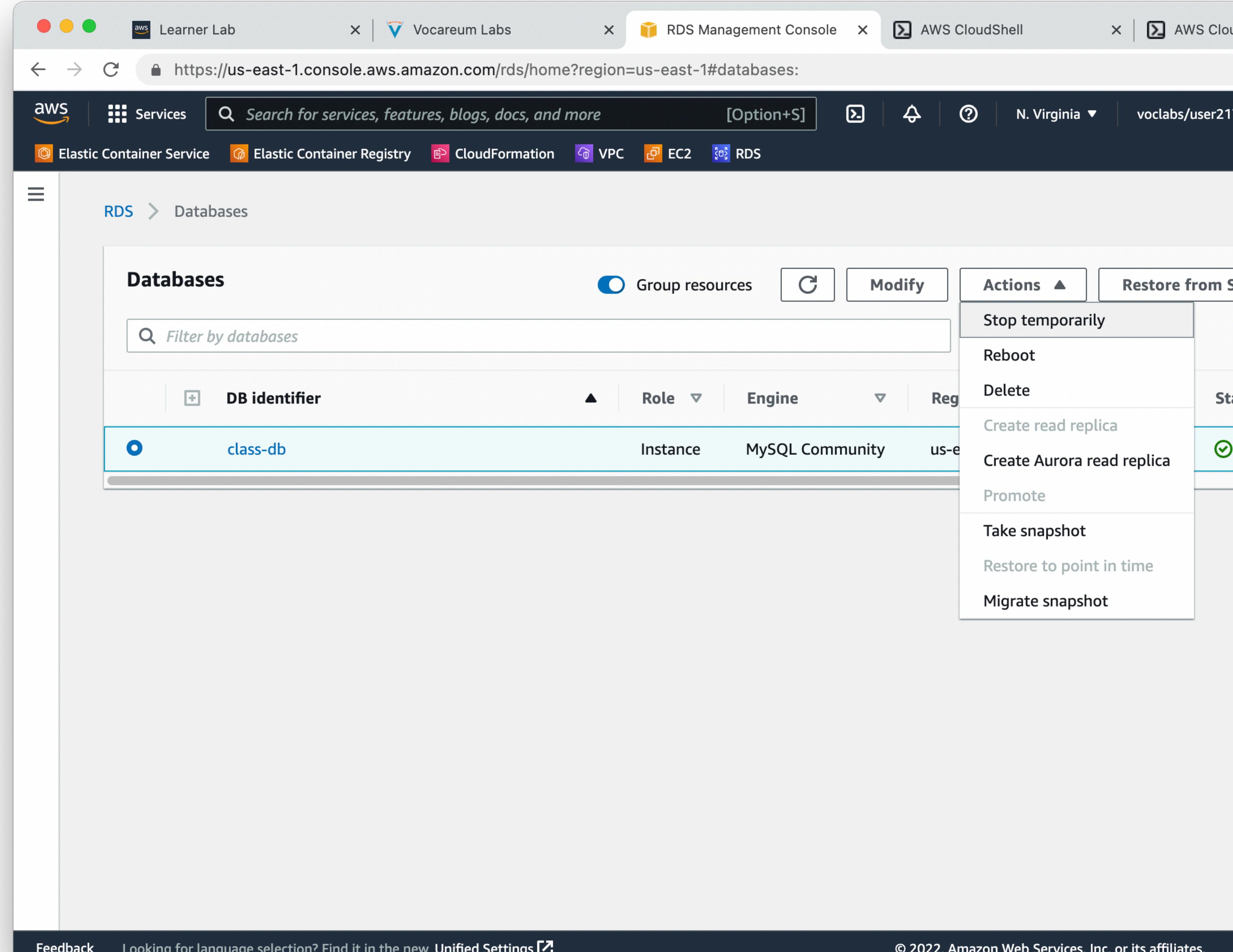
print(cursor.fetchone())

[ec2-user@ip-172-31-84-94 ~]$ python3 mysql.py
('2.1.1', '8.0.28')
[ec2-user@ip-172-31-84-94 ~]$
```

AWS RDS

Cleaning Up

- RDS instances are NOT automatically stopped when your AWS Academy lab session ends
- You will keep getting charged as long as it is active
- You can temporarily stop an RDS instance though



The screenshot shows the AWS RDS Management Console interface. The top navigation bar includes tabs for Learner Lab, Vocareum Labs, RDS Management Console, AWS CloudShell, and AWS CloudWatch Metrics. The main title bar displays the URL: https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#databases:. The header features the AWS logo, a search bar with placeholder text "Search for services, features, blogs, docs, and more", and a "[Option+S]" keybinding. Below the header are navigation links for Elastic Container Service, Elastic Container Registry, CloudFormation, VPC, EC2, and RDS.

The main content area is titled "Databases" and shows a table with one row. The table columns are "DB identifier", "Role", "Engine", and "Region". The single row contains the value "class-db" for all four columns. To the right of the table is a vertical "Actions" menu with the following options: Stop temporarily, Reboot, Delete, Create read replica, Create Aurora read replica, Promote, Take snapshot, Restore to point in time, and Migrate snapshot. At the bottom of the page, there are links for Feedback and Unified Settings, and a copyright notice: © 2022, Amazon Web Services, Inc. or its affiliates.

The screenshot shows the AWS RDS console with the navigation path: RDS > Databases. A modal dialog box is open, titled "Stop DB instance temporarily". The dialog contains the following text: "You are stopping this DB instance for up to 7 days. You can restart the DB instance manually at any time. To stop the DB instance permanently, save it in a snapshot and delete it. [Learn more](#)". Below this is an "Acknowledgement" section with a checked checkbox: "I acknowledge that the DB instance will restart automatically after 7 days, on October 12, 2022, 19:25 (UTC-07:00)". There is also an optional "Snapshot - optional" section with an unchecked checkbox: "Save the DB instance in a snapshot" and the note "The snapshot enables you to restore the DB instance to its last state before it was stopped". At the bottom right of the dialog are "Cancel" and "Stop temporarily" buttons.

AWS RDS

Cleaning Up

- Can stop an RDS instance for up to 7 days
- After that it will automatically restart so AWS can keep it patched
- Still have to pay for the storage
- If you are done with an RDS instance, terminate it instead