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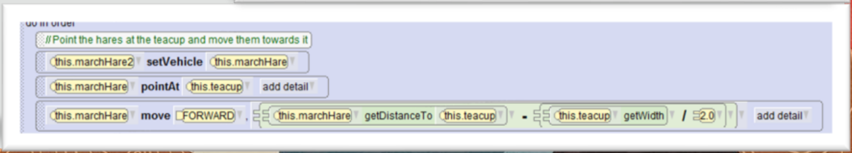
Java Fundamentals

2-9

Expressions



```
do in order
// Point the hares at the teacup and move them towards it
this.marchHare2 setVehicle this.marchHare
this.marchHare pointAt this.teacup add detail
this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - this.teacup getWidth / 2.0 add detail
```

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Objectives

- This lesson covers the following objectives:
  - Create an expression to perform a math operation
  - Interpret a math expression

Using Expressions

- Expressions are a combination of values that, when arranged correctly, result in a final value
- Expressions are typically used in Alice 3 to solve timing and distance problems in your programs
- Example: 2 + 2 = 4
  - Two values (2, 2) and the operator (+) result in the final value (4)

Expressions in Alice 3

- Expressions are created in Alice 3 using the following built-in math operators:
  - Add (**+**)
  - Subtract (**-**)
  - Multiply (*****)
  - Divide (**/**)

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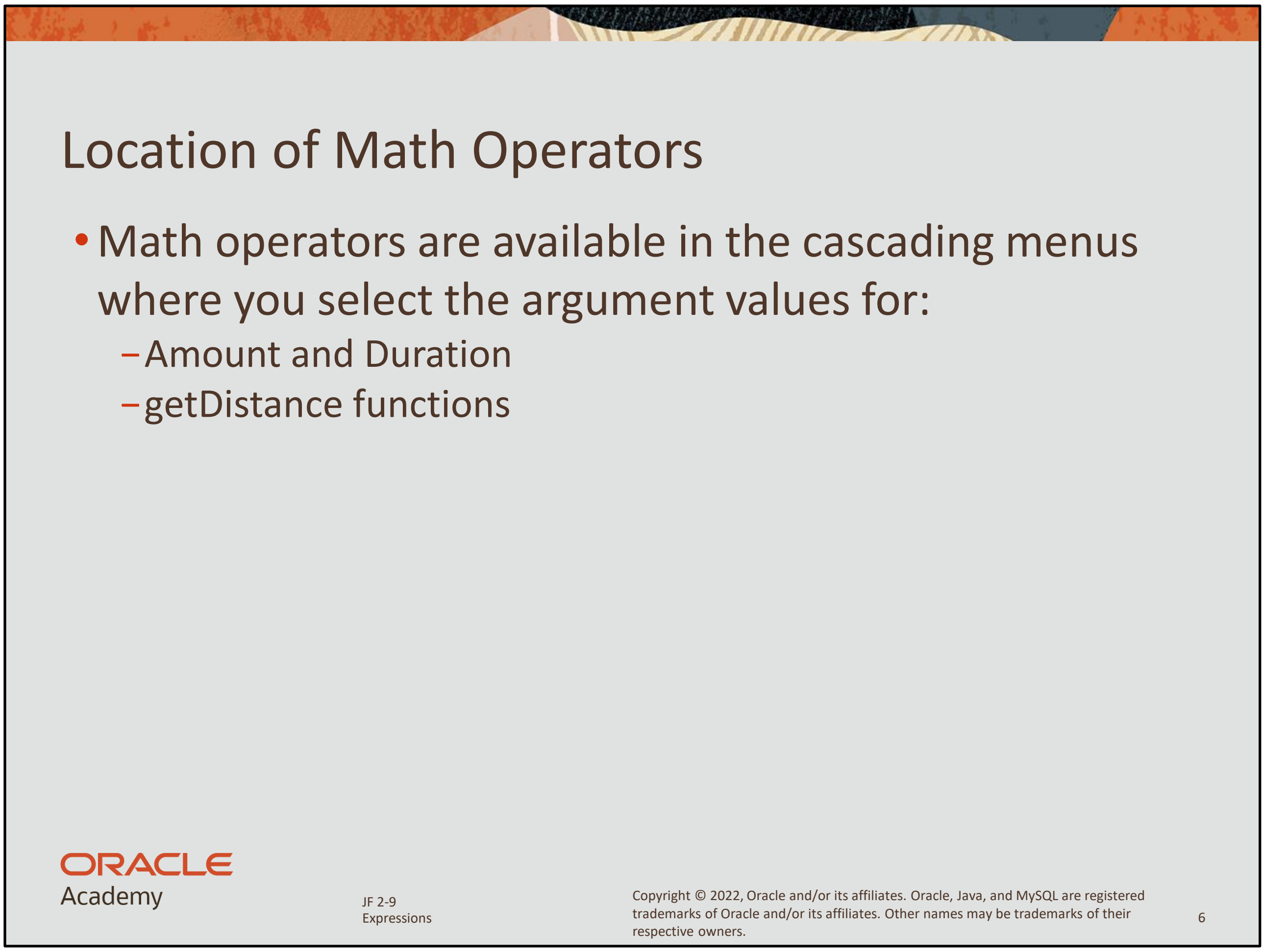

Location of Math Operators

- Math operators are available in the cascading menus where you select the argument values for:
  - Amount and Duration
  - getDistance functions

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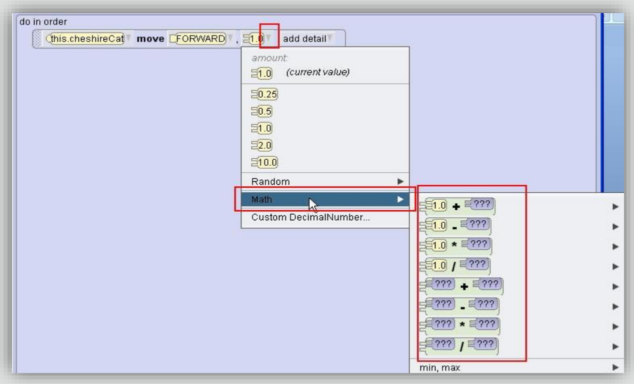
Expressions

You should already be familiar with math expressions as they have been introduced in previous chapters of the course.

View Expressions in a Distance Argument

- Select the Math option to view the available math operators in a procedure's distance argument
- Select from two different sets of math expressions:
  - The first set lets you specify the value of one operator
  - The second set lets you specify the values of both operators



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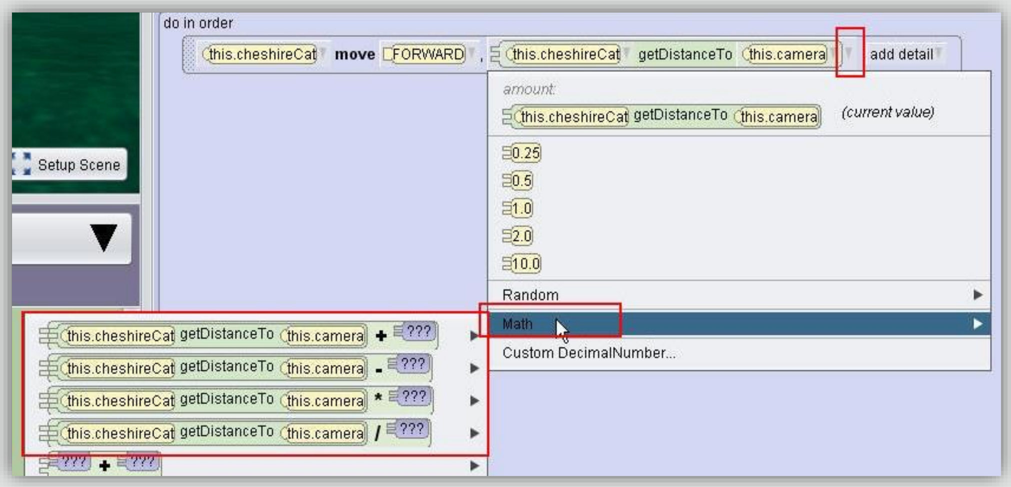
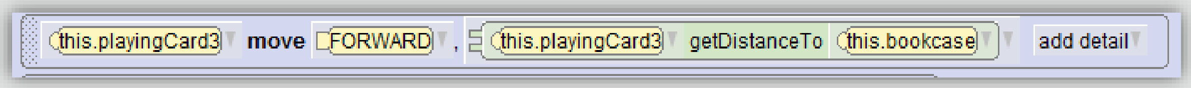
getDistanceTo Function Display

- Select the Math option to view the available math operators for the getDistanceTo function's argument


do in order
this.cheshireCat move FORWARD , this.cheshireCat getDistanceTo this.camera add detail
amount:
this.cheshireCat getDistanceTo this.camera (current value)
0.25
0.5
1.0
2.0
10.0
Random
Math
Custom DecimalNumber...
Setup Scene
this.cheshireCat getDistanceTo this.camera + ???
this.cheshireCat getDistanceTo this.camera - ???
this.cheshireCat getDistanceTo this.camera * ???
this.cheshireCat getDistanceTo this.camera / ???
??? + ???

Distance Problem

- The problem:
  - A PlayingCard object moves to the center of the bookcase, rather than near it
  - This is because the getDistanceTo function calculates the distance from the center of the person object to the center of the target object (bookcase)
  - We need to reduce the distance the PlayingCard object moves so it does not collide with the bookcase
  - A math calculation is used to reduce the distance the PlayingCard object moves



```
this.playingCard3 move FORWARD , this.playingCard3 getDistanceTo this.bookcase add detail
```

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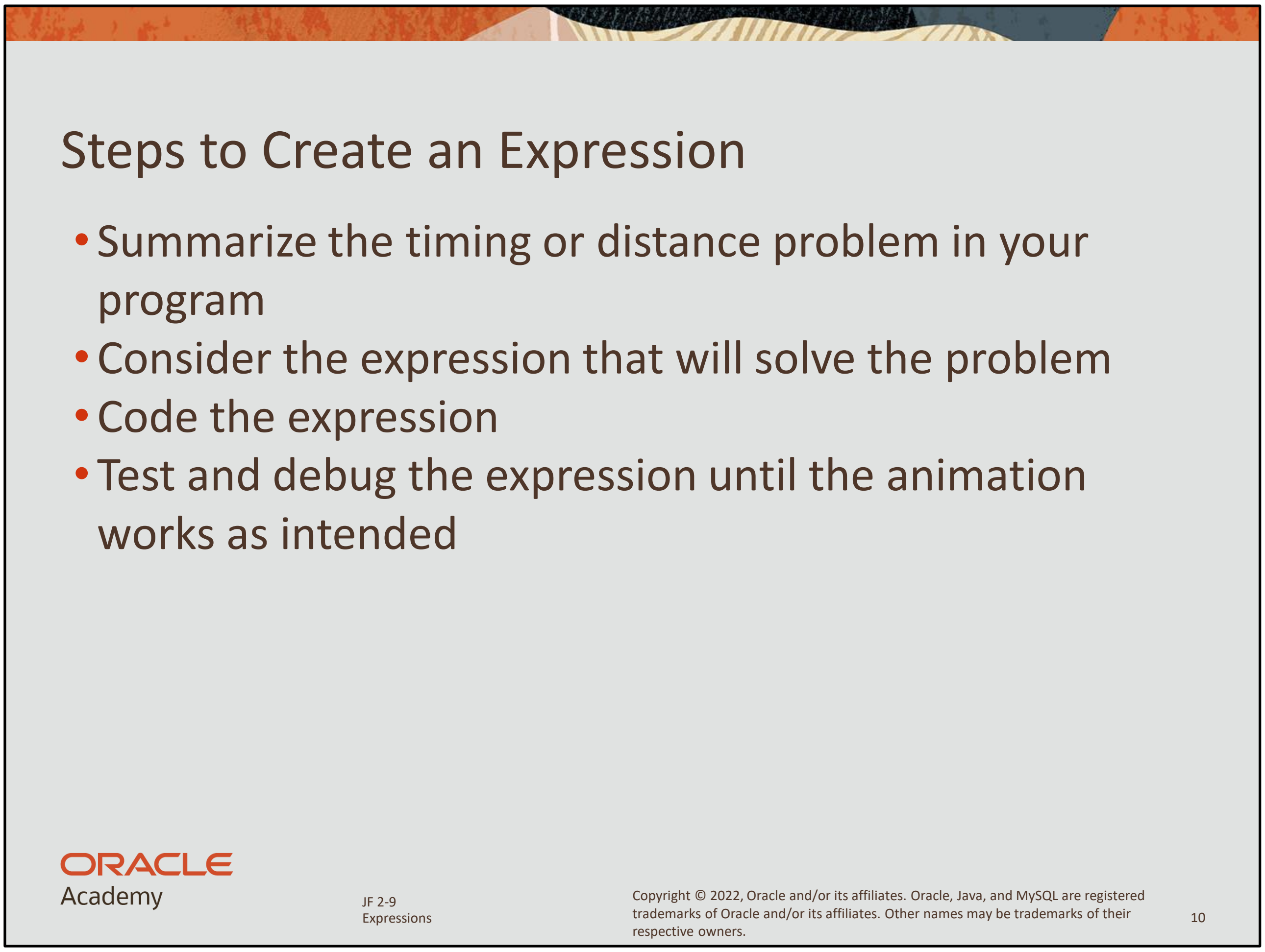
Expressions

This problem has already been looked at in a previous chapter so you should be familiar with the concept if not the method of execution. An object is defined by its center point position. Therefore when two objects move to the same position in your scene they will meet at their center .



Steps to Create an Expression

- Summarize the timing or distance problem in your program
- Consider the expression that will solve the problem
- Code the expression
- Test and debug the expression until the animation works as intended

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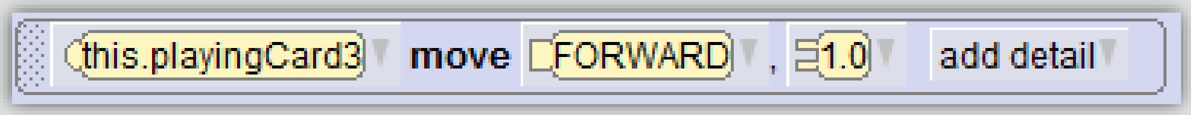
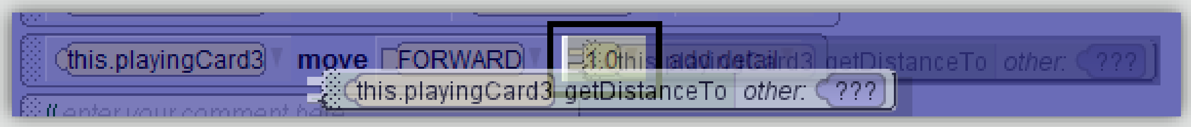
An expression is something that may have to be designed further from your initial design. If your initial design states that an object should move to another object, then you will have to refine that to design the actual expression required to fulfill the task.

Steps to Move an Object the Distance to Another Object

1. Drag the move procedure for an object into the Code editor
2. Select forward and a distance placeholder value



3. From the Functions tab, drag the getDistanceTo function onto the distance argument placeholder


this.playingCard3
move
FORWARD
1.0
add detail
this.playingCard3 getDistanceTo other: ???
// enter your comment here

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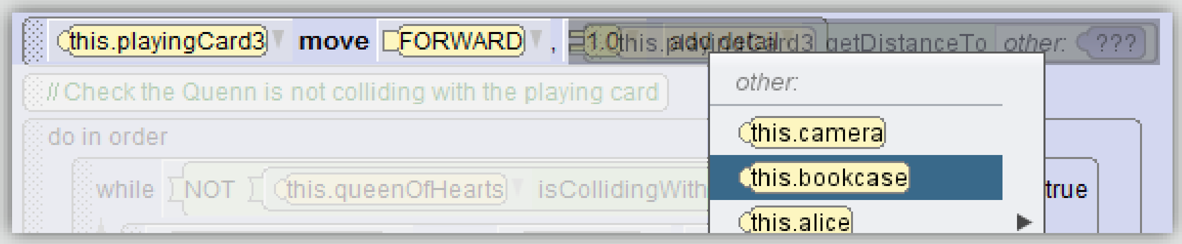
Follow the steps on the subsequent slides to ensure correct creation of an expression within Alice 3.

Steps to Move an Object the Distance to Another Object

4. From the cascading menu, select the target object to which the object should move


this.playingCard3
move
FORWARD
1.0
this.playingCard3 getDistanceTo other: ???
add detail
// Check the Quenn is not colliding with the playing card
do in order
while NOT this.queenOfHearts isCollidingWith
true
other:
this.camera
this.bookcase
this.alice

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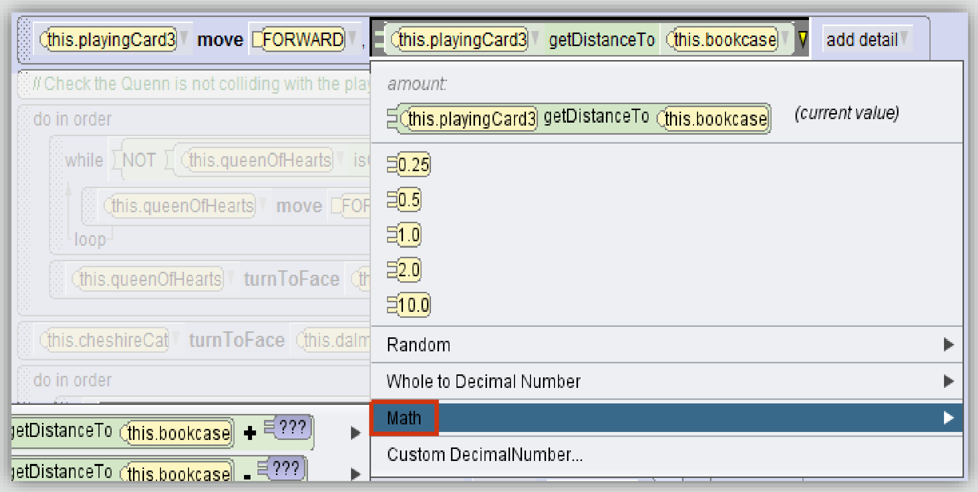
Follow the steps on the subsequent slides to ensure correct creation of an expression within Alice 3.

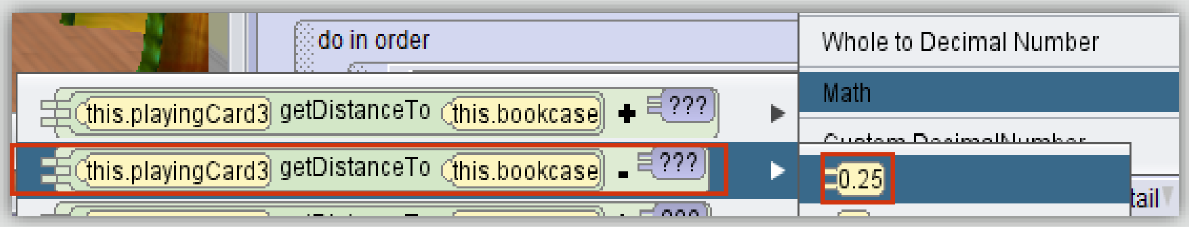
Steps to Modify the Distance Using a Math Operator

- From the getDistanceTo tile, click the outer-most arrow to open the menu of distance values, and then select the Math option


this.playingCard3 move FORWARD
this.playingCard3 getDistanceTo this.bookcase
add detail
// Check the Quenn is not colliding with the play
do in order
while NOT this.queenOfHearts is
this.queenOfHearts move FOR
loop
this.queenOfHearts turnToFace th
this.cheshireCat turnToFace this.dalm
do in order
getDistanceTo this.bookcase + ???
getDistanceTo this.bookcase - ???
amount:
this.playingCard3 getDistanceTo this.bookcase
(current value)
0.25
0.5
1.0
2.0
10.0
Random
Whole to Decimal Number
Math
Custom DecimalNumber...

Steps to Modify the Distance Using a Math Operator

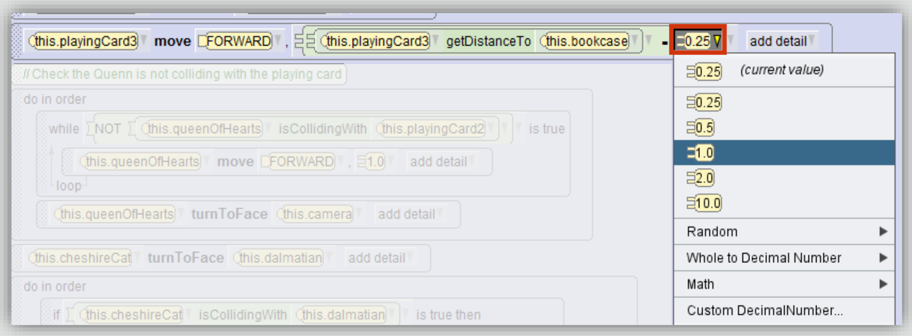
- Select getDistanceTo - ???
- Select a default value to reduce the distance by, or select Custom DecimalNumber… to enter a value


do in order
this.playingCard3 getDistanceTo this.bookcase + ???
this.playingCard3 getDistanceTo this.bookcase - ???
Whole to Decimal Number
Math
0.25

- Test and debug the expression as necessary

Editing the Expression

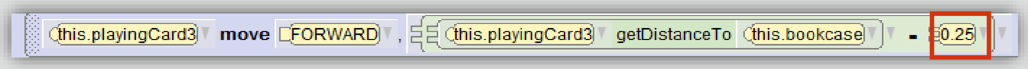
- During the debugging process, you may need to adjust the value of the expression
- Click the arrow next to the value, and select a new default value or use the Custom DecimalNumber... menu to select a more defined value



```
this.playingCard3 move FORWARD , this.playingCard3 getDistanceTo this.bookcase - 0.25 add detail
// Check the Quenn is not colliding with the playing card
do in order
    while NOT this.queenOfHearts isCollidingWith this.playingCard2 is true
        this.queenOfHearts move FORWARD , 1.0 add detail
    loop
    this.queenOfHearts turnToFace this.camera add detail
this.cheshireCat turnToFace this.dalmatian add detail
do in order
    if this.cheshireCat isCollidingWith this.dalmatian is true then
```

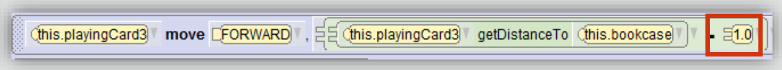
Expression Example

- This expression reduces the distance that the Playing Card travels so that it does not collide with the bookcase
- This was tested and debugged several times until the correct expression was achieved
- With a value of 0.25 the Playing card was still too close



```
this.playingCard3 move FORWARD , this.playingCard3 getDistanceTo this.bookcase - 0.25
```

- With a value of 1.0 the distance is correct



```
this.playingCard3 move FORWARD , this.playingCard3 getDistanceTo this.bookcase - 1.0
```

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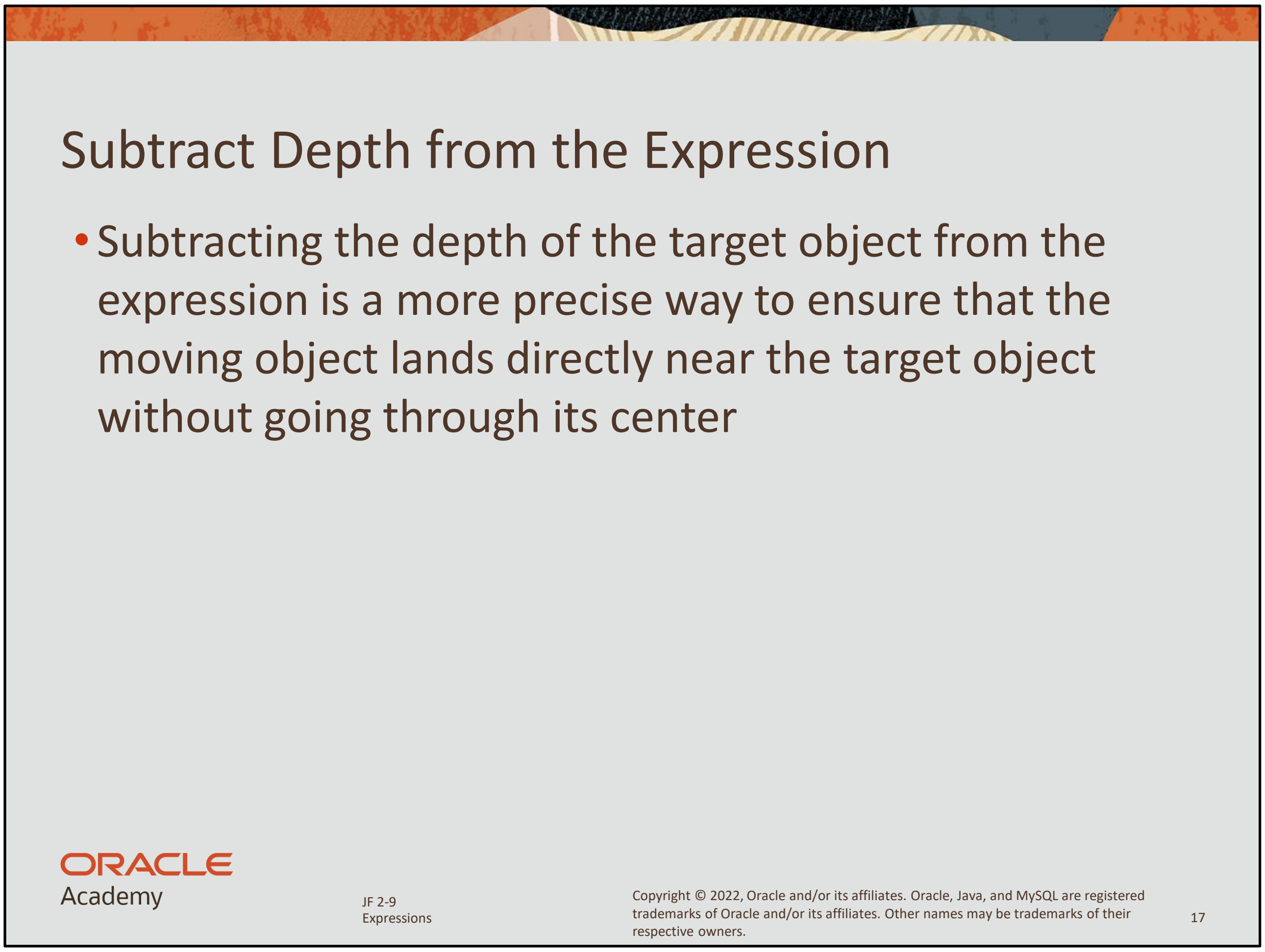


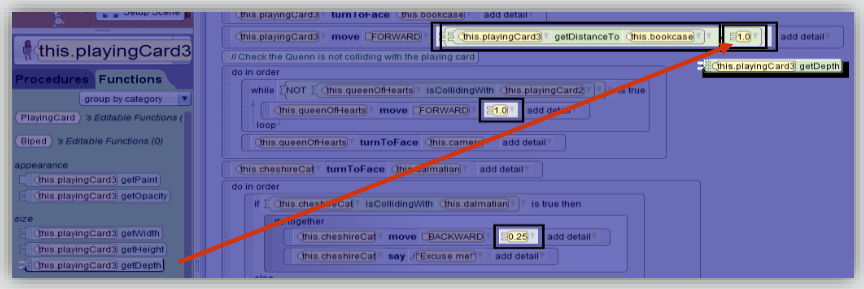
Subtract Depth from the Expression

- Subtracting the depth of the target object from the expression is a more precise way to ensure that the moving object lands directly near the target object without going through its center

Although hard coding values works for this particular example, hard coded values are never a good idea in programming. If you want to create code that can easily be re-used then you need to use variables instead of hard coded values.

Steps to Subtract Depth from Expression

- Select the target object in the instance menu
- From the Functions tab, drag the getDepth tile onto the existing distance value in the expression


this.playingCard3
Procedures
Functions
group by category
PlayingCard 's Editable Functions (
Biped 's Editable Functions (0)
appearance
this.playingCard3 getPaint
this.playingCard3 getOpacity
size
this.playingCard3 getWidth
this.playingCard3 getHeight
this.playingCard3 getDepth

```
this.playingCard3 turnToFace this.bookcase add detail
this.playingCard3 move FORWARD this.playingCard3 getDistanceTo this.bookcase 1.0 add detail
                                                          this.playingCard3 getDepth
// Check the Quenn is not colliding with the playing card
do in order
    while NOT this.queenOfHearts isCollidingWith this.playingCard2 is true
        this.queenOfHearts move FORWARD 1.0 add detail
    loop
    this.queenOfHearts turnToFace this.camera add detail
this.cheshireCat turnToFace this.dalmatian add detail
do in order
    if this.cheshireCat isCollidingWith this.dalmatian is true then
        do together
            this.cheshireCat move BACKWARD 0.25 add detail
            this.cheshireCat say "Excuse me!" add detail
```

- Test and debug the animation, and adjust the expression as necessary

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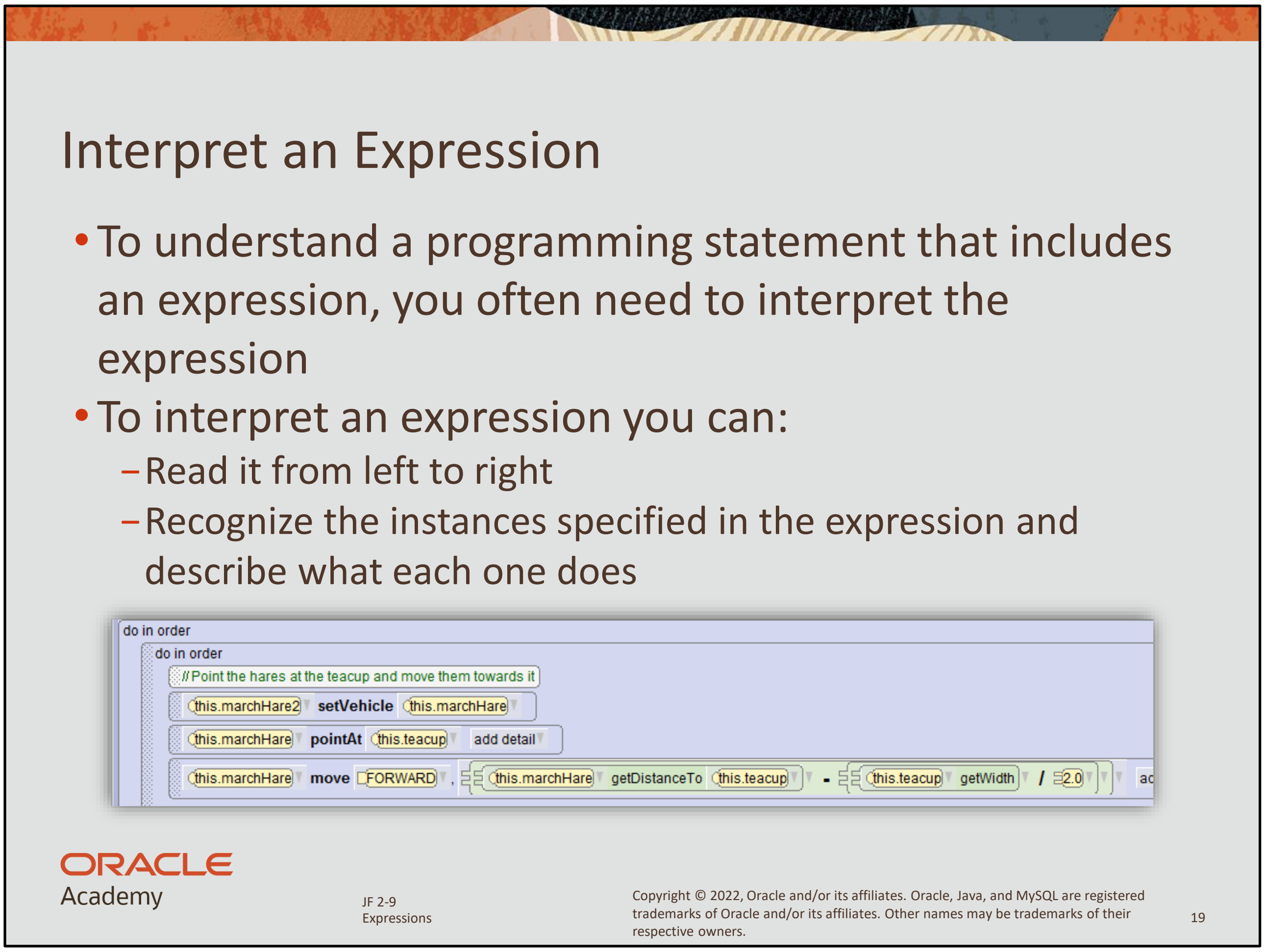
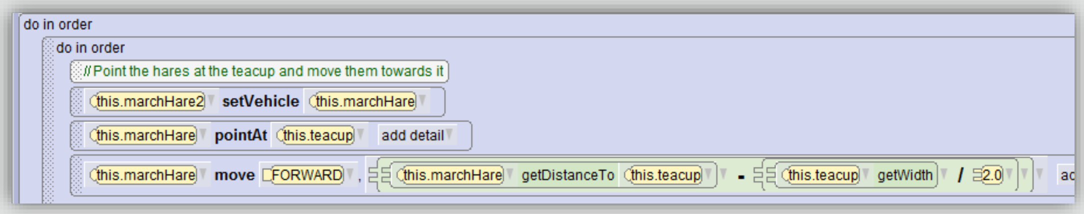
It is always important to test everything you do at regular intervals.



Interpret an Expression

- To understand a programming statement that includes an expression, you often need to interpret the expression
- To interpret an expression you can:
  - Read it from left to right
  - Recognize the instances specified in the expression and describe what each one does



```
do in order
  do in order
    //Point the hares at the teacup and move them towards it
    this.marchHare2 setVehicle this.marchHare
    this.marchHare pointAt this.teacup add detail
    this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - this.teacup getWidth / 2.0 ac
```

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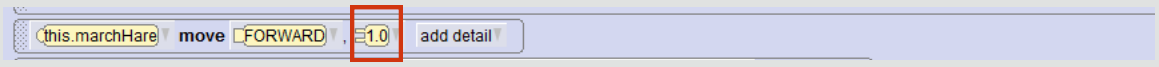
Expressions

Reading code can make a huge difference to your understanding of code. It is a good idea to read other peoples code as well as your own to better your understanding of programming principles.

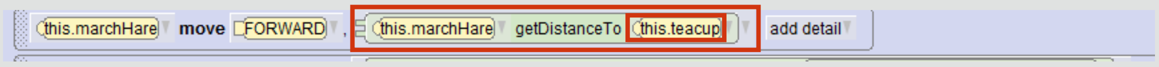
Building the Example Expression

1. Add a move procedure from the marchHare and use a placeholder value



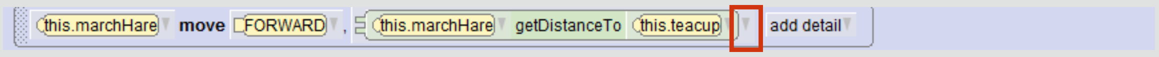
```
this.marchHare move FORWARD , 1.0 add detail
```

2. Drag the getDistanceTo function from the marchHare and choose the teacup as the target object



```
this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup add detail
```

3. Click on the outside arrow of the expression



```
this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup add detail
```

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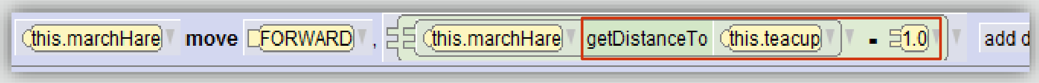
Expressions

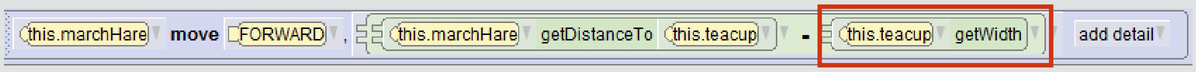
These slides give you a step by step guide on creating the given expression within Alice 3.

Building the Example Expression

4. Choose math from the list and choose the subtract option


this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - 1.0 add d

5. Replace the placeholder value with the getWidth function from the teacup class


this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - this.teacup getWidth add detail

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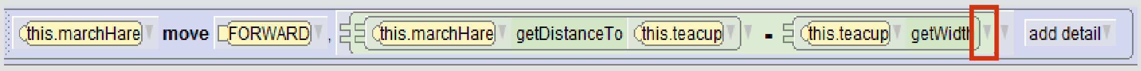
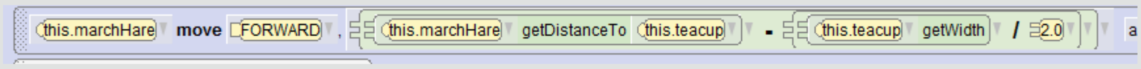
Building the Example Expression

6. Click on the inner arrow after getWidth and choose Math, then the division operator and choose 2 as the value



```
this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - this.teacup getWidth add detail
```

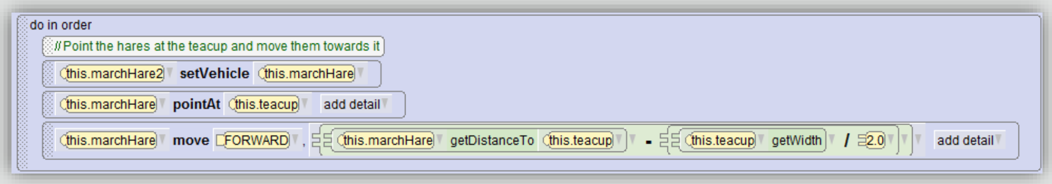
7. This completes the expression that should look like this:



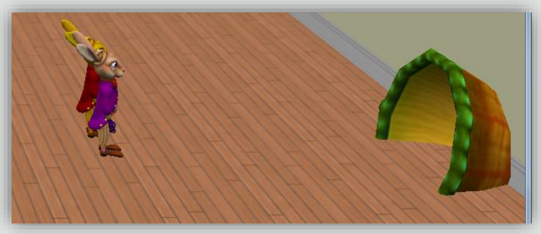
```
this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - this.teacup getWidth / 2.0 a
```

Expression Example

- Examine the visual associated with this expression
- The hares are moving towards the teacup
- Do you think they will go inside?



```
do in order
    // Point the hares at the teacup and move them towards it
    this.marchHare2 setVehicle this.marchHare
    this.marchHare pointAt this.teacup add detail
    this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - this.teacup getWidth / 2.0 add detail
```



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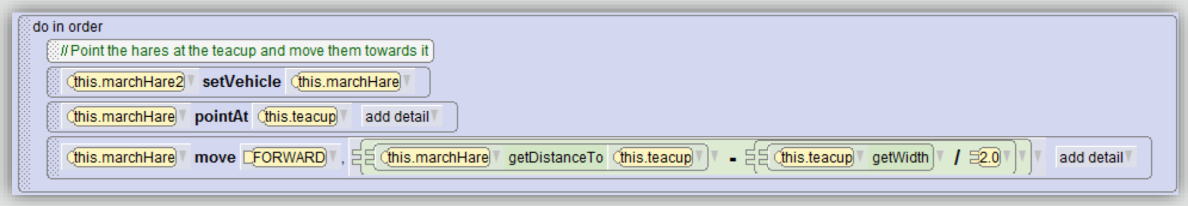
Use your knowledge of reading code to make a decision on the question provided on the slide. The answer will be provided later but what do you think?

Interpretation of an Expression

- This expression tells us the following:
  - The marchHare moves forward towards the teacup
  - The distance between the marchHare and the teacup is determined by the getDistanceTo function
  - The distance traveled is reduced by half the width of the teacup
    - The width of the teacup is determined by the getWidth function



```
do in order
    // Point the hares at the teacup and move them towards it
    this.marchHare2 setVehicle this.marchHare
    this.marchHare pointAt this.teacup add detail
    this.marchHare move FORWARD , this.marchHare getDistanceTo this.teacup - this.teacup getWidth / 2.0 add detail
```

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Formulating the Expression

- To interpret an expression, it is helpful to draw a picture or write the values you know before formulating the expression
- Example:
  - Z = X – (a / b)
    - Z = Distance moved
    - X = Distance from marchHare to teacup
    - a = Teacup width
    - b = 2

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Expression Example Answer

- You were asked if you thought the marchHares would go into the teacup?
- The Answer is: No, they stop outside the teacup
- This is because we used the expression to manipulate the distance between the objects

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Here is the answer to the question posed on slide 21. Were you correct?

Terminology

- Key terms used in this lesson included:
  - Expression
  - Math operator

Summary

- In this lesson, you should have learned how to:
  - Create an expression to perform a math operation
  - Interpret a math expression

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