Name: \_\_\_\_\_



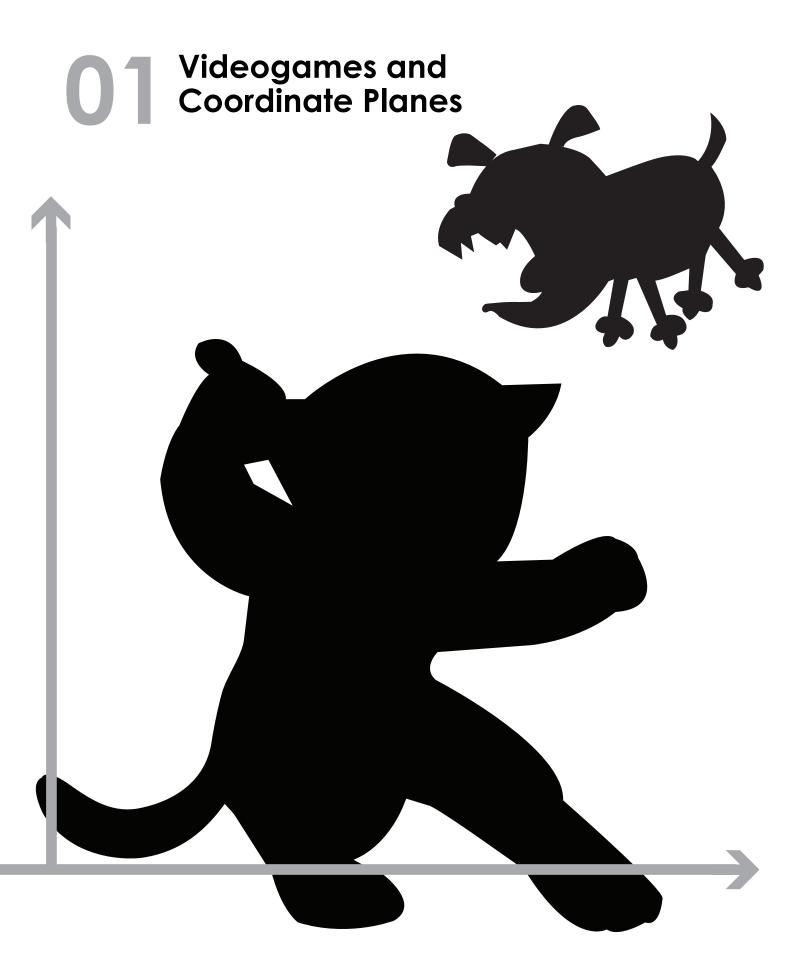
# **BOØTSTRAP** www.bootstrapworld.org

**Student Workbook** 

Class: \_\_\_\_\_

# **Bootstrap Units**

01	Videogames and Coordinate Planes	06	Comparing Functions
02	Contracts, Strings, and Images	07	Conditional Branching
03	Intro to Definitions	80	Collision Detection
04	Design Recipe	09	Prepping for Launch
05	Game Animation	10	Additional Material

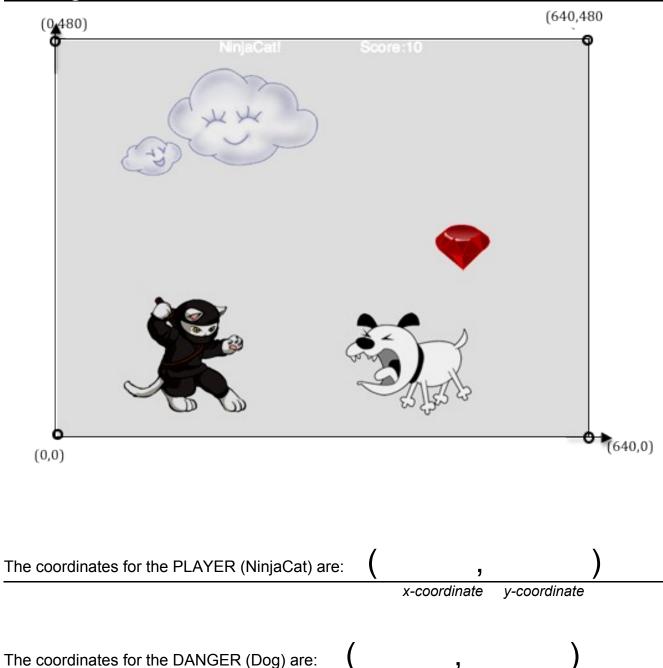


# Lesson 1

#### Reverse-Engineering: How does NinjaCat work?

Thing in the game	What changes about it?	More specifically
Thing in the game Cloud	position	More specifically X-COOrdinate
	•	

# Finding Coordinates



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

,

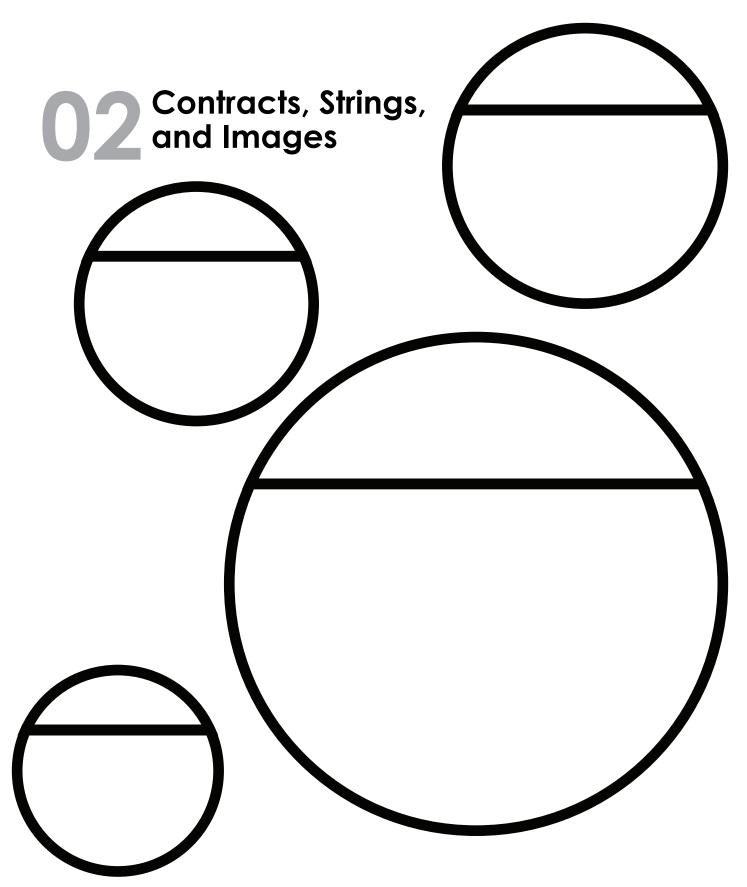
# Our Videogame

Created by (write your names):
Background
Our game takes place in:
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.
<b>The Danger</b> Your player LOSES points when they hit the danger.
The Danger is a

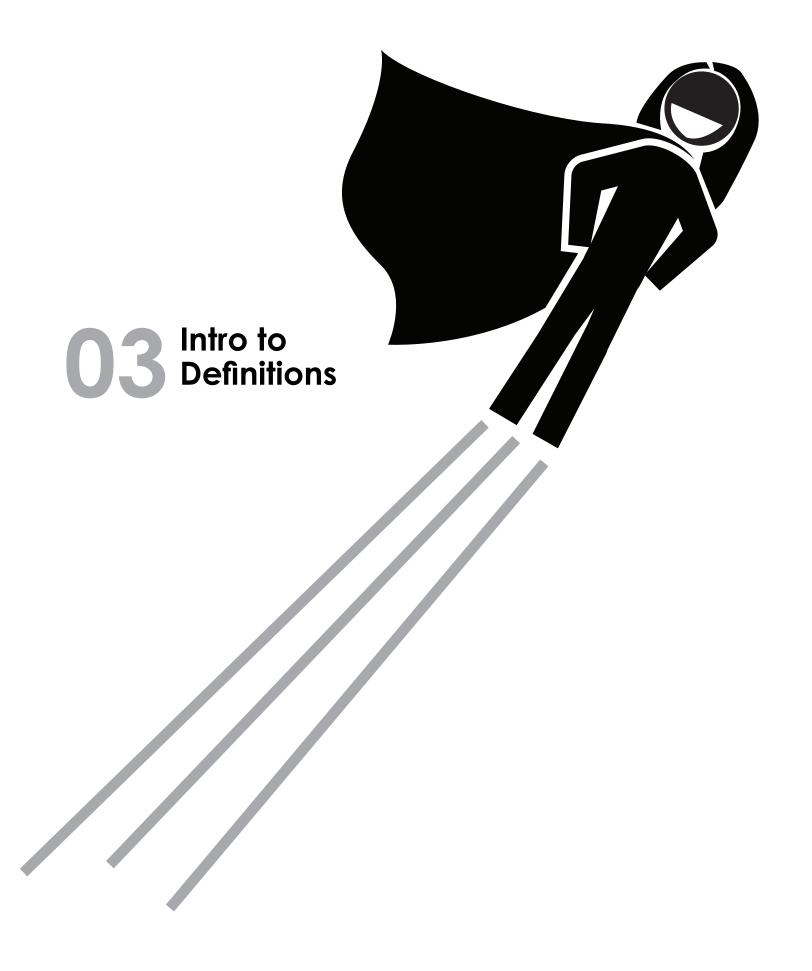
The Danger moves only to the left and right.

# 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)		
<u>5 x 10</u> 8 - 2		
8 - 2		

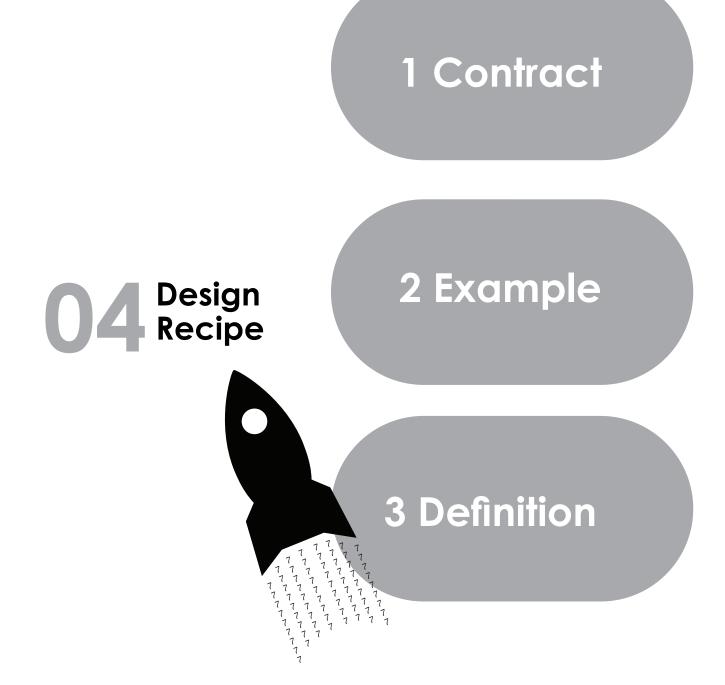


	Circles Cor	npetition	Time: 5 minutes
	Math	Circle of Evaluation	Pyret Code
Round 1	(3 * 7) - (1 + 2)		
Round 2	3 - (1 + 2)		
Round 3	3 - (1 + (5 * 6))		
Round 4	(1 + (5 * 6)) - 3		



Fast Functio	ns					
				->		
name	··	doma	ain	 	range	
examples:						
	(	)	is			
	(	)	is	 		
end		·				
	( )	•				end
	(/	•		 		Cina
				->		
name		dom	nain	 	range	
examples:						
	(	)	is			
	(	)	is			
end		`				
fun	(	):				end
	_ `			 		
		:		->		
name		dom	nain	-	range	
examples:						
	(	)	is			
	(	)	is			
end						
fun	(	):				end
	_ `	·		 		

## Fast Functions :: -> name domain range examples: \_\_\_\_\_(\_\_\_\_) is \_\_\_\_\_ ) is \_\_\_\_\_ \_\_\_\_\_( end fun (\_\_\_): \_\_\_\_\_ end \_\_\_\_\_\_--> \_\_\_\_\_\_ domain name range examples: \_\_\_\_\_(\_\_\_\_) is \_\_\_\_\_ ( ) **is** \_\_\_\_\_ end fun \_\_\_\_(\_\_\_): \_\_\_\_\_ end :: -> domain name range examples: \_\_\_\_\_(\_\_\_\_) is \_\_\_\_\_ ( \_\_\_\_\_) is \_\_\_\_\_ end fun (\_\_\_): end



## Word Problem: rocket-height

**Directions:** A rocket blasts off, traveling at 7 meters per second. Write a function called 'rocketheight' 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.

ery contract has th	nree parts.					
	::				->	
function name				domaiı	n	range
				what does t	he function do?	
xamples						
ite some example:	s, then circ	cle and label v	vhat ch	nanges		
kamples:						
	(		)	is		
function name		input(s)			what the function produces	-
	(		)	is		
function name		input(s)			what the function produces	_
nd						
Definition						
rite the definition, g	given varic	able names to	all you	input val	ues	
ın	(			):		
function nam	e	variables	;			
					hose variables	

## Word Problem: red-square

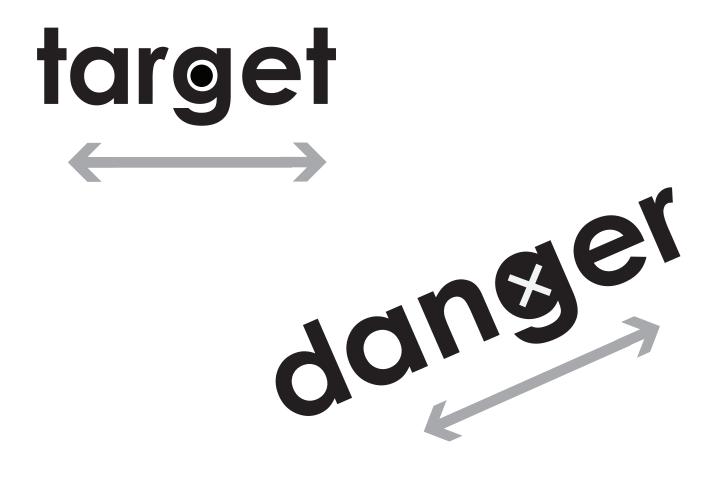
**Directions:** Use the Design Recipe to write a function 'red-square', which takes in a number (the side of the square) and outputs a solid red rectangle whose length and width are the same size.

connuct nus nin	ee parts.				
	::				->
function name				domain	range
				what does the function do?	
amples					
some examples,	then circ	l cle and label v	vhat ci	nanges	
mples:					
	(		)	is	
function name		input(s)			
what t	he function	produces			
	(		)	is	
function name		input(s)			
wha	t the functic	on produces			
L					
efinition					
e the definition, giv	ven varia	able names to	all you	rinput values	
	(			):	
L					

#### 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	l Purp	ose Statem	nen	it		
Every contract has th	ree parts.					
	::				_>	
function name				doi	main	range
#						
				what do	es the function do?	
Examples						
Write some examples	, then cire	cle and label wh	at cl	hanges	i	
examples:						
	(		)	is		
function name		input(s)			what the function produces	
	(		)	is		
function name		input(s)			what the function produces	
end						
Definition						
Write the definition, g	iven vario	able names to all	l you	r input	values	
fun	(			):		
function name	9	variables				
		what the f	unctio	n does wi	ith those variables	_





## Word Problem: update-danger

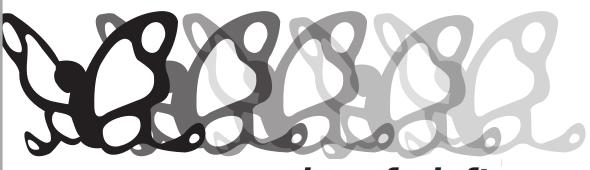
**Directions:** Use the Design Recipe to write a function 'update-danger', which takes in the danger's x-coordinate and y-coordinate and produces the next x-coordinate, which is 50 pixels to the left.

Contract and F	urpos	e Statem	en	it 👘			
Every contract has three	parts						
	::					->	
function name				dom	ain		range
#							
				what does	s the function do?		
Examples							
Write some examples, th	en circle	and label who	at cl	hanges			
examples:							
	(		)	is			
function name		input(s)	_	-	what the function produces		
	(		)	is			
function name		input(s)	_	-	what the function produces		
end							
Definition							
Write the definition, give	n variable	e names to all	уои	r input v	alues		
fun	(	х, у		):			
function name		variables					
		what the fu	nctio	n does with	n those variables		

## Word Problem: update-target

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

Contract an	d Purpose Sto	atement		
Every contract has	three parts			
	::		->	
function name		doma	in	range
#				
· · · · · · · · · · · · · · · · · · ·		what does	the function do?	
Examples				
Write some example	es, then circle and la	bel 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 name	es to all your input va	lues	
fun	(	):		
function na	me va	riables		
	w	hat the function does with	those variables	



# is-safe-left

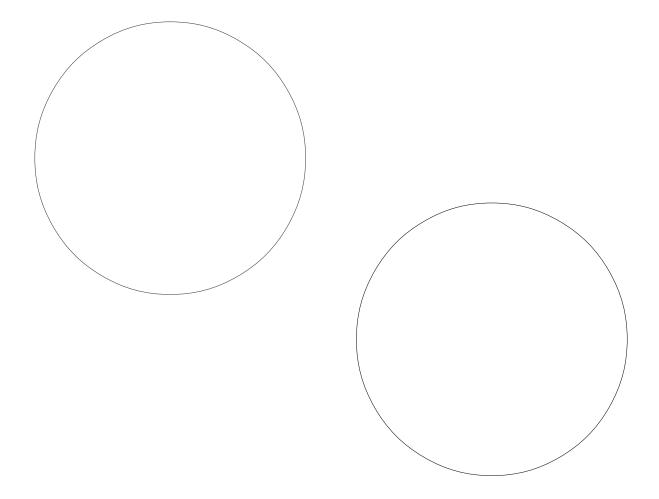


# 19

## 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

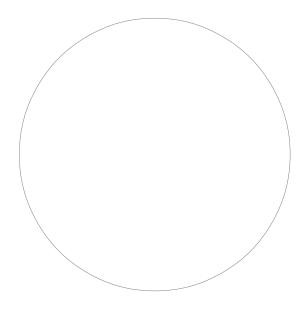
Every contract has t	hree parts					
	·					
	::				_:	>
function name				domai	n	range
#						
				what does t	he function do?	
Examples						
Write some example	s, then circ	cle and label w	/hat cl	hanges		
examples:						
	(		)	is		
function name		input(s)			what the function produces	_
	(		)	is		
function name		input(s)			what the function produces	-
end						
Definition						
Write the definition,	given varic	ble names to	all you	r input val	ues	
fun	(			):		
function nan	ne	variables				

## Word Problem: is-safe-right

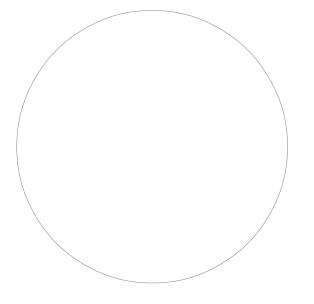
**Directions:** Use the Design Recipe to write a function 'is-safe-right', which takes in an x-coordinate and checks to see if the x-coordinate is less than 690.

Contract and	d Purpose St	atement		
Every contract has th	nree parts			
	::		-:	>
function name		domair	1	range
#				
		what does th	he function do?	
Examples				
Write some examples	s, then circle and Ic	ibel 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, g	jiven variable nam	es to all your input val	ues	
fun	(	):		
function name	e vo	ariables		
	и	vhat the function does with th	nose variables	

# <u>Write the Circles of Evaluation for these statements, and then convert them to Pyret</u> 1. Two is less than five, <u>and</u> zero is equal to six.



2. Two is less than four <u>or</u> four is equal to six.

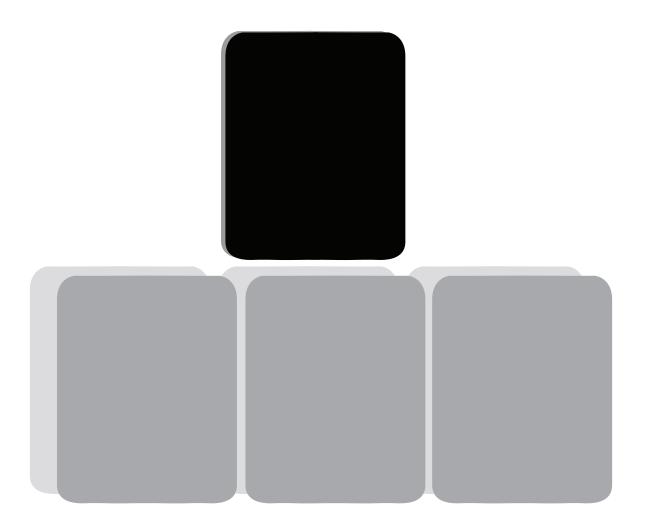


#### Word Problem: is-onscreen

**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 an	d Purpos <u>e S</u>	latement		
Every contract has t	three parts			
	::		->	
function name		domain		range
#				
		what does the function	do?	
Examples				
	es, then circle and I	abel what changes		
examples:				
-	(	) is		
function name	input(			
	what the function pro	duces		
	(	) is		
function name	input(			
	what the function p	roduces		
end				
Definition				
Write the definition,	given variable nan	nes to all your input values		
fun	(	):		
function nar	me	rariables		
		what the function does with those variabl	les	





#### 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 an	d Pu	rpose Statem	en	it		
Every contract has t	hree p	arts				
	:	:			->	
function name				dor	main	range
#						
				what do	es the function do?	
Examples						
Write some example	s, then	circle and label who	at cl	hanges		
examples:						
cost	(	"pepperoni"	)	is		
function name		input(s)	_		what the function produces	
	(		)	is		
function name		input(s)	_		what the function produces	
	(		)	is		

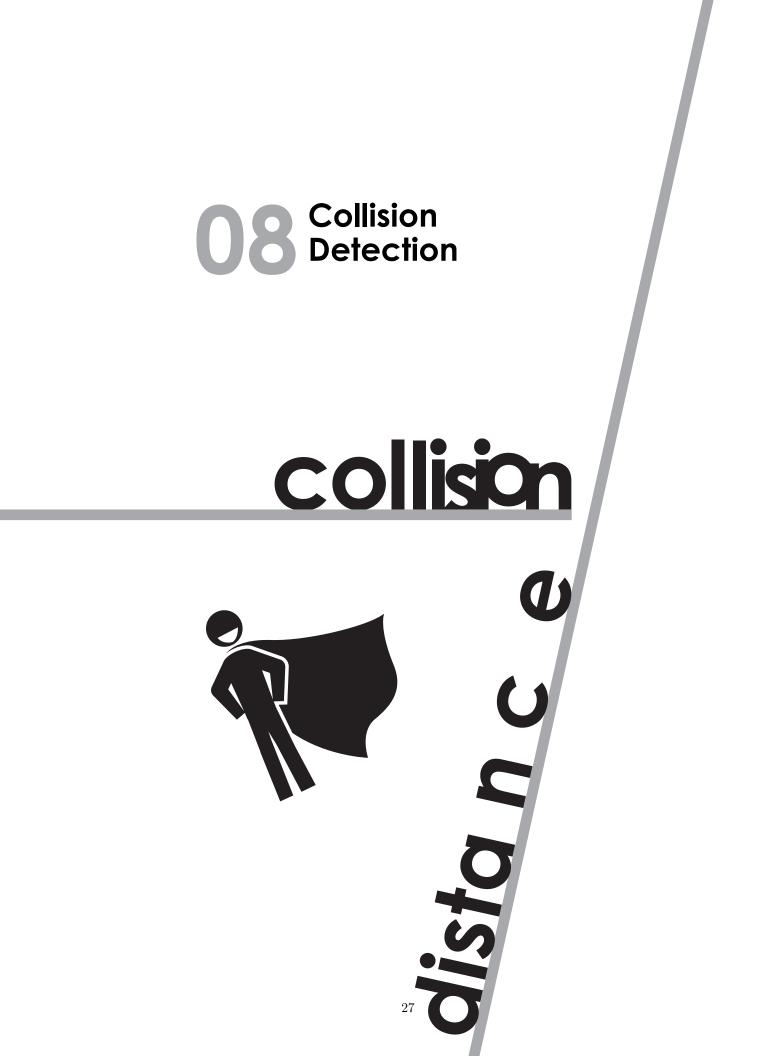
cost	(	"pepperoni"	) is	
function name		input(s)	_	what the function produces
	(		) is	
function name		input(s)	_	what the function produces
	(		) is	
function name		input(s)	_	what the function produces
	(		) is	
function name		input(s)	_	what the function produces
	(		) is	
function name		input(s)	_	what the function produces

	(	):			
function name	V	ariables			
if		:			
else if			:		
else if			:		
else if			:		
else:					

## 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	Purpo	se Sta	teme	nt			
Every contract has thre	ee parts						
	::					->	
function name					dom	ain	range
#							
				w	/hat doe	s the function do?	
Examples							
Write some examples,	then circle	e and lab	el what	chc	anges		
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, giv	ren variab	le names	to all yo	our i	nput v	alues	
fun	(				):		
function name		vario	ables		-		
if					:		
else if						:	
else:							
end							
end							



## 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.

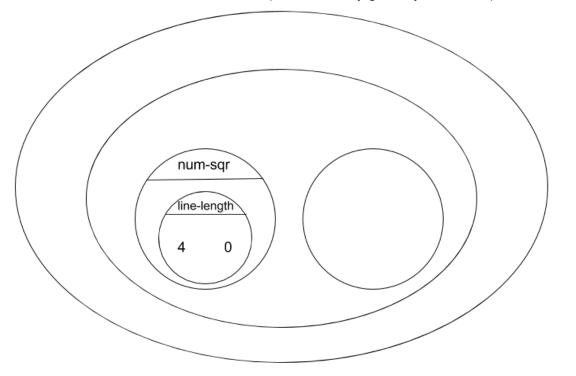
Contract and	Purp	oose State	ement_		
every contract has thr	ee par	ts			
	::				->
function name				domain	range
#					
			what	does the function do?	
Examples					
Write some examples,	then c	ircle and label	what chang	es	
examples:					
line-length	(	10, 5	) is	10 - 5	
function name		input(s)		what the function produces	S
line-length	(	2, 8	) is	8 – 2	
function name		input(s)		what the function produces	s
end Definition Write the definition, gi	ven val	riable names to	all your inp	ut values	
Eun		(	)	:	
function name		variable	es		
if				:	
else: end					
:110					

# The Distance Formula (an example)

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

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

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!)

very contract ha		atement		
very connact has	s mee pans			
			_>	
function name		domain		range
ŧ				
		what does the function do?		
Examples				
Vrite some examp	oles, then circle and lo	abel what changes		
examples:				
	(	) is		
function name	input(s	)		
		what the function produces		
	(	) is		
function name	input(s	)		
		what the function produces		
end				
Definition				
	n, given variable nam	es to all your input values		
un		):		
	(			

what the function does with those variables

#### 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

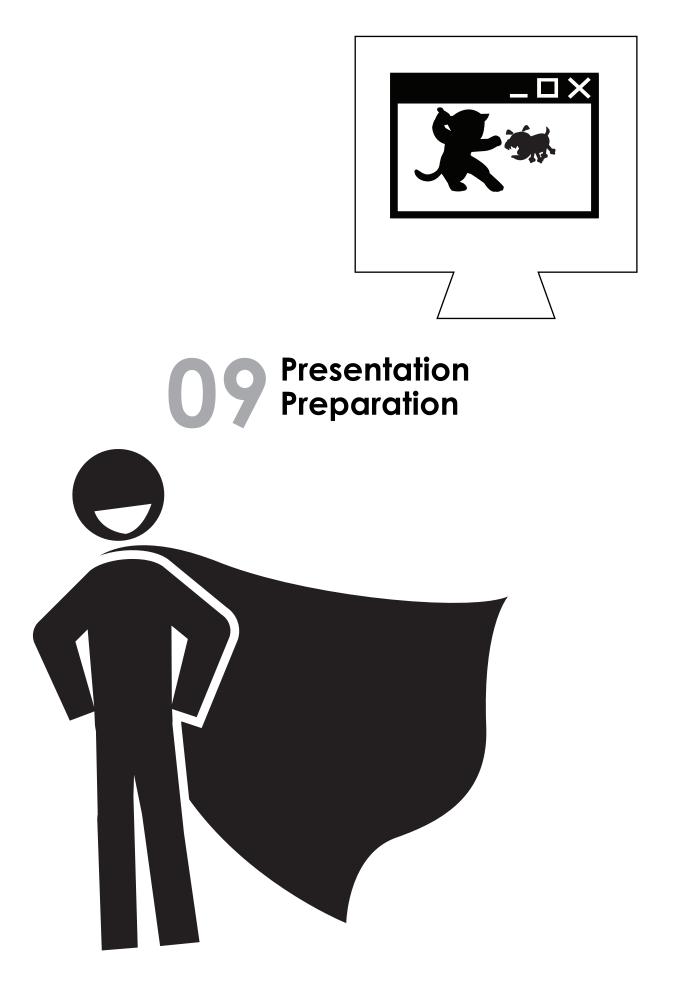
Are the coordinates of the player within 50 pixels of the coordinates of the other character?

Contract	and Purp	ose Stater	ment	ł.	
Every contract I	has three parts	5			
	::			->	
function na	me			domain range	-
#					
			wi	what does the function do?	_
Examples	\$				
Write some exa		cle and label w	hat cha	anges	
examples:				Č	
-	(		)	is	
function nam	ne `	input(s)			
	what the function	produces			
	(		) :	is	
function nam	ne	input(s)			
	what the function	produces			
end					
Definition					
Write the definit		able names to a	all your ir	input values	
fun	(			):	

function name variables

end

what the function does with those variables



# Lesson 9

Catchy Intro:

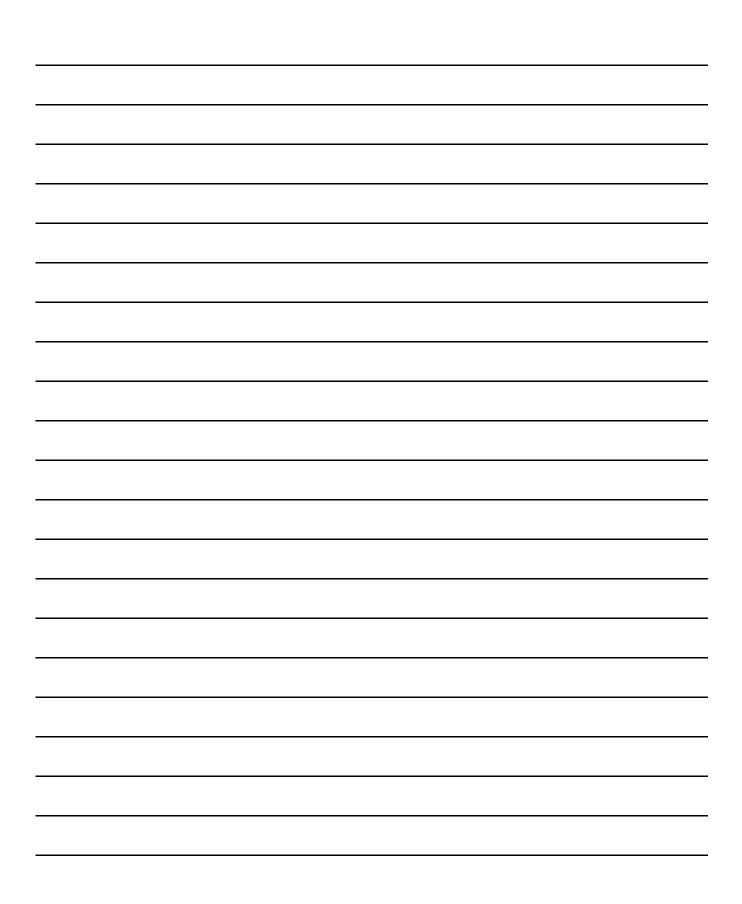
Name, Age, Grade:

Game Title:

Back Story:

Characters:

Explain a piece of your code:



Presentation Feedback For each question, circle the answer t	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	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 eve contact?	Nowayi	A little.	Definitely/
Did they make eye contact?	No way!		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	e function produces	
	(		)	is			
function name		input(s)			what	the function produces	
	(		)	is			
function name		input(s)			wi	nat the function produc	es
			)	is			
function name		input(s)			what the f	unction produces	
	(		)	is			
function name		input(s)			what the fun	ction produces	

#### end

## Definition

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

un	(	):	
function name if	variables	:	circle(50, "solid", "red")
else if			:
else if			:
else if			:
else:			
end			
end			

# **Translating into Algebra**

# **Value Definitions**

Pyret Code	Algebra
x = 10	x = 10
$y = x \star 2$	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
<pre>fun area(length, width):     length * width end</pre>	area(length, width) = length * width
<pre>pi = 3.1415926 fun circle-area(radius):     pi * radius end</pre>	
<pre>fun distance(x1, y1, x2, y2):     num-sqrt(         num-sqr(x1 - x2)         + num-sqr(y1 - y2)     )     end</pre>	

#### 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 I						
	::				->	
t an ella en entre e				-1		
function name				do	omain	range
				what d	bes the function do?	
Examples						
rite some examples, tl	hen circ	le and label w	/hat cł	nange	S	
xamples:						
ocket-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)		15	what the function produces	
Tunction name		inpui(s)			what the function produces	
nd						
Definition						
rite the definition, give	en varia	ble names to o	all your	'input	values	
un	(			):		
function name		variables				
		what the	e functio	n does v	vith those variables	

#### 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.

ry contract has t	hree parts.											
	::				->							
function name	on name domain											
				what does t	he function do?							
amples												
e some example	s then cirr	cle and label y	what ch	anges								
	es, men circ			iunges								
amples:												
	(		)	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							
1												
efinition												
e the definition,	aiven varic	able names to	all you	r input val	ues							
1	- (		,	):								
function nar	ne `_	variable:	s	_ / -								
	-											

#### 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?

very contract has thre	e pans.								
	::				->				
function name				do	main	range			
ŧ									
				what d	pes the function do?				
Examples									
Vrite some examples,	then circ	cle and label v	vhat ch	ange	5				
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									
Vrite the definition, giv	en varia	ıble names to	all your	input	values				
fun	(			):					
function name		variable	s	_					

# Design Recipe

I. Contract+Purpos	e Statement	
Every contract has three		
•		->
name	Domain	Range
#		
	What does the function do?	
II. Give Examples		
	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?	
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Use the function here	What should the function produce?	
III. Definition		
	variable names to all your input values.	
fun (	):	
end		

# Design Recipe

I. Contract+Purpos	e Statement	
Every contract has three		
•		->
name	Domain	Range
#		
	What does the function do?	
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Contracts	Domain		::			::													
	Name																		

S	example	•																	
Contracts	Range	<u>^</u>	۸	<b>^</b> -	۸	<b>^</b> -	^	<b>^</b> -	< -	<u>۸</u>	^	^	^	^ -	^	۸ '	^	^ -	^
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	Name																		