End-end web app

Creating a simple end-end web app which calculates base to the power of the exponent

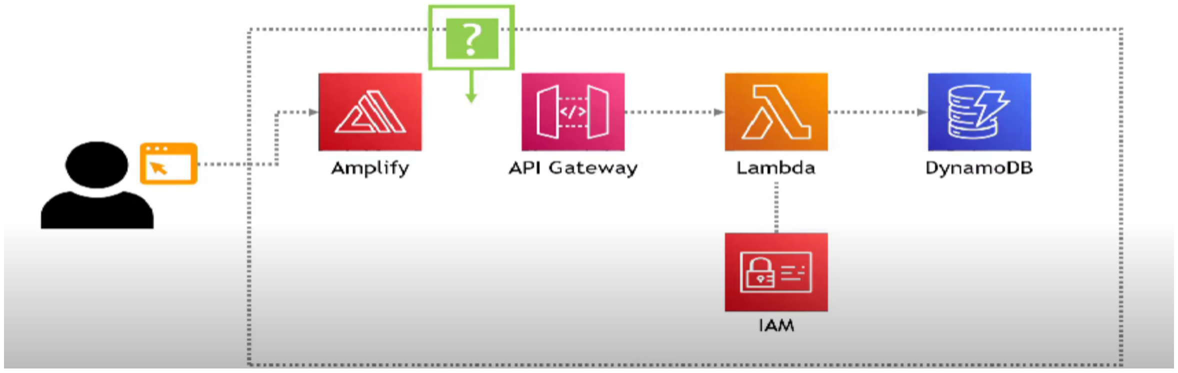
Technologies used
AWS Amplify
AWS Lambda
Amazon API Gateway
Amazon DynamoDB
AWS Identity and Access Management(IAM)

What we need
1. A way to create/host a webpage--1st step--using amplify
   This is where users will navigate to check the result.
1. A way to invoke math functionality--invoke lambda function
   This is where the math functionality will be invoked using a lambda function.
1. A way to do math -- 2nd step using lambda function
   Performing the actual math using the lambda function
1. Somewhere to store/return the math result -- store the result in DynamoDB
2. A way to handle permissions-- IAM
   API Gateway : https://0jmjwm9z86.execute-api.us-east-2.amazonaws.com/dev

From <https://us-east-2.console.aws.amazon.com/apigateway/home?region=us-east-2#/apis/0jmjwm9z86/stages/dev>

What we need to execute the project
1. A text editor
2. An AWS management console access (Free tier allows the users to access the console for free for upto 12 months)
3. AWS knowledge

CURRENT ARCHITECTURE :

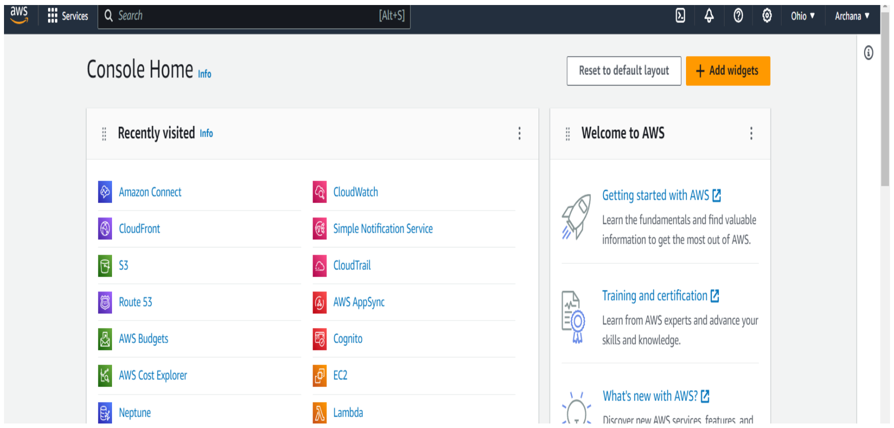


APPLICATION ARCHITECTURE :

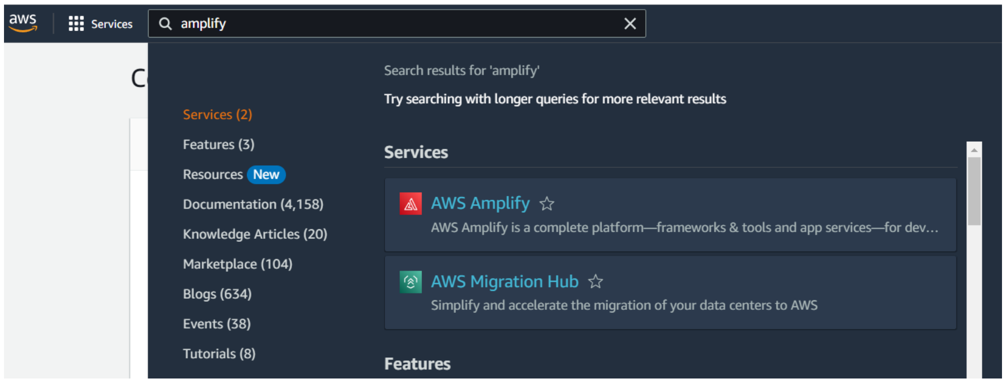
AWS Amplify :
It's used to create and host web pages. We will use any text editor(notepad++,html ..) to create a simple web page and name it as index.html .This would be the front-end for the app.
Zip the index.html file so that all the files can be deployed together.

We will use amplify to deploy and host the app .

Navigate to console



Search for Amplify



Search results for 'amplify'

Try searching with longer queries for more relevant results

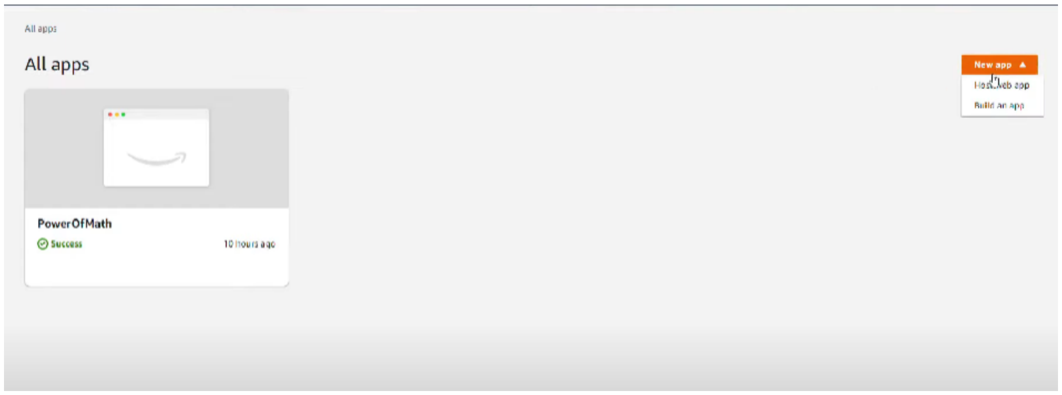
Services

AWS Amplify ☆
AWS Amplify is a complete platform—frameworks & tools and app services—for dev…

AWS Migration Hub ☆
Simplify and accelerate the migration of your data centers to AWS

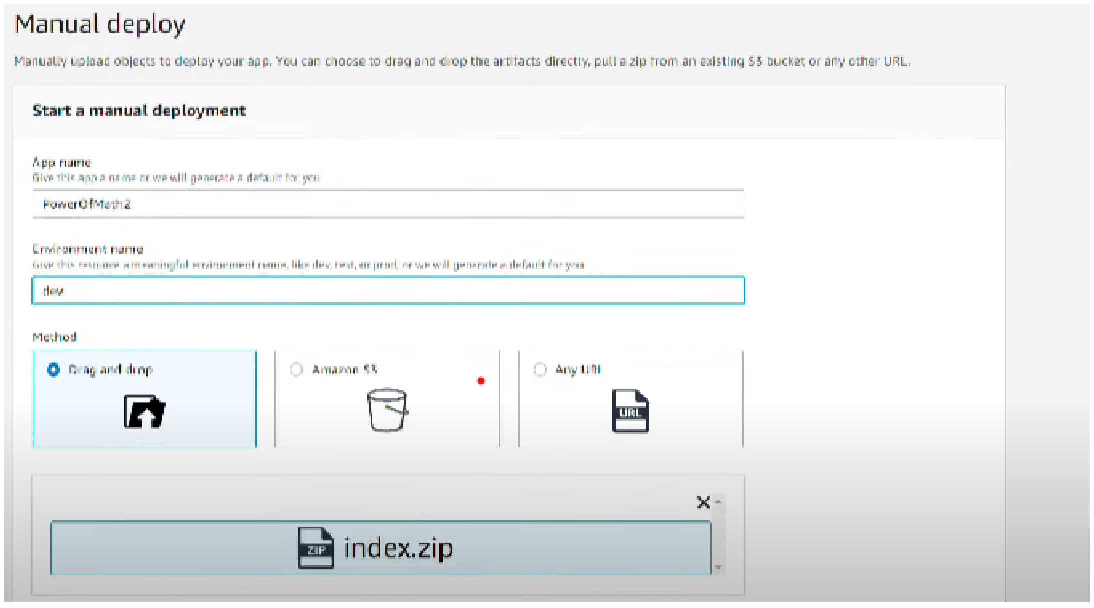
Features

Create a new app



PowerOfMath
Success 10 hours ago

Save and deploy after giving the name and attaching the index.html zip file


Manual deploy

Manually upload objects to deploy your app. You can choose to drag and drop the artifacts directly, pull a zip from an existing S3 bucket or any other URL.

Start a manual deployment

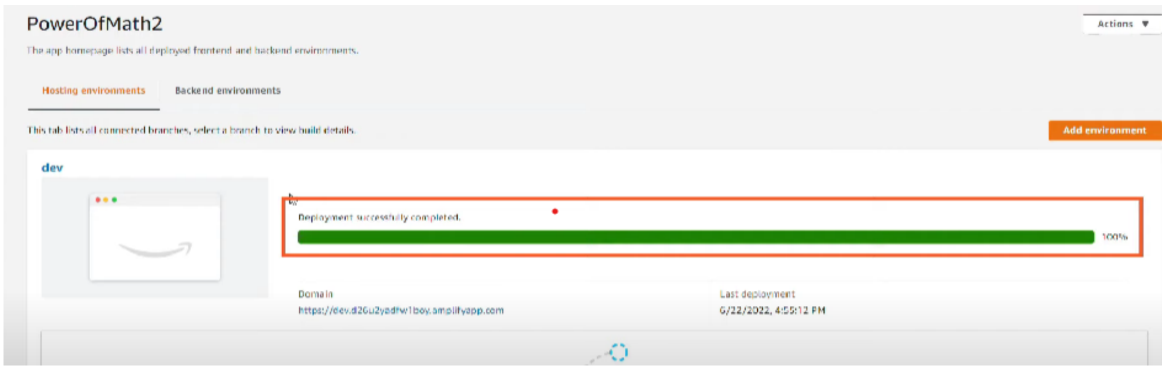
App name
Give this app a name or we will generate a default for you
PowerOfMath2

Environment name
Give this resource a meaningful environment name, like dev, test, or prod, or we will generate a default for you
dev

Method
[✓ Drag and drop] Amazon S3 Any URL

index.zip

Deployment successful will be displayed after you save and deploy


PowerOfMath2

The app homepage lists all deployed frontend and backend environments.

Hosting environments | Backend environments

This tab lists all connected branches, select a branch to view build details.

dev

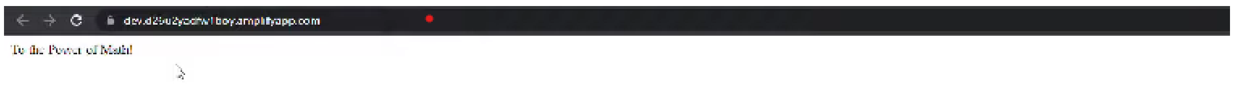
Deployment successfully completed. 100%

Domain
https://dev.d26u2yadfw1boy.amplifyapp.com

Last deployment
6/22/2022, 4:55:12 PM

It would also display the domain link which will be used to open the web app
DOMAIN : https://dev.d2c0iw0p8dith7.amplifyapp.com/

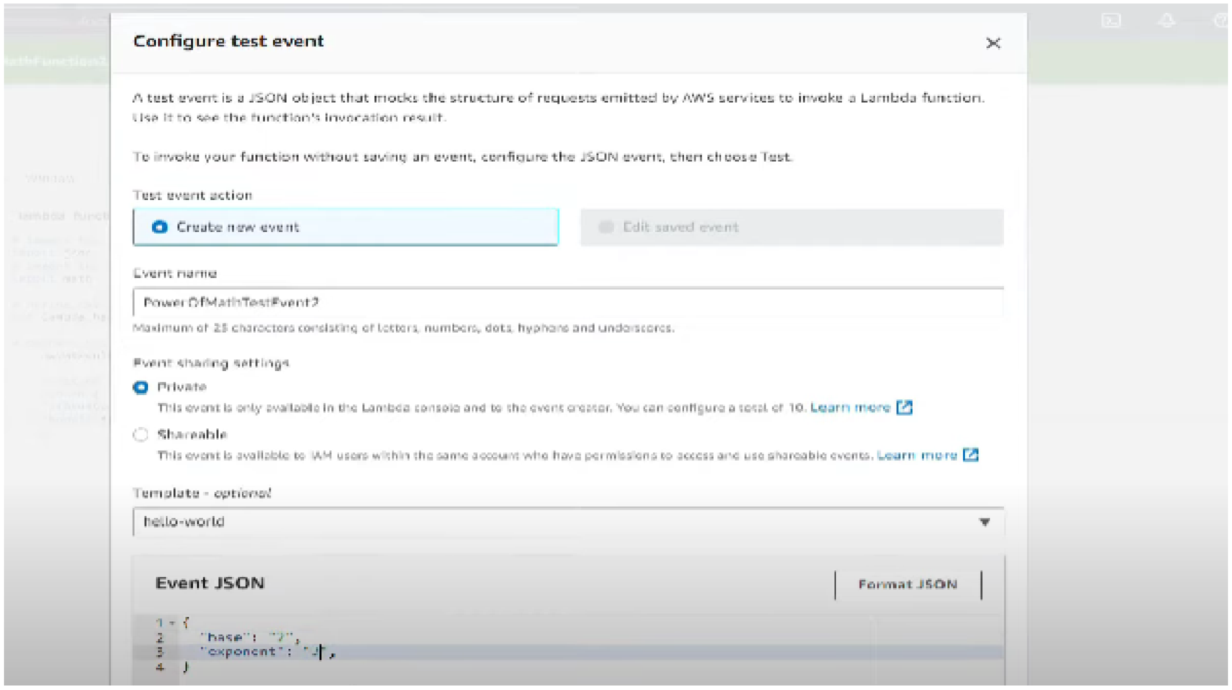
This simple html page would be displayed


dev.d26u2yadfw1boy.amplifyapp.com

To the Power of Math!

We will try to invoke the lambda function for it to do the math and give the base to the power of the number.
And we create a python function and write some basic code. Refer to lambda original. Then deploy the function.

Then configure test event. Make sure to give base and exponent values in json



Configure test event

A test event is a JSON object that mocks the structure of requests emitted by AWS services to invoke a Lambda function. Use it to see the function's invocation result.

To invoke your function without saving an event, configure the JSON event, then choose Test.

Test event action: [✓ Create new event] Edit saved event

Event name: PowerOfMathTestEvent2

Maximum of 25 characters consisting of letters, numbers, dots, hyphens and underscores.

Event sharing settings

[✓ Private] This event is only available in the Lambda console and to the event creator. You can configure a total of 10. Learn more

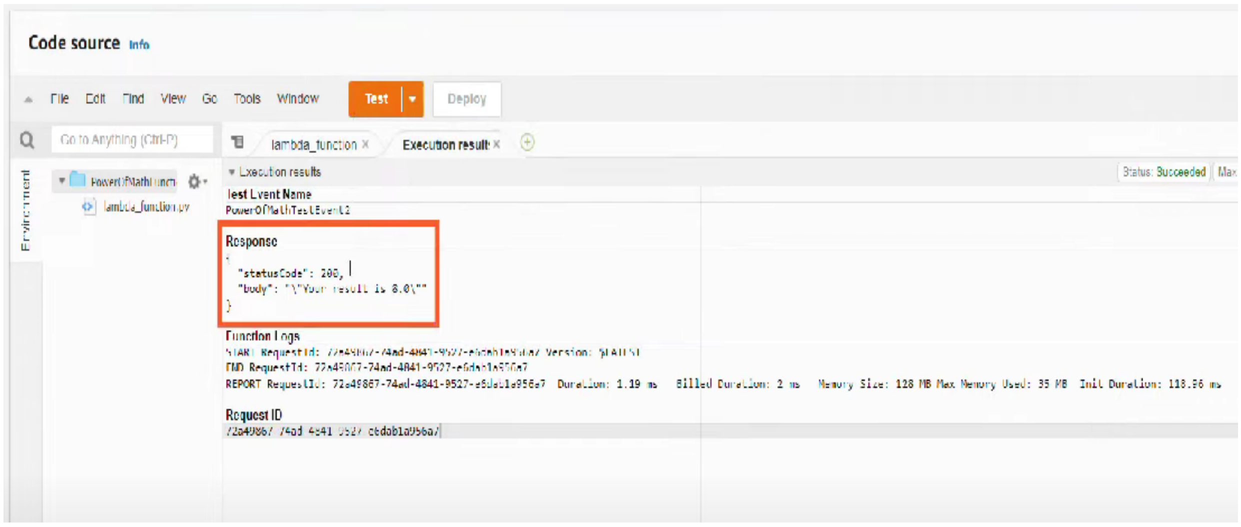
Shareable: This event is available to IAM users within the same account who have permissions to access and use shareable events. Learn more

Template - optional: hello-world

Event JSON

```
{
  "base": "2",
  "exponent": "3",
}
```

Run the function. It gives status code as 200 and result as 8.



Code source

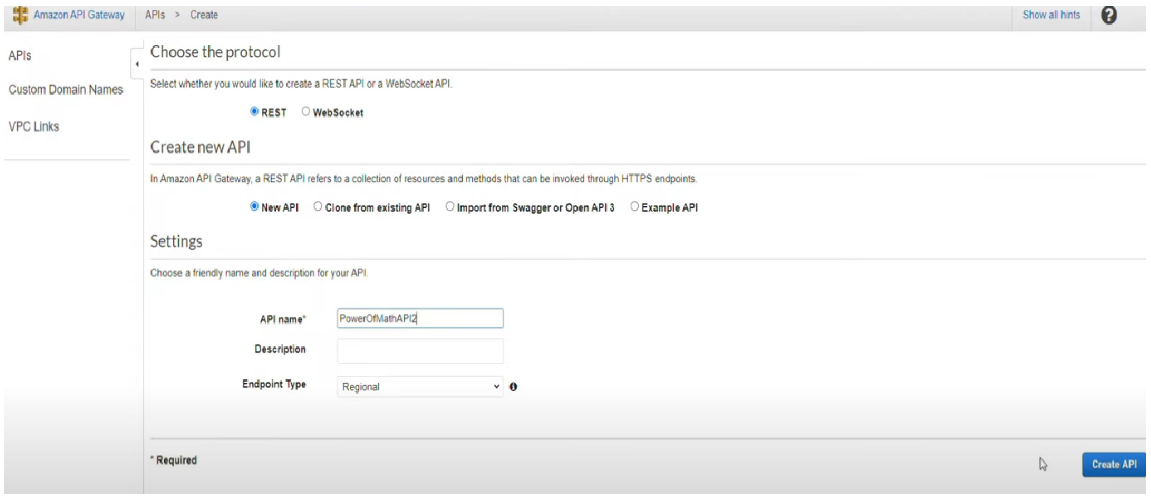
```
Test Event Name
PowerOfMathTestEvent2

Response
{
  "statusCode": 200,
  "body": "\"Your result is 8.0\""
}

Function Logs
START RequestId: 72a49867-74ad-4841-9527-e6dab1a956a7 Version: $LATEST
END RequestId: 72a49867-74ad-4841-9527-e6dab1a956a7
REPORT RequestId: 72a49867-74ad-4841-9527-e6dab1a956a7  Duration: 1.19 ms   Billed Duration: 2 ms   Memory Size: 128 MB Max Memory Used: 35 MB  Init Duration: 118.96 ms

Request ID
72a49867-74ad-4841-9527-e6dab1a956a7
```

Next step would be to connect the API gateway. Open API gateway on the console and create REST API .Give the name of the API as whatever name you want



Choose the protocol

Select whether you would like to create a REST API or a WebSocket API.

[✓ REST] WebSocket

Create new API

In Amazon API Gateway, a REST API refers to a collection of resources and methods that can be invoked through HTTPS endpoints.

[✓ New API] Clone from existing API Import from Swagger or Open API 3 Example API

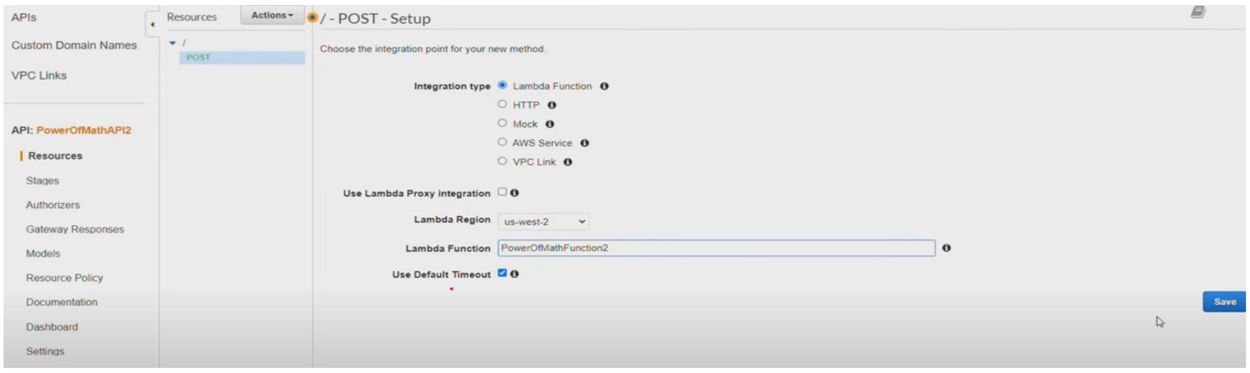
Settings

Choose a friendly name and description for your API.

API name*	PowerOfMathAPI2
Description	
Endpoint Type	Regional

* Required

We will create method and the type would be post.

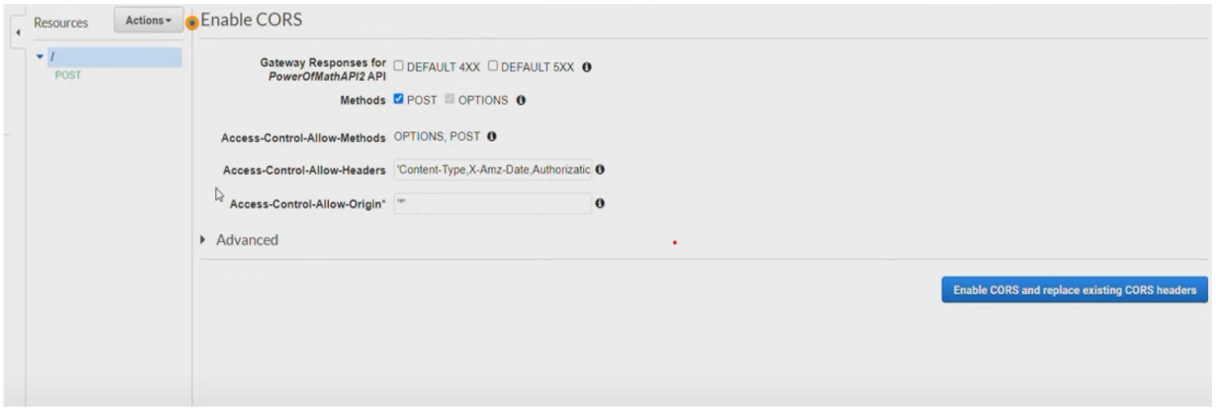


/ - POST - Setup

Choose the integration point for your new method.

Integration type	[✓ Lambda Function] HTTP Mock AWS Service VPC Link
Use Lambda Proxy integration	☐
Lambda Region	us-west-2
Lambda Function	PowerOfMathFunction2
Use Default Timeout	☑

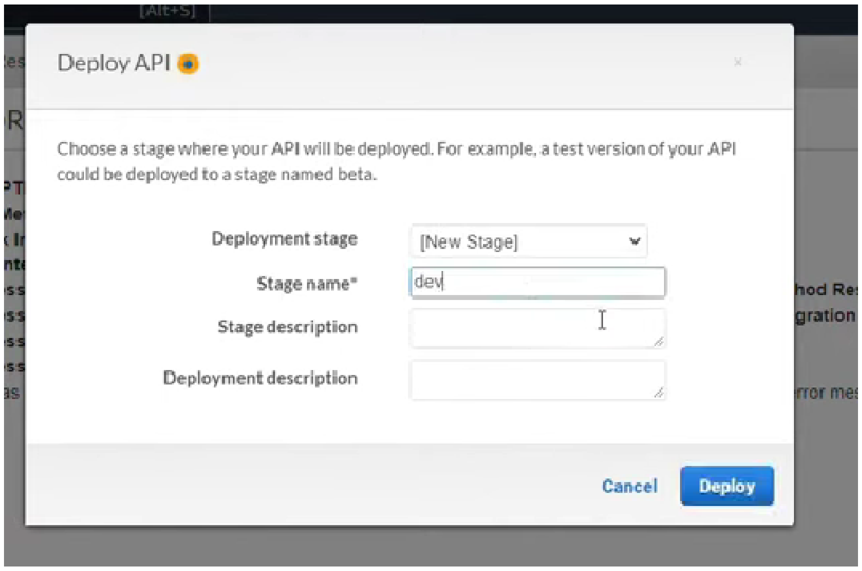
Next step is to execute the post method by enabling CORS which basically makes the application run on any origin/domain.



Enable CORS

Gateway Responses for *PowerOfMathAPI2* API	☐ DEFAULT 4XX ☐ DEFAULT 5XX
Methods	☑ POST ☐ OPTIONS
Access-Control-Allow-Methods	OPTIONS, POST
Access-Control-Allow-Headers	'Content-Type,X-Amz-Date,Authorizatic
Access-Control-Allow-Origin*	'*'

Deploy API from actions menu.



Choose a stage where your API will be deployed. For example, a test version of your API could be deployed to a stage named beta.

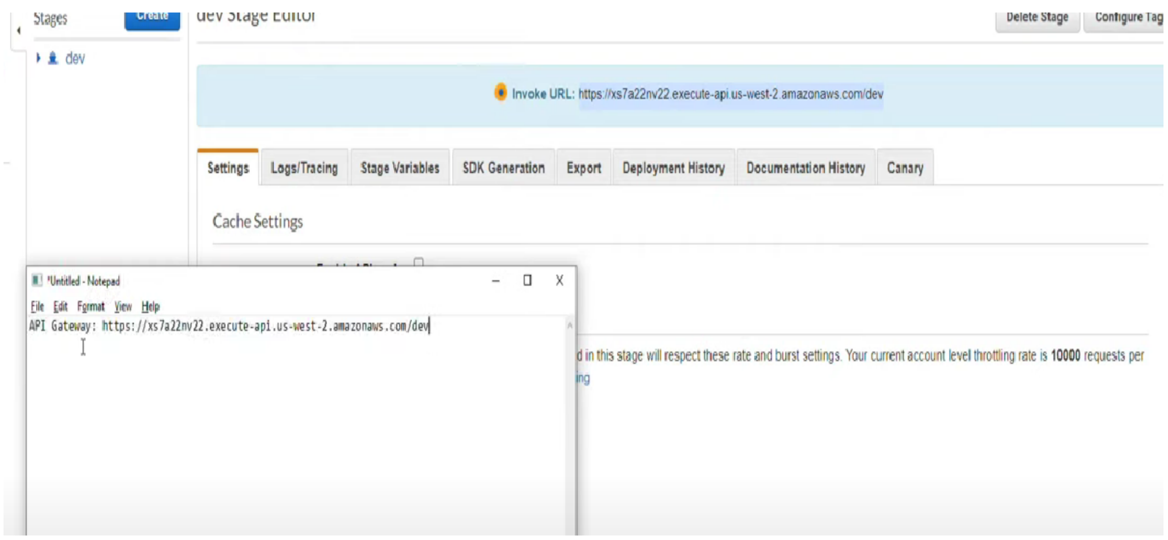
Deployment stage: [New Stage]

Stage name*: dev

Stage description:

Deployment description:

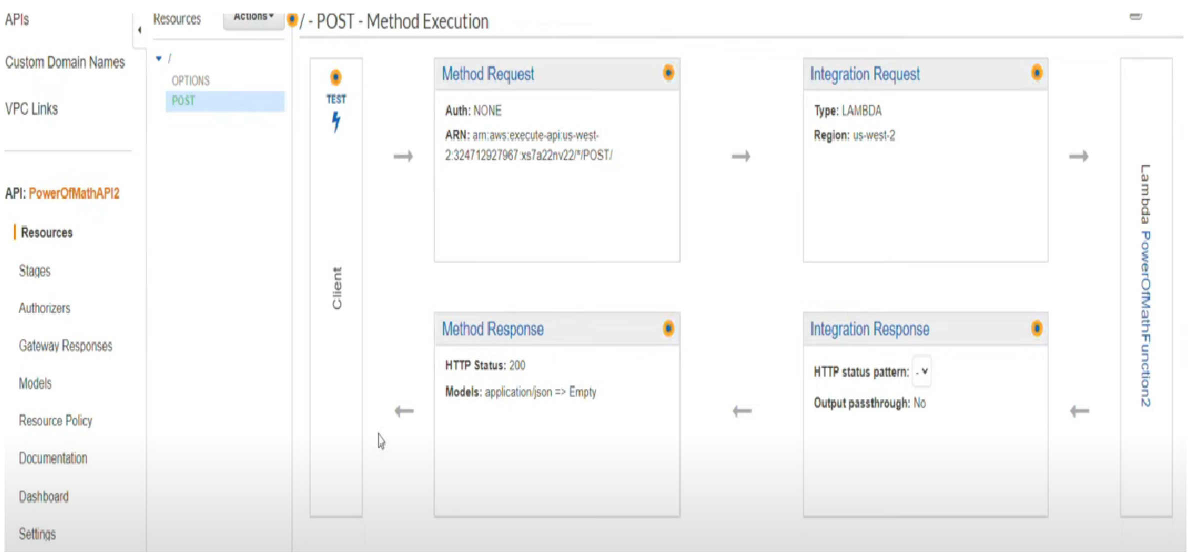
Make sure to copy the API Gateway URL



Invoke URL: https://xs7a22nv22.execute-api.us-west-2.amazonaws.com/dev

```
API Gateway: https://xs7a22nv22.execute-api.us-west-2.amazonaws.com/dev
```

Go back to the post method page to check the flow of the function.



/ - POST - Method Execution

Method Request

Auth: NONE

ARN: arn:aws:execute-api:us-west-2:324712927967:xs7a22nv22/*/POST/

Integration Request

Type: LAMBDA

Region: us-west-2

Method Response

HTTP Status: 200

Models: application/json => Empty

Integration Response

HTTP status pattern: -

Output passthrough: No

Now click on test and give base and exponent and their respective values in the body section.

{

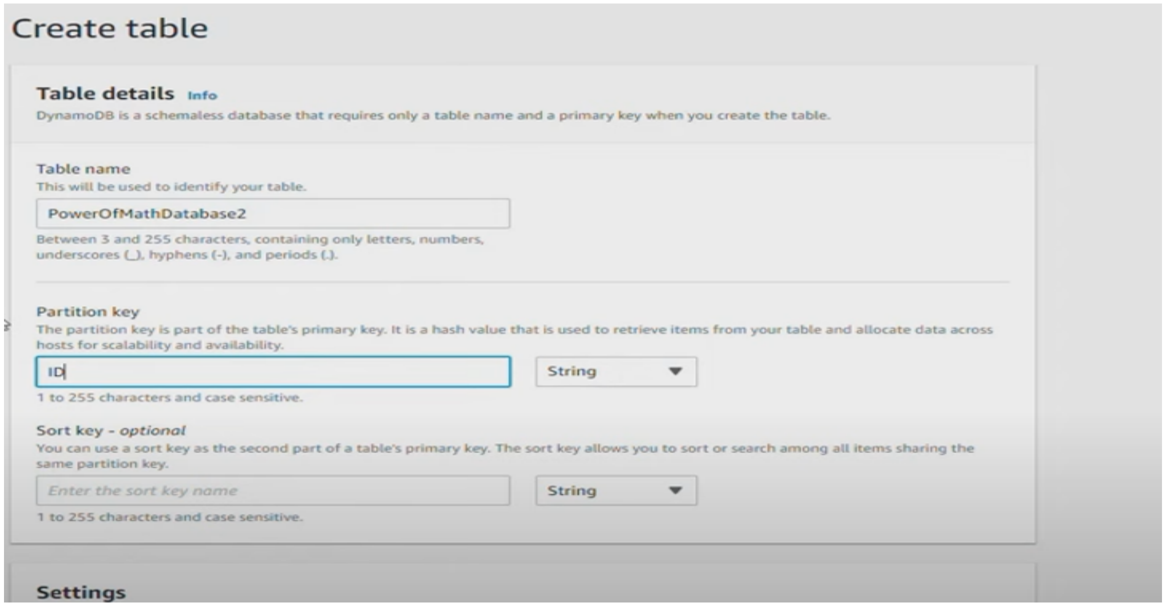
"Base" : 2

"Exponent" : 3

}

DynamoDB Database :

Key - value(NO SQL) Database to store/return the values. Go to the console and create table inside dynamoDB.



Create table

Table details Info

DynamoDB is a schemaless database that requires only a table name and a primary key when you create the table.

Table name

This will be used to identify your table.

PowerOfMathDatabase2

Between 3 and 255 characters, containing only letters, numbers, underscores (_), hyphens (-), and periods (.).

Partition key

The partition key is part of the table's primary key. It is a hash value that is used to retrieve items from your table and allocate data across hosts for scalability and availability.

ID — String

1 to 255 characters and case sensitive.

Sort key - *optional*

You can use a sort key as the second part of a table's primary key. The sort key allows you to sort or search among all items sharing the same partition key.

Enter the sort key name — String

1 to 255 characters and case sensitive.

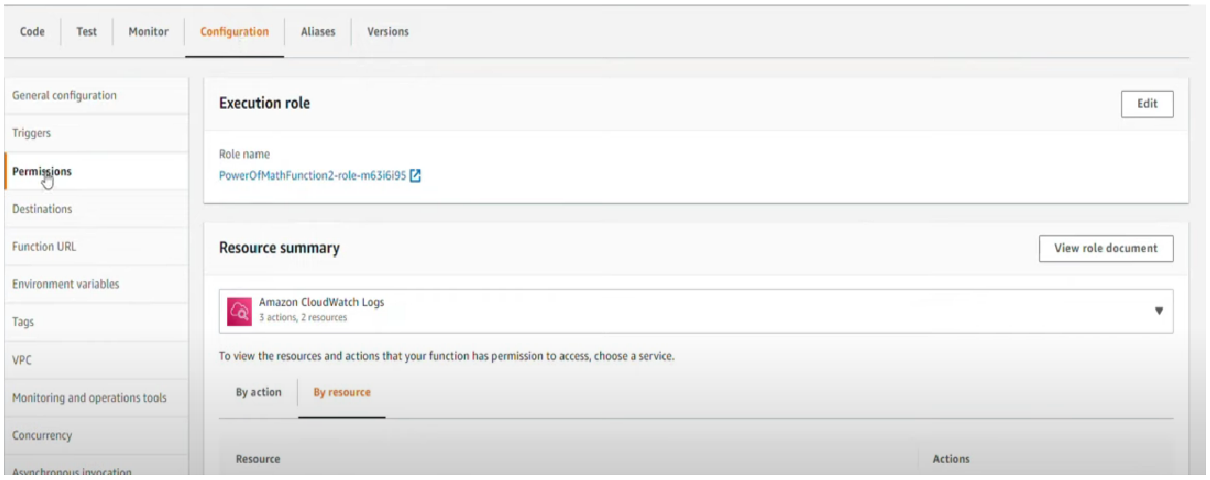
Settings

Copy the ARN for the database
arn:aws:dynamodb:us-east-2:087276982965:table/PowerOfMathDatabase

From <https://us-east-2.console.aws.amazon.com/dynamodbv2/home?region=us-east-2#table?name=PowerOfMathDatabase>

DOMAIN : https://dev.d2c0iw0p8dith7.amplifyapp.com/

Now we have to give permissions to lambda function. Navigate to lambda function and go to configuration tab



Execution role

Role name
PowerOfMathFunction2-role-m63i6i95

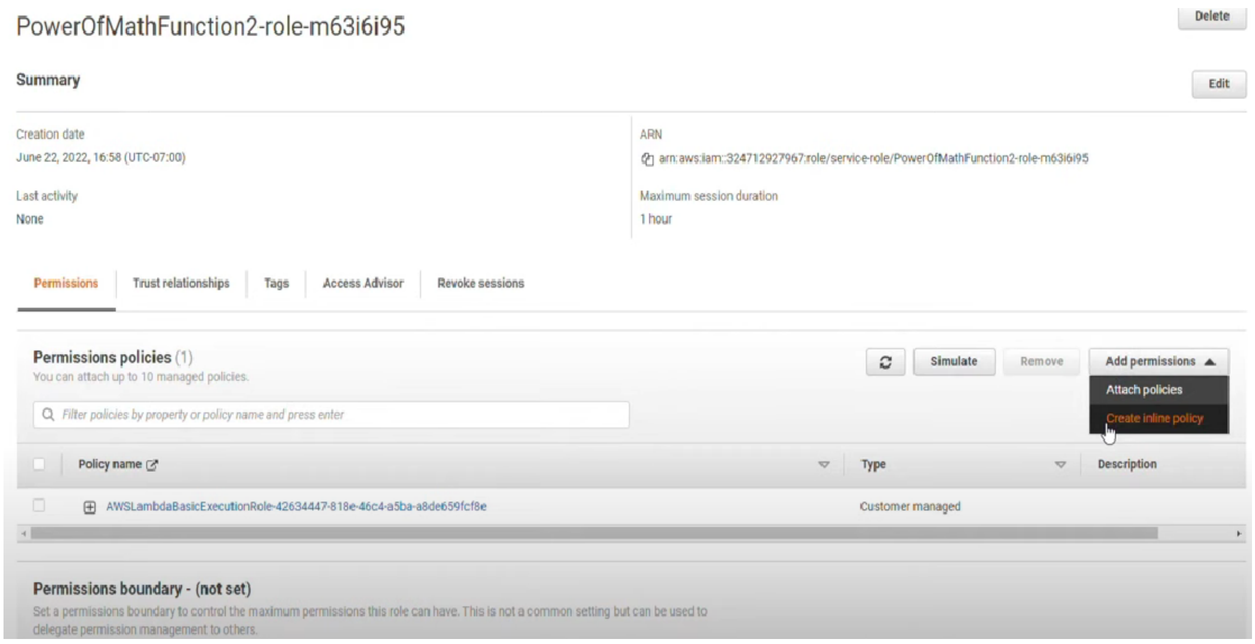
Resource summary

Amazon CloudWatch Logs
3 actions, 2 resources

To view the resources and actions that your function has permission to access, choose a service.

Click on the "Role name" which you see and it opens the permissions tab to add the required permissions.

Click on add permissions and navigate to create policy.



PowerOfMathFunction2-role-m63i6i95

Summary

Creation date
June 22, 2022, 16:58 (UTC-07:00)

Last activity
None

ARN
arn:aws:iam::324712927967:role/service-role/PowerOfMathFunction2-role-m63i6i95

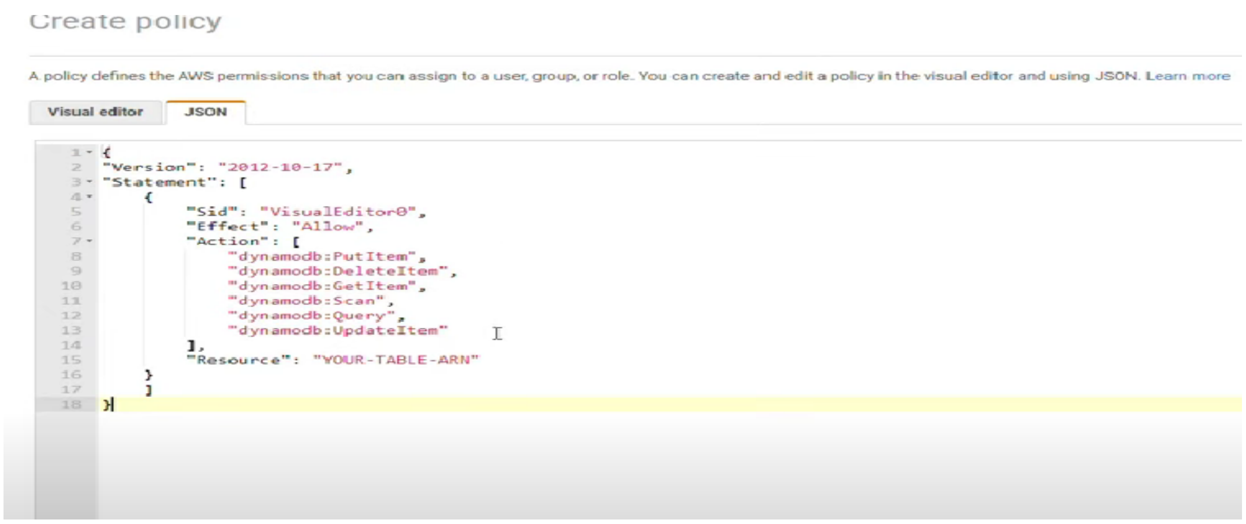
Maximum session duration
1 hour

Permissions policies (1)
You can attach up to 10 managed policies.

Policy name	Type	Description
AWSLambdaBasicExecutionRole-42634447-818e-46c4-a5ba-a8de659fcf8e	Customer managed	

Permissions boundary - (not set)
Set a permissions boundary to control the maximum permissions this role can have. This is not a common setting but can be used to delegate permission management to others.

Create the policy . Navigate to JSON



Create policy

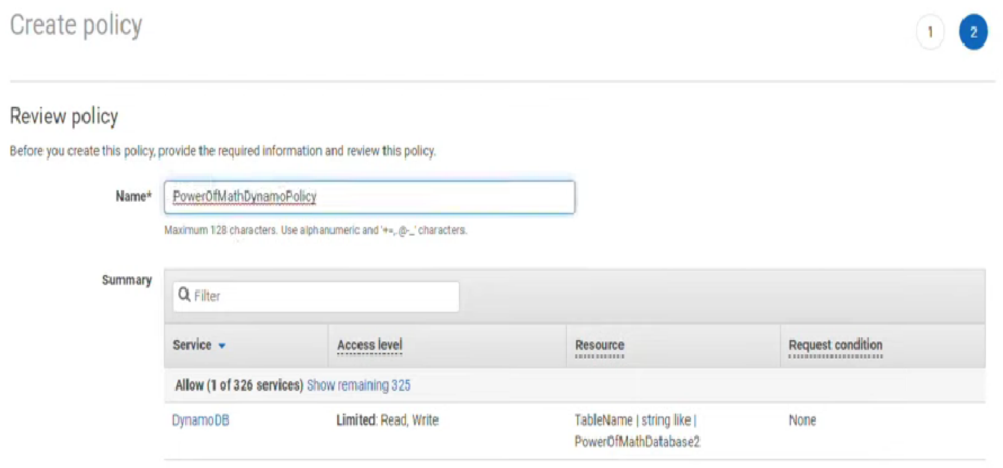
A policy defines the AWS permissions that you can assign to a user, group, or role. You can create and edit a policy in the visual editor and using JSON. Learn more

```
{
"Version": "2012-10-17",
"Statement": [
    {
        "Sid": "VisualEditor0",
        "Effect": "Allow",
        "Action": [
            "dynamodb:PutItem",
            "dynamodb:DeleteItem",
            "dynamodb:GetItem",
            "dynamodb:Scan",
            "dynamodb:Query",
            "dynamodb:UpdateItem"
        ],
        "Resource": "YOUR-TABLE-ARN"
    }
    ]
}
```

Replace the ARN with the ARN that we copied earlier

arn:aws:dynamodb:us-east-2:087276982965:table/PowerOfMathDatabase

Review Policy and give a name



Review policy

Before you create this policy, provide the required information and review this policy.

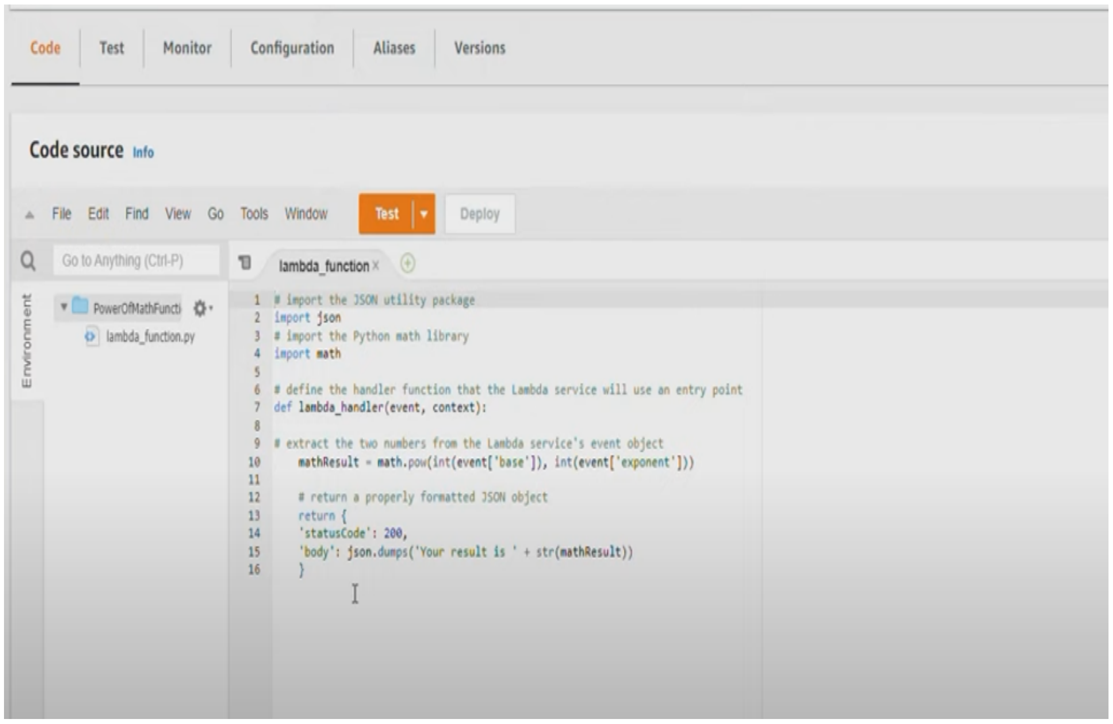
Name* PowerOfMathDynamoPolicy

Maximum 128 characters. Use alphanumeric and '+=,.@-_' characters.

Summary

Service	Access level	Resource	Request condition
Allow (1 of 326 services) Show remaining 325			
DynamoDB	Limited: Read, Write	TableName | string like | PowerOfMathDatabase2	None

Now we will go to code under lambda function and replace the code that we created earlier
Code : Power of math lambda final



```python
# import the JSON utility package
import json
# import the Python math library
import math

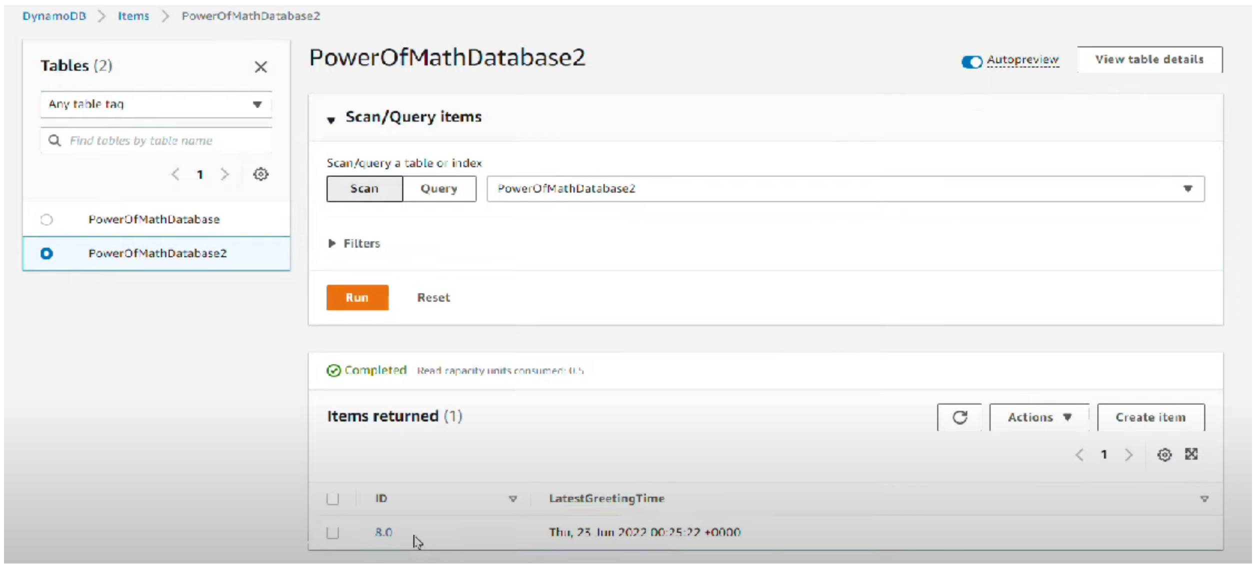
# define the handler function that the Lambda service will use an entry point
def lambda_handler(event, context):

# extract the two numbers from the Lambda service's event object
    mathResult = math.pow(int(event['base']), int(event['exponent']))

    # return a properly formatted JSON object
    return {
    'statusCode': 200,
    'body': json.dumps('Your result is ' + str(mathResult))
    }
```

We have 2 imports in this code one boto3 package for python and another import to show date and time while you execute the code
Save and deploy the changes
Initiate test to see the result
Status code would be 200 and result is 8

We can go to dynamo db to check the value stored



DynamoDB > Items > PowerOfMathDatabase2

Tables (2)

- PowerOfMathDatabase
- PowerOfMathDatabase2

PowerOfMathDatabase2

Scan/Query items

Scan/query a table or index: Scan — PowerOfMathDatabase2

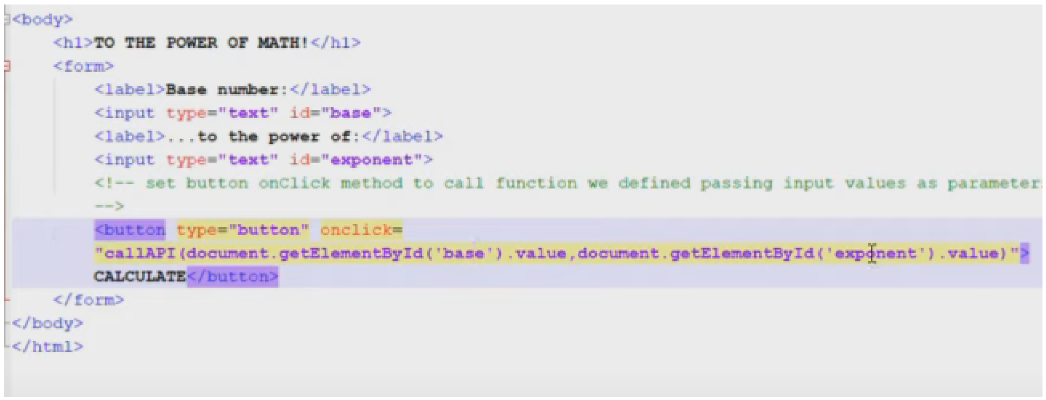
Completed Read capacity units consumed: 0.5

Items returned (1)

ID	LatestGreetingTime
8.0	Thu, 23 Jun 2022 00:25:22 +0000

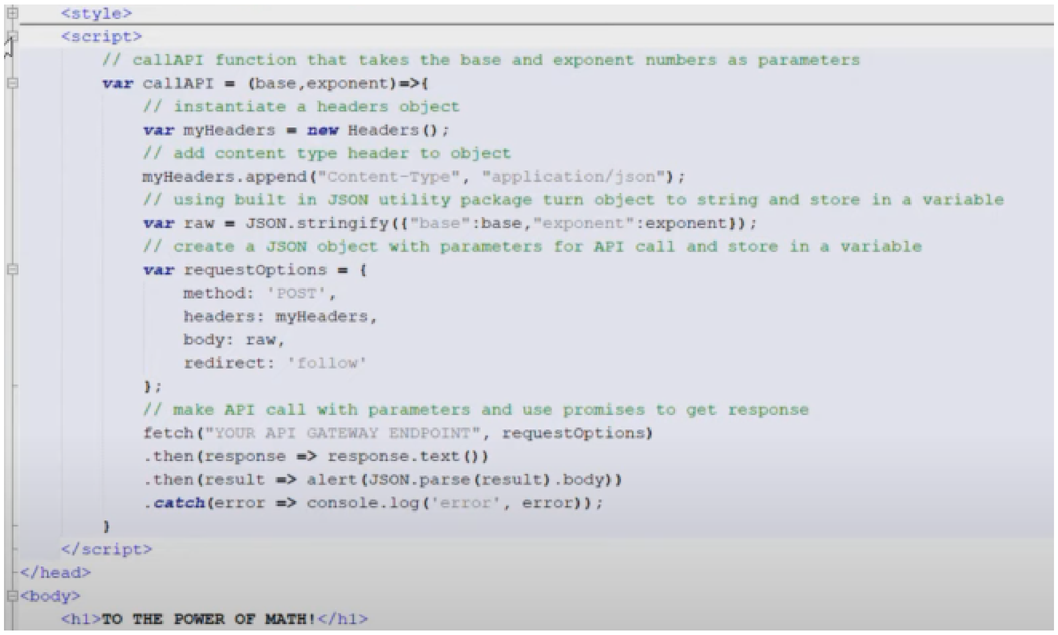
The current architecture misses the connection between the amplify and API gateway because we need to update the html code to create the connection

Inside the html code feel free to update the CSS styling
Under the body tag we have form to input the text and fields to input the numbers and we have calculate button as well.
"CallAPI" will do the work in calculating the base to the exponent power



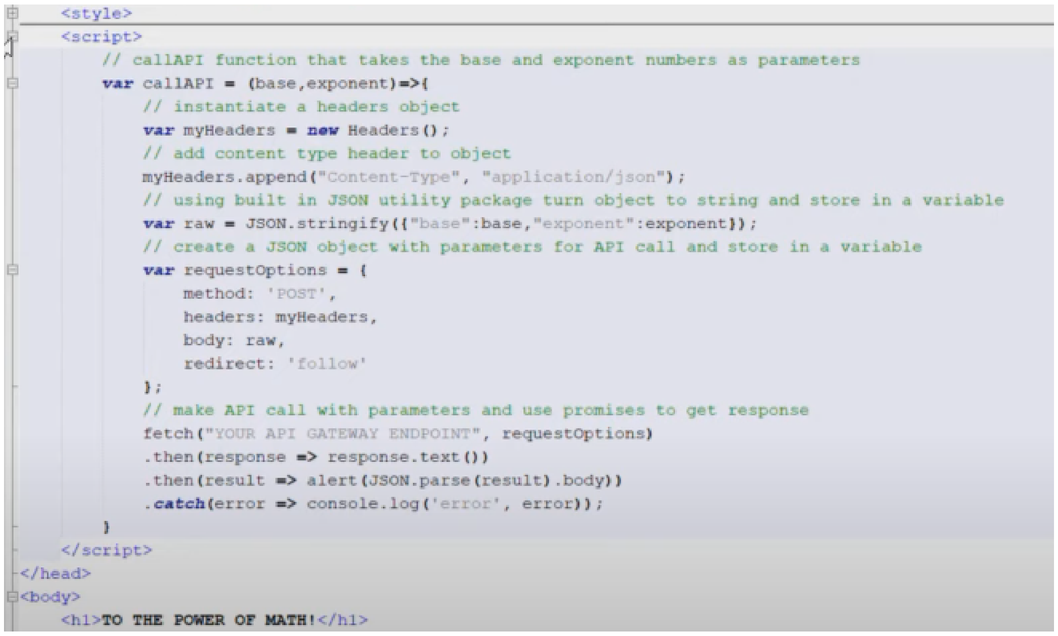
```
<body>
    <h1>TO THE POWER OF MATH!</h1>
    <form>
        <label>Base number:</label>
        <input type="text" id="base">
        <label>...to the power of:</label>
        <input type="text" id="exponent">
        <!-- set button onClick method to call function we defined passing input values as parameter
        -->
        <button type="button" onclick=
        "callAPI(document.getElementById('base').value,document.getElementById('exponent').value)">
        CALCULATE</button>
    </form>
</body>
</html>
```

Under the script tag CallAPI function is called



```
    <style>
    <script>
        // callAPI function that takes the base and exponent numbers as parameters
        var callAPI = (base,exponent)=>{
            // instantiate a headers object
            var myHeaders = new Headers();
            // add content type header to object
            myHeaders.append("Content-Type", "application/json");
            // using built in JSON utility package turn object to string and store in a variable
            var raw = JSON.stringify({"base":base,"exponent":exponent});
            // create a JSON object with parameters for API call and store in a variable
            var requestOptions = {
                method: 'POST',
                headers: myHeaders,
                body: raw,
                redirect: 'follow'
            };
            // make API call with parameters and use promises to get response
            fetch("YOUR API GATEWAY ENDPOINT", requestOptions)
            .then(response => response.text())
            .then(result => alert(JSON.parse(result).body))
            .catch(error => console.log('error', error));
        }
    </script>
</head>
<body>
    <h1>TO THE POWER OF MATH!</h1>
```

Update with the ARN to create the API gateway Endpoint



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    <style>
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            var myHeaders = new Headers();
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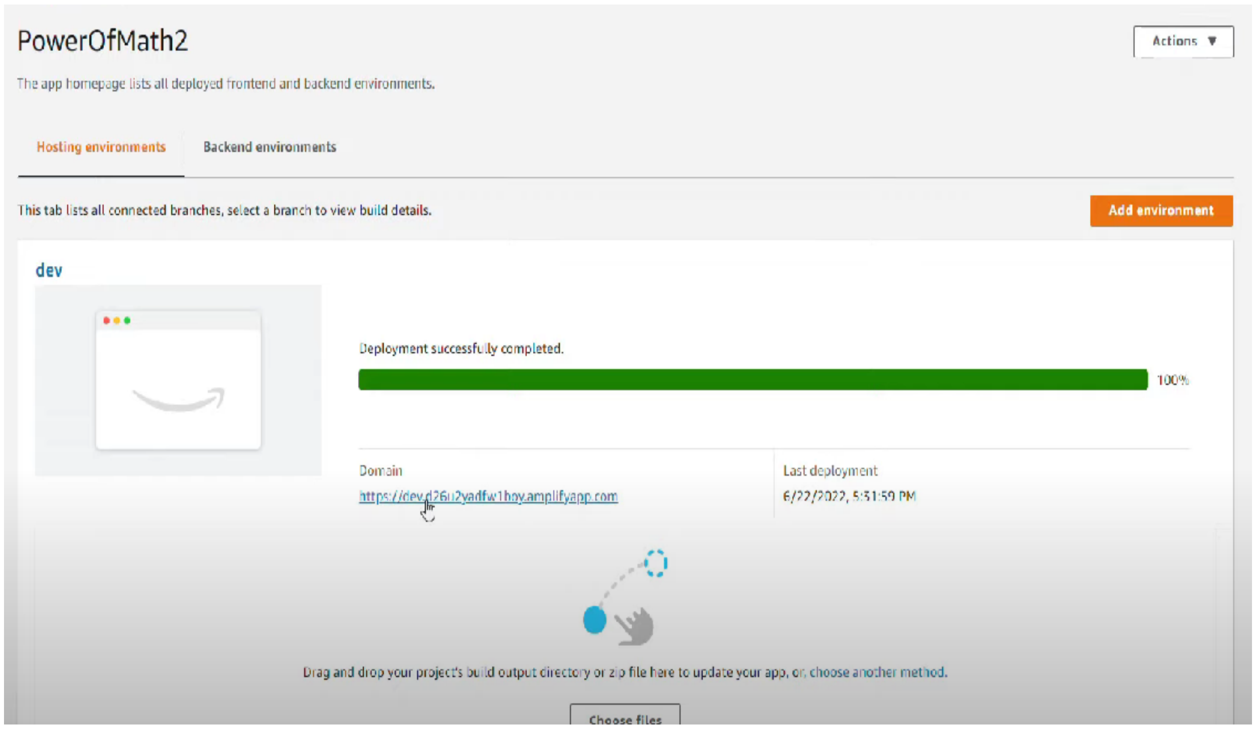
            };
            // make API call with parameters and use promises to get response
            fetch("YOUR API GATEWAY ENDPOINT", requestOptions)
            .then(response => response.text())
            .then(result => alert(JSON.parse(result).body))
            .catch(error => console.log('error', error));
        }
    </script>
</head>
<body>
    <h1>TO THE POWER OF MATH!</h1>
```

It executes and gives the alert as result.

We zip all the folders together and re-deploy through Amplify



PowerOfMath2

The app homepage lists all deployed frontend and backend environments.

This tab lists all connected branches, select a branch to view build details.

Deployment successfully completed.

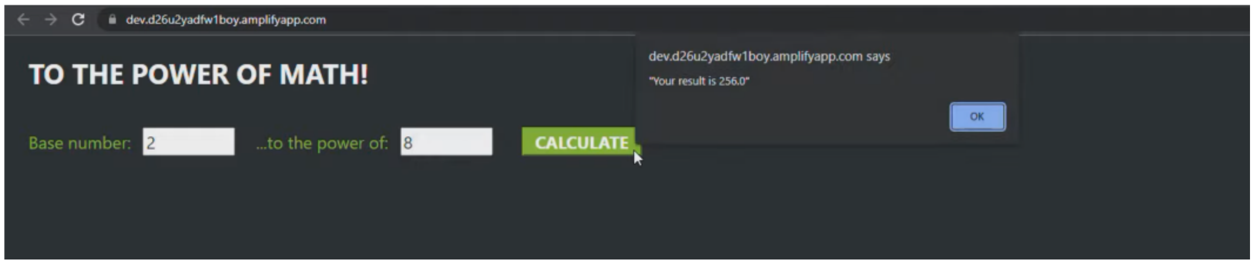
100%

Domain
https://dev.d26u2yadfw1boy.amplifyapp.com

Last deployment
6/22/2022, 5:31:59 PM

Drag and drop your project's build output directory or zip file here to update your app, or, choose another method.

Click on the Domain name to navigate to the web to check results



dev.d26u2yadfw1boy.amplifyapp.com

TO THE POWER OF MATH!

Base number: 2 ...to the power of: 8

dev.d26u2yadfw1boy.amplifyapp.com says

"Your result is 256.0"

If not being used delete things from the AWS management console.