### **OOP In Dart**

**Object-oriented programming (OOP)** is a programming method that uses objects and their interactions to design and program applications

In **OOP**, an object can be anything, such as a person, a bank account, a car, or a house. Each object has its attributes (or properties) and behavior (or methods). For example, a person object may have the attributes **name**, **age** and **height**, and the behavior **walk** and **talk**.

### **Features Of OOP**

1. Class
2. Object
3. Encapsulation
4. Inheritance
5. Polymorphism
6. Abstraction

Note: The main purpose of OOP is to break complex problems into smaller objects.

### **Class In Dart**

In object-oriented programming, a class is a blueprint for creating objects. A class defines the properties and methods that an object will have. For example, a class called **Dog** might have properties like **breed**, **color** and methods like **bark**, **run**.

### **Declaring Class In Dart**

You can declare a class in dart using the **class** keyword followed by class name and braces {}. It’s a good habit to write class name in **PascalCase**. For example, **Employee**, **Student**, **QuizBrain**, etc.

### **Syntax**

class ClassName {

// properties or fields

// methods or functions

}

In the above syntax:

* The **class** keyword is used for defining the class.
* **ClassName** is the name of the class and must start with capital letter.
* Body of the class consists of **properties** and **functions**.
* **Properties** are used to store the data. It is also known as **fields** or **attributes**.
* **Functions** are used to perform the operations. It is also known as **methods**.

### **Example : Declaring A Person Class In Dart**

In this example below, there is class **Person** with four properties: **name**, **phone**, **isMarried**, and **age**. The class also has a method called **displayInfo**, which prints out the values of the four properties.

class Person {

String? name;

String? phone;

bool? isMarried;

int? age;

void displayInfo() {

print("Person name: $name.");

print("Phone number: $phone.");

print("Married: $isMarried.");

print("Age: $age.");

}

}

### **Object In Dart**

**In object-oriented programming**, an object is a self-contained unit of code and data. Objects are created from templates called classes. An object is made up of properties(variables) and methods(functions). An object is an instance of a class.

**For example**, a bicycle object might have attributes like color, size, and current speed. It might have methods like changeGear, pedalFaster, and brake.

 Info

**Note**: To create an object, you must create a class first. It’s a good practice to declare the object name in lower case.

### **Instantiation**

In object-oriented programming, instantiation is the process of creating an instance of a class. In other words, you can say that instantiation is the process of creating an object of a class. For example, if you have a class called **Bicycle**, then you can create an object of the class called **bicycle**.

### **Declaring Object In Dart**

Once you have created a class, it’s time to declare the object. You can declare an object by the following syntax:

### **Syntax**

ClassName objectName = ClassName();

### **Example Declaring An Object In Dart**

In this example below, there is class **Bycycle** with three properties: **color**, **size**, and **currentSpeed**. The class has two methods. One is **changeGear**, which changes the gear of the bicycle, and **display** method prints out the values of the three properties. We also have an object of the class **Bycycle** called **bicycle**.

class Bicycle {

String? color;

int? size;

int? currentSpeed;

void changeGear(int newValue) {

currentSpeed = newValue;

}

void display() {

print("Color: $color");

print("Size: $size");

print("Current Speed: $currentSpeed");

}

}

void main(){

// Here bicycle is object of class Bicycle.

Bicycle bicycle = Bicycle();

bicycle.color = "Red";

bicycle.size = 26;

bicycle.currentSpeed = 0;

bicycle.changeGear(5);

bicycle.display();

}

 Show Output

Color: Red

Size: 26

Current Speed: 5

 Here **!** is used to tell the compiler that the variable is not null. If you don’t use **!**, then you will get an error. You will learn more about it in [null safety](https://dart-tutorial.com/null-safety/) later.

### **Example 3: Find Simple Interest Using Class and Objects**

In this example below there is class **SimpleInterest** with three properties: **principal**, **rate**, and **time**. The class also has a method called **interest**, which calculates the simple interest.

class SimpleInterest{

//properties of simple interest

double? principal;

double? rate;

double? time;

//functions of simple interest

double interest(){

return (principal! \* rate! \* time!)/100;

}

}

void main(){

//object of simple interest created

SimpleInterest simpleInterest = SimpleInterest();

//setting properties for simple interest

simpleInterest.principal=1000;

simpleInterest.rate=10;

simpleInterest.time=2;

//functions of simple interest called

print("Simple Interest is ${simpleInterest.interest()}.");

}

 Show Output

Simple Interest is 200.

### **Constructor In Dart**

**A constructor** is a special method used to initialize an object. It is called automatically when an object is created, and it can be used to set the initial values for the object’s properties. For example, the following code creates a **Person** class object and sets the initial values for the **name** and **age** properties.

Person person = Person("John", 30);

### **Without Constructor**

If you don’t define a constructor for class, then you need to set the values of the properties manually. For example, the following code creates a **Person** class object and sets the values for the **name** and **age** properties.

Person person = Person():

person.name = "John";

person.age = 30;

### **Things To Remember**

* The constructor’s name should be the same as the class name.
* Constructor doesn’t have any return type.

### **Syntax**

class ClassName {

// Constructor declaration: Same as class name

ClassName() {

// body of the constructor

}

}

 Info

**Note**: When you create a object of a class, the constructor is called automatically. It is used to initialize the values when an object is created.

### **Example 1: How To Declare Constructor In Dart**

In this example below, there is a class **Student** with three properties: **name**, **age**, and **rollNumber**. The class has one constructor. The constructor is used to initialize the values of the three properties. We also created an object of the class **Student** called **student**.

class Student {

String? name;

int? age;

int? rollNumber;

// Constructor

Student(String name, int age, int rollNumber) {

print(

"Constructor called"); // this is for checking the constructor is called or not.

this.name = name;

this.age = age;

this.rollNumber = rollNumber;

}

}

void main() {

// Here student is object of class Student.

Student student = Student("John", 20, 1);

print("Name: ${student.name}");

print("Age: ${student.age}");

print("Roll Number: ${student.rollNumber}");

}

 Show Output

Constructor called

Name: John

Age: 20

Roll Number: 1

**Note**: The **this** keyword is used to refer to the current instance of the class. It is used to access the current class properties. In the example above, parameter names and class properties of constructor **Student** are the same. Hence to avoid confusion, we use the **this** keyword.

### **Example 5: Write Constructor Single Line**

In the avobe section, you have written the constructor in long form. You can also write the constructor in short form. You can directly assign the values to the properties. For example, the following code is the short form of the constructor in one line.

class Person{

String? name;

int? age;

String? subject;

double? salary;

// Constructor in short form

Person(this.name, this.age, this.subject, this.salary);

// display method

void display(){

print("Name: ${this.name}");

print("Age: ${this.age}");

print("Subject: ${this.subject}");

print("Salary: ${this.salary}");

}

}

void main(){

Person person = Person("John", 30, "Maths", 50000.0);

person.display();

}

 Show Output

Name: John

Age: 30

Subject: Maths

Salary: 50000

### **Constructor With Optional Parameters**

In the example below, we have created a class **Employee** with four properties: **name**, **age**, **subject**, and **salary**. Class has one constructor for initializing the all properties values. For **subject** and **salary**, we have used optional parameters. It means we can pass or not pass the values of **subject** and **salary**. The Class also contain method **display()** which is used to display the values of the properties. We also created an object of the class **Employee** called **employee**.

class Employee {

String? name;

int? age;

String? subject;

double? salary;

// Constructor

Employee(this.name, this.age, [this.subject = "N/A", this.salary=0]);

// Method

void display() {

print("Name: ${this.name}");

print("Age: ${this.age}");

print("Subject: ${this.subject}");

print("Salary: ${this.salary}");

}

}

void main(){

Employee employee = Employee("John", 30);

employee.display();

}

 Show Output

Name: John

Age: 30

Subject: N/A

Salary: 0

### **Default Constructor**

The constructor which is automatically created by the dart compiler if you don’t create a constructor is called a default constructor. A default constructor has no parameters. A default constructor is declared using the class name followed by parentheses ().

### **Example 1: Default Constructor In Dart**

In this example below, there is a class **Laptop** with two properties: **brand**, and **prize**. Lets create constructor with no parameter and print something from the constructor. We also have an object of the class **Laptop** called **laptop**.

class Laptop {

String? brand;

int? prize;

// Constructor

Laptop() {

print("This is a default constructor");

}

}

void main() {

// Here laptop is object of class Laptop.

Laptop laptop = Laptop();

}

 Show Output

This is a default constructor

**Note**: The default constructor is called automatically when you create an object of the class. It is used to initialize the instance variables of the class.

### **Parameterized Constructor**

Parameterized constructor is used to initialize the instance variables of the class. Parameterized constructor is the constructor that takes parameters. It is used to pass the values to the constructor at the time of object creation.

### **Syntax**

class ClassName {

// Instance Variables

int? number;

String? name;

// Parameterized Constructor

ClassName(this.number, this.name);

}

### **Example 1: Parameterized Constructor In Dart**

In this example below, there is a class **Student** with three properties: **name**, **age**, and **rollNumber**. The class has one constructor. The constructor is used to initialize the values of the three properties. We also have an object of the class **Student** called **student**.

class Student {

String? name;

int? age;

int? rollNumber;

// Constructor

Student(this.name, this.age, this.rollNumber);

}

void main(){

// Here student is object of class Student.

Student student = Student("John", 20, 1);

print("Name: ${student.name}");

print("Age: ${student.age}");

print("Roll Number: ${student.rollNumber}");

}

 Show Output

Name: John

Age: 20

Roll Number: 1

### **Example 2: Parameterized Constructor With Named Parameters In Dart**

In this example below, there is a class **Student** with three properties: **name**, **age**, and **rollNumber**. The class has one constructor. The constructor is used to initialize the values of the three properties. We also have an object of the class **Student** called **student**.

class Student {

String? name;

int? age;

int? rollNumber;

// Constructor

Student({String? name, int? age, int? rollNumber}) {

this.name = name;

this.age = age;

this.rollNumber = rollNumber;

}

}

void main(){

// Here student is object of class Student.

Student student = Student(name: "John", age: 20, rollNumber: 1);

print("Name: ${student.name}");

print("Age: ${student.age}");

print("Roll Number: ${student.rollNumber}");

}

**Example 3: Parameterized Constructor With Default Values In Dart**

In this example below, there is class **Student** with two properties: **name**, and **age**. The class has parameterized constructor with default values. The constructor is used to initialize the values of the two properties. We also have an object of the class **Student** called **student**.

class Student {

String? name;

int? age;

// Constructor

Student({String? name = "John", int? age = 0}) {

this.name = name;

this.age = age;

}

}

void main(){

// Here student is object of class Student.

Student student = Student();

print("Name: ${student.name}");

print("Age: ${student.age}");

}

**Note**: In parameterized constructor, at the time of object creation, you must pass the parameters through the constructor which initialize the variables value, avoiding the null values.

### **: Named Constructor In Dart**

In this example below, there is a class **Animal** with two properties **name** and **age**. The class has three constructors. The first constructor is a default constructor. The second and third constructors are named constructors. The second constructor is used to initialize the values of name and age, and the third constructor is used to initialize the value of name only. We also have an object of the class **Animal** called **animal**.

class Animal {

String? name;

int? age;

// Default Constructor

Animal() {

print("This is a default constructor");

}

// Named Constructor

Animal.namedConstructor(String name, int age) {

this.name = name;

this.age = age;

}

// Named Constructor

Animal.namedConstructor2(String name) {

this.name = name;

}

}

void main(){

// Here animal is object of class Animal.

Animal animal = Animal.namedConstructor("Dog", 5);

print("Name: ${animal.name}");

print("Age: ${animal.age}");

Animal animal2 = Animal.namedConstructor2("Cat");

print("Name: ${animal2.name}");

}

 Show Output

Name: Dog

Age: 5

Name: Cat

### **Constant Constructor In Dart**

**Constant constructor** is a constructor that creates a constant object. A constant object is an object whose value cannot be changed. A constant constructor is declared using the keyword **const**.

 Info

**Note**: **Constant Constructor** is used to create a object whose value cannot be changed. It Improves the performance of the program.

### **Rule For Declaring Constant Constructor In Dart**

* All properties of the class must be final.
* It does not have any body.
* Only class containing **const** constructor is initialized using the **const** keyword.

### **Example 1: Constant Constructor In Dart**

In this example below, there is a class **Point** with two final properties: **x** and **y**. The class also has a constant constructor that initializes the two properties. The class also has a method called **display**, which prints out the values of the two properties.

class Point {

final int x;

final int y;

const Point(this.x, this.y);

}

void main() {

// p1 and p2 has the same hash code.

Point p1 = const Point(1, 2);

print("The p1 hash code is: ${p1.hashCode}");

Point p2 = const Point(1, 2);

print("The p2 hash code is: ${p2.hashCode}");

// without using const

// this has different hash code.

Point p3 = Point(2, 2);

print("The p3 hash code is: ${p3.hashCode}");

Point p4 = Point(2, 2);

print("The p4 hash code is: ${p4.hashCode}");

}

 Show Output

The p1 hash code is: 918939239

The p2 hash code is: 918939239

The p3 hash code is: 745146896

The p4 hash code is: 225789186

### **Factory Constructor In Dart**

All of the constructors that you have learned until now are **generative constructors**. Dart also provides a special type of constructor called a **factory constructor**.

A **factory constructor** gives more flexibility to create an object. Generative constructors only create an instance of the class. But, the factory constructor can return an instance of the **class or even subclass**. It is also used to return the **cached instance** of the class.

### **Syntax**

class ClassName {

factory ClassName() {

// TODO: return ClassName instance

}

factory ClassName.namedConstructor() {

// TODO: return ClassName instance

}

}

### **Rules For Factory Constructors**

* Factory constructor must return an instance of the **class** or **sub-class**.
* You can’t use **this** keyword inside factory constructor.
* It can be **named** or **unnamed** and called like normal constructor.
* It can’t access **instance members** of the class.

### **Example 1: Without Factory Constructor**

In this example below, there is a class named **Area** with final properties **length** and **breadth**, and **area**. When you pass the **length** and **breadth** to the constructor, it calculates the **area** and stores it in the **area** property.

 Info

**Note**: An initializer list allows you to assign properties to a new instance variable before the constructor body runs, but after creation.

class Area {

final int length;

final int breadth;

final int area;

// Initializer list

const Area(this.length, this.breadth) : area = length \* breadth;

}

void main() {

Area area = Area(10, 20);

print("Area is: ${area.area}");

// notice that here is a negative value

Area area2 = Area(-10, 20);

print("Area is: ${area2.area}");

}

 Show Output

Area is: 200

Area is: -200

Here **area2** object has a negative value. This is because we are not validating the input. Let’s create a factory constructor to validate the input.

### **Example 2: With Factory Constructor**

In this example below, **factory constructor** is used to validate the input. If the input is valid, it will return a new class instance. If the input is invalid, then it will throw an exception.

class Area {

final int length;

final int breadth;

final int area;

// private constructor

const Area.\_internal(this.length, this.breadth) : area = length \* breadth;

// Factory constructor

factory Area(int length, int breadth) {

if (length < 0 || breadth < 0) {

throw Exception("Length and breadth must be positive");

}

// redirect to private constructor

return Area.\_internal(length, breadth);

}

}

void main() {

// This works

Area area = Area(10, 20);

print("Area is: ${area.area}");

// notice that here is negative valu

Area area2 = Area(-10, 20);

print("Area is: ${area2.area}");

}

 Show Output

Area is: 200

Unhandled exception:

Exception: Length and breadth must be positive

### **Encapsulation In Dart**

In Dart, **Encapsulation** means **hiding data** within a library, preventing it from outside factors. It helps you control your program and prevent it from becoming too complicated.

### **What Is Library In Dart?**

By default, every **.dart** file is a library. A library is a collection of functions and classes. A library can be imported into another library using the **import** keyword.

### **How To Achieve Encapsulation In Dart?**

Encapsulation can be achieved by:

* Declaring the class properties as **private** by using **underscore(\_)**.
* Providing public **getter** and **setter** methods to access and update the value of private property.

 Info

**Note:** Dart doesn’t support keywords like **public**, **private**, and **protected**. Dart uses **\_** (underscore) to make a property or method private. The encapsulation happens at library level, not at class level.

### **Getter and Setter Methods**

**Getter** and **setter** methods are used to access and update the value of private property. **Getter** methods are used to access the value of private property. **Setter** methods are used to update the value of private property.

### **Example 1: Encapsulation In Dart**

In this example, we will create a class named **Employee**. The class will have two private properties **\_id** and **\_name**. We will also create two public methods **getId()** and **getName()** to access the private properties. We will also create two public methods **setId()** and **setName()** to update the private properties.

class Employee {

// Private properties

int? \_id;

String? \_name;

// Getter method to access private property \_id

int getId() {

return \_id!;

}

// Getter method to access private property \_name

String getName() {

return \_name!;

}

// Setter method to update private property \_id

void setId(int id) {

this.\_id = id;

}

// Setter method to update private property \_name

void setName(String name) {

this.\_name = name;

}

}

void main() {

// Create an object of Employee class

Employee emp = new Employee();

// setting values to the object using setter

emp.setId(1);

emp.setName("John");

// Retrieve the values of the object using getter

print("Id: ${emp.getId()}");

print("Name: ${emp.getName()}");

}

 Show Output

Id: 1

Name: John

### **Private Properties**

**Private property** is a property that can only be accessed from same **library**. Dart does not have any keywords like **private** to define a private property. You can define it by prefixing an **underscore (\_)** to its name.

### **Example 2: Private Properties In Dart**

In this example, we will create a class named **Employee**. The class has one private property **\_name**. We will also create a public method **getName()** to access the private property.

class Employee {

// Private property

var \_name;

// Getter method to access private property \_name

String getName() {

return \_name;

}

// Setter method to update private property \_name

void setName(String name) {

this.\_name = name;

}

}

void main() {

var employee = Employee();

employee.setName("Jack");

print(employee.getName());

}

 Show Output

Jack

### **Why Aren’t Private Properties Private?**

In the main method, if you write the following code, it will compile and run without any error. Let’s see why it is happening.

class Employee {

// Private property

var \_name;

// Getter method to access private property \_name

String getName() {

return \_name;

}

// Setter method to update private property \_name

void setName(String name) {

this.\_name = name;

}

}

void main() {

var employee = Employee();

employee.\_name = "John"; // It is working, but why?

print(employee.getName());

}

 Show Output

John

### **Reason**

The reason is that using **underscore (\_)** before a variable or method name makes it **library private** not **class private**. It means that the variable or method is only visible to the library in which it is declared. It is not visible to any other library. In simple words, library is one file. If you write the main method in a separate file, this will not work.

### **Solution**

To see private properties in action, you must create a separate file for the class and import it into the main file.**Read-only Properties**

You can control the properties’s access and implement the encapsulation in the dart by using the read-only properties. You can do that by adding the **final** keyword before the properties declaration. Hence, you can only access its value, but you cannot change it.

### **How To Create Getter and Setter Methods?**

You can create getter and setter methods by using the **get** and **set** keywords. In this example below, we have created a class named **Vehicle**. The class has two private properties **\_model** and **\_year**. We have also created two getter and setter methods for each property. The getter and setter methods are named **model** and **year**. The getter and setter methods are used to access and update the value of the private properties.

class Vehicle {

String \_model;

int \_year;

// Getter method

String get model => \_model;

// Setter method

set model(String model) => \_model = model;

// Getter method

int get year => \_year;

// Setter method

set year(int year) => \_year = year;

}

void main() {

var vehicle = Vehicle();

vehicle.model = "Toyota";

vehicle.year = 2019;

print(vehicle.model);

print(vehicle.year);

}

 Show Output

Toyota

2019

**Note:** In dart, any identifier like (class, class properties, top-level function, or variable) that starts with an underscore \_ it is private to its library.

### **Why Encapsulation Is Important?**

* **Data Hiding**: Encapsulation hides the data from the outside world. It prevents the data from being accessed by the code outside the class. This is known as data hiding.
* **Testability**: Encapsulation allows you to test the class in isolation. It will enable you to test the class without testing the code outside the class.
* **Flexibility**: Encapsulation allows you to change the implementation of the class without affecting the code outside the class.
* **Security**: Encapsulation allows you to restrict access to the class members. It will enable you to limit access to the class members from the code outside the library

### **Getter In Dart**

**Getter** is used to get the value of a property. It is mostly used to access a **private property’s** value. Getter provide explicit read access to an object properties.

### **Syntax**

return\_type get property\_name {

// Getter body

}

**Note:** Instead of writing { } after the property name, you can also write **=>** (fat arrow) after the property name.

### **Example 1: Getter In Dart**

In this example below, there is a class named **Person**. The class has two properties **firstName** and **lastName**. There is getter **fullName** which is responsible to get full name of person.

class Person {

// Properties

String? firstName;

String? lastName;

// Constructor

Person(this.firstName, this.lastName);

// Getter

String get fullName => "$firstName $lastName";

}

void main() {

Person p = Person("John", "Doe");

print(p.fullName);

}

 Show Output

John Doe

### **Example 2: Getter In Dart**

In this example below, there is a class named **NoteBook**. The class has two private properties **\_name** and **\_prize**. There are two getters **name** and **prize** to access the value of the properties.

class NoteBook {

// Private properties

String? \_name;

double? \_prize;

// Constructor

NoteBook(this.\_name, this.\_prize);

// Getter method to access private property \_name

String get name => this.\_name!;

// Getter method to access private property \_prize

double get prize => this.\_prize!;

}

void main() {

// Create an object of NoteBook class

NoteBook nb = new NoteBook("Dell", 500);

// Display the values of the object

print(nb.name);

print(nb.prize);

}

 Show Output

Name: Dell

Price: 500.0

### **Setter In Dart**

**Setter** is used to set the value of a property. It is mostly used to update a **private property’s** value. Setter provide explicit write access to an object properties.

### **Syntax**

set property\_name (value) {

// Setter body

}

**Note:** Instead of writing { } after the property name, you can also write **=>** (fat arrow) after the property name.

### **Example 1: Setter In Dart**

In this example below, there is a class named **NoteBook**. The class has two private properties **\_name** and **\_prize**. There are two setters **name** and **prize** to update the value of the properties. There is also a method **display** to display the value of the properties.

class NoteBook {

// Private Properties

String? \_name;

double? \_prize;

// Setter to update private property \_name

set name(String name) => this.\_name = name;

// Setter to update private property \_prize

set prize(double prize) => this.\_prize = prize;

// Method to display the values of the properties

void display() {

print("Name: ${\_name}");

print("Price: ${\_prize}");

}

}

void main() {

// Create an object of NoteBook class

NoteBook nb = new NoteBook();

// setting values to the object using setter

nb.name = "Dell";

nb.prize = 500.00;

// Display the values of the object

nb.display();

}

 Show Output

Name: Dell

Price: 500.0

### **Getter And Setter**

[**Getter**](https://dart-tutorial.com/object-oriented-programming/getter-in-dart/) and [**Setter**](https://dart-tutorial.com/object-oriented-programming/getter-in-dart/) provide explicit read and write access to an object properties. In dart, **get** and **set** are the keywords used to create getter and setter. Getter read the value of property and act as **accessor**. Setter update the value of property and act as **mutator**.

 Info

**Note:** You can use same name for **getter** and **setter**. But, you can’t use same name for **getter**, **setter** and **property name**.

### **Use Of Getter and Setter**

* Validate the data before reading or writing.
* Restrict the read and write access to the properties.
* Making the properties read-only or write-only.
* Perform some action before reading or writing the properties.

### **Example 1: Getter And Setter In Dart**

In this example below, there is a class named **Student** with three private properties **\_firstName**, **\_lastName** and **\_age**. There are two getters **fullName** and **age** to get the value of the properties. There are also three setters **firstName**, **lastName** and **age** to update the value of the properties. If **age** is less than 0, it will throw an error.

class Student {

// Private Properties

String? \_firstName;

String? \_lastName;

int? \_age;

// Getter to get full name

String get fullName => this.\_firstName! + " " + this.\_lastName!;

// Getter to read private property \_age

int get age => this.\_age!;

// Setter to update private property \_firstName

set firstName(String firstName) => this.\_firstName = firstName;

// Setter to update private property \_lastName

set lastName(String lastName) => this.\_lastName = lastName;

// Setter to update private property \_age

set age(int age) {

if (age < 0) {

throw new Exception("Age can't be less than 0");

}

this.\_age = age;

}

}

void main() {

// Create an object of Student class

Student st = new Student();

// setting values to the object using setter

st.firstName = "John";

st.lastName = "Doe";

st.age = 20;

// Display the values of the object

print("Full Name: ${st.fullName}");

print("Age: ${st.age}");

}

 Show Output

Full Name: John Doe

Age: 20

### **Example 2: Getter And Setter In Dart**

In this example below, there is a class named **BankAccount** with one private property **\_balance**. There is one getter **balance** to read the value of the property. There are methods **deposit** and **withdraw** to update the value of the **\_balance**.

class BankAccount {

// Private Property

double \_balance = 0.0;

// Getter to read private property \_balance

double get balance => this.\_balance;

// Method to deposit money

void deposit(double amount) {

this.\_balance += amount;

}

// Method to withdraw money

void withdraw(double amount) {

if (this.\_balance >= amount) {

this.\_balance -= amount;

} else {

throw new Exception("Insufficient Balance");

}

}

}

void main() {

// Create an object of BankAccount class

BankAccount account = new BankAccount();

// Deposit money

account.deposit(1000);

// Display the balance

print("Balance after deposit: ${account.balance}");

// Withdraw money

account.withdraw(500);

// Display the balance

print("Balance after withdraw: ${account.balance}");

}

 Show Output

Balance after deposit: 1000

Balance after withdraw: 500

### **When To Use Getter And Setter**

* Use getter and setter when you want to restrict the access to the properties.
* Use getter and setter when you want to perform some action before reading or writing the properties.
* Use getter and setter when you want to validate the data before reading or writing the properties.
* Don’t use getter and setter when you want to make the properties read-only or write-only

### **Inheritance In Dart**

Inheritance is a sharing of behaviour between two classes. It allows you to define a class that extends the functionality of another class. The **extend** keyword is used for inheriting from parent class.

**Note**: Whenever you use inheritance, it always create a **is-a** relation between the parent and child class like **Student is a Person**, **Truck is a Vehicle**, **Cow is a Animal** etc.

Dart supports single inheritance, which means that a class can only inherit from a single class. Dart does not support multiple inheritance which means that a class cannot inherit from multiple classes.

### **Syntax**

class ParentClass {

// Parent class code

}

class ChildClass extends ParentClass {

// Child class code

}

In this syntax, **ParentClass** is the super class and **ChildClass** is the sub class. The **ChildClass** inherits the properties and methods of the **ParentClass**.

### **Terminology**

**Parent Class:** The class whose properties and methods are inherited by another class is called parent class. It is also known as base class or super class.

**Child Class:** The class that inherits the properties and methods of another class is called child class. It is also known as derived class or sub class.

### **Example 1: Inheritance In Dart**

In this example, we will create a class **Person** and then create a class **Student** that inherits the properties and methods of the **Person** class.

class Person {

// Properties

String? name;

int? age;

// Method

void display() {

print("Name: $name");

print("Age: $age");

}

}

// Here In student class, we are extending the

// properties and methods of the Person class

class Student extends Person {

// Fields

String? schoolName;

String? schoolAddress;

// Method

void displaySchoolInfo() {

print("School Name: $schoolName");

print("School Address: $schoolAddress");

}

}

void main() {

// Creating an object of the Student class

var student = Student();

student.name = "John";

student.age = 20;

student.schoolName = "ABC School";

student.schoolAddress = "New York";

student.display();

student.displaySchoolInfo();

}

 Show Output

Name: John

Age: 20

School Name: ABC School

School Address: New York

### **Advantages Of Inheritance In Dart**

* It promotes reusability of the code and reduces redundant code.
* It helps to design a program in a better way.
* It makes code simpler, cleaner and saves time and money on maintenance.
* It facilitates the creation of class libraries.
* It can be used to enforce standard interface to all children classes.

### **Example 2: Inheritance In Dart**

In this example, here is parent class **Car** and child class **Toyota**. The **Toyota** class inherits the properties and methods of the **Car** class.

class Car{

String color;

int year;

void start(){

print("Car started");

}

}

class Toyota extends Car{

String model;

int prize;

void showDetails(){

print("Model: $model");

print("Prize: $prize");

}

}

void main(){

var toyota = Toyota();

toyota.color = "Red";

toyota.year = 2020;

toyota.model = "Camry";

toyota.prize = 20000;

toyota.start();

toyota.showDetails();

}

 Show Output

Car started

Model: Camry

Prize: 20000

### **Types Of Inheritance In Dart**

1. **Single Inheritance** - In this type of inheritance, a class can inherit from only one class. In Dart, we can only extend one class at a time.
2. **Multilevel Inheritance** - In this type of inheritance, a class can inherit from another class and that class can also inherit from another class. In Dart, we can extend a class from another class which is already extended from another class.
3. **Hierarchical Inheritance** - In this type of inheritance, parent class is inherited by multiple subclasses. For example, the **Car** class can be inherited by the **Toyota** class and **Honda** class.
4. **Multiple Inheritance** - In this type of inheritance, a class can inherit from multiple classes. **Dart does not support multiple inheritance.** For e.g. **Class Toyota extends Car, Vehicle {}** is not allowed in Dart.

### **Example 3: Single Inheritance In Dart**

In this example below, there is super class named **Car** with two properties **name** and **prize**. There is sub class named **Tesla** which inherits the properties of the super class. The sub class has a method **display** to display the values of the properties.

class Car {

// Properties

String? name;

double? prize;

}

class Tesla extends Car {

// Method to display the values of the properties

void display() {

print("Name: ${name}");

print("Prize: ${prize}");

}

}

void main() {

// Create an object of Tesla class

Tesla t = new Tesla();

// setting values to the object

t.name = "Tesla Model 3";

t.prize = 50000.00;

// Display the values of the object

t.display();

}

 Show Output

Name: Tesla Model 3

Prize: 50000.0

### **Example 4: Multilevel Inheritance In Dart**

In this example below, there is super class named **Car** with two properties **name** and **prize**. There is sub class named **Tesla** which inherits the properties of the super class. The sub class has a method **display** to display the values of the properties. There is another sub class named **Model3** which inherits the properties of the sub class **Tesla**. The sub class has a property **color** and a method **display** to display the values of the properties.

class Car {

// Properties

String? name;

double? prize;

}

class Tesla extends Car {

// Method to display the values of the properties

void display() {

print("Name: ${name}");

print("Prize: ${prize}");

}

}

class Model3 extends Tesla {

// Properties

String? color;

// Method to display the values of the properties

void display() {

super.display();

print("Color: ${color}");

}

}

void main() {

// Create an object of Model3 class

Model3 m = new Model3();

// setting values to the object

m.name = "Tesla Model 3";

m.prize = 50000.00;

m.color = "Red";

// Display the values of the object

m.display();

}

 Show Output

Name: Tesla Model 3

Prize: 50000.0

Color: Red

**Note:** Here super keyword is used to call the method of the parent class.

### **Example 5: Multilevel Inheritance In Dart**

In this example below, there is class named **Person** with two properties **name** and **age**. There is sub class named **Doctor** with properties **listofdegrees** and **hospitalname**. There is another subclass named **Specialist** with property **specialization**. The sub class has a method **display** to display the values of the properties.

class Person {

// Properties

String? name;

int? age;

}

class Doctor extends Person {

// Properties

List<String>? listofdegrees;

String? hospitalname;

// Method to display the values of the properties

void display() {

print("Name: ${name}");

print("Age: ${age}");

print("List of Degrees: ${listofdegrees}");

print("Hospital Name: ${hospitalname}");

}

}

class Specialist extends Doctor {

// Properties

String? specialization;

// Method to display the values of the properties

void display() {

super.display();

print("Specialization: ${specialization}");

}

}

void main() {

// Create an object of Specialist class

Specialist s = new Specialist();

// setting values to the object

s.name = "John";

s.age = 30;

s.listofdegrees = ["MBBS", "MD"];

s.hospitalname = "ABC Hospital";

s.specialization = "Cardiologist";

// Display the values of the object

s.display();

}

 Show Output

Name: John

Age: 30

List of Degrees: [MBBS, MD]

Hospital Name: ABC Hospital

Specialization: Cardiologist

### **Example 6: Hierarchical Inheritance In Dart**

In this example below, there is class named **Shape** with two properties **diameter1** and **diameter2**. There is sub class named **Rectangle** with method **area** to calculate the area of the rectangle. There is another subclass named **Triangle** with method **area** to calculate the area of the triangle.

class Shape {

// Properties

double? diameter1;

double? diameter2;

}

class Rectangle extends Shape {

// Method to calculate the area of the rectangle

double area() {

return diameter1! \* diameter2!;

}

}

class Triangle extends Shape {

// Method to calculate the area of the triangle

double area() {

return 0.5 \* diameter1! \* diameter2!;

}

}

void main() {

// Create an object of Rectangle class

Rectangle r = new Rectangle();

// setting values to the object

r.diameter1 = 10.0;

r.diameter2 = 20.0;

// Display the area of the rectangle

print("Area of the rectangle: ${r.area()}");

// Create an object of Triangle class

Triangle t = new Triangle();

// setting values to the object

t.diameter1 = 10.0;

t.diameter2 = 20.0;

// Display the area of the triangle

print("Area of the triangle: ${t.area()}");

}

 Show Output

Area of the rectangle: 200.0

Area of the triangle: 100.0

### **Key Points**

* Inheritance is used to reuse the code.
* Inheritance is a concept which is achieved by using the **extends** keyword.
* Properties and methods of the super class can be accessed by the sub class.
* Class **Dog** extends class **Animal**{} means Dog is sub class and Animal is super class.
* The sub class can have its own properties and methods.

### **Why Dart Does Not Support Multiple Inheritance?**

Dart does not support multiple inheritance because it can lead to ambiguity. For example, if class **Apple** inherits class **Fruit** and class **Vegetable**, then there may be two methods with the same name **eat**. If the method is called, then which method should be called? This is the reason why Dart does not support multiple inheritance.

### **What’s problem Of Copy Paste Instead Of Inheritance?**

If you copy the code from one class to another class, then you will have to maintain the code in both the classes. If you make any changes in one class, then you will have to make the same changes in the other class. This can lead to errors and bugs in the code.

### **Does Inheritance Finished If I Learned Extending Class?**

No, there is a lot more to learn about inheritance. You need to learn about **Constructor Inheritance**, **Method Overriding**, **Abstract Class**, **Interface** and **Mixin** etc. You will learn about these concepts in the next chapters.

### **What Is Inheritance Of Constructor In Dart?**

Inheritance of constructor in Dart is a process of inheriting the constructor of the parent class to the child class. It is a way of reusing the code of the parent class.

### **Example 1: Inheritance Of Constructor In Dart**

In this example below, there is class named **Laptop** with a constructor. There is another class named **MacBook** which extends the **Laptop** class. The **MacBook** class has its own constructor.

class Laptop {

// Constructor

Laptop() {

print("Laptop constructor");

}

}

class MacBook extends Laptop {

// Constructor

MacBook() {

print("MacBook constructor");

}

}

void main() {

var macbook = MacBook();

}

 Show Output

Laptop constructor

MacBook constructoR

**Note**: The constructor of the parent class is called first and then the constructor of the child class is called.

### **Example 2: Inheritance Of Constructor With Parameters In Dart**

In this example below, there is class named **Laptop** with a constructor with parameters. There is another class named **MacBook** which extends the **Laptop** class. The **MacBook** class has its own constructor with parameters.

class Laptop {

// Constructor

Laptop(String name, String color) {

print("Laptop constructor");

print("Name: $name");

print("Color: $color");

}

}

class MacBook extends Laptop {

// Constructor

MacBook(String name, String color) : super(name, color) {

print("MacBook constructor");

}

}

void main() {

var macbook = MacBook("MacBook Pro", "Silver");

}

 Show Output

Laptop constructor

Name: MacBook Pro

Color: Silver

MacBook constructo

### **Example 3: Inheritance Of Constructor**

In this example below, there is class named **Person** with properties **name** and **age**. There is another class named **Student** which extends the **Person** class. The **Student** class has additional property **rollNumber**. Lets see how to create a constructor for the **Student** class.

class Person {

String name;

int age;

// Constructor

Person(this.name, this.age);

}

class Student extends Person {

int rollNumber;

// Constructor

Student(String name, int age, this.rollNumber) : super(name, age);

}

void main() {

var student = Student("John", 20, 1);

print("Student name: ${student.name}");

print("Student age: ${student.age}");

print("Student roll number: ${student.rollNumber}");

}

 Show Output

Student name: John

Student age: 20

Student roll number: 1

### **Example 4: Inheritance Of Constructor With Named Parameters In Dart**

In this example below, there is class named **Laptop** with a constructor with named parameters. There is another class named **MacBook** which extends the **Laptop** class. The **MacBook** class has its own constructor with named parameters.

class Laptop {

// Constructor

Laptop({String name, String color}) {

print("Laptop constructor");

print("Name: $name");

print("Color: $color");

}

}

class MacBook extends Laptop {

// Constructor

MacBook({String name, String color}) : super(name: name, color: color) {

print("MacBook constructor");

}

}

void main() {

var macbook = MacBook(name: "MacBook Pro", color: "Silver");

}

 Show Output

Laptop constructor

Name: MacBook Pro

Color: Silver

MacBook constructor

### **Example 5: Calling Named Constructor Of Parent Class In Dart**

In this example below, there is class named **Laptop** with one default constructor and one named constructor. There is another class named **MacBook** which extends the **Laptop** class. The **MacBook** class has its own constructor with named parameters. You can call the named constructor of the parent class using the **super** keyword.

class Laptop {

// Default Constructor

Laptop() {

print("Laptop constructor");

}

// Named Constructor

Laptop.named() {

print("Laptop named constructor");

}

}

class MacBook extends Laptop {

// Constructor

MacBook() : super.named() {

print("MacBook constructor");

}

}

void main() {

var macbook = MacBook();

}

 Show Output

Laptop named constructor

MacBook constructor

### **What Is Super In Dart?**

Super is used to refer to the parent class. It is used to call the parent class’s properties and methods.

### **Example 1: Super In Dart**

In this example below, the **show()** method of the **MacBook** class calls the **show()** method of the parent class using the **super** keyword.

class Laptop {

// Method

void show() {

print("Laptop show method");

}

}

class MacBook extends Laptop {

void show() {

super.show(); // Calling the show method of the parent class

print("MacBook show method");

}

}

void main() {

// Creating an object of the MacBook class

MacBook macbook = MacBook();

macbook.show();

}

 Show Output

Laptop show method

MacBook show method

### **Example 2: Accessing Super Properties In Dart**

In this example below, the **display()** method of the **Tesla** class calls the **noOfSeats** property of the parent class using the **super** keyword.

class Car {

int noOfSeats = 4;

}

class Tesla extends Car {

int noOfSeats = 6;

void display() {

print("No of seats in Tesla: $noOfSeats");

print("No of seats in Car: ${super.noOfSeats}");

}

}

void main() {

var tesla = Tesla();

tesla.display();

}

 Show Output

No of seats in Tesla: 6

No of seats in Car: 4

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### **Example 3: Super With Constructor In Dart**

In this example below, the **Manager** class constructor calls the **Employee** class constructor using the **super** keyword.

class Employee {

// Constructor

Employee(String name, double salary) {

print("Employee constructor");

print("Name: $name");

print("Salary: $salary");

}

}

class Manager extends Employee {

// Constructor

Manager(String name, double salary) : super(name, salary) {

print("Manager constructor");

}

}

void main() {

Manager manager = Manager("John", 25000.0);

}

 Show Output

Employee constructor

Name: John

Salary: 25000.0

Manager constructor

### **Example 4: Super With Named Constructor In Dart**

In this example below, the **Manager** class named constructor calls the **Employee** class named constructor using the **super** keyword.

class Employee {

// Named constructor

Employee.manager() {

print("Employee named constructor");

}

}

class Manager extends Employee {

// Named constructor

Manager.manager() : super.manager() {

print("Manager named constructor");

}

}

void main() {

Manager manager = Manager.manager();

}

 Show Output

Employee named constructor

Manager named constructor

### **Example 5: Super With Multilevel Inheritance In Dart**

In this example below, the **MacBookPro** class method **display** calls the **display** method of the parent class **MacBook** using the **super** keyword. The **MacBook** class method **display** calls the **display** method of the parent class **Laptop** using the **super** keyword.

class Laptop {

// Method

void display() {

print("Laptop display");

}

}

class MacBook extends Laptop {

// Method

void display() {

print("MacBook display");

super.display();

}

}

class MacBookPro extends MacBook {

// Method

void display() {

print("MacBookPro display");

super.display();

}

}

void main() {

var macbookpro = MacBookPro();

macbookpro.display();

}

 Show Output

MacBookPro display

MacBook display

Laptop display

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### **Key Points To Remember**

* The **super** keyword is used to access the parent class members.
* The **super** keyword is used to call the method of the parent class.

### **Polymorphism In Dart**

Poly means **many** and morph means **forms**. Polymorphism is the ability of an object to take on many forms. As humans, we have the ability to take on many forms. We can be a student, a teacher, a parent, a friend, and so on. Similarly, in object-oriented programming, polymorphism is the ability of an object to take on many forms.

 Info

**Note**: In the real world, polymorphism is updating or modifying the feature, function, or implementation that already exists in the parent class.

### **Polymorphism By Method Overriding**

Method overriding is a technique in which you can create a method in the child class that has the same name as the method in the parent class. The method in the child class overrides the method in the parent class.

### **Syntax**

class ParentClass{

void functionName(){

}

}

class ChildClass extends ParentClass{

@override

void functionName(){

}

}

### **Example 1: Polymorphism By Method Overriding In Dart**

In this example below, there is a class named **Animal** with a method named **eat()**. The **eat()** method is overridden in the child class named **Dog**.

class Animal {

void eat() {

print("Animal is eating");

}

}

class Dog extends Animal {

@override

void eat() {

print("Dog is eating");

}

}

void main() {

Animal animal = Animal();

animal.eat();

Dog dog = Dog();

dog.eat();

}

 Show Output

Animal is eating

Dog is eating

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### **Example 2: Polymorphism By Method Overriding In Dart**

In this example below, there is a class named **Vehicle** with a method named **run()**. The **run()** method is overridden in the child class named **Bus**.

class Vehicle {

void run() {

print("Vehicle is running");

}

}

class Bus extends Vehicle {

@override

void run() {

print("Bus is running");

}

}

void main() {

Vehicle vehicle = Vehicle();

vehicle.run();

Bus bus = Bus();

bus.run();

}

 Show Output

Vehicle is running

Bus is running

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 Info

**Note**: If you don’t write **@override**, the program still runs. But, it is a good practice to write **@override**.

### **Example 3: Polymorphism By Method Overriding In Dart**

In this example below, there is a class named **Car** with a method named **power()**. The **power()** method is overridden in two child classes named **Honda** and **Tesla**.

class Car{

void power(){

print("It runs on petrol.");

}

}

class Honda extends Car{

}

class Tesla extends Car{

@override

void power(){

print("It runs on electricity.");

}

}

void main(){

Honda honda=Honda();

Tesla tesla=Tesla();

honda.power();

tesla.power();

}

 Show Output

It runs on petrol.

It runs on electricity.

[Run Online](https://dartpad.dev/?id=2b5da787f6cf4edd03096669a1ac44b5)

### **Example 4: Polymorphism By Method Overriding In Dart**

In this example below, there is a class named **Employee** with a method named **salary()**. The **salary()** method is overridden in two child classes named **Manager** and **Developer**.

class Employee{

void salary(){

print("Employee salary is \$1000.");

}

}

class Manager extends Employee{

@override

void salary(){

print("Manager salary is \$2000.");

}

}

class Developer extends Employee{

@override

void salary(){

print("Developer salary is \$3000.");

}

}

void main(){

Manager manager=Manager();

Developer developer=Developer();

manager.salary();

developer.salary();

}

 Show Output

Manager salary is $2000.

Developer salary is $3000.

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### **Advantage Of Polymorphism In Dart**

* Subclasses can override the behavior of the parent class.
* It allows us to write code that is more flexible and reusable.

### **Static In Dart**

If you want to define a variable or method that is shared by all instances of a class, you can use the **static** keyword. Static members are accessed using the class name. It is used for **memory management**.

### **Dart Static Variable**

A static variable is a variable that is shared by all instances of a class. It is declared using the static keyword. It is initialized only once when the class is loaded. It is used to store the **class-level data**.

### **How To Declare A Static Variable In Dart**

To declare a static variable in Dart, you must use the static keyword before the variable name.

class ClassName {

static dataType variableName;

}

### **How To Initialize A Static Variable In Dart**

To initialize a static variable simply assign a value to it.

class ClassName {

static dataType variableName = value;

// for e.g

// static int num = 10;

// static String name = "Dart";

}

### **How To Access A Static Variable In Dart**

You need to use the **ClassName.variableName** to access a static variable in Dart.

class ClassName {

static dataType variableName = value;

// Accessing the static variable inside same class

void display() {

print(variableName);

}

}

void main() {

// Accessing static variable outside the class

dataType value =ClassName.variableName;

}

### **Example 1: Static Variable In Dart**

In this example below, there is a class named **Employee**. The class has a static variable **count** to count the number of employees.

class Employee {

// Static variable

static int count = 0;

// Constructor

Employee() {

count++;

}

// Method to display the value of count

void totalEmployee() {

print("Total Employee: $count");

}

}

void main() {

// Creating objects of Employee class

Employee e1 = new Employee();

e1.totalEmployee();

Employee e2 = new Employee();

e2.totalEmployee();

Employee e3 = new Employee();

e3.totalEmployee();

}

 Show Output

Total Employee: 1

Total Employee: 2

Total Employee: 3

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 Info

**Note:** While creating the objects of the class, the static variable **count** is incremented by 1. The **totalEmployee()** method displays the value of the static variable **count**.

### **Example 2: Static Variable In Dart**

In this example below, there is a class named **Student**. The class has a static variable **schoolName** to store the name of the school. If every student belongs to the same school, then it is better to use a static variable.

class Student {

int id;

String name;

static String schoolName = "ABC School";

Student(this.id, this.name);

void display() {

print("Id: ${this.id}");

print("Name: ${this.name}");

print("School Name: ${Student.schoolName}");

}

}

void main() {

Student s1 = new Student(1, "John");

s1.display();

Student s2 = new Student(2, "Smith");

s2.display();

}

 Show Output

Id: 1

Name: John

School Name: ABC School

Id: 2

Name: Smith

School Name: ABC School

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### **Dart Static Method**

A static method is shared by all instances of a class. It is declared using the static keyword. You can access a static method without creating an object of the class.

### **Syntax**

class ClassName{

static returnType methodName(){

//statements

}

}

### **Example 3: Static Method In Dart**

In this example, we will create a static method **calculateInterest()** which calculates the simple interest. You can call **SimpleInterest.calculateInterest()** anytime without creating an instance of the class.

class SimpleInterest {

static double calculateInterest(double principal, double rate, double time) {

return (principal \* rate \* time) / 100;

}

}

void main() {

print(

"The simple interest is ${SimpleInterest.calculateInterest(1000, 2, 2)}");

}

 Show Output

The simple interest is 40.0

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### **Example 4: Static Method In Dart**

In this example below, there is static method **generateRandomPassword()** which generates a random password. You can call **PasswordGenerator.generateRandomPassword()** anytime without creating an instance of the class.

import 'dart:math';

class PasswordGenerator {

static String generateRandomPassword() {

List<String> allalphabets = 'abcdefghijklmnopqrstuvwxyz'.split('');

List<int> numbers = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9];

List<String> specialCharacters = ["@", "#", "%", "&", "\*"];

List<String> password = [];

for (int i = 0; i < 5; i++) {

password.add(allalphabets[Random().nextInt(allalphabets.length)]);

password.add(numbers[Random().nextInt(numbers.length)].toString());

password

.add(specialCharacters[Random().nextInt(specialCharacters.length)]);

}

return password.join();

}

}

void main() {

print(PasswordGenerator.generateRandomPassword());

}

 Show Output

v5\*p4\*o2&c7%k1@

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 Info

**Note**: You don’t need to create an instance of a class to call a static method.

### **Key Points To Remember**

* Static members are accessed using the class name.
* All instances of a class share static members.

### **Enum In Dart**

An enum is a special type that represents a fixed number of constant values. An enum is declared using the keyword **enum** followed by the enum’s name.

### **Syntax Of Enum In Dart**

enum enumName {

constantName1,

constantName2,

constantName3,

...

constantNameN

}

### **Example 1: Enum In Dart**

In this example below, there is enum type named **days**. It contains seven constants days. The **days** enum type is used in the **main()** function.

enum days {

Sunday,

Monday,

Tuesday,

Wednesday,

Thrusday,

Friday,

Saturday

}

void main() {

var today = days.Friday;

switch (today) {

case days.Sunday:

print("Today is Sunday.");

break;

case days.Monday:

print("Today is Monday.");

break;

case days.Tuesday:

print("Today is Tuesday.");

break;

case days.Wednesday:

print("Today is Wednesday.");

break;

case days.Thursday:

print("Today is Thursday.");

break;

case days.Friday:

print("Today is Friday.");

break;

case days.Saturday:

print("Today is Saturday.");

break;

}

}

 Show Output

Today is Friday.

### **Example 2: Enum In Dart**

In this example, there is an enum type named **Gender**. It contains three constants **Male**, **Female**, and **Other**. The **Gender** enum type is used in the **Person** class.

enum Gender { Male, Female, Other }

class Person {

// Properties

String? firstName;

String? lastName;

Gender? gender;

// Constructor

Person(this.firstName, this.lastName, this.gender);

// display() method

void display() {

print("First Name: $firstName");

print("Last Name: $lastName");

print("Gender: $gender");

}

}

void main() {

Person p1 = Person("John", "Doe", Gender.Male);

p1.display();

Person p2 = Person("Menuka", "Sharma", Gender.Female);

p2.display();

}

 Show Output

First Name: John

Last Name: Doe

Gender: Gender.Male

First Name: Menuka

Last Name: Sharma

Gender: Gender.Female

### **How to Print All Enum Values**

In this example, there is enum type named **Days**. It contain 7 days. The for loop iterates through all the enum values.

enum Days { Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday }

void main() {

// Days.values: It returns all the values of the enum.

for (Days day in Days.values) {

print(day);

}

}

 Show Output

Days.Sunday

Days.Monday

Days.Tuesday

Days.Wednesday

Days.Thursday

Days.Friday

Days.Saturday

### **Advantages Of Enum In Dart**

* It is used to define a set of named constants.
* Makes your code more readable and maintainable.
* It makes the code more reusable and makes it easier for developers.

### **Characteristics Of Enum**

* It must contain at least one constant value.
* Enums are declared outside the class.
* Used to store a large number of constant values.

### **Enhanced Enum In Dart**

In dart, you can declare enums with members. For example, for your accounting software you can store company types like **Sole Proprietorship**, **Partnership**, **Corporation**, and **Limited Liability Company**. You can declare an enum with members as shown below.

enum CompanyType {

soleProprietorship("Sole Proprietorship"),

partnership("Partnership"),

corporation("Corporation"),

limitedLiabilityCompany("Limited Liability Company");

// Members

final String text;

const CompanyType(this.text);

}

void main() {

CompanyType soleProprietorship = CompanyType.soleProprietorship;

print(soleProprietorship.text);

}

 Show Output

Sole Proprietorship

### **Abstract Class**

Abstract classes are classes that cannot be initialized. It is used to define the behavior of a class that can be inherited by other classes. An abstract class is declared using the keyword **abstract**.

### **Syntax**

abstract class ClassName {

//Body of abstract class

method1();

method2();

}

### **Abstract Method**

An abstract method is a method that is declared without an implementation. It is declared with a semicolon (;) instead of a method body.

### **Syntax**

abstract class ClassName {

//Body of abstract class

method1();

method2();

}

### **Why We Need Abstract Class**

Subclasses of an abstract class must implement all the abstract methods of the abstract class. It is used to achieve abstraction in the Dart programming language.

### **Example 1: Abstract Class In Dart**

In this example below, there is an abstract class **Vehicle** with two abstract methods **start()** and **stop()**. The subclasses **Car** and **Bike** implement the abstract methods and override them to print the message.

abstract class Vehicle {

// Abstract method

void start();

// Abstract method

void stop();

}

class Car extends Vehicle {

// Implementation of start()

@override

void start() {

print('Car started');

}

// Implementation of stop()

@override

void stop() {

print('Car stopped');

}

}

class Bike extends Vehicle {

// Implementation of start()

@override

void start() {

print('Bike started');

}

// Implementation of stop()

@override

void stop() {

print('Bike stopped');

}

}

void main() {

Car car = Car();

car.start();

car.stop();

Bike bike = Bike();

bike.start();

bike.stop();

}

 Show Output

Car started

Car stopped

Bike started

Bike stopped

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 Info

**Note**: The abstract class is used to define the behavior of a class that can be inherited by other classes. You can define an abstract method inside an abstract class.

### **Example 2: Abstract Class In Dart**

In this example below, there is an abstract class **Shape** with one abstract method **area()** and two subclasses **Rectangle** and **Triangle**. The subclasses implement the **area()** method and override it to calculate the area of the rectangle and triangle, respectively.

abstract class Shape {

int dim1, dim2;

// Constructor

Shape(this.dim1, this.dim2);

// Abstract method

void area();

}

class Rectangle extends Shape {

// Constructor

Rectangle(int dim1, int dim2) : super(dim1, dim2);

// Implementation of area()

@override

void area() {

print('The area of the rectangle is ${dim1 \* dim2}');

}

}

class Triangle extends Shape {

// Constructor

Triangle(int dim1, int dim2) : super(dim1, dim2);

// Implementation of area()

@override

void area() {

print('The area of the triangle is ${0.5 \* dim1 \* dim2}');

}

}

void main() {

Rectangle rectangle = Rectangle(10, 20);

rectangle.area();

Triangle triangle = Triangle(10, 20);

triangle.area();

}

 Show Output

The area of the rectangle is 200

The area of the triangle is 100.0

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### **Constructor In Abstract Class**

You can’t create an object of an abstract class. However, you can define a constructor in an abstract class. The constructor of an abstract class is called when an object of a subclass is created.

### **Example 3: Constructor In Abstract Class**

In this example below, there is an abstract class **Bank** with a constructor which takes two parameters **name** and **rate**. There is an abstract method **interest()**. The subclasses **SBI** and **ICICI** implement the abstract method and override it to print the interest rate.

abstract class Bank {

String name;

double rate;

// Constructor

Bank(this.name, this.rate);

// Abstract method

void interest();

//Non-Abstract method: It have an implementation

void display() {

print('Bank Name: $name');

}

}

class SBI extends Bank {

// Constructor

SBI(String name, double rate) : super(name, rate);

// Implementation of interest()

@override

void interest() {

print('The rate of interest of SBI is $rate');

}

}

class ICICI extends Bank {

// Constructor

ICICI(String name, double rate) : super(name, rate);

// Implementation of interest()

@override

void interest() {

print('The rate of interest of ICICI is $rate');

}

}

void main() {

SBI sbi = SBI('SBI', 8.4);

ICICI icici = ICICI('ICICI', 7.3);

sbi.interest();

icici.interest();

icici.display();

}

 Show Output

The rate of interest of SBI is 8.4

The rate of interest of ICICI is 7.3

Bank Name: ICICI

### **Key Points To Remember**

* You can’t create an object of an abstract class.
* It can have both abstract and non-abstract methods.
* It is used to define the behavior of a class that other classes can inherit.
* Abstract method only has a signature and no implementation.

### **Interface In Dart**

**An interface defines a syntax that a class must follow**. It is a contract that defines the capabilities of a class. It is used to achieve abstraction in the Dart programming language. When you implement an interface, you must implement all the properties and methods defined in the interface. Keyword **implements** is used to implement an interface.

### **Syntax Of Interface In Dart**

class InterfaceName {

// code

}

class ClassName implements InterfaceName {

// code

}

### **Declaring Interface In Dart**

In dart there is no keyword **interface** but you can use **class** or **abstract class** to declare an interface. All classes implicitly define an interface. Mostly **abstract class** is used to declare an interface.

// creating an interface using abstract class

abstract class Person {

canWalk();

canRun();

}

### **Implementing Interface In Dart**

You must use the **implements** keyword to implement an interface. The class that implements an interface must implement all the methods and properties of the interface.

class Student implements Person {

// implementation of canWalk()

@override

canWalk() {

print('Student can walk');

}

// implementation of canRun()

@override

canRun() {

print('Student can run');

}

}

### **Example 1: Interface In Dart**

In this example below, there is an interface **Laptop** with two methods **turnOn()** and **turnOff()**. The class **MacBook** implements the interface and overrides the methods to print the message.

// creating an interface using concrete class

class Laptop {

// method

turnOn() {

print('Laptop turned on');

}

// method

turnOff() {

print('Laptop turned off');

}

}

class MacBook implements Laptop {

// implementation of turnOn()

@override

turnOn() {

print('MacBook turned on');

}

// implementation of turnOff()

@override

turnOff() {

print('MacBook turned off');

}

}

void main() {

var macBook = MacBook();

macBook.turnOn();

macBook.turnOff();

}

 Show Output

MacBook turned on

MacBook turned off

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 Info

**Note:** Most of the time, **abstract class** is used instead of **concrete class** to declare an interface.

### **Example 2: Interface In Dart**

In this example below, there is an abstract class named **Vehicle**. The **Vehicle** class has two abstract methods **start()** and **stop()**. The **Car** class implements the **Vehicle** interface. The **Car** class has to implement the **start()** and **stop()** methods.

// abstract class as interface

abstract class Vehicle {

void start();

void stop();

}

// implements interface

class Car implements Vehicle {

@override

void start() {

print('Car started');

}

@override

void stop() {

print('Car stopped');

}

}

void main() {

var car = Car();

car.start();

car.stop();

}

 Show Output

Car started

Car stopped

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### **Multiple Inheritance In Dart**

**Multiple inheritance** means a class can inherit from more than one class. In dart, you can’t inherit from more than one class. But you can implement multiple interfaces in a class.

### **Syntax For Implementing Multiple Interfaces In Dart**

class ClassName implements Interface1, Interface2, Interface3 {

// code

}

### **Example 3: Interface In Dart With Multiple Interfaces**

In this example below, two abstract classes are named **Area** and **Perimeter**. The **Area** class has an abstract method **area()** and the **Perimeter** class has an abstract method **perimeter()**. The **Shape** class implements both the **Area** and **Perimeter** classes. The **Shape** class has to implement the **area()** and **perimeter()** methods.

// abstract class as interface

abstract class Area {

void area();

}

// abstract class as interface

abstract class Perimeter {

void perimeter();

}

// implements multiple interfaces

class Rectangle implements Area, Perimeter {

// properties

int length, breadth;

// constructor

Rectangle(this.length, this.breadth);

// implementation of area()

@override

void area() {

print('The area of the rectangle is ${length \* breadth}');

}

// implementation of perimeter()

@override

void perimeter() {

print('The perimeter of the rectangle is ${2 \* (length + breadth)}');

}

}

void main() {

Rectangle rectangle = Rectangle(10, 20);

rectangle.area();

rectangle.perimeter();

}

 Show Output

The area of the rectangle is 200

The perimeter of the rectangle is 60

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### **Example 4: Interface In Dart**

In this example below, there is an abstract class named **Person**. The **Person** class has one property **name** and two abstract methods **run** and **walk**. The **Student** class implements the **Person** interface. The **Student** class has to implement the **run** and **walk** methods.

// abstract class as interface

abstract class Person {

// properties

String? name;

// abstract method

void run();

void walk();

}

class Student implements Person {

// properties

String? name;

// implementation of run()

@override

void run() {

print('Student is running');

}

// implementation of walk()

@override

void walk() {

print('Student is walking');

}

}

void main() {

var student = Student();

student.name = 'John';

print(student.name);

student.run();

student.walk();

}

 Show Output

John

Student is running

Student is walking

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### **Example 5: Interface In Dart**

In this example below, there is abstract class named **CalculateTotal** and **CalculateAverage**. The **CalculateTotal** class has an abstract method **total()** and the **CalculateAverage** class has an abstract method **average()**. The **Student** class implements both the **CalculateTotal** and **CalculateAverage** classes. The **Student** class has to implement the **total()** and **average()** methods.

// abstract class as interface

abstract class CalculateTotal {

int total();

}

// abstract class as interface

abstract class CalculateAverage {

double average();

}

// implements multiple interfaces

class Student implements CalculateTotal, CalculateAverage {

// properties

int marks1, marks2, marks3;

// constructor

Student(this.marks1, this.marks2, this.marks3);

// implementation of average()

@override

double average() {

return total() / 3;

}

// implementation of total()

@override

int total() {

return marks1 + marks2 + marks3;

}

}

void main() {

Student student = Student(90, 80, 70);

print('Total marks: ${student.total()}');

print('Average marks: ${student.average()}');

}

 Show Output

Total marks: 240

Average marks: 80.0

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### **Difference Between Extends & Implements**

| **extends** | **implements** |
| --- | --- |
| Used to inherit a class in another class. | Used to inherit a class as an interface in another class. |
| Gives complete method definition to sub-class. | Gives abstract method definition to sub-class. |
| Only one class can be extended. | Multiple classes can be implemented. |
| It is optional to override the methods. | Concrete class must override the methods of an interface. |
| Constructors of the superclass is called before the sub-class constructor. | Constructors of the superclass is not called before the sub-class constructor. |
| The super keyword is used to access the members of the superclass. | Interface members can’t be accessed using the super keyword. |
| Sub-class need not to override the fields of the superclass. | Subclass must override the fields of the interface. |

### **Key Points To Remember**

* An interface is a contract that defines the capabilities of a class.
* Dart has no keyword interface, but you can use class or abstract class to declare an interface.
* Use abstract class to declare an interface.
* A class can extend only one class but can implement multiple interfaces.
* Using the interface, you can achieve multiple inheritance in Dart.
* It is used to achieve abstraction.

### **Mixin In Dart**

Mixins are a way of reusing the code in multiple classes. Mixins are declared using the keyword **mixin** followed by the mixin name. Three keywords are used while working with mixins: **mixin**, **with**, and **on**. It is possible to use multiple mixins in a class.

 Info

**Note:** The **with** keyword is used to apply the mixin to the class. It promotes DRY(Don’t Repeat Yourself) principle.

### **Rules For Mixin**

* **Mixin** can’t be instantiated. You can’t create object of mixin.
* Use the **mixin** to share the code between multiple classes.
* **Mixin** has no constructor and cannot be extended.
* It is possible to use multiple **mixins** in a class.

### **Syntax**

mixin Mixin1{

// code

}

mixin Mixin2{

// code

}

class ClassName with Mixin1, Mixin2{

// code

}

### **Example 1: Mixin In Dart**

In this example below, there are two mixins named **ElectricVariant** and **PetrolVariant**. The **ElectricVariant** mixin has a method **electricVariant()** and the **PetrolVariant** mixin has a method **petrolVariant()**. The **Car** class uses both the **ElectricVariant** and **PetrolVariant** mixins.

mixin ElectricVariant {

void electricVariant() {

print('This is an electric variant');

}

}

mixin PetrolVariant {

void petrolVariant() {

print('This is a petrol variant');

}

}

// with is used to apply the mixin to the class

class Car with ElectricVariant, PetrolVariant {

// here we have access of electricVariant() and petrolVariant() methods

}

void main() {

var car = Car();

car.electricVariant();

car.petrolVariant();

}

 Show Output

This is an electric variant

This is a petrol variant

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### **Example 2: Mixin In Dart**

In this example below, there are two mixins named **CanFly** and **CanWalk**. The **CanFly** mixin has a method **fly()** and the **CanWalk** mixin has a method **walk()**. The **Bird** class uses both the **CanFly** and **CanWalk** mixins. The **Human** class uses the **CanWalk** mixin.

mixin CanFly {

void fly() {

print('I can fly');

}

}

mixin CanWalk {

void walk() {

print('I can walk');

}

}

class Bird with CanFly, CanWalk {

}

class Human with CanWalk {

}

void main() {

var bird = Bird();

bird.fly();

bird.walk();

var human = Human();

human.walk();

}

 Show Output

I can fly

I can walk

I can walk

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### **On Keyword**

Sometimes, you want to use a mixin only with a specific class. In this case, you can use the **on** keyword.

### **Syntax Of On Keyword**

mixin Mixin1 on Class1{

// code

}

### **Example 3: On Keyword In Mixin In Dart**

In this example below, there is abstract class named **Animal** with properties **name** and **speed**. The **Animal** class has an abstract method **run()**. The **CanRun** mixin is only used by class that extends **Animal**. The **Dog** class extends the **Animal** class and uses the **CanRun** mixin. The **Bird** class cannot use the **CanRun** mixin because it does not extend the **Animal** class.

abstract class Animal {

// properties

String name;

double speed;

// constructor

Animal(this.name, this.speed);

// abstract method

void run();

}

// mixin CanRun is only used by class that extends Animal

mixin CanRun on Animal {

// implementation of abstract method

@override

void run() => print('$name is Running at speed $speed');

}

class Dog extends Animal with CanRun {

// constructor

Dog(String name, double speed) : super(name, speed);

}

void main() {

var dog = Dog('My Dog', 25);

dog.run();

}

// Not Possible

// class Bird with Animal { }

 Show Output

My Dog is Running at speed 25.0

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### **What Is Allowed For Mixin**

* You can add properties and static variables.
* You can add regular, abstract, and static methods.
* You can use one or more mixins in a class.

### **What Is Not Allowed For Mixin**

* You can’t define a constructor.
* You can’t extend a mixin.
* You can’t create an object of mixin.

### **Generics In Dart**

**Generics** is a way to create a class, or function that can work with different types of data **(objects)**. If you look at the internal implementation of [**List**](https://dart-tutorial.com/collections/list-in-dart/) class, it is a generic class. It can work with different data types like int, String, double, etc. For example, **List<int>** is a list of integers, **List<String>** is a list of strings, and **List<double>** is a list of double values.

### **Syntax**

class ClassName<T> {

// code

}

### **Example 1: Without Using Generics**

Suppose, you need to create a class that can work with both **int** and **double** data types. You can create two classes, one for **int** and another for **double** like this:

// Without Generics

// Creating a class for int

class IntData {

int data;

IntData(this.data);

}

// Creating a class for double

class DoubleData {

double data;

DoubleData(this.data);

}

void main() {

// Create an object of IntData class

IntData intData = IntData(10);

DoubleData doubleData = DoubleData(10.5);

// Print the data

print("IntData: ${intData.data}");

print("DoubleData: ${doubleData.data}");

}

 Show Output

IntData: 10

DoubleData: 10.5

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This is not a good practice because both class contain same code. You can create one **Generics** class that can work with different data types. See the example below.

### **Example 2: Using Generics**

In this example below, there is single class that can work with **int**, **double**, and any other data types using **Generics**.

// Using Generics

class Data<T> {

T data;

Data(this.data);

}

void main() {

// create an object of type int and double

Data<int> intData = Data<int>(10);

Data<double> doubleData = Data<double>(10.5);

// print the data

print("IntData: ${intData.data}");

print("DoubleData: ${doubleData.data}");

}

 Show Output

IntData: 10

DoubleData: 10.5

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### **Generics Type Variable**

Generics type variables are used to define the type of data that can be used with the class. In the above example, **T** is a type variable. You can use any name for the type variable. A few typical names are **T**, **E**, **K**, and **V**.

| **Name** | **Work** |
| --- | --- |
| T | Type |
| E | Element |
| K | Key |
| V | Value |

### **Dart Map Class**

Like [**List**](https://dart-tutorial.com/collections/list-in-dart/), internal implementation of [**Map**](https://dart-tutorial.com/collections/map-in-dart/) work with different types of data like int, String, double, etc. This is because Map is a generic class.

// Dart implementation of Map class

abstract class Map<K, V> {

// code

external factory Map();

}

This simply means that the Map class can work with different types of data.

void main() {

final info = {

"name": "John",

"age": 20,

"height": 5.5,

}

}

### **Generics Methods**

You can also create a generic method. For this, you need to use the **<T>** keyword before the method’s return type. See the example below.

// Define generic method

T genericMethod<T>(T value) {

return value;

}

void main() {

// call the generic method

print("Int: ${genericMethod<int>(10)}");

print("Double: ${genericMethod<double>(10.5)}");

print("String: ${genericMethod<String>("Hello")}");

}

 Show Output

Int: 10

Double: 10.5

String: Hello

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### **Example 3: Generic Method With Multiple Parameters**

In this example below, you will learn to create a generic method with multiple parameters.

// Define generic method

T genericMethod<T, U>(T value1, U value2) {

return value1;

}

void main() {

// call the generic method

print(genericMethod<int, String>(10, "Hello"));

print(genericMethod<String, int>("Hello", 10));

}

 Show Output

10

Hello

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### **Restricting the Type of Data**

While implementing generics, you can restrict the type of data that can be used with the class or method. This is done by using the **extends** keyword. See the example below.

### **Example 4: Generic Class With Restriction**

In this example below, there is a **Data** class that works only with **int** and **double** types. It will not work with other types..

// Define generic class with bounded type

class Data<T extends num> {

T data;

Data(this.data);

}

void main() {

// create an object of type int and double

Data<int> intData = Data<int>(10);

Data<double> doubleData = Data<double>(10.5);

// print the data

print("IntData: ${intData.data}");

print("DoubleData: ${doubleData.data}");

// Not Possible

// Data<String> stringData = Data<String>("Hello");

}

 Show Output

IntData: 10

DoubleData: 10.5

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### **Example 5: Generic Method With Restriction**

In this example below, a generic method **getAverage** takes two parameters of Type **T**, which is considered a **num**. The method returns the average of the two parameters.

// Define generic method

double getAverage<T extends num>(T value1, T value2) {

return (value1 + value2) / 2;

}

void main() {

// call the generic method

print("Average of int: ${getAverage<int>(10, 20)}");

print("Average of double: ${getAverage<double>(10.5, 20.5)}");

}

 Show Output

Average of int: 15

Average of double: 15.5

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### **Example 6: Generic Class In Dart**

In this example below, there is an abstract class **Shape** with one abstract method called area which returns a double. Also there are two classes that implement Shape, **Circle** and **Rectangle**. There is class **Region** which takes a list of Shape objects and has a method called totalArea which returns the sum of the areas of all the shapes in the list.

// abstract class Shape

abstract class Shape {

// abstract method area

double get area;

}

// class Circle which implements Shape

class Circle implements Shape {

// field radius

final double radius;

// constructor

Circle(this.radius);

// implementation of area method

@override

double get area => 3.14 \* radius \* radius;

}

// class Rectangle which implements Shape

class Rectangle implements Shape {

// fields width and height

final double width;

final double height;

// constructor

Rectangle(this.width, this.height);

// implementation of area method

@override

double get area => width \* height;

}

// Generic class Region

class Region<T extends Shape> {

// field shapes

List<T> shapes;

// constructor

Region({required this.shapes});

// method totalArea

double get totalArea {

double total = 0;

shapes.forEach((shape) {

total += shape.area;

});

return total;

}

}

void main() {

// create objects of Circle and Rectangle

var circle = Circle(10);

var rectangle = Rectangle(10, 20);

// create a list of Shape objects

var region = Region(shapes: [circle, rectangle]);

// print the total area

print("Total Area of Region: ${region.totalArea}");

}

 Show Output

Total Area of Region: 514

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### **Advantages of Generics**

* It solve the problem of type safety.
* It helps to reuse our code.