Name: _____

BOOTSTRAP

www.bootstrapworld.org

Student Workbook

Class: _____

Bootstrap Units

01 Videogames and Coordinate Planes

02 Contracts, Strings, and Images

03 Intro to Definitions

04 Design Recipe

05 Game Animation

06 Comparing Functions

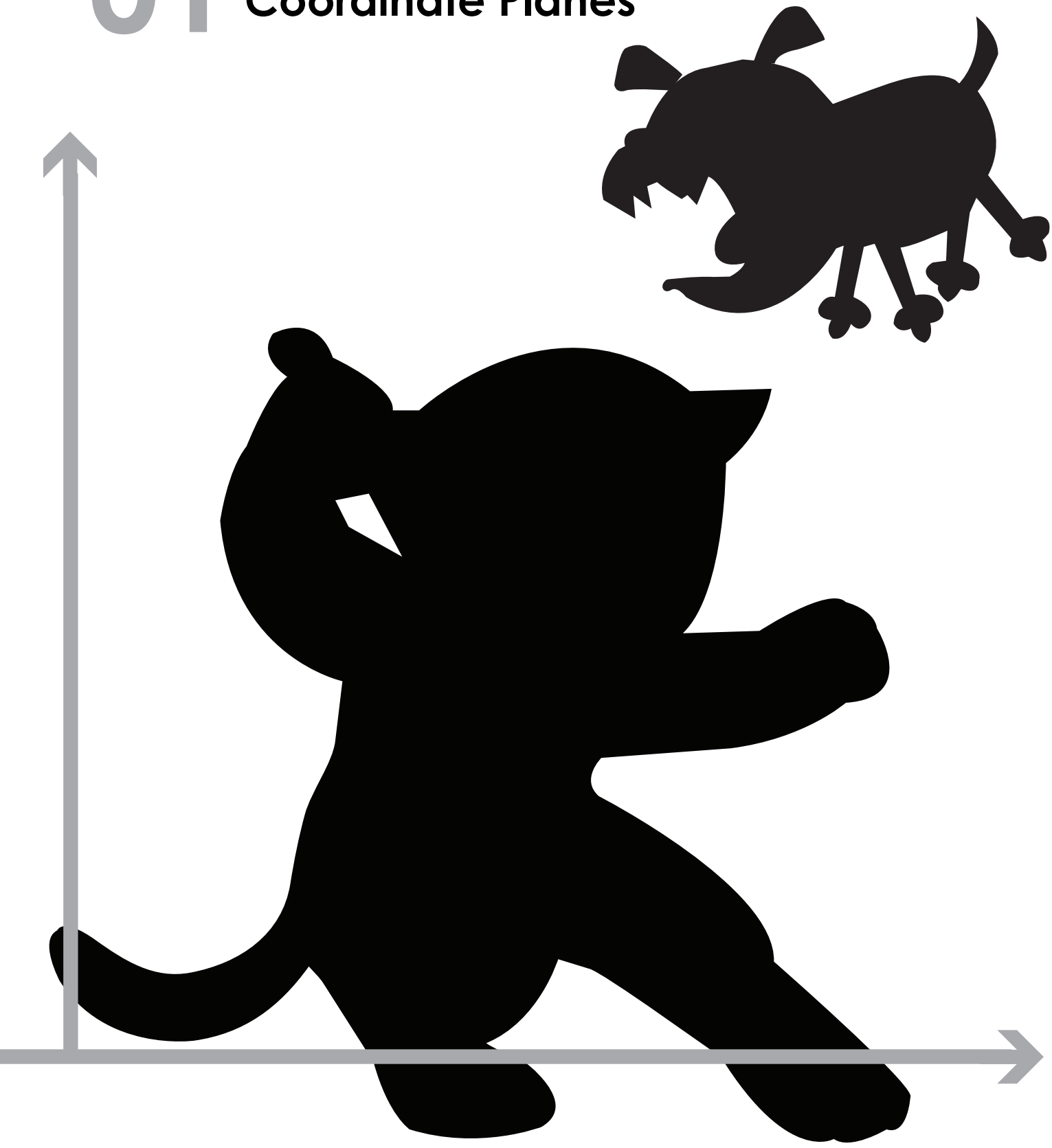
07 Conditional Branching

08 Collision Detection

09 Prepping for Launch

10 Additional Material

01 Videogames and Coordinate Planes



Lesson 1

Reverse-Engineering: How does NinjaCat work?

Thing in the game…	What changes about it?	More specifically...
cloud	*position*	*x-coordinate*

Finding Coordinates

The coordinates for the PLAYER (NinjaCat) are: (,)

x-coordinate *y-coordinate*

The coordinates for the DANGER (Dog) are: (,)

The coordinates for the TARGET (Ruby) are: (,)

Our Videogame

Created by (write your names): _____

Background

Our game takes place in: _____
(space? the desert? a mall?)

The Player

The player is a _____.

The player moves only up and down.

The Target

Your player GAINS points when they hit the target.

The Target is a _____.

The Target moves only to the left and right.

The Danger

Your player LOSES points when they hit the danger.

The Danger is a _____.

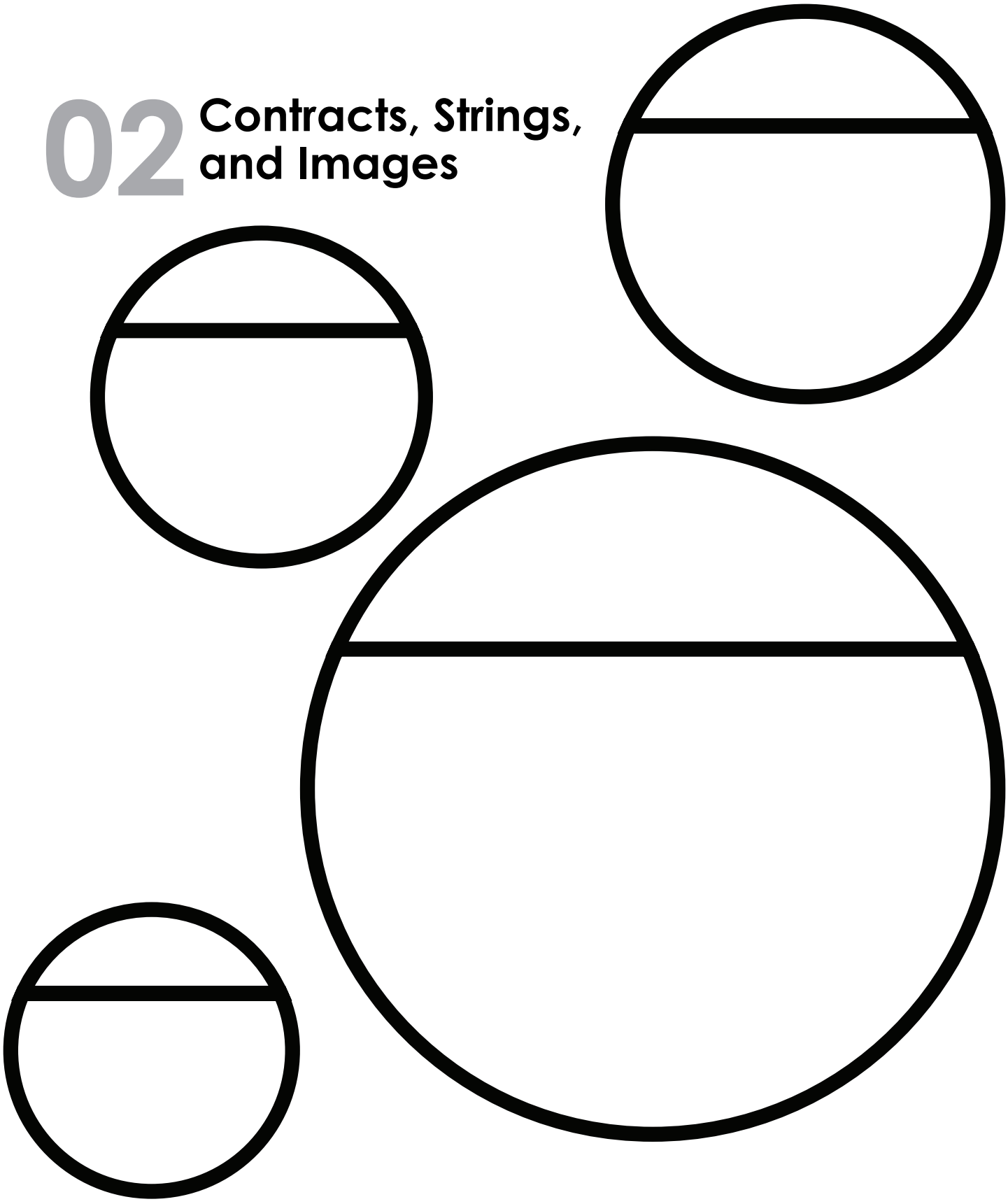
The Danger moves only to the left and right.

Circle of Evaluation Practice **Time: 5 minutes**

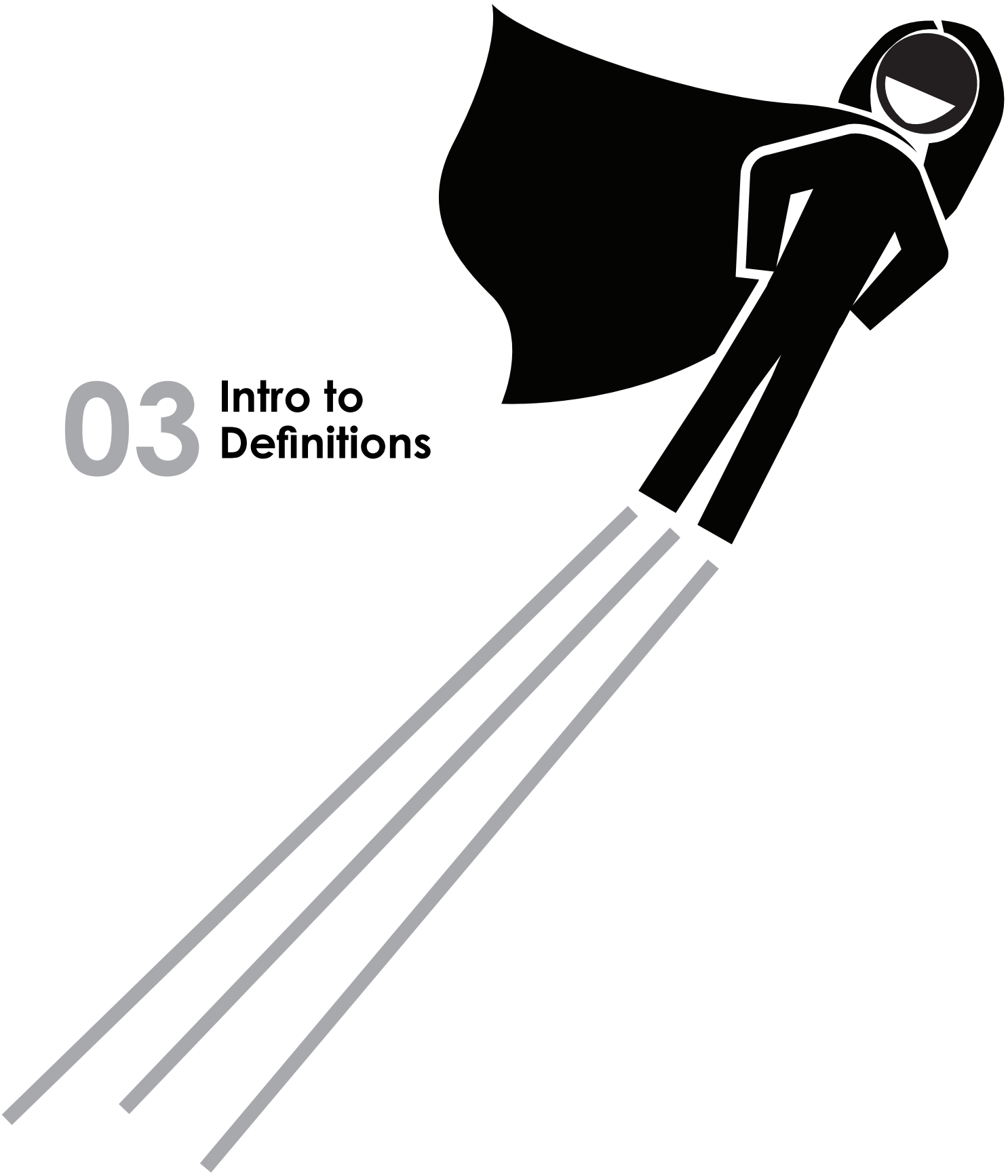
Don't forget to use the computer's symbols for things like multiply and divide!

Math	***Circle of Evaluation***	***Pyret Code***
5 x 10		
8 + (5 x 10)		
(8 + 2) - (5 x 10)		
$\frac{5 \times 10}{8 - 2}$		

02 Contracts, Strings, and Images



Circles Competition			Time: 5 minutes
	Math	***Circle of Evaluation***	***Pyret Code***
Round 1	*(3 * 7) - (1 + 2)*		
Round 2	*3 - (1 + 2)*		
Round 3	*3 - (1 + (5 * 6))*		
Round 4	*(1 + (5 * 6)) - 3*		



03 Intro to Definitions

Fast Functions

_____::_____ -> _____

name domain range

examples:

_____(_____) **is** _____

_____(_____) **is** _____

end

fun _____(_____): _____ **end**

_____::_____ -> _____

name domain range

examples:

_____(_____) **is** _____

_____(_____) **is** _____

end

fun _____(_____): _____ **end**

_____::_____ -> _____

name domain range

examples:

_____(_____) **is** _____

_____(_____) **is** _____

end

fun _____(_____): _____ **end**

Fast Functions

_____::_____ -> _____

name domain range

examples:

_____(_____) **is** _____

_____(_____) **is** _____

end

fun _____(_____): _____ **end**

_____::_____ -> _____

name domain range

examples:

_____(_____) **is** _____

_____(_____) **is** _____

end

fun _____(_____): _____ **end**

_____::_____ -> _____

name domain range

examples:

_____(_____) **is** _____

_____(_____) **is** _____

end

fun _____(_____): _____ **end**

---

04 Design Recipe

1 Contract

2 Example

3 Definition

Word Problem: rocket-height

Directions: *A rocket blasts off, traveling at 7 meters per second. Write a function called 'rocket-height' that takes in the number of seconds that have passed since the rocket took off, and which produces the height of the rocket at that time.*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

_____

what the function does with those variables

end

Word Problem: red-square

Directions: *Use the Design Recipe to write a function 'red-square', which takes in a number (the side of the square) and outputs a solid red rectangle whose length and width are the same size.*

Contract and Purpose Statement

Every contract has three parts...

_____ `::` _____ `->` _____

function name *domain* *range*

`#` _____

what does the function do?

Examples

Write some examples, then circle and label what changes...

`examples:`

_____ `(` _____ `) is`

function name *input(s)*

_____

what the function produces

_____ `(` _____ `) is`

function name *input(s)*

_____

what the function produces

`end`

Definition

Write the definition, given variable names to all your input values...

`fun` _____ `(` _____ `):`

function name *variables*

_____

what the function does with those variables

`end`

Word Problem: lawn-area

Directions: *Use the Design Recipe to write a function 'lawn-area', which takes in the width and length of a lawn, and returns the area of the lawn. (Don't forget: area = length * width!)*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

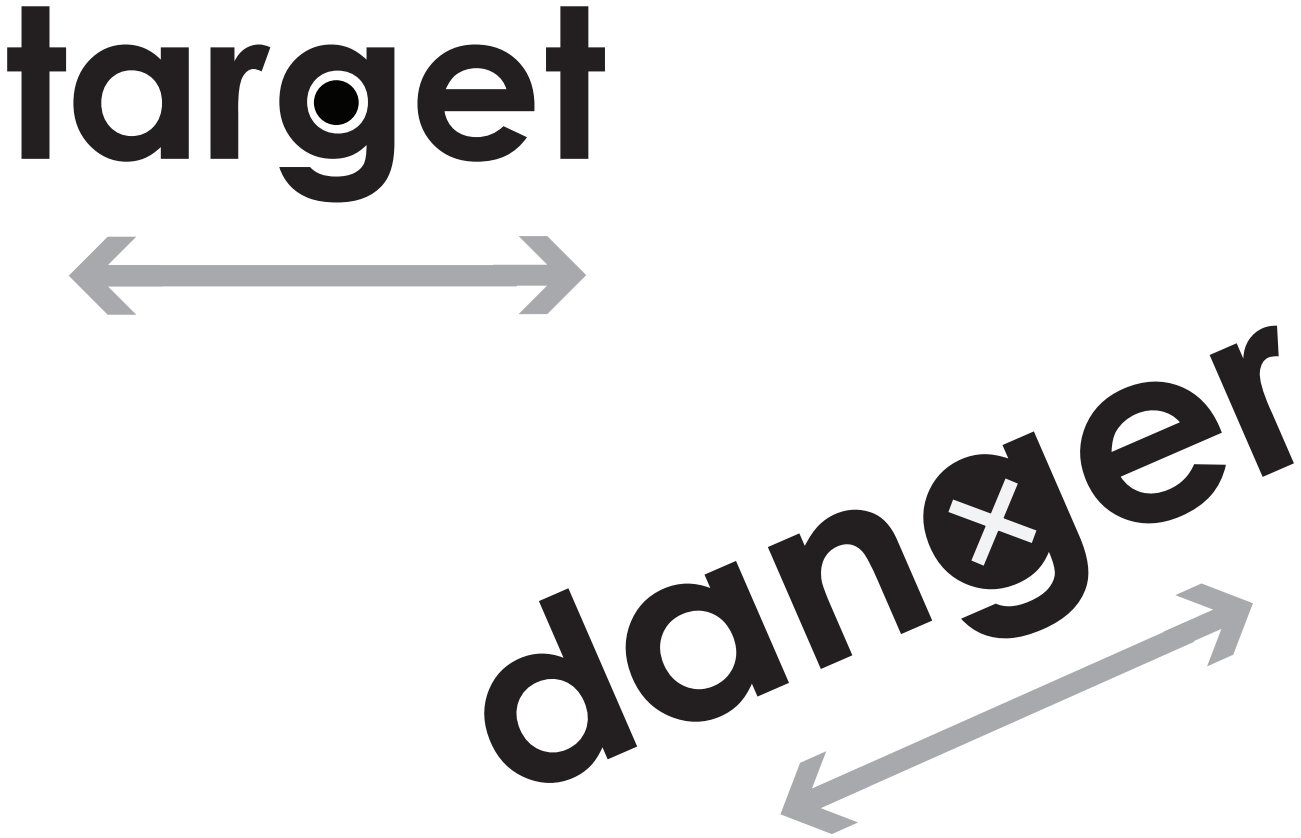
fun _____ **(** _____ **):**

function name *variables*

_____

what the function does with those variables

end



05 Game Animation

Word Problem: update-danger

Directions: *Use the Design Recipe to write a function 'update-danger', which takes in the danger's x-coordinate and y-coordinate and produces the next x-coordinate, which is 50 pixels to the left.*

Contract and Purpose Statement

Every contract has three parts...

_____ `::` _____ `->` _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

`examples:`

_____ `(` _____ `) is` _____

function name *input(s)* *what the function produces*

_____ `(` _____ `) is` _____

function name *input(s)* *what the function produces*

`end`

Definition

Write the definition, given variable names to all your input values...

`fun` _____ `(  x, y  ):`

function name *variables*

_____

what the function does with those variables

`end`

Word Problem: update-target

Directions: *Write a function 'update-target', which takes in the target's x-coordinate and y-coordinate and produces the next x-coordinate, which is 50 pixels to the right.*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

_____

what the function does with those variables

end

06 Comparing Functions

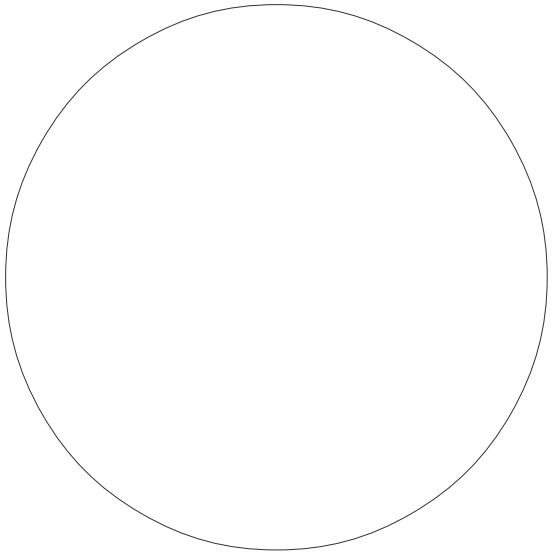
Design Recipe

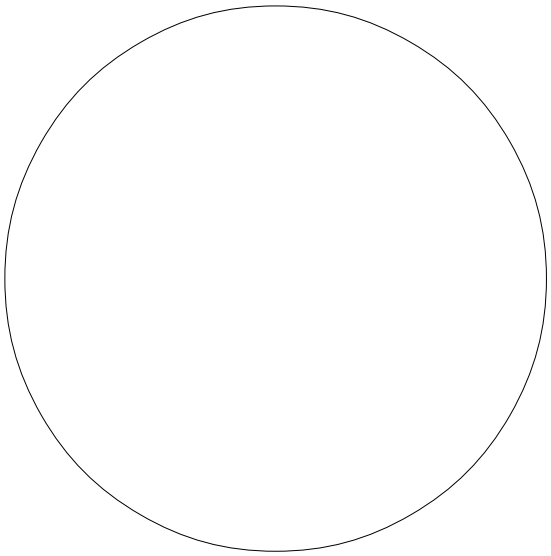
Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

1. A piece of Sam is still visible on the left as long as... $x > -50$

2. A piece of Sam is still visible on the right as long as... _____

3. Draw the Circle of Evaluation for these two expressions in the circles below:





Word Problem: is-safe-left

Directions: *Use the Design Recipe to write a function 'is-safe-left', which takes in an x-coordinate and checks to see if the x-coordinate is greater than -50*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

_____

what the function does with those variables

end

Word Problem: is-safe-right

Directions: *Use the Design Recipe to write a function 'is-safe-right', which takes in an x-coordinate and checks to see if the x-coordinate is less than 690.*

Contract and Purpose Statement

Every contract has three parts...

`_____ :: _____ -> _____`

function name | *domain* | *range*

`#` _____

what does the function do?

Examples

Write some examples, then circle and label what changes...

`examples:`

`_____ ( _____ ) is _____`

function name | *input(s)* | *what the function produces*

`_____ ( _____ ) is _____`

function name | *input(s)* | *what the function produces*

`end`

Definition

Write the definition, given variable names to all your input values...

`fun` `_____ ( _____ ):`

function name | *variables*

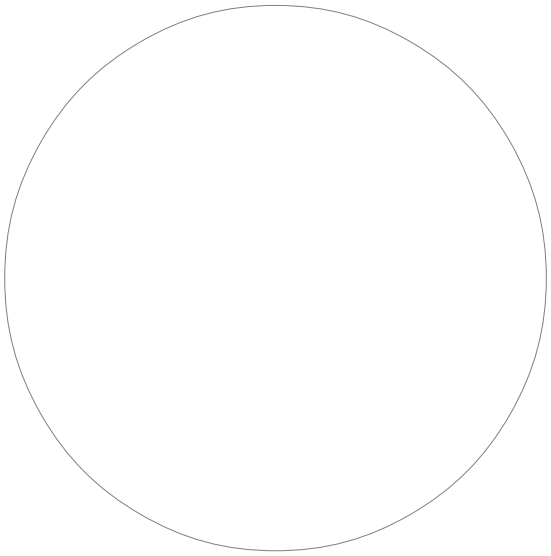
_____

what the function does with those variables

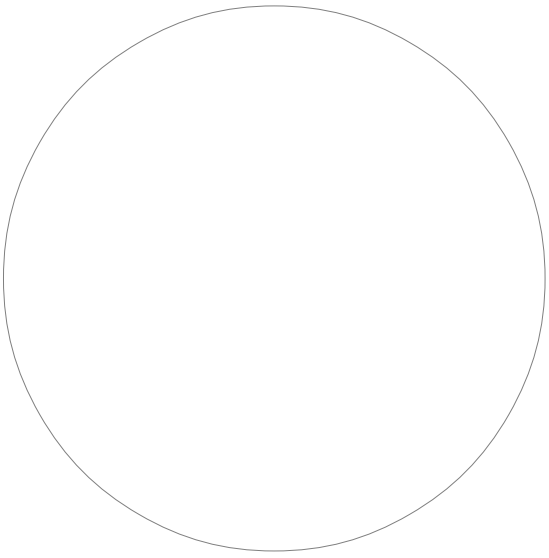
`end`

Write the Circles of Evaluation for these statements, and then convert them to Pyret

1. Two is less than five, *and* zero is equal to six.



2. Two is less than four *or* four is equal to six.



Word Problem: is-onscreen

Directions: *Use the Design Recipe to write a function 'is-onscreen', which takes in an x- and y-coordinate and checks to see if Sam is safe on the left AND safe on the right.*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

_____ **(** _____ **) is**

function name *input(s)*

_____

what the function produces

_____ **(** _____ **) is**

function name *input(s)*

_____

what the function produces

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

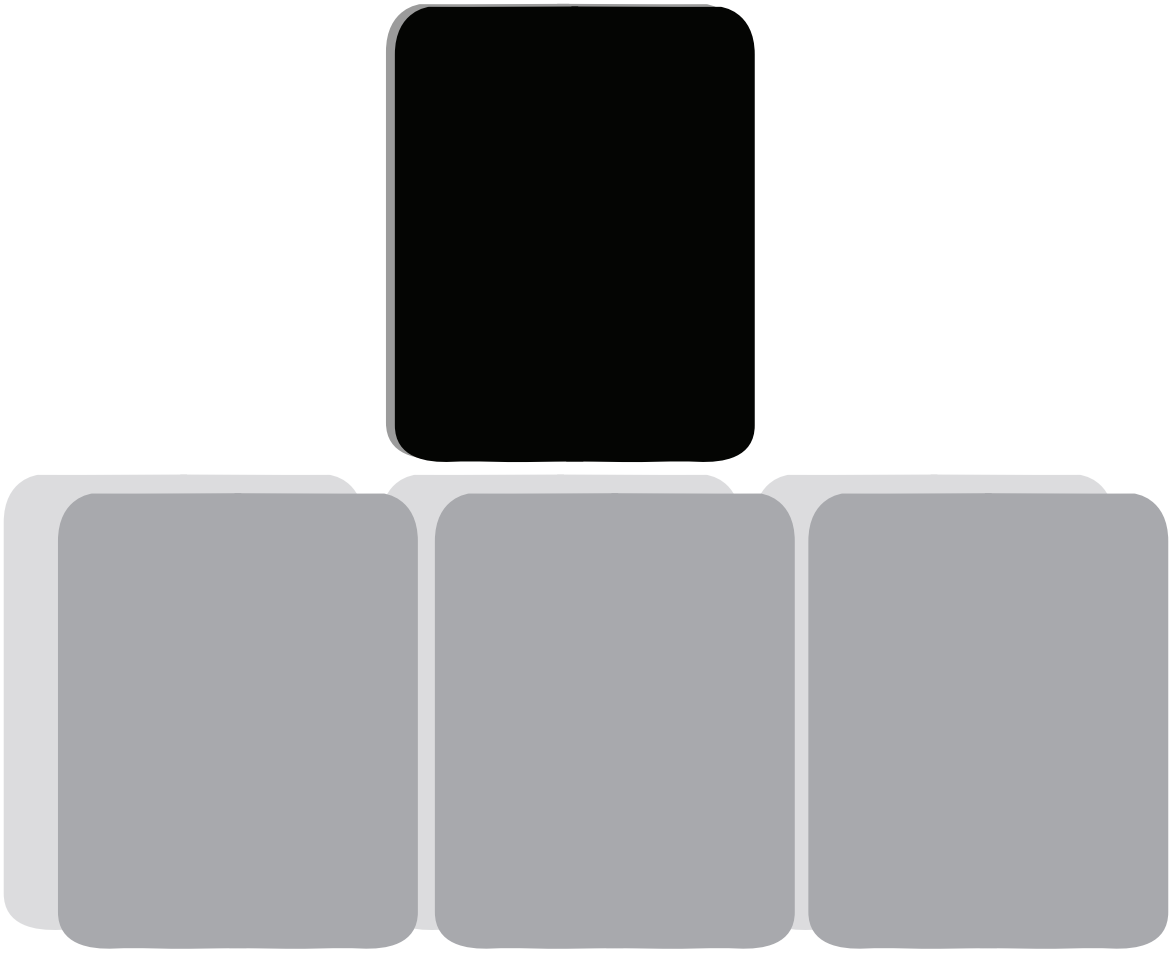
function name *variables*

_____

what the function does with those variables

end

07 Conditional Branching



Word Problem: cost

Directions: *Luigi's Pizza has hired you as a programmer. They offer Pepperoni ($10.50), Cheese ($9.00), Chicken ($11.25) and Broccoli ($10.25). Write a function called "cost" which takes in the name of a topping and outputs the cost of a pizza with that topping.*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

cost **(** "pepperoni" **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

if _____ **:** _____

else if _____ **:** _____

else if _____ **:** _____

else if _____ **:** _____

else: _____

end

end

Word Problem: update-player

Directions: *Write a function called "update-player", which takes in the player's x-coordinate and y-coordinate, and the name of the key pressed, and returns the new y-coordinate.*

Contract and Purpose Statement

Every contract has three parts...

_____ :: _____ -> _____

function name *domain* *range*

\# _____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

update-player (100, 320, "up") is _____

function name *input(s)* *what the function produces*

update-player (200, 100, "up") is _____

function name *input(s)* *what the function produces*

_____ (_____) is _____

function name *input(s)* *what the function produces*

_____ (_____) is _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ (_____):

function name *variables*

  if _____ : _____

  else if _____ : _____

  else: _____

  end

end

08 Collision Detection

collision

distance

Word Problem: line-length

Directions: *Write a function called 'line-length', which takes in two numbers and returns the *positive difference* between them. It should always subtract the smaller number from the bigger one, and if they are equal it should return zero.*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

`line-length` **(** `10, 5` **) is** `10 - 5`

function name *input(s)* *what the function produces*

`line-length` **(** `2, 8` **) is** `8 - 2`

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

if _____ **:** _____

else: _____

end

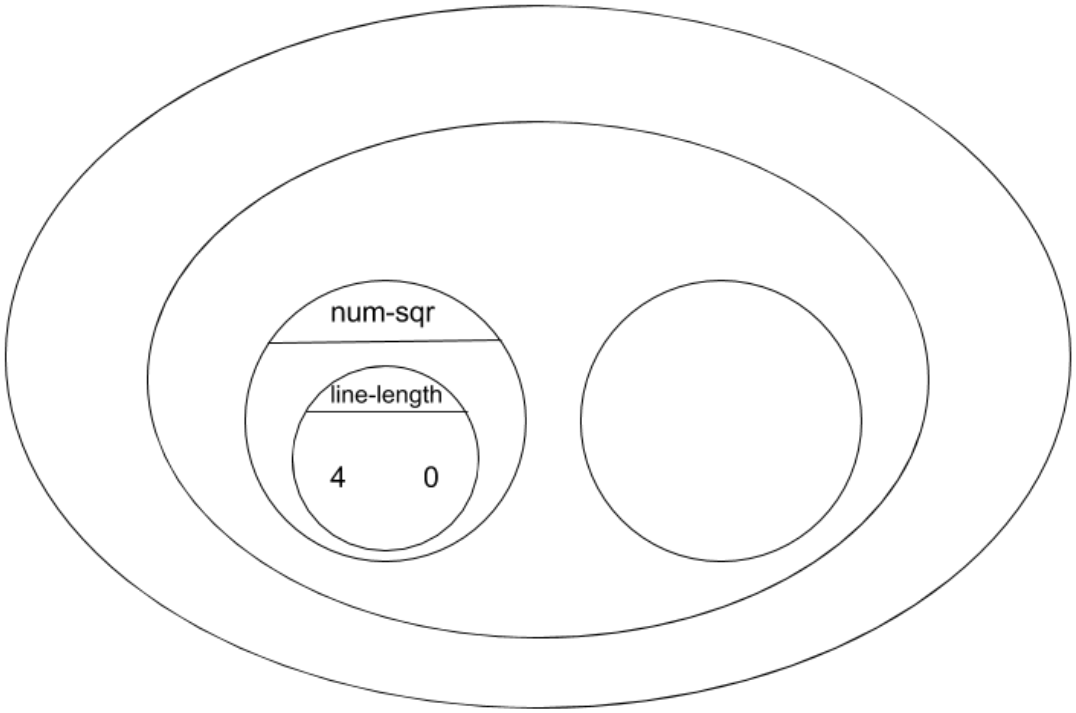
end

The Distance Formula (an example)

The distance between the points (0, 0) and (4, 3) is given by:

$$\sqrt{\texttt{line-length}(4,0)^2 + \texttt{line-length}(3,0)^2}$$

Turn the formula above into a Circle of Evaluation. (We've already gotten you started!)



Convert the Circle of Evaluation into Pyret code:

Word Problem: distance

Directions: *Write a function "distance", which takes FOUR inputs:*

- *px: The x-coordinate of the player*
- *py: The y-coordinate of the player*
- *cx: the x-coordinate of another game character*
- *cy: the y-coordinate of another game character*

It should return the distance between the two, using the Distance formula. (HINT: look at what you did on the previous page!)

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

_____ **(** _____ **) is**

function name *input(s)*

_____

what the function produces

_____ **(** _____ **) is**

function name *input(s)*

_____

what the function produces

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

_____

what the function does with those variables

end

Word Problem: is-collision

Directions: *Write a function "is-collision", which takes FOUR inputs:*

- *px: The x-coordinate of the player*
- *py: The y-coordinate of the player*
- *cx: the x-coordinate of another game character*
- *cy: the y-coordinate of another game character*

Are the coordinates of the player within 50 pixels of the coordinates of the other character?

Contract and Purpose Statement

Every contract has three parts...

_____ `::` _____ `->` _____

function name *domain* *range*

`#` _____

what does the function do?

Examples

Write some examples, then circle and label what changes...

`examples:`

_____ `(` _____ `) is`

function name *input(s)*

_____

what the function produces

_____ `(` _____ `) is`

function name *input(s)*

_____

what the function produces

`end`

Definition

Write the definition, given variable names to all your input values...

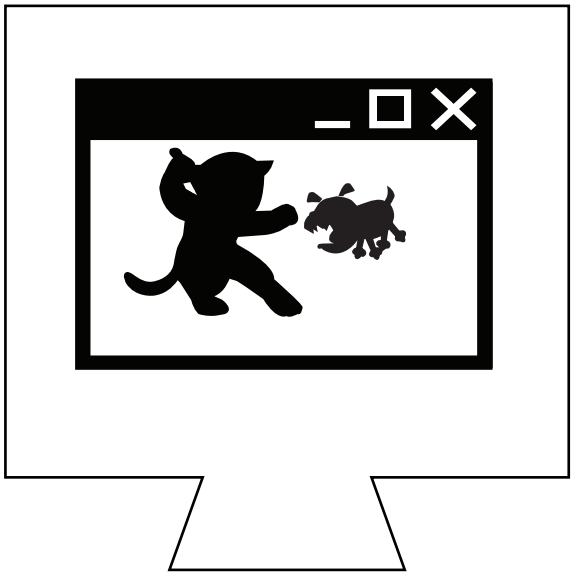
`fun` _____ `(` _____ `):`

function name *variables*

_____

what the function does with those variables

`end`



09 Presentation Preparation

Lesson 9

Catchy Intro:

Name, Age, Grade:

Game Title:

Back Story:

Characters:

Explain a piece of your code:

Presentation Feedback

For each question, circle the answer that fits best.

Was the introduction catchy?	No way!	A little.	Definitely!
Did they talk about their characters?	No way!	A little.	Definitely!
Did they explain the code well?	No way!	A little.	Definitely!
Did they speak slowly enough?	No way!	A little.	Definitely!
Did they speak loudly enough?	No way!	A little.	Definitely!
Were they standing confidently?	No way!	A little.	Definitely!
Did they make eye contact?	No way!	A little.	Definitely!

Presentation Feedback

For each question, circle the answer that fits best.

Was the introduction catchy?	No way!	A little.	Definitely!
Did they talk about their characters?	No way!	A little.	Definitely!
Did they explain the code well?	No way!	A little.	Definitely!
Did they speak slowly enough?	No way!	A little.	Definitely!
Did they speak loudly enough?	No way!	A little.	Definitely!
Were they standing confidently?	No way!	A little.	Definitely!
Did they make eye contact?	No way!	A little.	Definitely!

Word Problem: red-shape

Directions: *Write a function called "red-shape", which takes in the name of a shape and draws that shape (solid and red). Add an otherwise clause that produces a sensible output.*

Contract and Purpose Statement

Every contract has three parts...

_____ :: _____ -> _____

function name *domain* *range*

\# _____

what does the function do?

Examples

Write some examples, then circle and label what changes...

```
examples:
   red-shape    (    "circle"    ) is  circle(50,  "solid",  "red")
```

function name *input(s)* *what the function produces*

_____ (_____) is _____

function name *input(s)* *what the function produces*

_____ (_____) is _____

function name *input(s)* *what the function produces*

_____ (_____) is _____

function name *input(s)* *what the function produces*

_____ (_____) is _____

function name *input(s)* *what the function produces*

```
 end
```

Definition

Write the definition, given variable names to all your input values...

```
fun _____ ( _____ ):
   if _____ :     circle(50,  "solid",  "red")
   else if _____ : _____
   else if _____ : _____
   else if _____ : _____
   else: _____
   end
end
```

function name *variables*

Translating into Algebra

Value Definitions

Pyret Code	Algebra
`x = 10`	x = 10
`y = x * 2`	y = x*2
`z = x / y`	
`w = num-sqrt(num-sqr(x) + 1)`	
`days = (age * 12) * 30`	
`y = (v * x) + x0`	
`y = ((0.5 * a) * num-sqr(x)) + y0`	

Function Definitions

Pyret Code	Algebra

`fun area(length, width):`
`  length * width`
`end`
	area(length, width) = length * width

`pi = 3.1415926`
`fun circle-area(radius):`
`  pi * radius`
`end`	

`fun distance(x1, y1, x2, y2):`
`  num-sqrt(`
`  num-sqr(x1 - x2)`
`  + num-sqr(y1 - y2)`
`  )`
`end`	

Word Problem: rocket-distance

Directions: *A rocket is flying from Earth to Mars at 80 miles per second. Write a function that describes the distance that the rocket has traveled, as a function of time.*

Contract and Purpose Statement

Every contract has three parts...

_____ `::` _____ `->` _____

function name *domain* *range*

`#` _____

what does the function do?

Examples

Write some examples, then circle and label what changes...

`examples:`

`rocket-distance (  0  ) is  80 * 0`

function name *input(s)* *what the function produces*

_____ `(` _____ `) is` _____

function name *input(s)* *what the function produces*

_____ `(` _____ `) is` _____

function name *input(s)* *what the function produces*

_____ `(` _____ `) is` _____

function name *input(s)* *what the function produces*

`end`

Definition

Write the definition, given variable names to all your input values...

`fun` _____ `(` _____ `):`

function name *variables*

_____

what the function does with those variables

`end`

Word Problem: rocket-time

Directions: *A rocket is traveling from Earth to Mars at 80 miles per second. Write a function that describes the time the rocket has been traveling, as a function of distance.*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

_____

what the function does with those variables

end

Word Problem: rocket-collide

Directions: *A rocket leaves Earth, headed for Mars at 80 miles per second. At the exact same time, an asteroid leaves Mars traveling towards Earth, moving at 70 miles per second. If the distance from the Earth to Mars is 50,000,000 miles, how long will it take for them to meet?*

Contract and Purpose Statement

Every contract has three parts...

_____ **::** _____ **->** _____

function name *domain* *range*

_____

what does the function do?

Examples

Write some examples, then circle and label what changes...

examples:

`rocket-collide (  0  ) is  0 / (70 + 80)`

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

_____ **(** _____ **) is** _____

function name *input(s)* *what the function produces*

end

Definition

Write the definition, given variable names to all your input values...

fun _____ **(** _____ **):**

function name *variables*

_____

what the function does with those variables

end

Design Recipe

I. Contract+Purpose Statement

Every contract has three parts:

_____ : _____ -> _____

name Domain Range

_____

What does the function do?

II. Give Examples

Write an example of your function for some sample inputs

_____ is _____

Use the function here What should the function produce?

_____ is _____

Use the function here What should the function produce?

_____ is _____

Use the function here What should the function produce?

_____ is _____

Use the function here What should the function produce?

III. Definition

Write the function, giving variable names to all your input values.

```
fun          (        ):
end
```

Design Recipe

I. Contract+Purpose Statement

Every contract has three parts:

_____ : _____ -> _____

name Domain Range

_____

What does the function do?

II. Give Examples

Write an example of your function for <u>some sample inputs</u>

_____ is _____

Use the function here What should the function produce?

_____ is _____

Use the function here What should the function produce?

_____ is _____

Use the function here What should the function produce?

_____ is _____

Use the function here What should the function produce?

III. Definition

Write the function, giving variable names to all your input values.

```
fun          (        ):
end
```

Contracts

Name	Domain	Range	example
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	

Contracts

Name	Domain	Range	example
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	
	::	->	