

Contracts

[illegible]

Contracts

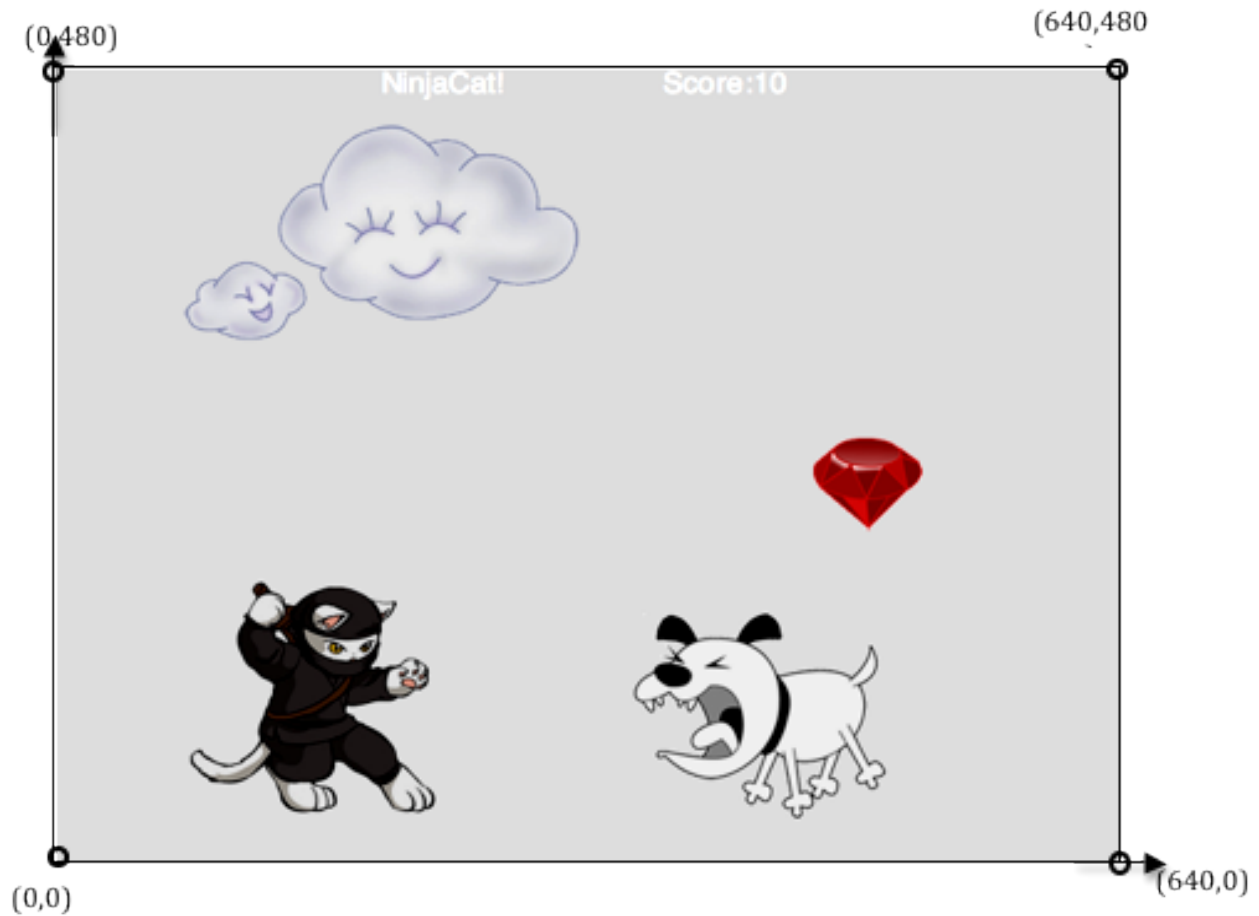
[illegible]

Lesson 1

Reverse-Engineering: How does NinjaCat work?

[illegible]

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.

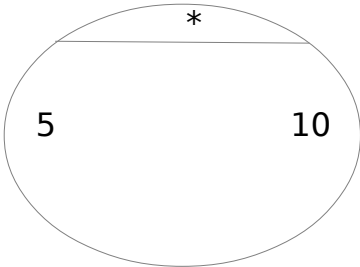
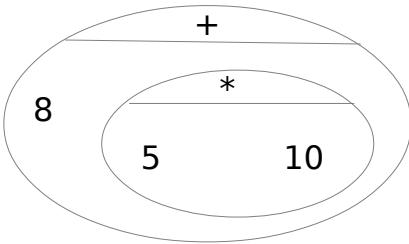
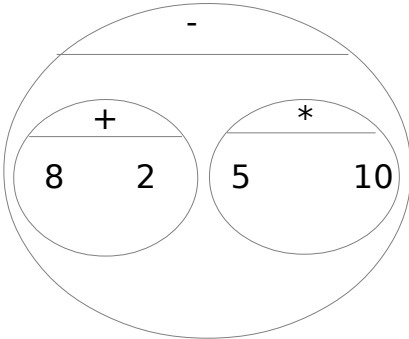
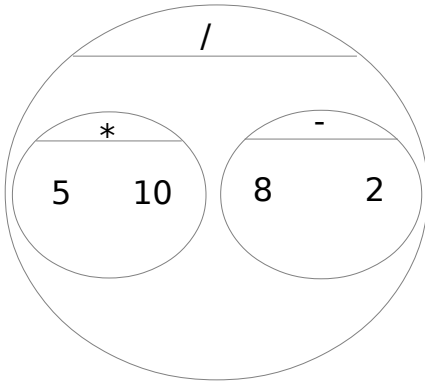
The Danger is a _____ Zookeeper _____.

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!

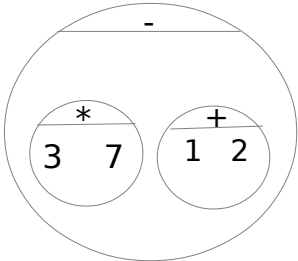
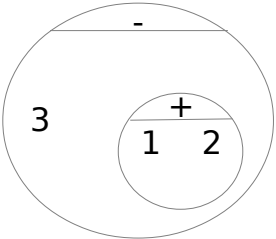
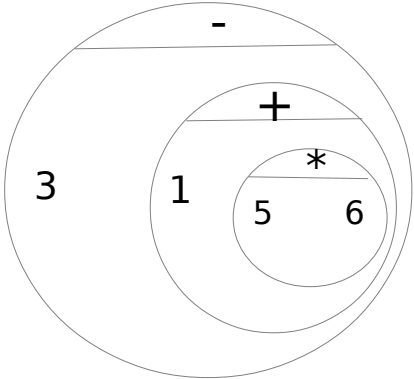
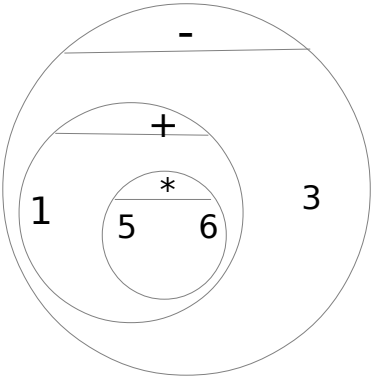
Math	Circle of Evaluation	Pyret Code
5×10		<code>5 * 10</code>
$8 + (5 \times 10)$		<code>8 + (5 * 10)</code>
$(8 + 2) - (5 \times 10)$		<code>(8+2) - (5 * 10)</code>
$\frac{5 \times 10}{8 - 2}$		<code>(5 * 10) / (8 - 2)</code>

Lesson 2

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

Circles Competition minutes

Time: 5

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

Lesson 3

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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.scrib

(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: $\text{area} = \text{length} * \text{width}$!)

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

UNUSED - See pages/lawn-area.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 5

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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.scrib

(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

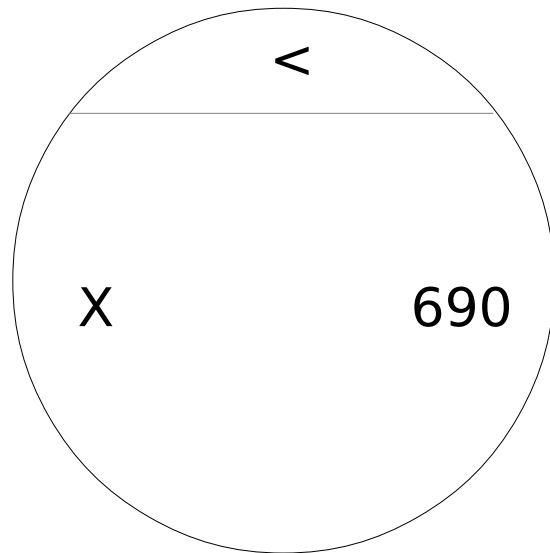
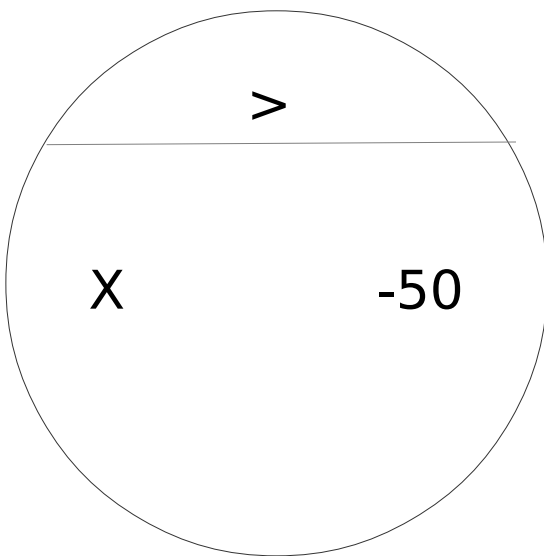
_____)
.....and the computer does this

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:



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

_____)

...and the computer does this

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

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

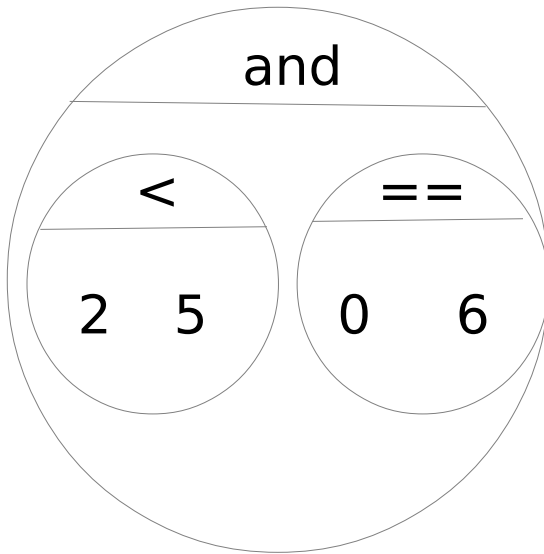
_____)

...and the computer does this

and / or

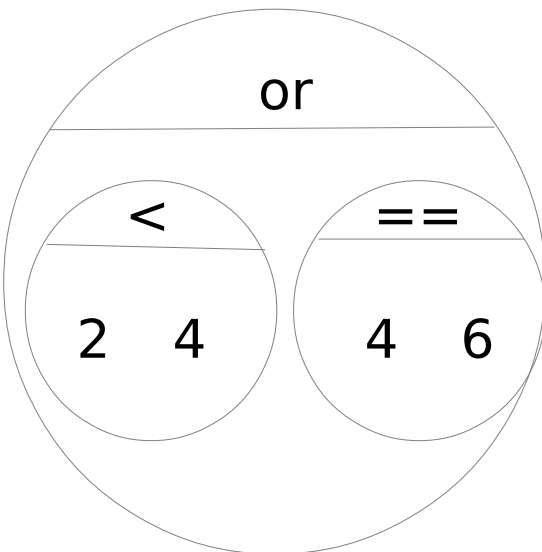
Write the Circles of Evaluation for these statements, and then convert them to Pyret

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 onscreen?, which takes in an x-coordinate and checks to see if Sam is safe on the left and 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 _____)
find another way to get the same result here

pages/onscreen.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 7

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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 *update-player*, 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 (update-player 128 "up")
_____) Use the function here What should the function produce?

(EXAMPLE (update-player 451 "down")
_____) 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/lipdate-
player.scribble**

)

Lesson 8

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

DESIGN RECIPE

Write a function called line-length, 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

)

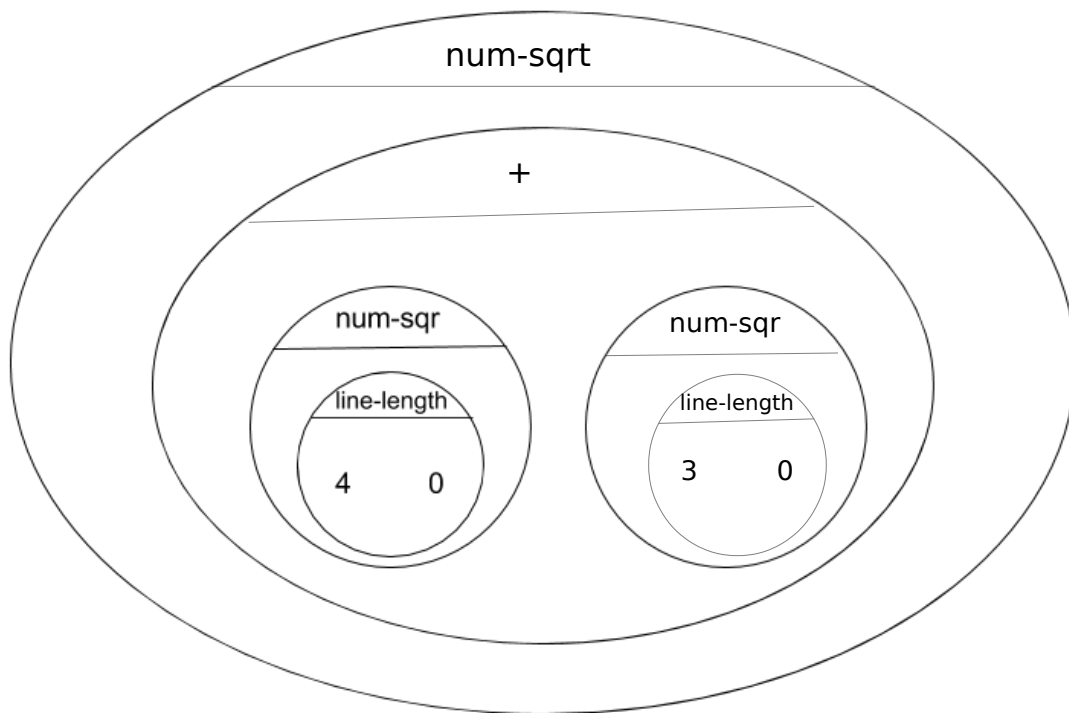
...and the computer does this

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 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 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

(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

$$f : \text{Domain} \rightarrow \text{Range}$$

What does the function do?

III. Give Examples

(EXAMPLE (_____))
Use the function here

UNUSED - See

(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

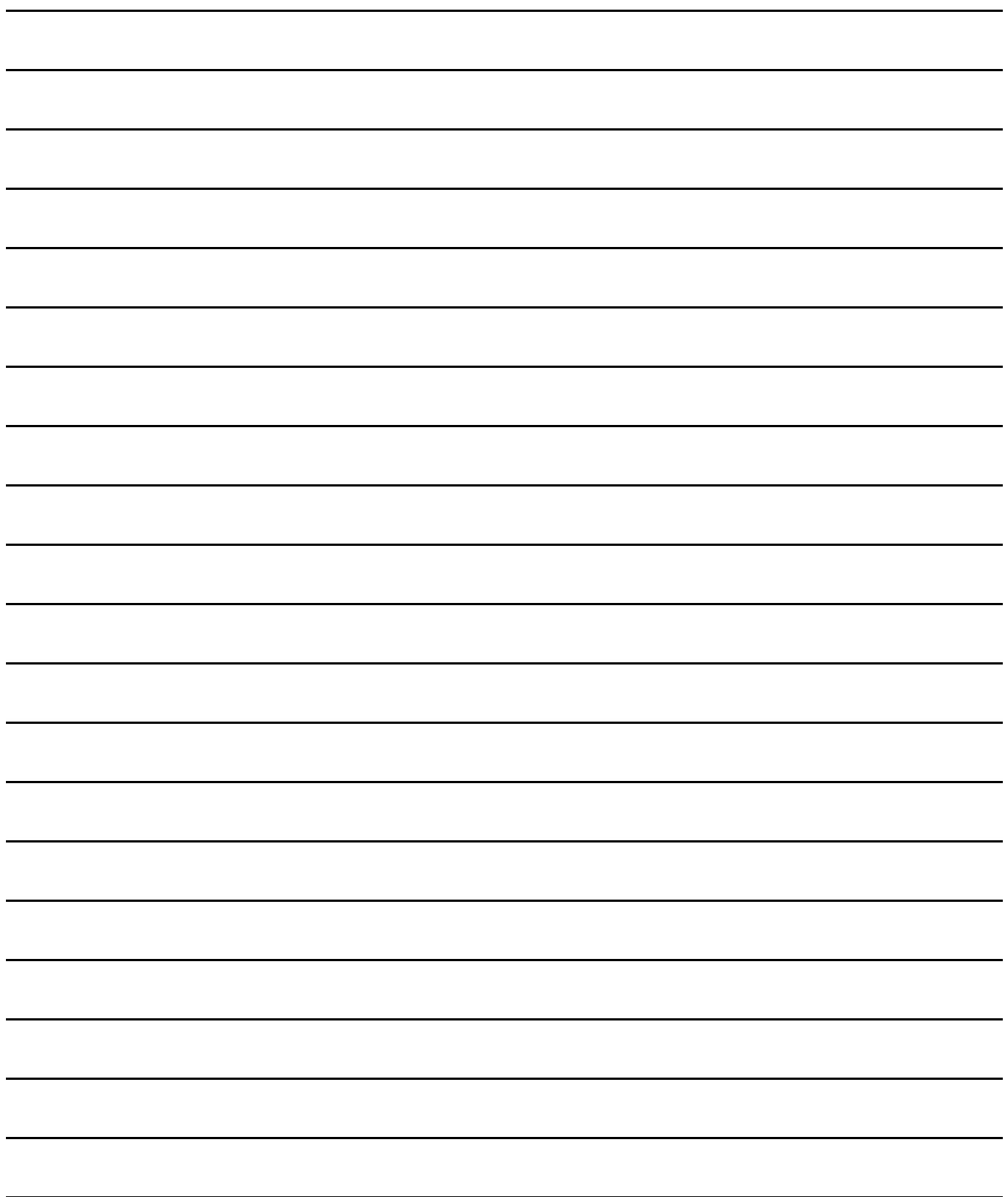
to run fast to grab food and escape the evil zookeeper.

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!

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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...

<u>red-shape</u>	::	<u>String</u>	->	<u>Image</u>
<i>function name</i>		<i>domain</i>		<i>range</i>

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:

<u>red-shape</u>	(	<u>"circle"</u>	) is	<u>circle(50, "solid", "red")</u>
<i>function name</i>		<i>input(s)</i>		<i>what the function produces</i>
<u>red-shape</u>	(	<u>"triangle"</u>	) is	<u>triangle(50, "solid", "red")</u>
<i>function name</i>		<i>input(s)</i>		<i>what the function produces</i>
<u>red-shape</u>	(	<u>"rectangle"</u>	) is	<u>rectangle(5, 1, "solid", "red")</u>
<i>function name</i>		<i>input(s)</i>		<i>what the function produces</i>
<u>red-shape</u>	(	<u>"star"</u>	) is	<u>star(50, "solid", "red")</u>
<i>function name</i>		<i>input(s)</i>		<i>what the function produces</i>
<u>red-shape</u>	(	<u>"garbanzo"</u>	) is	<u>text("???", 20, "red")</u>
<i>function name</i>		<i>input(s)</i>		<i>what the function produces</i>

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
<code>x = 10</code>	$x = 10$
<code>y = x * 2</code>	$y = x * 2$
<code>z = x / y</code>	$z = x \div y$
<code>w = num-sqrt(num-sqr(x) + 1)</code>	$w = \sqrt{x^2 + 1}$
<code>days = (age * 12) * 30</code>	$\text{days} = (\text{age} * 12) * 30$
<code>y = (v * x) + x0</code>	$y = (v * x) + x_0$
<code>y = ((0.5 * a) * num-sqr(x)) + y0</code>	$y = (0.5 * a) * x^2 + y_0$

Function Definitions

Pyret Code	Algebra
<pre>fun area(length, width): length * width end</pre>	$\text{area}(\text{length}, \text{width}) = \text{length} * \text{width}$
<pre>pi = 3.14 fun circle-area(radius): pi * num-sqr(radius) end</pre>	$\text{circle-area}(\text{radius}) = \text{pi} * \text{radius}^2$
<pre>fun distance(x1, y1, x2, y2): num-sqrt(num-sqr(x1 - x2) + num-sqr(y1 - y2)) end</pre>	$\text{distance}(x1, y1, x2, y2) =$ $\sqrt{(x1 - x2)^2 + (y1 - y2)^2}$

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:

<u> D </u>	:	<u> Number </u>	->	<u> Number </u>
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 some sample inputs

<u> D(1) </u>	is	<u> 80 * 1 </u>
Use the function here		What should the function produce?

<u> D(2) </u>	is	<u> 80 * 2 </u>
Use the function here		What should the function produce?

<u> D(14) </u>	is	<u> 80 * 14 </u>
Use the function here		What should the function produce?

<u> D(100) </u>	is	<u> 80 * 100 </u>
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:

<u>time</u>	:	<u>Number</u>	->	<u>Number</u>
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 some sample inputs

<u>time(0)</u>	<u>is</u>	<u>0 / 80</u>
Use the function here		What should the function produce?
<u>time(10)</u>	<u>is</u>	<u>10 / 80</u>
Use the function here		What should the function produce?
<u>time(200)</u>	<u>is</u>	<u>200 / 80</u>
Use the function here		What should the function produce?
<u>time(560)</u>	<u>is</u>	<u>560 / 80</u>
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:

<u>collide</u>	:	<u>Number</u>	->	<u>Number</u>
name		Domain		Range

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

II. Give Examples

Write an example of your function for some sample inputs

<u>collide(0)</u>	is	<u>0 / 150</u>
Use the function here		What should the function produce?

<u>collide(2000)</u>	is	<u>2000 / 150</u>
Use the function here		What should the function produce?

<u>collide(5000)</u>	is	<u>5000 / 150</u>
Use the function here		What should the function produce?

<u>collide(15000)</u>	is	<u>15000 / 150</u>
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 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 _____