



# Inovação com dados em nuvem

**TRILHA**

**#** TheDevConf  
Oracle

## Machine Learning com SQL e Autonomous Database

Erika Nagamine

03.12.20 12h10



# Inovação com dados em nuvem

**TRILHA**

**#TheDevConf**  
Oracle



Este trabalho está licenciado sob uma Licença Creative Commons Atribuição-Compartilhual 4.0 Internacional. Para ver uma cópia desta licença, visite <http://creativecommons.org/licenses/by-sa/4.0/>.



# Inovação com dados em nuvem

**MACHINE LEARNING COM SQL  
E ORACLE AUTONOMOUS  
DATABASE**



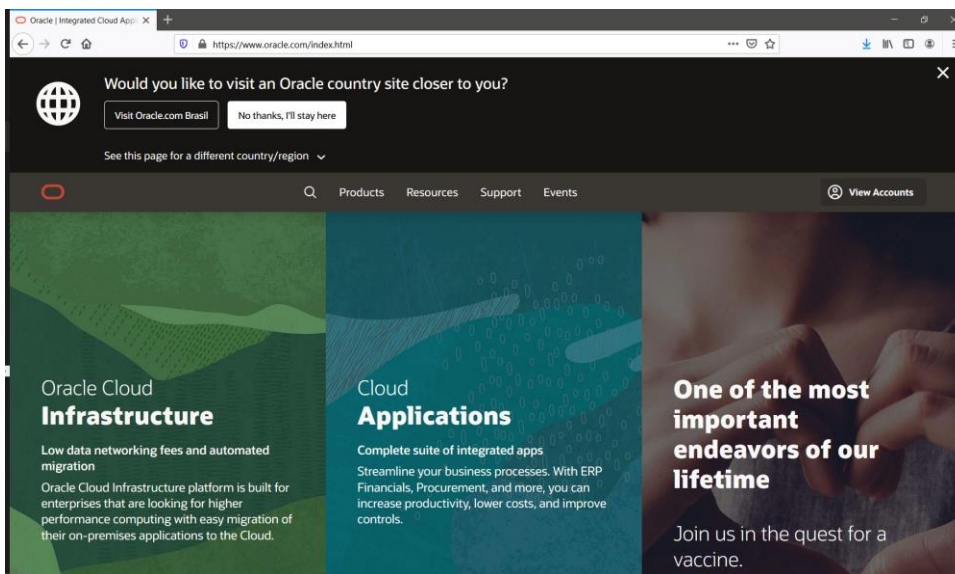
# Índice

1.	Oracle Cloud .....	5
2.	Criando um object storage .....	9
3.	Criando um autonomous database .....	12
4.	Oracle Machine Learning notebooks .....	15
5.	Exemplo de código no Oracle Machine Learning.....	23
6.	APEX.....	25
7.	ORDS.....	26
8.	Links uteis .....	27

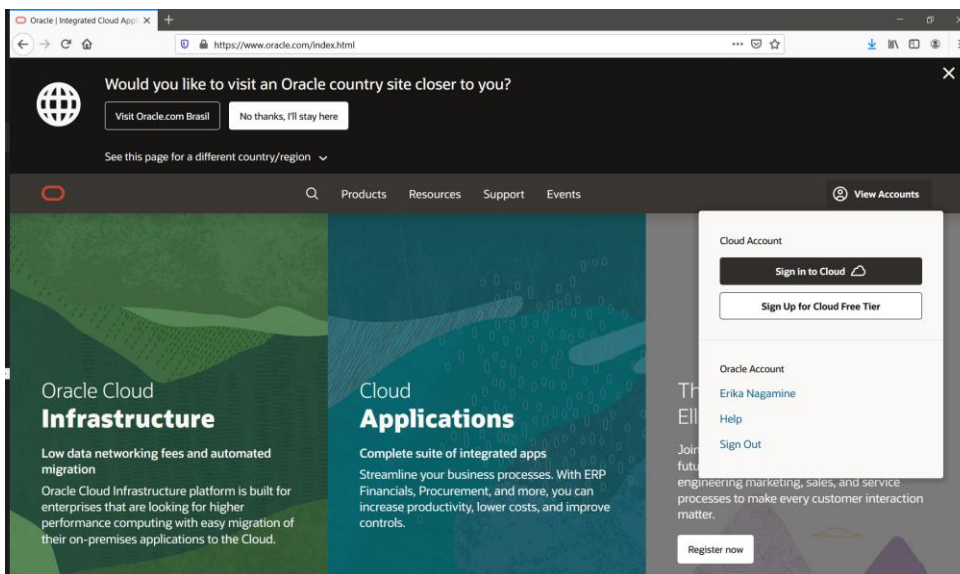
# 1. Oracle Cloud

A Oracle Cloud, também conhecida como OCI (oracle cloud infrastructure) pode ser acessada de algumas formas. Neste documento utilizaremos o acesso via console web. Tenha em mãos a sua conta cloud. Para acessar a console web, você deverá ir no site:

- [www.oracle.com](http://www.oracle.com)
- ou
- [cloud.oracle.com](http://cloud.oracle.com)



Ao acessar a console clique em “view accounts”:





## Digite as informações da sua conta cloud:

Cloud Sign In

ORACLE Cloud

Cloud Account Name @

enagamine

Next

Forgot your cloud account name? Get help

Sign In using a Traditional Cloud Account

Not a Customer yet?  
Sign up

Resources for  
Developers  
Startups  
Students and Educators

Partners  
Oracle PartnerNetwork  
Find a Partner  
Log in to OPN

Solutions  
Artificial Intelligence  
Internet of Things  
Blockchain

What's New  
How we're taking on COVID-19  
Java SE Downloads  
Try Oracle Cloud Free Tier

Contact Us  
US Sales: +1.800.633.0738  
How can we help?  
Subscribe to emails

ORACLE Cloud Infrastructure

SIGN IN

Signing in to cloud tenant  
enagamine  
[Change tenant](#)

Single Sign-On (SSO)

We have detected that your tenancy has been federated to another Identity Provider.

Select your Identity Provider below.

IDENTITY PROVIDER  
oracleidentitycloudservice

Continue

OR

Oracle Cloud Infrastructure ⓘ

The login is uncommon for federated accounts. If you have questions, please review the [FAQ](#) or contact your tenancy administrator.

USER NAME

PASSWORD

Sign In

[Forgot password?](#)

ORACLE Cloud

enagamine

Oracle Cloud Account Sign In

User Name

User name or email

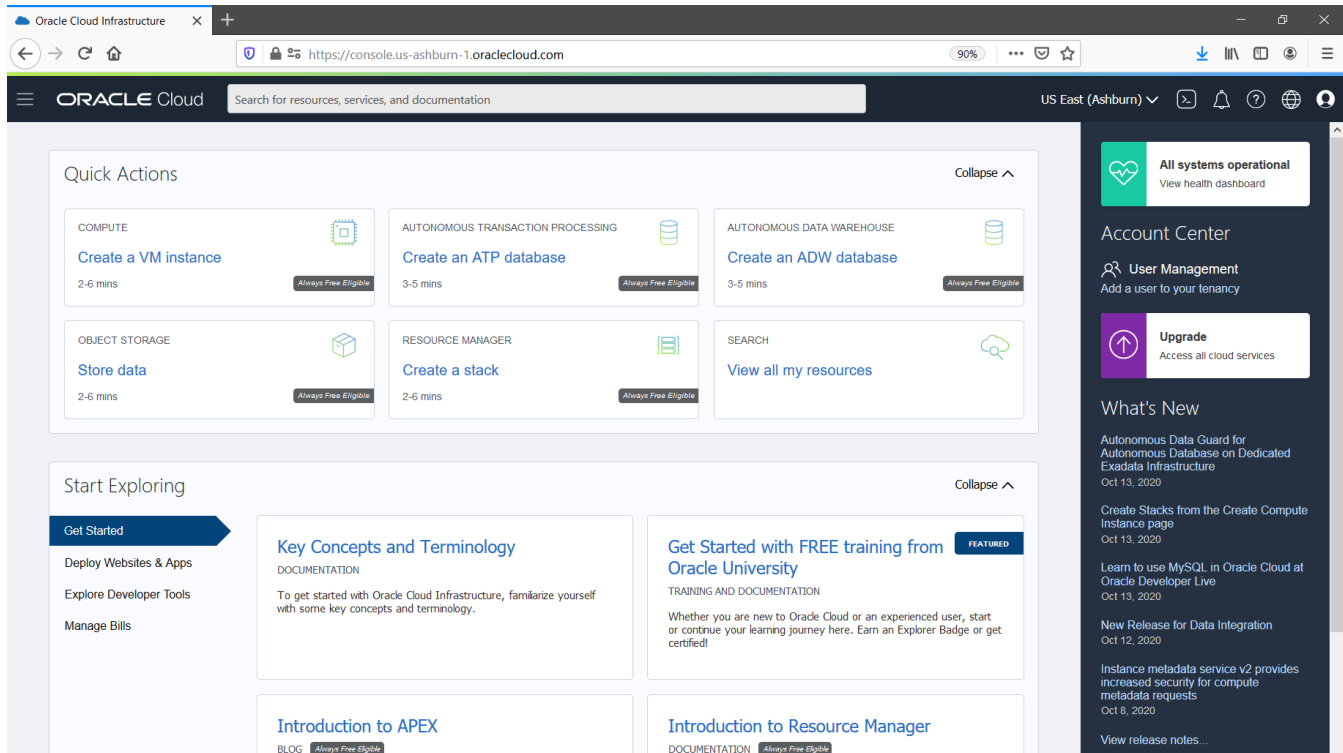
Password

Password

Sign In

Need help signing in? [Click here](#)

Após inserir suas credenciais, você estará na página inicial da console da Oracle cloud:



Note que do lado superior esquerdo temos o menu da oracle cloud. Nele iremos criar a maior parte das tarefas descritas aqui.

Obs: para uma melhor experiencia deste passo a passo as telas estarão em inglês. Para alterar a sua tela clique no globo presente no lado superior direito:

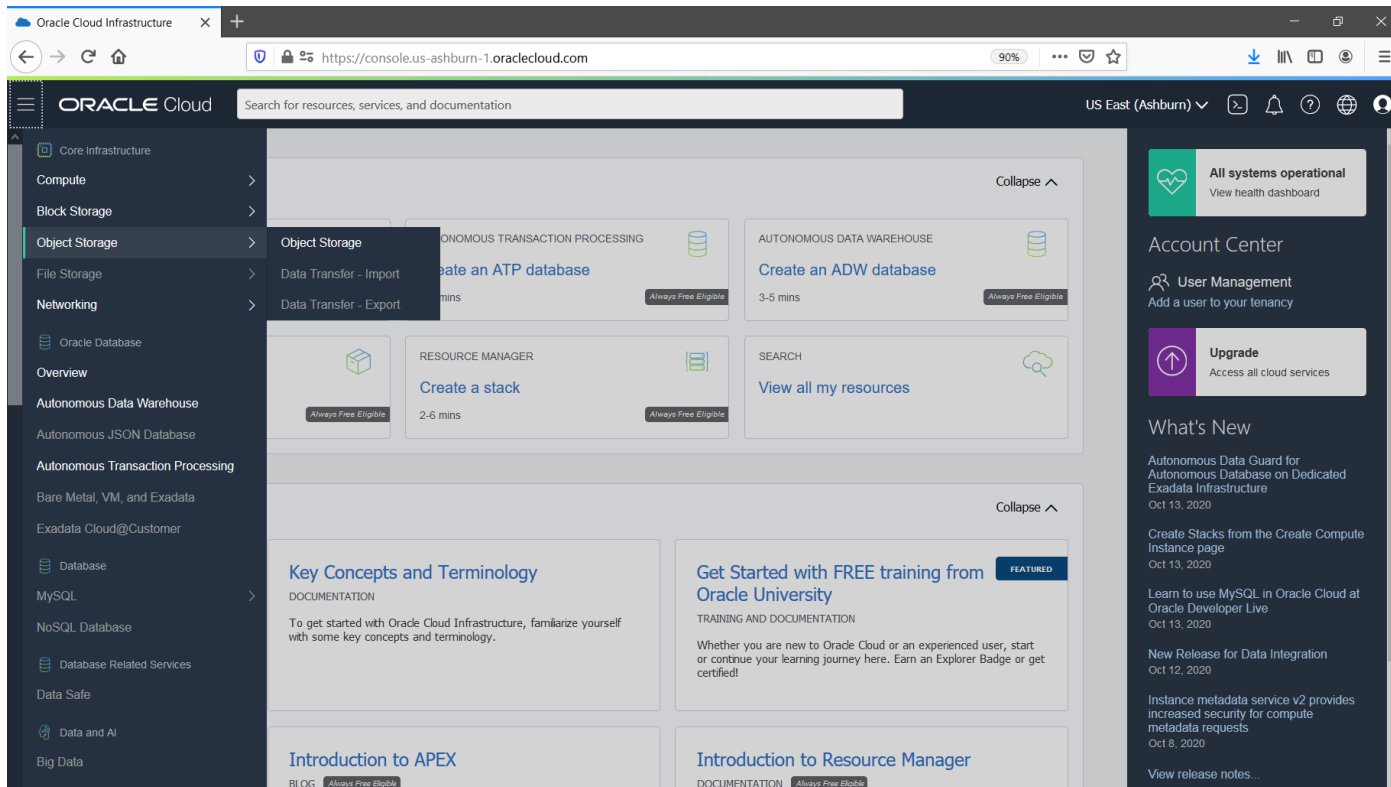
The screenshot displays the Oracle Cloud console interface. At the top, there's a navigation bar with the Oracle Cloud logo, a search bar, and the region 'US East (Ashburn)'. Below this, the 'Quick Actions' section is visible, featuring six cards for various services: COMPUTE (Create a VM instance), AUTONOMOUS TRANSACTION PROCESSING (Create an ATP database), AUTONOMOUS DATA WAREHOUSE (Create an ADW database), OBJECT STORAGE (Store data), RESOURCE MANAGER (Create a stack), and SEARCH (View all my resources). Each card includes an icon, a brief description, and a 'Always Free Eligible' badge. The 'Start Exploring' section below it offers a 'Get Started' button and links to 'Key Concepts and Terminology', 'Get Started with FREE training from Oracle University', 'Introduction to APEX', and 'Introduction to Resource Manager'. On the right side, a sidebar shows the user's account information, a language dropdown menu (currently set to English), and a 'What's New' section with recent updates.



## 2. Criando um object storage

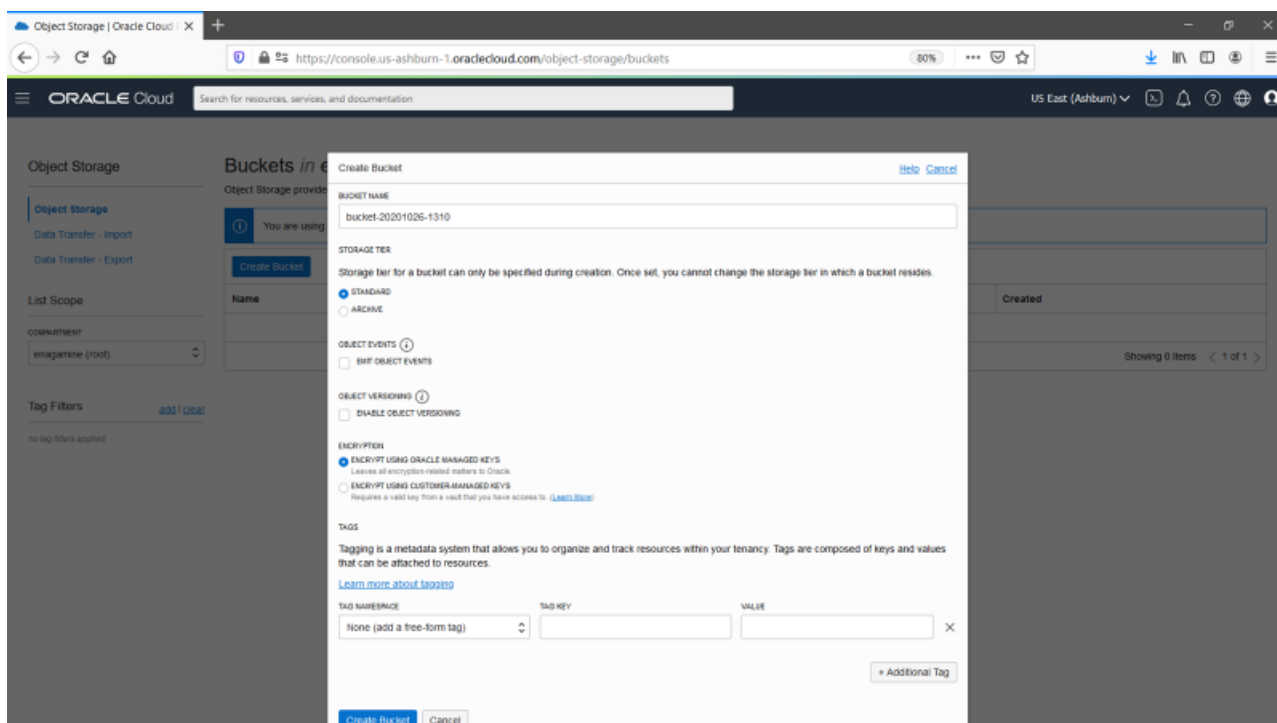
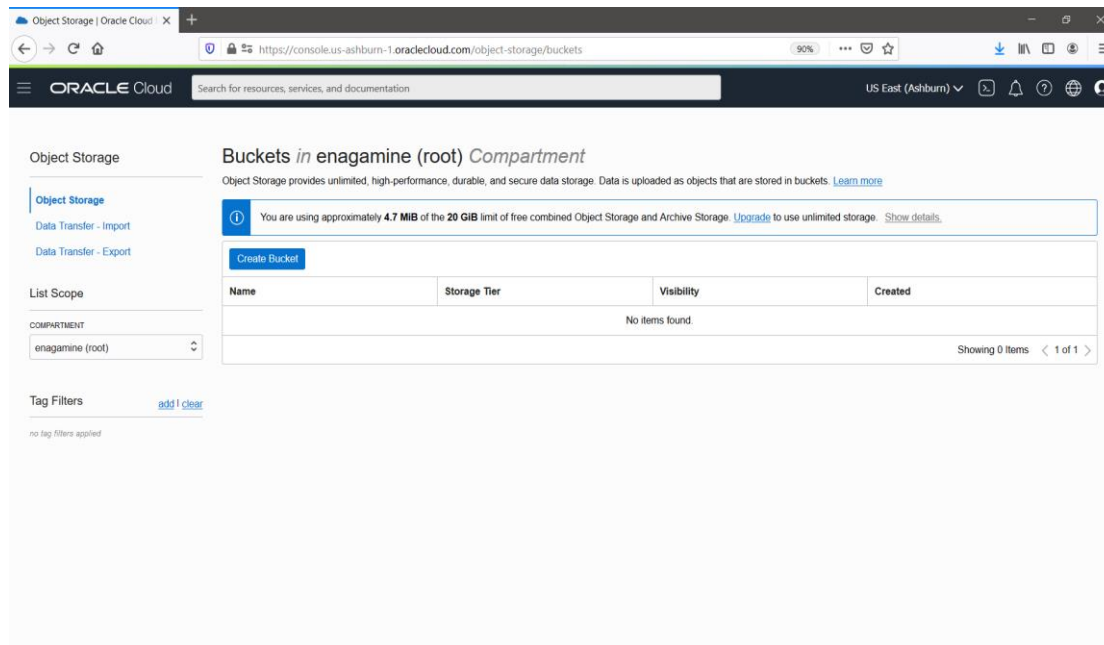
Object storage é uma das opções de armazenamento que possuímos na cloud. Ele oferece uma forma de armazenamento elástico, podendo ser utilizado para diversos tipos de dados não estruturados / semi-estruturados.

Para criar um object storage, vá no menu -> object storage -> object storage:



Clique em “create bucket” e insira as informações:

- Nome do bucket (caso queira alterar): meu\_primeiro\_bucket



Após a criação irá aparecer uma tela semelhante a essa:

Object Storage | Oracle Cloud

→ ↻ 🏠

🔒 🛡️ https://console.us-ashburn-1.oraclecloud.com/object-storage/buckets

133% ⋮ 🛡️ ⭐

⬇️ 📄 🗑️ 🌐

☰

ORACLE Cloud

Search for resources, services, and documentation

US East (Ashburn) ▾

> 🔔 ? 🌐 👤

Object Storage

Object Storage

Data Transfer - Import

Data Transfer - Export

List Scope

COMPARTMENT

enagamine (root) ▾

Tag Filters

[add](#) | [clear](#)

no tag filters applied

Buckets *in enagamine (root) Compartment*

Object Storage provides unlimited, high-performance, durable, and secure data storage. Data is uploaded as objects that are stored in buckets. [Learn more](#)

📘

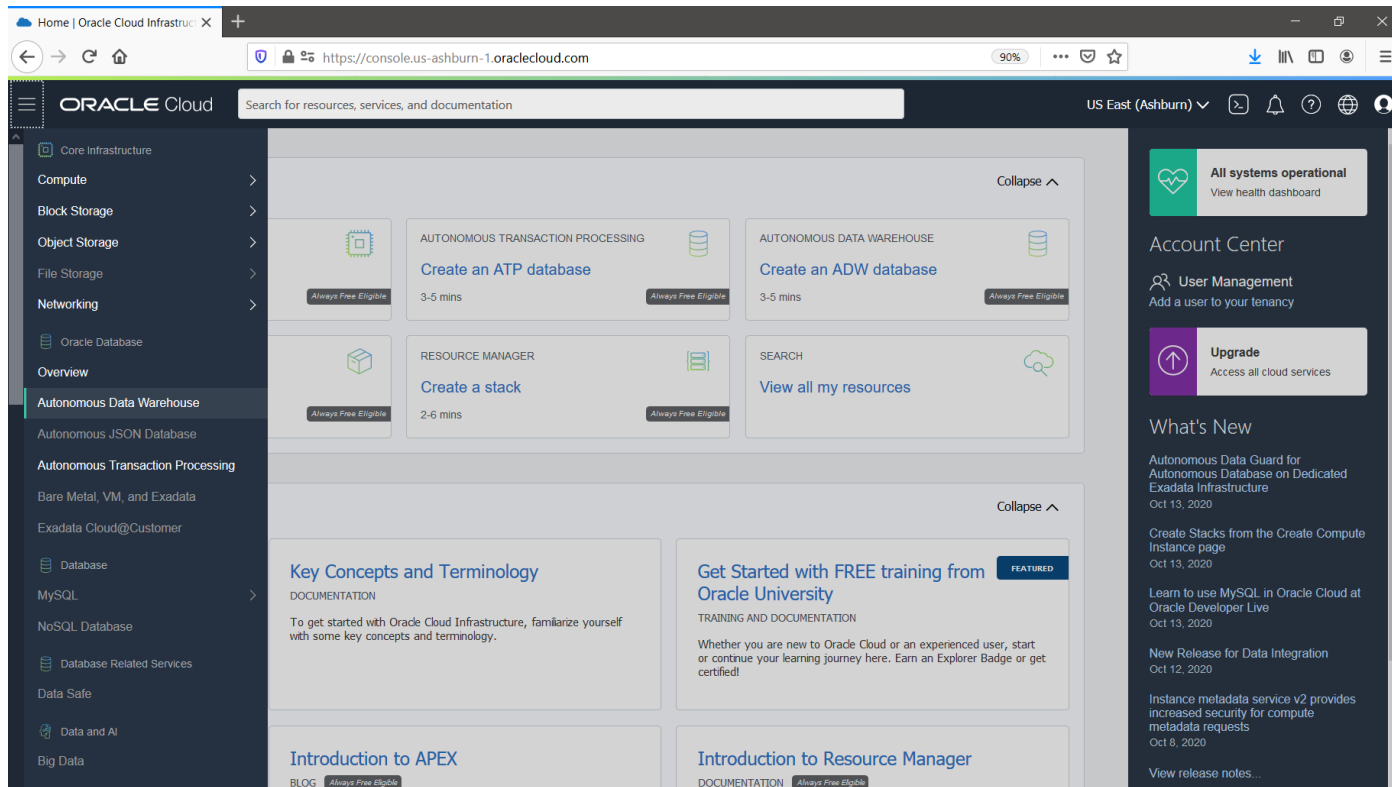
You are using approximately **4.7 MiB** of the **20 GiB** limit of free combined Object Storage and Archive Storage. [Upgrade](#) to use unlimited storage. [Show details.](#)

Create Bucket

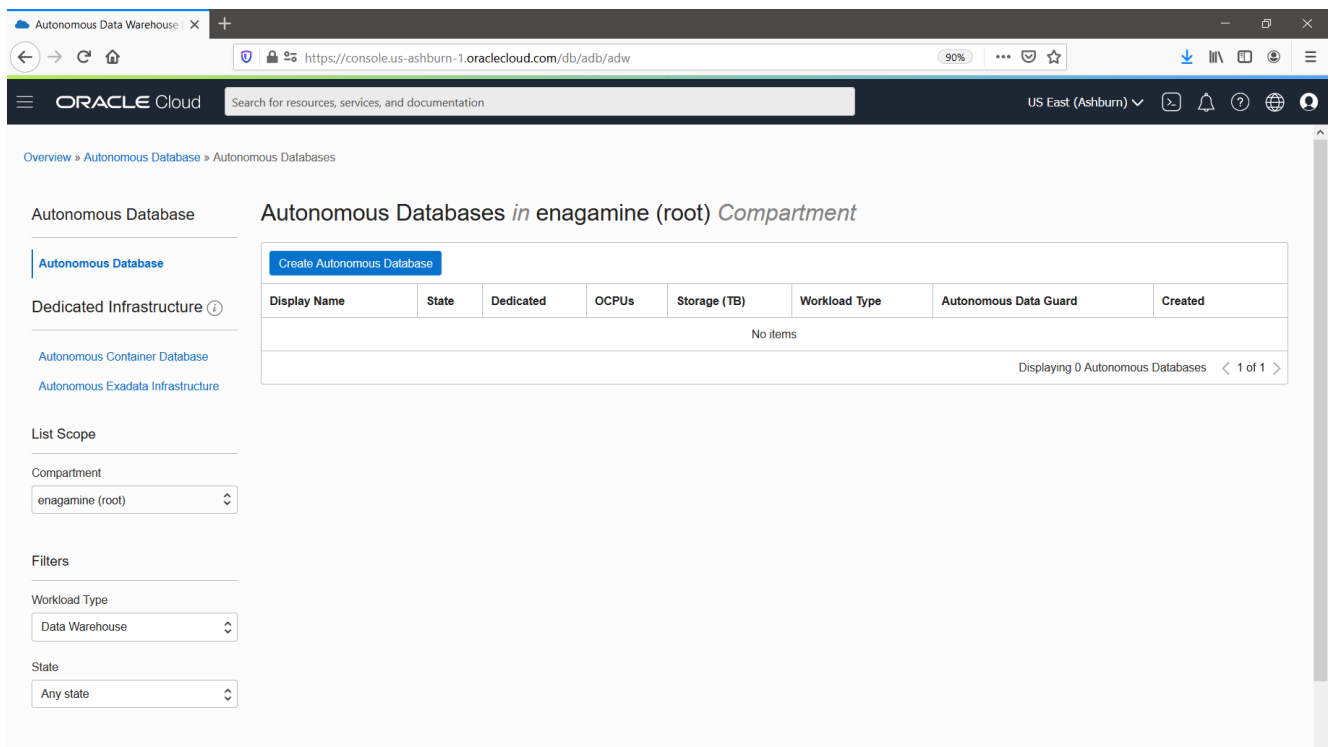
Name ▲	Storage Tier	Visibility	Created
<a href="#">meu_primeiro_bucket</a>	Standard	Private	Mon, Oct 26, 2020, 16:18:52 UTC ⋮
Showing 1 Item < 1 of 1 >			

### 3. Criando um autonomous database

Para criar um autonomous database, vá no menu -> autonomous database



Clique em “create autonomous database”:



Preencha/selecione as seguintes informações:

- Display name: adw
- Database name: adw
- Workload type: data warehouse
- Deployment type: shared infrastructure
- OCPU: 1
- Storage: 1
- Coloque a senha de admin de sua preferencia
- Access type: allow secure from everywhere
- License included

E clique em “Create Autonomous Database”

Oracle Cloud Infrastructure

https://console.us-ashburn-1.oraclecloud.com/db/adw/create

US East (Ashburn)

## Create Autonomous Database

Provide basic information for the Autonomous Database

Compartment  
enagamine (root)

Display name  
DB 202010261519  
A user-friendly name to help you easily identify the resource.

Database name  
DB202010261519  
The name must contain only letters and numbers, starting with a letter. Maximum of 14 characters.

Choose a workload type

**Data Warehouse**  
Built for decision support and data warehouse workloads. Fast queries over large volumes of data.

Transaction Processing  
Built for transactional workloads. High concurrency for short-running queries and transactions.

JSON  
Built for JSON-centric application development. Developer-friendly document APIs and native JSON storage.

Choose a deployment type

**Shared Infrastructure**  
Run Autonomous Database on shared Exadata infrastructure.

Dedicated Infrastructure  
Run Autonomous Database on dedicated Exadata infrastructure.

Dedicated Exadata infrastructure is not available for Always Free Oracle Autonomous Database.

Create Autonomous Database Cancel

Caso seu autonomous seja criado com sucesso você verá uma tela semelhante:

Oracle Cloud Infrastructure

https://console.us-ashburn-1.oraclecloud.com/db/adw/ocid1.autonomousdatabase.oc1.iad.abuwcljst77daljja2mdxhssn

US East (Ashburn)

Overview » Autonomous Database » Autonomous Database Details

## adw Always Free

DB Connection Performance Hub Service Console Scale Up/Down More Actions

Autonomous Database Information Tools Tags

### General Information

Database Name: adw  
Workload Type: Data Warehouse  
Compartment: enagamine (root)/enagamine-analytics  
OCID: ...a22vpq [Show](#) [Copy](#)  
Created: Mon, Sep 28, 2020, 19:40:58 UTC  
OCPU Count: 1  
Storage: 0.02 TB  
License Type: License included  
Database Version: 19c  
Auto Scaling: Disabled ⓘ  
Lifecycle State: Available  
Instance Type: Free [Upgrade to Paid](#)  
Mode: Read/Write [Edit](#)

### Infrastructure

Dedicated Infrastructure: No

### Autonomous Data Guard ⓘ

Status: Disabled ⓘ

### Backup

Last Automatic Backup: Tue, Oct 27, 2020, 05:26:34 UTC

### Network

Access Type: Allow secure access from everywhere  
Access Control List: Disabled [Edit](#)

### Maintenance ⓘ

Next Maintenance: Sun, Nov 1, 2020, 00:00:00 UTC - 04:00:00 UTC

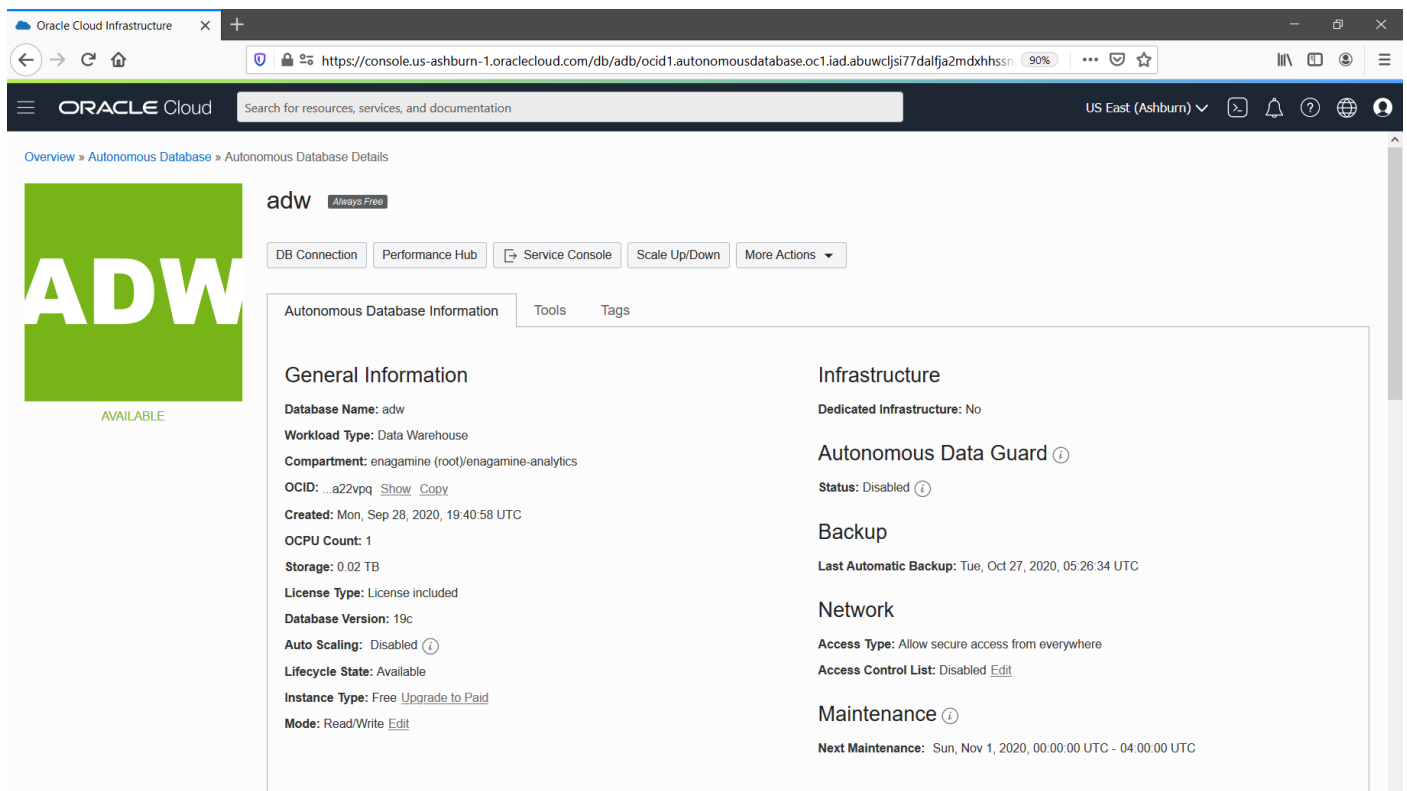


## 4. Oracle Machine Learning notebooks

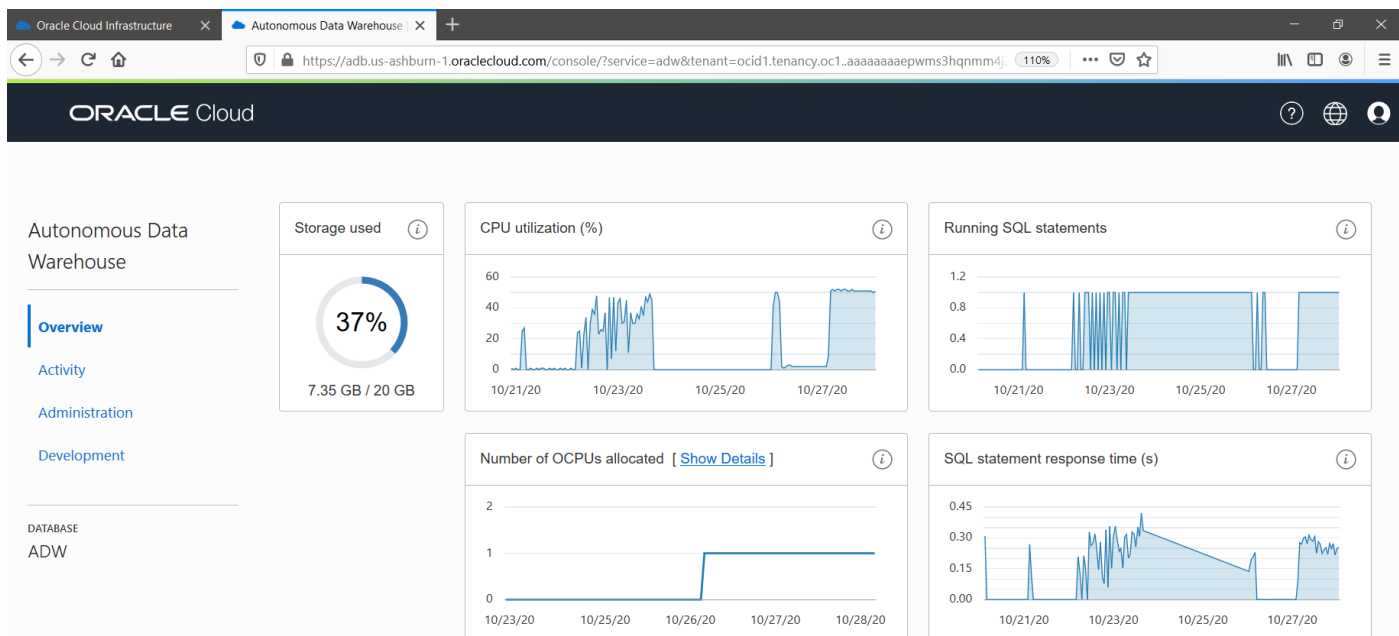
O Oracle Machine Learning notebooks é um ambiente colaborativo que pode ser utilizado para mineração de dados e/ou até mesmo para você fazer visualizações com dados.

Utilizaremos este ambiente no workshop para trabalharmos com nossos dados.

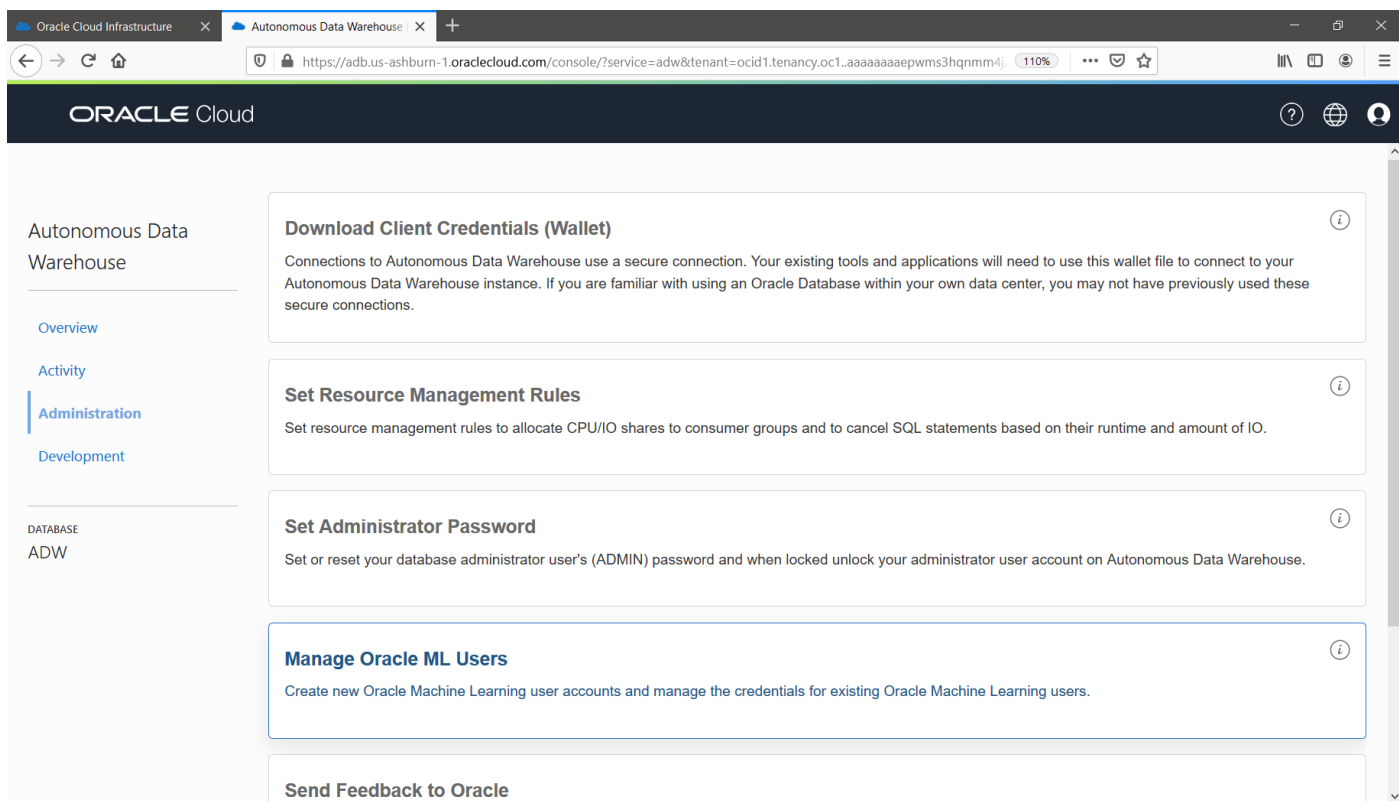
O primeiro passo é criar o usuário para acesso do Machine Learning Notebooks. Para isso, clique em service console na tela inicial do autonomous:



Ao acessar a service console, utilize o menu do lado esquerdo a opção administração:




Em administração clique em “Manage Oracle ML Users”



Na tela de criação clique em “create”:

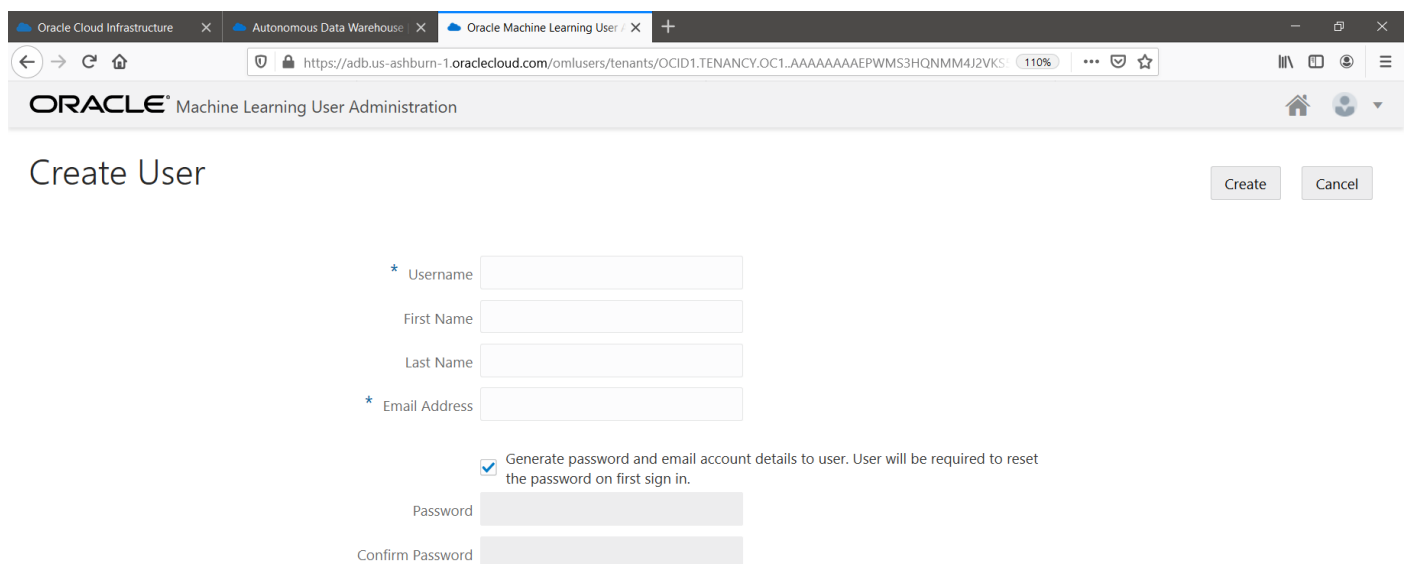
## Users

<a href="#">+ Create</a>	<a href="#">X Delete</a>	<input type="checkbox"/> Show All Users	<input type="text" value="Search..."/> 			
User Name	Full Name	Role	Email	Created On	Status	
ADMIN		System Administrator		1/27/20 11:34 PM	Open	

Na página de criação do usuário, digite:

- Username: userml
- Email: um email válido
- Desmarque a opção de generate password
- Digite a senha desejada

E crie seu usuário



ORACLE<sup>®</sup> Machine Learning User Administration

Create User [Create](#) [Cancel](#)

\* Username

First Name

Last Name

\* Email Address

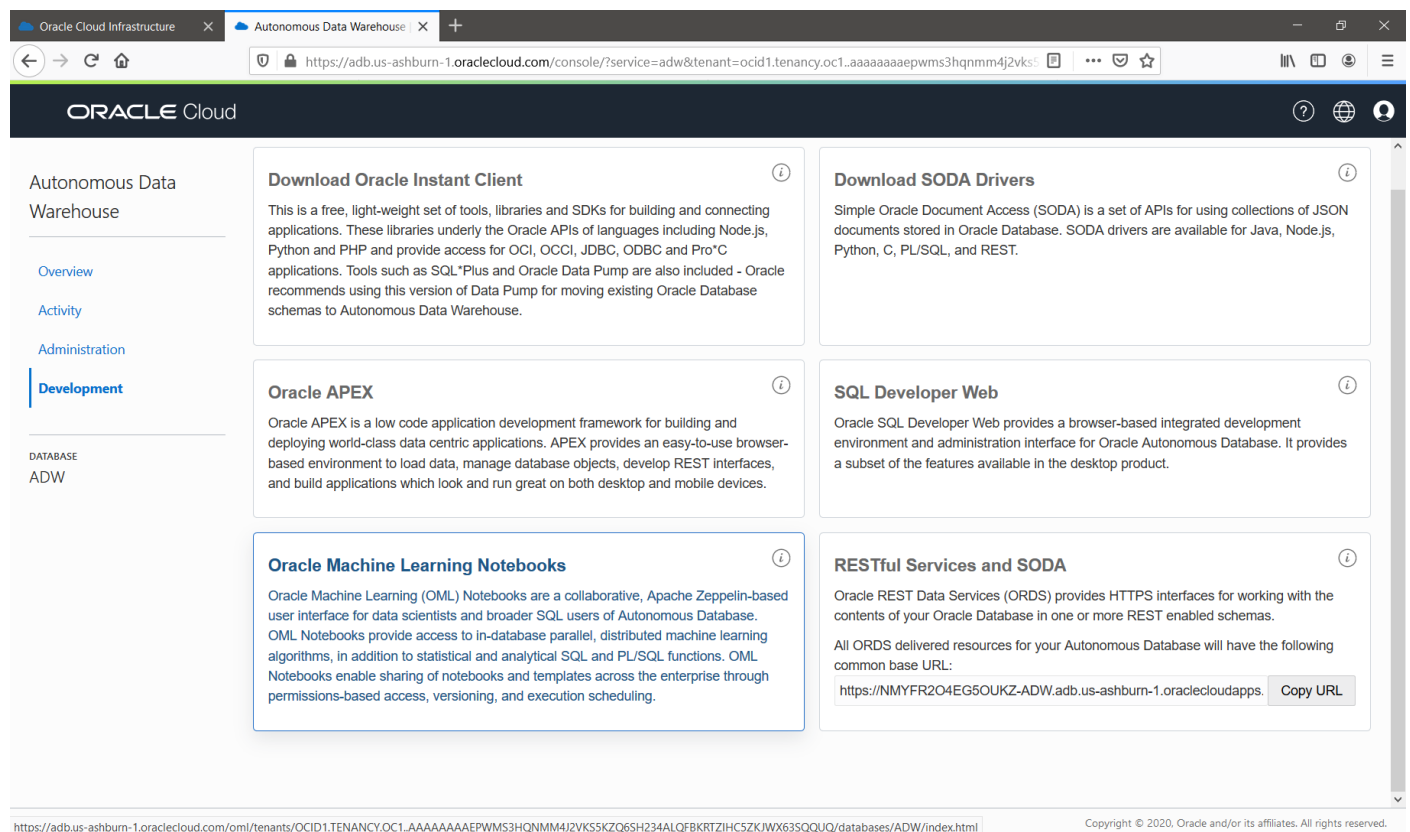
☒ Generate password and email account details to user. User will be required to reset the password on first sign in.

Password

Confirm Password

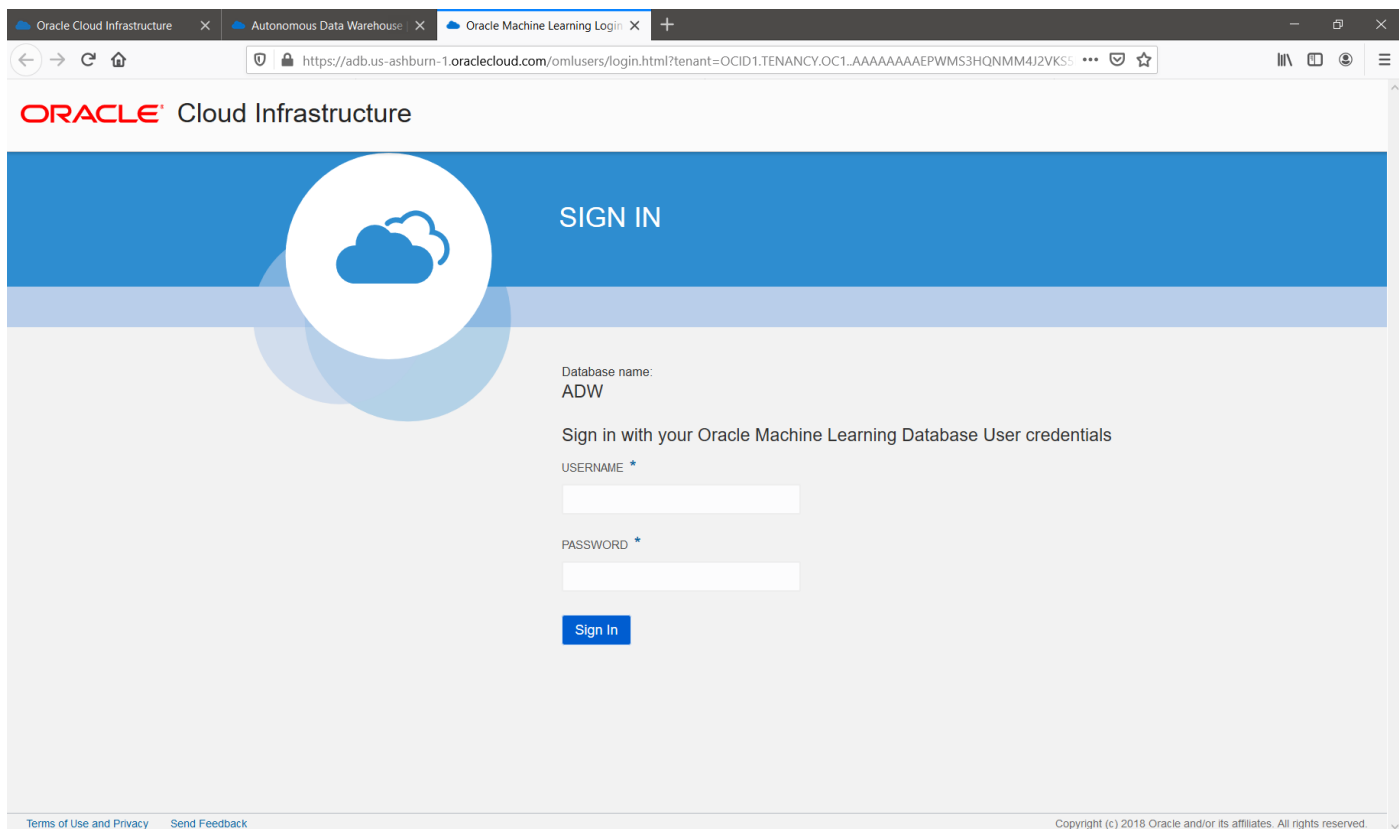
Após a criação você está apto a criar seu próprio notebook!

Para criar seu notebook, volte ao “service console” e clique na opção “Oracle Machine Learning Notebooks:”

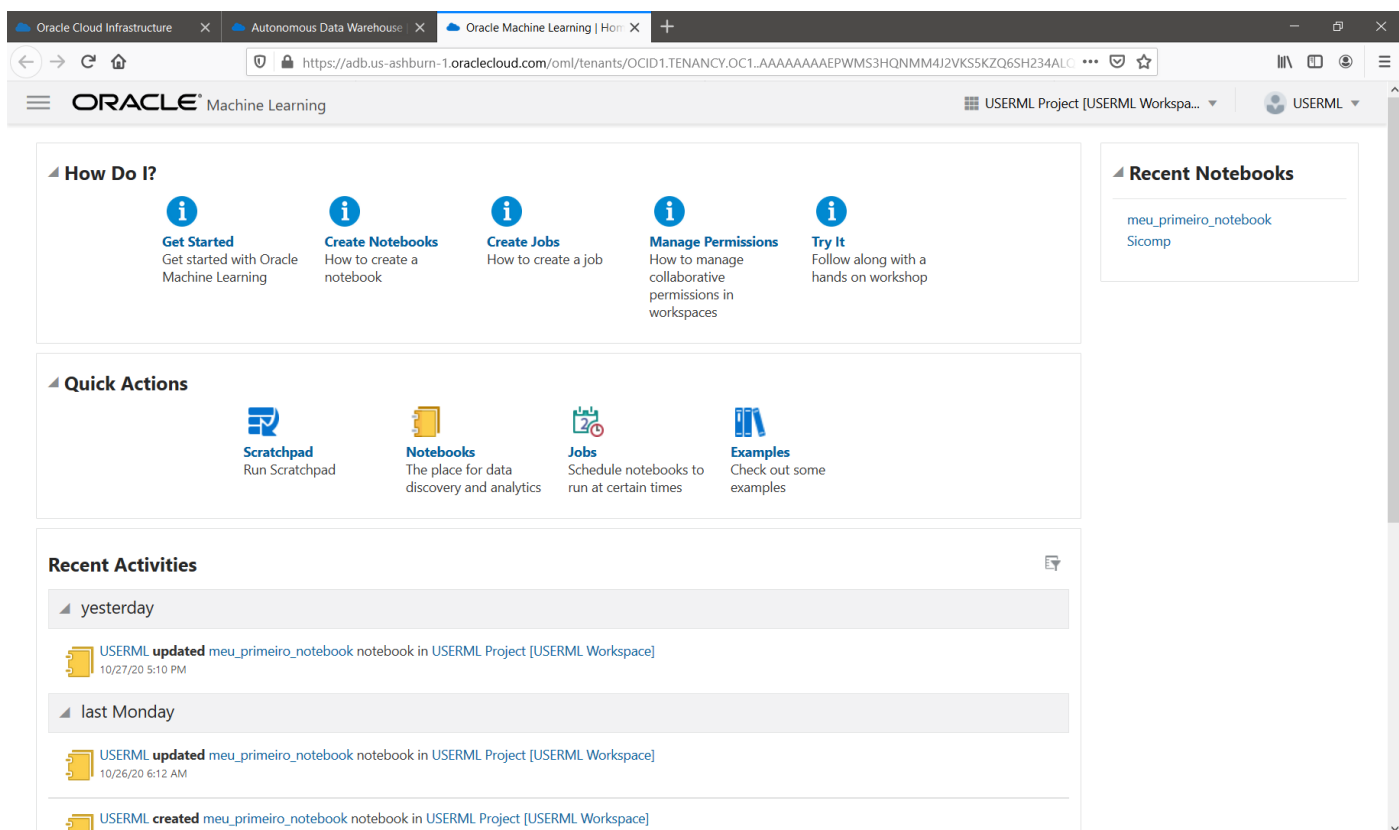


The screenshot shows the Oracle Cloud console interface. On the left, a sidebar lists navigation options: Overview, Activity, Administration, and Development (which is selected). Below the sidebar, it indicates the current database is ADW. The main content area displays several cards for development tools. The 'Oracle Machine Learning Notebooks' card is highlighted with a blue border. It describes OML Notebooks as a collaborative, Apache Zeppelin-based interface for data scientists. Other cards include 'Download Oracle Instant Client', 'Download SODA Drivers', 'Oracle APEX', 'SQL Developer Web', and 'RESTful Services and SODA'. At the bottom, a URL bar shows the specific OML notebook endpoint, and a copyright notice for 2020 is visible.

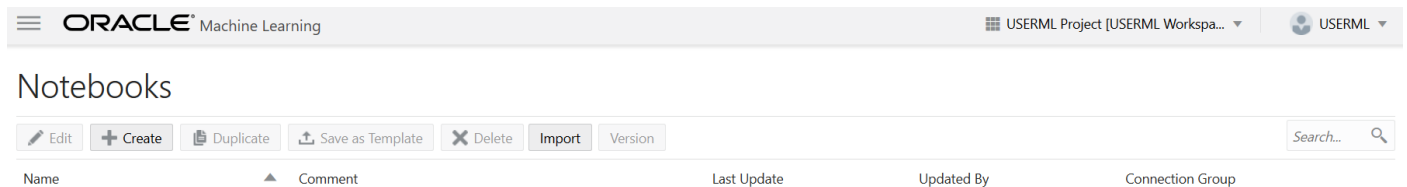
Digite os dados do usuário criado no passo anterior (userml/<senha da sua escolha>):



Na tela inicial do Oracle machine Learning notebooks clique no ícone “Notebooks”:



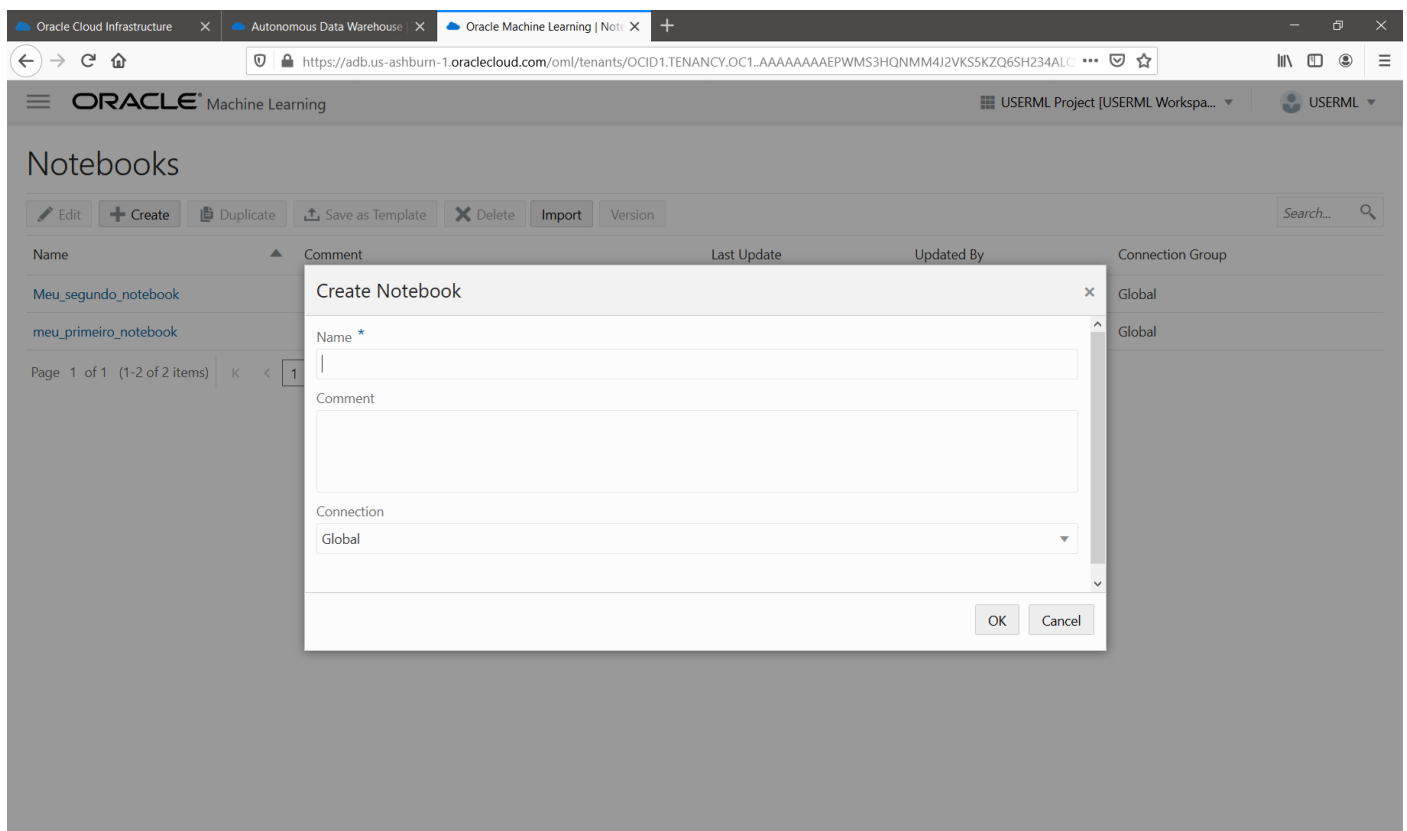
Na página de criação, clique em create:



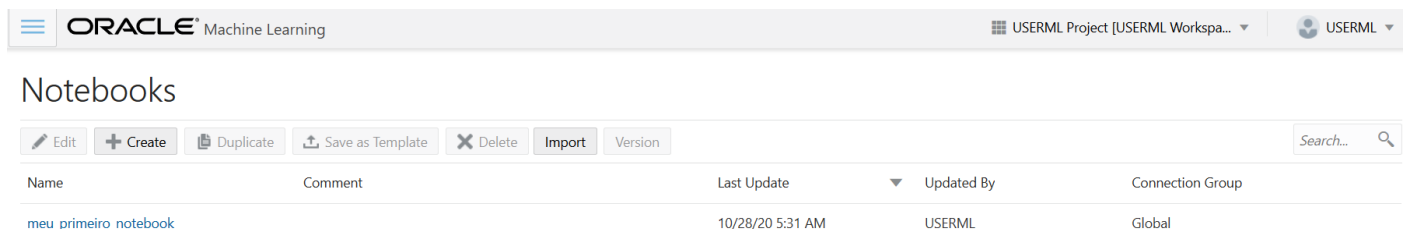
Preencha com as seguintes informações:

- Name: meu\_primeiro\_notebook

E clique em OK



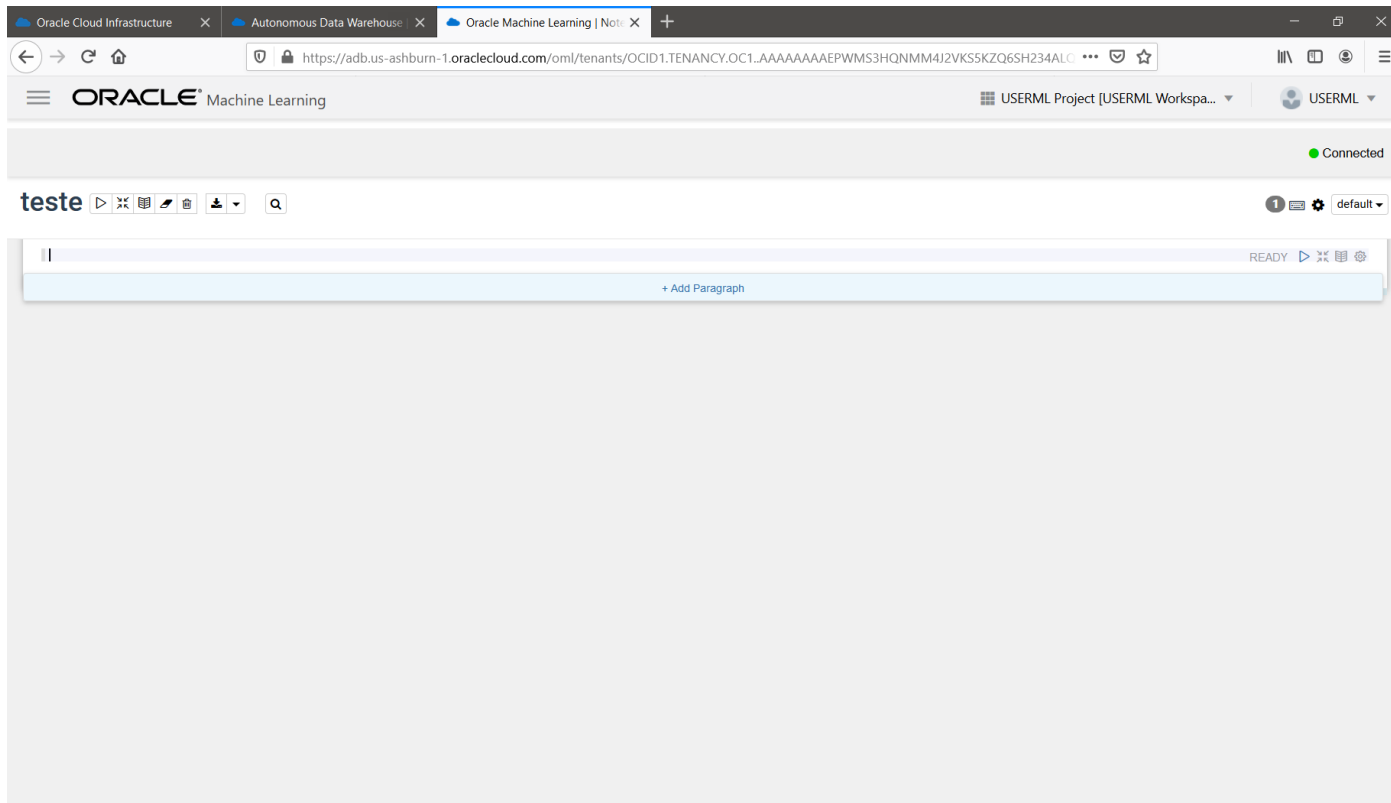
Clique no seu notebook:



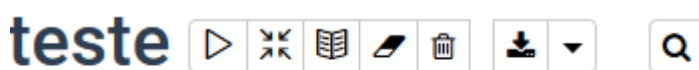
Seu notebook está pronto para ser utilizado, algumas dicas:



- Organização: o notebook é organizado em parágrafos. Em cada um deles você coloca seu trecho de código. Pense em como contar uma história com seus dados, explore!



- Todas as ações que você tomar no canto superior serão executadas para todos os parágrafos:



- As ações que você executar no paragrafo são isoladas (são executadas apenas no paragrafo selecionado):



- A primeira linha do paragrafo indica como você irá executar o parágrafo podendo ser: %sql ou %script

The screenshot displays the Oracle Machine Learning web interface. The browser tabs at the top include 'Oracle Cloud Infrastructure', 'Autonomous Data Warehouse', and 'Oracle Machine Learning | Note'. The address bar shows a URL from 'adb.us-ashburn-1.oraclecloud.com'. The page header features the 'ORACLE Machine Learning' logo and a 'USERML Project [USERML Workspa...]' dropdown. A 'Connected' status indicator is visible in the top right.

The main content area is titled 'teste' and contains two execution blocks. The first block, labeled '%sql', shows the command 'select sysdate from dual' and the result '2020-10-28 05:42:10'. The second block, labeled '%script', shows the same command and the result '28-OCT-20'. Both blocks indicate they were 'FINISHED' and provide a timestamp for when they were last updated.

SYSDATE
2020-10-28 05:42:10

SYSDATE
28-OCT-20

## 5.Exemplo de código no Oracle Machine Learning

O exemplo abaixo pode ser copiado / colado separadamente por parágrafos e tem o intuito de apenas você conhecer como minerar dados com SQL. Há um mundo a ser explorado e este é só um exemplo. Explore muito mais em links uteis.

Cada quadrado representa o que deve ser colocado em um paragrafo:

Acessando seu dataset no banco de dados:

```
%script
declare
  v_region      varchar2(30) := '<selecione sua region>';
  v_namespace   varchar2(30) := '<namespace do object storage>';
  v_bucket      varchar2(30) := '<nome do seu bucket>';
  v_table_name  varchar2(30) := 'CASAS';
  v_data_source varchar2(1000) := 'houses_to_rent.csv';
  v_credential  VARCHAR2(100) := 'CRED_OBJ_STORAGE';
  v_url         varchar2(4000);
begin

  v_url :=
'https://swiftobjectstorage.'||v_region||'.oraclecloud.com/v1/'||v_namespace|| '/'||v_bucket|| '/'||v_data_s
ource;

  begin
    execute immediate 'drop table '||v_table_name;
  exception
    when others then
      null;
  end;

  dbms_output.put_line(v_url);

  DBMS_CLOUD.CREATE_EXTERNAL_TABLE(
    table_name => v_table_name,
    credential_name => v_credential,
    file_uri_list => v_url,
    format => json_object('type' value 'csv','ignoremissingcolumns' value 'true', 'delimiter' value ',',
'skipheaders' value '1', 'dateformat' value 'YYYY-MM-DD'),
    column_list => 'id varchar2(4000),
                    city varchar2(4000),
                    area varchar2(4000),
                    rooms varchar2(4000),
                    bathroom varchar2(4000),
                    parking_spaces varchar2(4000),
                    floor varchar2(4000),
                    animal varchar2(4000),
                    furniture varchar2(4000),
                    hoa varchar2(4000),
                    rent_amount varchar2(4000),
                    property_tax varchar2(4000),
                    fire_insurance varchar2(4000),
                    total varchar2(4000)'
  );
END;
```

Teste o seu dataset:

```
%sql
select * from casas
```

Configure os parâmetros para o seu modelo:

```
%script
```

```
BEGIN
EXECUTE IMMEDIATE 'CREATE TABLE CONFIG_MODELO (SETTING_NAME VARCHAR2(30), SETTING_VALUE VARCHAR2(4000))';
EXECUTE IMMEDIATE 'INSERT INTO CONFIG_MODELO (SETTING_NAME, SETTING_VALUE) VALUES
(''ALGO_NAME'', ''ALGO_DECISION_TREE'')';
EXECUTE IMMEDIATE 'CALL
DBMS_DATA_MINING.CREATE_MODEL(''MEU_PRIMEIRO_MODELO'', ''CLASSIFICATION'', ''DADOS_TREINO'', ''ID'', ''CITY'',
''CONFIG_MODELO'')';
END;
```

## Crie seu modelo:

```
%script
declare
  v_accuracy NUMBER;
begin
  DBMS_DATA_MINING.APPLY(
    model_name => 'MEU_PRIMEIRO_MODELO',
    data_table_name => 'dados_treino',
    case_id_column_name => 'id',
    result_table_name => 'DADOS_TREINO_RESULTADO');

  EXECUTE IMMEDIATE('CREATE VIEW DADOS_TREINO_RESULTADO_view as select id, city from DADOS_TREINO');

  DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX(
    accuracy => v_accuracy,
    apply_result_table_name => 'DADOS_TREINO_RESULTADO',
    target_table_name => 'DADOS_TREINO_RESULTADO_view',
    case_id_column_name => 'id',
    target_column_name => 'city',
    confusion_matrix_table_name => 'dados_treino_matriz_confusao'
  );
  DBMS_OUTPUT.PUT_LINE('Acuracia do modelo: ' || v_accuracy);
end;
```

Durante a sessão explicaremos com mais detalhes alguns modelos!

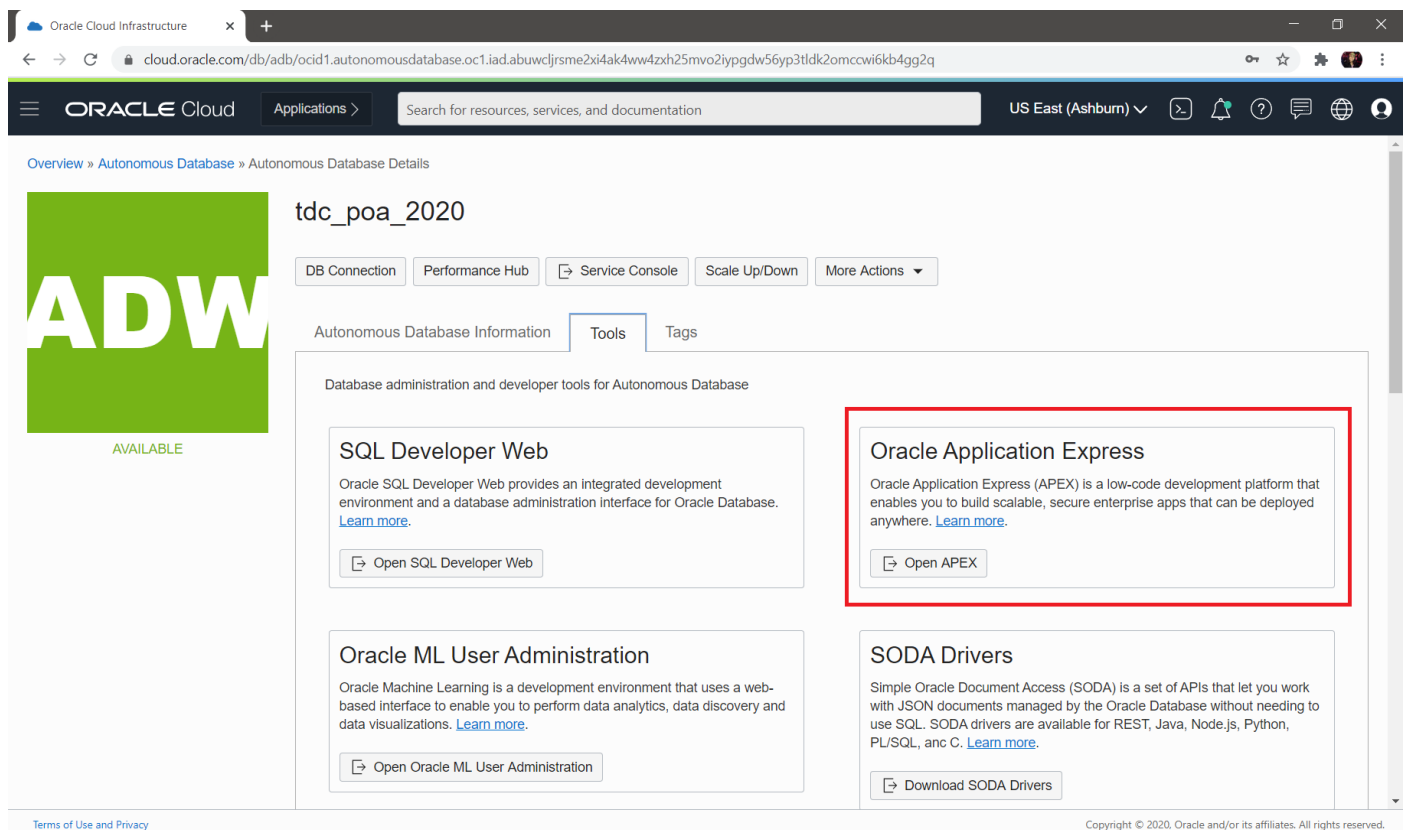
## 6.APEX

O Oracle Application Express (APEX) é um produto que pode ser instalado em qualquer versão do Oracle Database até mesmo nas versões de utilização gratuita. O autonomous database já oferece a integração nativa com o APEX.

O Apex é voltado para o desenvolvimento com baixa codificação. Maiores informações podem ser encontradas em

<http://apex.oracle.com>

Para esse Workshop utilizaremos a integração nativa com o autonomous database através da console:



The screenshot displays the Oracle Cloud console interface for an Autonomous Database instance named 'tdc\_poa\_2020'. On the left, there is a green square logo with the letters 'ADW' in white, and the word 'AVAILABLE' in green below it. The main content area is titled 'Autonomous Database Information' and includes tabs for 'Tools' and 'Tags'. Under the 'Tools' tab, there are four tool cards: 'SQL Developer Web', 'Oracle Application Express' (highlighted with a red border), 'Oracle ML User Administration', and 'SODA Drivers'. Each card provides a brief description and a button to open or download the tool. The 'Oracle Application Express' card states: 'Oracle Application Express (APEX) is a low-code development platform that enables you to build scalable, secure enterprise apps that can be deployed anywhere. [Learn more.](#)' and includes an 'Open APEX' button. The footer of the console shows 'Terms of Use and Privacy' on the left and 'Copyright © 2020. Oracle and/or its affiliates. All rights reserved.' on the right.

## 7. ORDS

O Oracle Rest Data Service (ORDS) é um serviço que pode ser instalado em qualquer versão mais recente do Oracle database. O Autonomous database oferece uma integração nativa com ORDS.

Com o ORDS você consegue expor seus dados via REST API Facilmente com códigos PL/SQL

Para esse Workshop utilizaremos a integração nativa do Autonomous database. O endpoint está na service console do autonomous.



## 8. Links uteis

- Oracle cloud:  
<https://www.oracle.com/cloud/>
- Autonomous Database:  
<https://www.oracle.com/autonomous-database/>
- Oracle Machine Learning:  
<https://www.oracle.com/data-science/machine-learning.html>
- Oracle Data Mining:  
<https://docs.oracle.com/en/database/oracle/oracle-database/18/dmcon/data-mining-concepts.pdf>