Contracts

Name	Domain		Range	example
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	

Contracts

Name	Domain	Range	example
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	
:	..	↑	

Lesson 1

Thing in the game...	What changes about it?	More specifically...
cloud	*position*	*x-coordinate*
Cat	Position	X,y coordinates
Ruby	Position	x-coordinate
Dog	Position	Y-coordinate
Score	Value	
Background	Nothing	

Finding Coordinates

The coordinates for the PLAYER (NinjaCat) are: (150 ,   50   )

x-coordinate   *y-coordinate*

The coordinates for the DANGER (Dog) are: (450 ,   50)

The coordinates for the TARGET (Ruby) are: (550 ,   250)

Our Videogame

Created by (write your names): _____Ellie and Danny_____

Background

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

The Player

The player is a _____Lion_____.

The player moves only up and down.

The Target
Your player GAINS points when they hit the target.

The Target is a _____Escaped gazelle_____.

The Target moves only to the left and right.

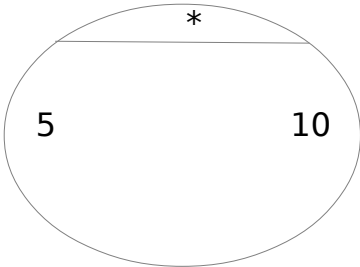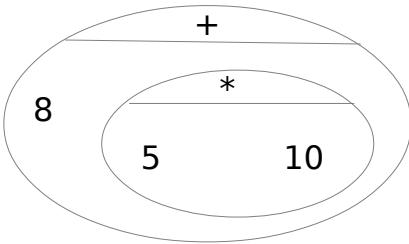## The Danger
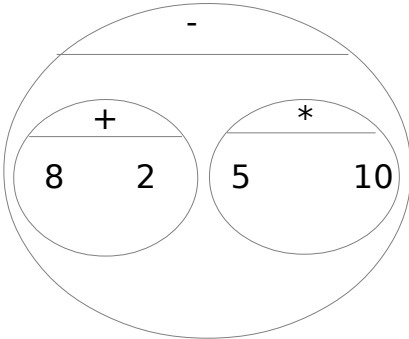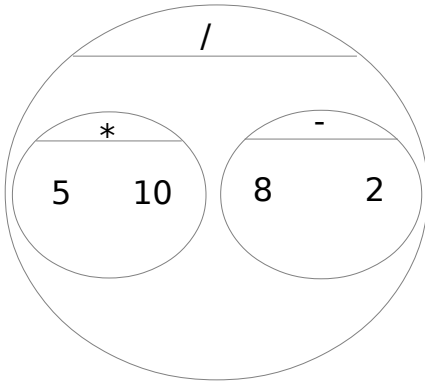*Your player LOSES points when they hit the danger.*

The Danger is a _____Zookeeper_____.

The Danger moves only to the left and right.

Circle of Evaluation Practice   Time: 5 minutes

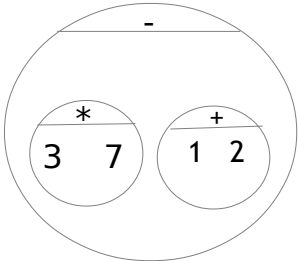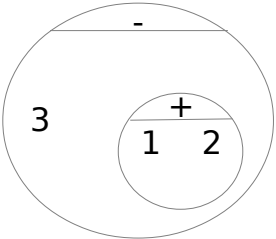Don't forget to use the computer's symbols for things like multiply and divide!
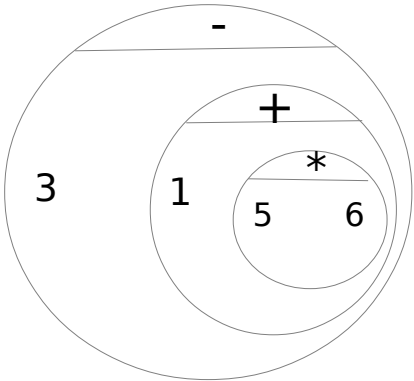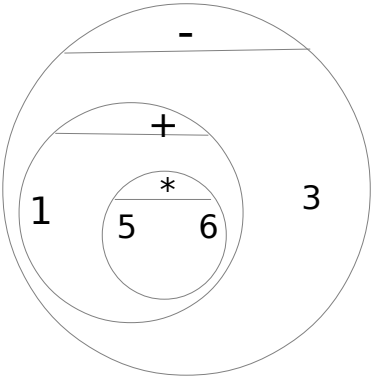
Math	Circle of Evaluation	Pyret Code
5 x 10	* 5 10	5 * 10
8 + (5 x 10)	+ 8 * 5 10	8 + (5 * 10)
(8 + 2) - (5 x 10)	- + 8 2 * 5 10	(8+2) - (5 * 10)
5 x 10 *8 - 2*	/ * 5 10 - 8 2	(5 * 10) / (8 - 2)

Lesson 2

(draw Circles of Evaluation here if you need extra scratch paper)

	Math	Circle of Evaluation	Pyret Code
Round 1	(3 x 7) - (1 + 2)		(3 * 7) - (1 + 2)
Round 2	3 - (1 + 2)		3 - (1 + 2)
Round 3	3 - (1 + (5 x 6))		3 - (1 +(5 * 6))
Round 4	(1 + (5 x 6)) - 3		(1 + (5 * 6)) - 3

Lesson 3

Fast Functions

_____gt_____ :: _____Number_____ -> _____Image_____
     name   domain   range

examples:

    ___gt___ (__7__) **is** ___triangle(7, "solid", "green")___

    ___gt___ (__500__) **is** ___triangle(500, "solid", "green")___

end

fun ___gt___ (_size_) **:** ___triangle(size, "solid", "green")___ **end**

_____bc_____ :: _____Number_____ -> _____Image_____
     name   domain   range

examples:

    ___gt___ (__19__) **is** ___circle(19, "solid", "blue")___

    ___gt___ (__43__) **is** ___circle(43, "solid", "blue")___

end

fun ___bc___ (_size_) **:** ___circle(size, "solid", "blue")___ **end**

_____dot_____ :: _____String_____ -> _____Image_____
     name   domain   range

examples:

    ___dot___ (_"blue"_) **is** ___circle(20, "solid", "blue")___

    ___dot___ (_"red "_) **is** ___circle(20, "solid", "red")___

end

fun ___dot___ (_color_) **:** ___circle(20, "solid", color)___ **end**

Fast Functions

_____g_____ :: _____Number_____ -> _____Number_____
    name   domain   range

examples:

___g___ (__10__) **is** _____20 * 10_____

___g___ (__23__) **is** _____20 * 23_____

end

fun ___g___ (_q_) : _____20 * q_____ **end**

_____h_____ :: _____Number_____ -> _____Number_____
    name   domain   range

examples:

___h___ (__10__) **is** _____10 / 2_____

___h___ (__15__) **is** _____15 / 2_____

end

fun ___h___ (_x_) : _____x / 2_____ **end**

_____ :: _____ -> _____
    name   domain   range

examples:

_____ (_____) **is** _____

_____ (_____) **is** _____

end

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

Lesson 4

DESIGN RECIPE

Word Problem: rocket-height
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.

I.   Contract+Purpose Statement
Every contract has three parts:

\# _____ : _____ -> _____
      name   Domain   Range

\# _____
                                What does the function do?

II.   Give Examples
On the computer, write an example of your function in action, using EXAMPLE.

(EXAMPLE (_____)
                     the user types...

UNUSED – See pages/rocket-height.scrbl

.....which should become

(EXAMPLE (_____)
                     the user types...

_____)
                     .....which should become

III.   Definition
Write the definition, giving variable names to all your input values.

(define (_____   _____)
             function name   variable names

_____)
             .....and the computer does this

DESIGN RECIPE

Word Problem: red-square

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

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
    Name   Domain   Range

; _____
                              What does the function do?

II.   Give Examples

On the computer, write an example of your function in action, using EXAMPLE

(EXAMPLE (_____)
                            the user says...

_____)
                            …..Racket replies

UNUSED – See pages/red-square.scrbl

(EXAMPLE (_____)
                            the user says...

_____)
                            …..Racket turns that into

III.   Definition

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

(define (_____   _____)
            function name   variable names

_____)
                    …..and the computer does this

DESIGN RECIPE

Word Problem: yard-area

Use the Design Recipe to write a function _yard-area_*, which takes in the width and length of a yard, and returns the area of the yard.*

(Don't forget: area = length * width !)

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
      name   Domain   Range

; _____
                         What does the function do?

II.   Give Examples

On the computer, write an example of your function in action, using EXAMPLE.

(EXAMPLE   (_____)
                  Use the function here

      _____)
              find another way to get the same result here

(EXAMPLE (_____
               Use the function here...

      _____)
              find another way to get the same result here

UNUSED – See pages/lawn-area.scrbl

III.   Definition

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

(define (_____   _____)
          function name   variable names

    _____)
          .....and the computer does this

Lesson 5

DESIGN RECIPE

Word Problem: update-danger

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

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
      name   Domain   Range

; _____
                            What does the function do?

II.   Give Examples

On the computer, write an example of your function in action, using EXAMPLE.

(EXAMPLE   (_____)
                  Use the function here

UNUSED – See pages/update-danger.scrbl

find another way to get the same result here

(EXAMPLE   (_____)
                  Use the function here...

_____)
             find another way to get the same result here

III.   Definition

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

(define (_____   _____)
           function name   variable names

_____)
            .....and the computer does this

DESIGN RECIPE

Word Problem: update-target

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

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
        name   Domain   Range

; _____
                                 What does the function do?

II.   Give Examples

On the computer, write an example of your function in action, using EXAMPLE.

(EXAMPLE   (_____)
                          Use the function here

        _____)
                   find another way to get the same result here

UNUSED – See pages/update-target.scrbl

(EXAMPLE   (_____)
                       use the function here...

        _____)
                   find another way to get the same result here

III.   Definition

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

(define (_____   _____)
             function name   variable names
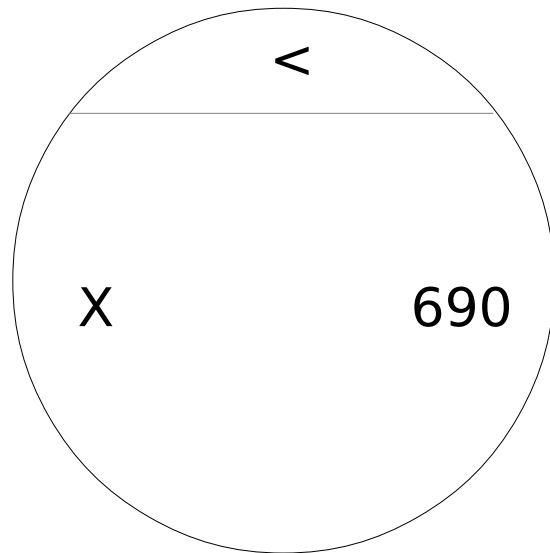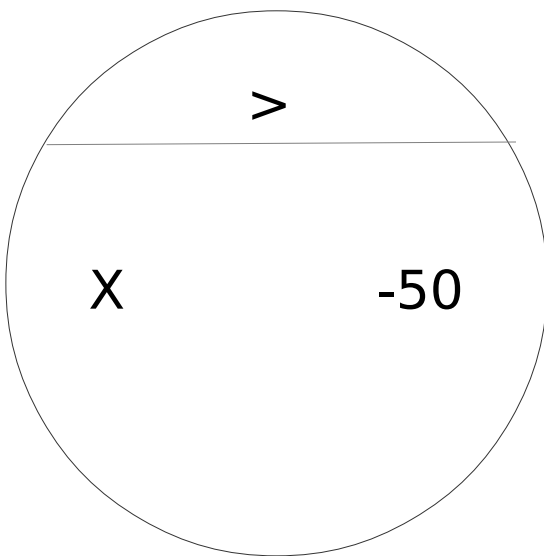
    _____)
          …..and the computer does this

Lesson 6

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...   x < 690

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

```
      >
  X        -50
```

```
      <
  X         690
```

DESIGN RECIPE

Word Problem: safe-left?

Use the Design Recipe to write a function `safe-left?`*, which takes in an x-coordinate and checks to see if it is greater than -50.*

I.   Contract+Purpose Statement
Every contract has three parts:

; _____ : _____ -> _____
        name   Domain   Range

; _____
                              What does the function do?

II.   Give Examples
On the computer, write an example of your function in action, using EXAMPLE.

(EXAMPLE   (_____)
                      Use the function here

UNUSED – See pages/safe-left.scrbl

                    find another way to get the same result here

(EXAMPLE   (_____)
                      Use the function here…

          _____)
                    find another way to get the same result here

III.   Definition
Write the definition, giving variable names to all your input values.

(define (_____   _____)
           function name   variable names

    _____)

Design Recipe

Word Problem: safe-right?

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

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
        name   Domain   Range

; _____
                           What does the function do?

II.   Give Examples

On the computer, write an example of your function in action, using EXAMPLE.

(EXAMPLE   (_____)
                    Use the function here

_____)
             find another way to get the same result here

UNUSED – See pages/safe-right.scrbl

(EXAMPLE   (_____)
                    Use the function here...

_____)
             find another way to get the same result here

III.   Definition

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

(define (_____ _____)
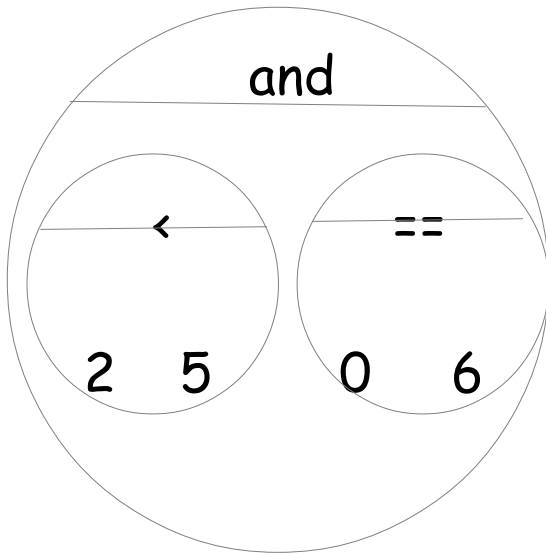   function name   variable names

_____)

…and the computer does this
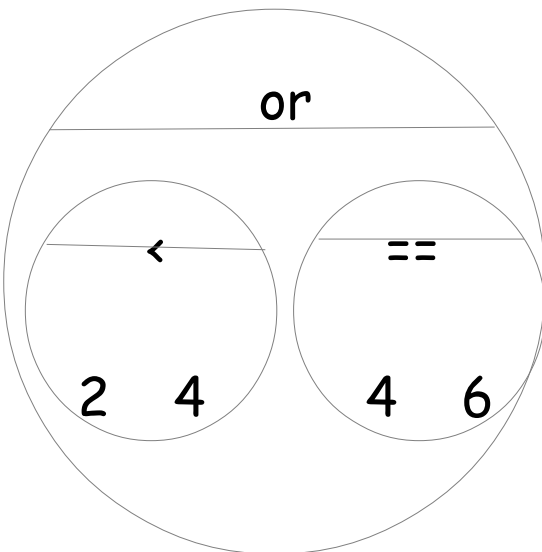
and / or

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 < 5) and (0 == 6)

2. Two is less than four _or_ four is equal to six.

(2 < 4) or (4 == 6)

DESIGN RECIPE

Word Problem: onscreen?

Use the Design Recipe to write a function <u>onscreen?</u>, which takes in an x-coordinate and checks to see if Sam is safe on the left <u>and</u> safe on the right.

I.   Contract+Purpose Statement
Every contract has three parts:

; _____ : _____ -> _____
       name   Domain   Range

; _____
                                What does the function do?

II.   Give Examples
On the computer, write an example of your function in action, using EXAMPLE.

(EXAMPLE   (_____)
                        Use the function here

UNUSED – See pages/onscreen.scrbl

_____)
                find another way to get the same result here

(EXAMPLE   (_____)
                        Use the function here…

_____)
                find another way to get the same result here

III.   Definition
Write the definition, giving variable names to all your input values.

(define (_____   _____)
              function name   variable names

_____)
                      …and the computer does this

Lesson 7

DESIGN RECIPE

Word Problem: cost

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.

I.   Contract+Purpose Statement

; _____ : _____ -> _____
      name   Domain   Range

II.   Give Examples

On the computer, write an example of your function for each topping, using EXAMPLE.

(EXAMPLE(cost_____ "pepperoni"__) _____)
                  Use the function here   What should the function produce?

(EXAMPLE(_____) _____)
                  Use the function here   What should the function produce?

(EXAMPLE(_____) _____)
                  Use the function here   What should the function produce?

(EXAMPLE(_____) _____)
                  Use the function here   What should the function produce?

III.   Definition

(define (_____   _____)
            function name   variable names

_____

UNUSED – See pages/cost.scrbl

)

DESIGN RECIPE

Word Problem: update-player

Write a function called <u>update-player</u>, which takes in the player's y-coordinate and the name of the key pressed, and returns the new y-coordinate.

I.   Contract+Purpose Statement

; _____ : _____ -> _____
       name   Domain   Range

II.   Give Examples

Finish the two examples we've started for you, and make two more

(EXAMPLE (<u>update-player   128   "up"</u>)
_____)
              Use the function here   What should the function produce?

(EXAMPLE (<u>update-player   451   "down"</u>)
_____)
              Use the function here   What should the function produce?

(EXAMPLE (_____) _____)
              Use the function here   What should the function produce?

(EXAMPLE (_____) _____)
              Use the function here   What should the function produce?

III.   Definition

(define (_____   _____)
            function name   variable names

    _____

UNUSED – See pages/update-player.scribl

)

Lesson 8

DESIGN RECIPE

Write a function called <u>line-length</u>, which takes in two numbers and returns the difference between them. It should always subtract the smaller number from the bigger one.

I. Contract+Purpose Statement
Every contract has three parts:

; _____ : _____ -> _____
      name   Domain   Range

II. Give Examples

(EXAMPLE (line-length   10   5   )   (-   10   5)   )
               Use the function here   What should the function produce?

(EXAMPLE (line-length   2   8   )   (-   8   2)   )
               Use the function here   What should the function produce?

III. Definition
Write the definition, giving variable names to all your input values.

(define (_____   _____)
           function name   variable names

_____

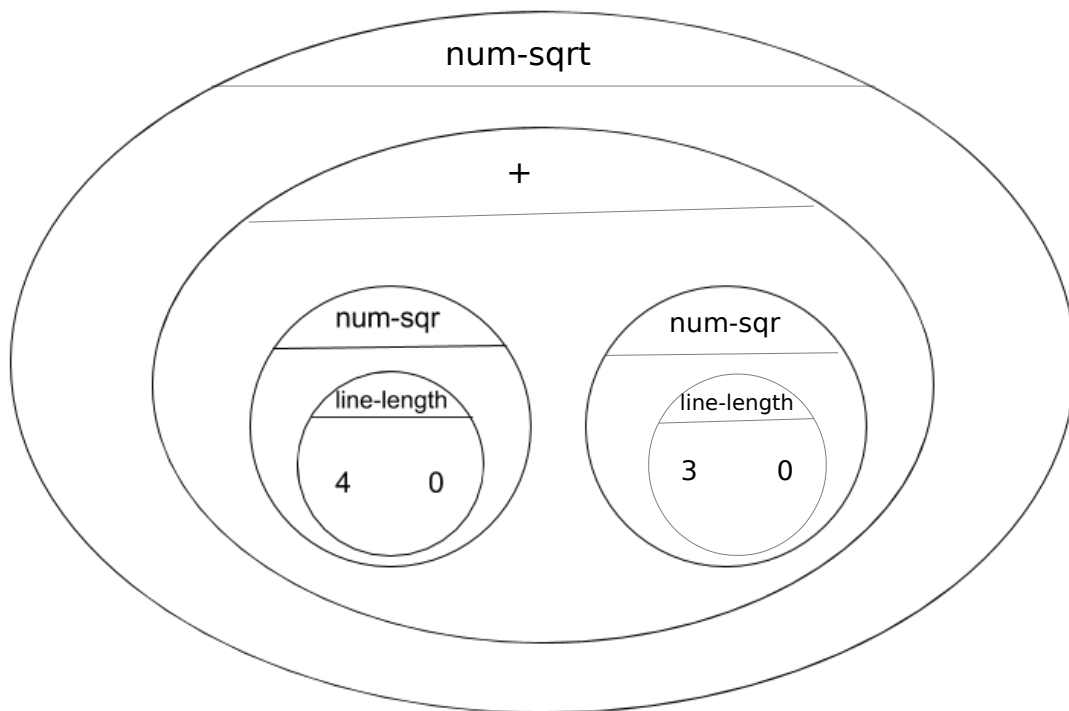**UNUSED – See pages/line-length.scrbl**

)

...and the computer does this

The Distance Formula (an example)

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

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

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

Convert the Circle of Evaluation into Pyret code:

num-sqrt(num-sqr(line-length(4, 0)) + (num-sqr(line-length(3, 0))))

DESIGN RECIPE

Write a function <u>distance</u>, 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 page 27!)

I. Contract+Purpose Statement

; _____ : _____ -> _____
      name   Domain   Range

; _____
                            What does the function do?

II. Give Examples

(EXAMPLE (_____)
                   Use the function here

UNUSED – See pages/distance.scrbl

_____)
              find another way to get the same result here

(EXAMPLE (_____)
                   Use the function here…

_____)
              find another way to get the same result here

III. Definition

(define (_____ _____)
          function name   variable names

_____)

DESIGN RECIPE

Write a function collide?,*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 true if the coordinates of the player are within 50 **pixels** of the coordinates of the other character. Otherwise, false.

I. Contract+Purpose Statement

; _____ : _____ -> _____
   name   Domain   Range

; _____
          What does the function do?

II. Give Examples

(EXAMPLE (_____)
        Use the function here

_____)
     find another way to get the same result here

(EXAMPLE (_____)
        Use the function here...

_____)
     find another way to get the same result here

III. Definition

(define (_____ _____)
     function name   variable names

_____)

Lesson 9

Catchy Intro: Feel like you never get enough to eat? So does Leo. Come catch your prey, and escape the zookeeper!

Name, Age, Grade: Ellie Programmer, 12, 7th grade

Game Title: Run for your Supper

Back Story:One day, a young lion was sitting in his cage. He saw an escaped gazelle come running past. It was lunch time, and he was hungry, so he leapt out to catch food. He has to run fast to grab food and escape the evil zookeeper.

Characters: Player: Leo the lion.

Danger: Zoe Zookeeper.

Target: Gary Gazelle

Explain a piece of your code: My update-danger function takes in the current x coordinate of the gazelle, and adds 50 to it. This moves the gazelle 50 pixels to the right.
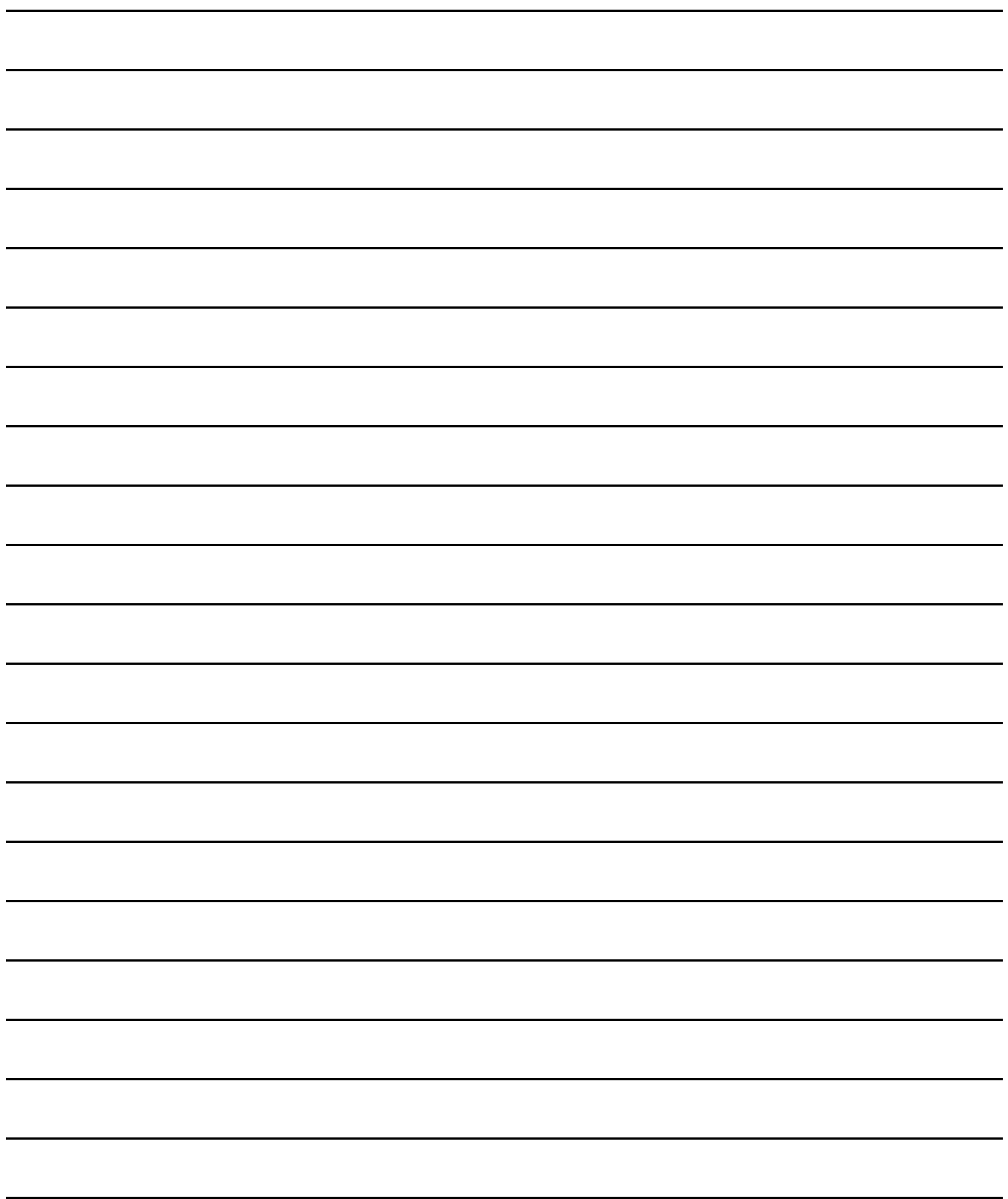
Presentation Feedback

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...

red-shape   ::   String   ->   Image

  function name   *domain*   *range*

\#   Create   a   solid   red   shape   of   the   given   kind

                    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*

red-shape   ("triangle"   ) is triangle(50, "solid", "red")

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

red-shape   ("rectangle"   ) is rectangle(5, 1, "solid", "red")

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

red-shape   "star"   ) is star(50, "solid", "red")

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

red-shape   ("garbanzo"   ) is text("???", 20, "red")

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

```
end
```

Definition

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

```
fun   red-shape  (     shape     ):
```

  function name   *variables*

```
  if    "circle" ==  shape       :     circle(50, "solid", "red")

  else if   "triangle" ==  shape    : triangle(50, "solid", "red")

  else if   "rectangle" ==  shape   : rectangle(9, "solid", "red")

  else if   "star" ==  shape        : star(50, "solid", "red")

  else: text(20, "???", "red")
   end
end
```

Translating into Algebra

Value Definitions

Pyret Code	Algebra
`x = 10`	x = 10
`y = x * 2`	y = x*2
`z = x / y`	**z = x ÷ y**
`w = num-sqrt(num-sqr(x) + 1)`	**w =** $\sqrt{x^2+1}$
`days = (age * 12) * 30`	**days = (age * 12) * 30**
`y = (v * x) + x0`	**y = (v * x) + x_0**
`y = ((0.5 * a) * num-sqr(x)) + y0`	**y = (0.5 * a) * x^2 + y_0**

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 * num-sqr(radius)`
`end`
	circle-area(radius) = pi * radius^2

`fun distance(x1, y1, x2, y2):`
`  num-sqrt(`
`    num-sqr(x1 - x2)`
`      + num-sqr(y1 - y2)`
`  )`
`end`
	distance(x1, y1, x2, y2)= $\sqrt{(x1-x2)^2+(y1-y2)^2}$

Design Recipe

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

I.   Contract+Purpose Statement
Every contract has three parts:

_____D_____ : _____Number_____ -> ___Number_____

     name   Domain   Range

___**Given a number of seconds, produces the height of a rocket moving at 80mi/s**___

                                                What does the function do?

II.   Give Examples
Write an example of your function for <u>some sample inputs</u>

_____D(1) is _____80 * 1_____

Use the function here   What should the function produce?

_____D(2) is _____80 * 2_____

Use the function here   What should the function produce?

_____D(14)   is ____80 * 14_____

Use the function here   What should the function produce?

_____`D(100)`   is ____80 * 100_____

Use the function here   What should the function produce?

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

```
fun D( time ) :   80 * time
end
```

Design Recipe

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**_.

I.   Contract+Purpose Statement

Every contract has three parts:

___time___ : ___Number___ -> ___Number___
       name   Domain   Range

\# ___Given the distance traveled, produce the time traveled if moving at 80mi/s___
                                   What does the function do?

II.   Give Examples

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

___time(0)___ is ___0 / 80___
Use the function here   What should the function produce?

___time(10)___ is ___10 / 80___
Use the function here   What should the function produce?

___time(200)___ is ___200 / 80___
Use the function here   What should the function produce?

___time(560)___ is ___560 / 80___
Use the function here   What should the function produce?

III.   Definition

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

```
fun time( distance ) :    distance / 80
end
```

Design Recipe

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?

I.   Contract+Purpose Statement
Every contract has three parts:

_____collide_____ **:** _____Number_____ -> __Number_____
name   Domain   Range

_Given the distance between a rocket (moving at 80mi/sec) & asteroid (70mi/sec), when will they_
                                                What does the function do?

   collide?

II.   Give Examples
Write an example of your function for <u>some sample inputs</u>

__collide(0)_____is_____0 / 150_____
Use the function here   What should the function produce?

__collide(2000)__is_____2000 / 150_____
Use the function here   What should the function produce?

__collide(5000)__is_____5000 / 150_____
Use the function here   What should the function produce?

__collide(15000)__is_____15000 / 150_____
Use the function here   What should the function produce?

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

fun **collide** (**distance**):   **distance / 150**
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
```