Contracts

Name	Domain	Range	example
••	•	^	
••	•	↑	
••	•		
••	•	↑	
••		↑	
••	•	↑	
••	•	↑	
••	:	↑	
••		^	
••		↑	
••	•		
••	:	↑	
••		^	
••	•	↑	
••	•	↑	
••		↑	
••		↑	

Contracts

example																	
Range	1	1	1	1	^	↑	1	↑	^	↑	↑	↑	^	↑	^	1	↑
Domain			<u></u>	•	•	•	<u></u>	:	•	•	:	:	•	•	:	•	<u></u>
Name		••	••	••	••	••	••	••	••	••	••	•	••	••	••	:	••

Reverse-Engineering: How does NinjaCat work?

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):	
Background	
Our game takes place in: A zoo (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 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 aZookeeper	
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 × 10)	8	8 + (5 * 10)
(8 + 2) - (5 x 10)	* * * * * * * * * * * * * * * * * * *	(8+2) - (5 * 10)
<u>5 x 10</u> 8 - 2	* 5 10 8 2	(5 * 10) / (8 - 2)

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

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

Fas	t Functions					
	gt	_::	Number	> _	Image	_
	name		domain		range	
exa	mples:					
_	gt (7)	is	triangle(7, "	solid", "green")	
	gt (<u>500</u>)	is	triangle(500	O, "solid", "green")	
end						
fun	gt(_size):	triangle	(size, "solid"	, "green")	_ end
	bc	::	Number	->	lmage	_
	name		domai	n	range	
exa	amples:					
_	gt (<u>19</u>) is	circle(19, "s	solid", "blue")	
_	gt (<u>43</u>) is	circle(43, "s	olid", "blue")	
end	i					
fur	n bc(_size	<u>e</u>):	circle(size, "solid",	"blue")	_ end
	dot	_::	String	> _	Image	_
	name		domai	n	range	
exa	amples:					
_	dot (<u>"blu</u>	e") is	circle(20, "s	olid", "blue")	
_	dot (<u>"red</u>	,, ,) is	circle(20, "s	olid", "red")	
end	i					
fur	n dot (col	or_):	circle(20, "solid", co	olor)	_ end

Fast Functions				
	∷ N	lumber -> _	Number	
name		domain	range	
examples:				
_	, <u>-</u>			
g (<u>10</u>) 1	s 20 * 10		_
g(23) i	s 20 * 23		_
end				
fun g (q):	20 * q		end
h	:: N	umber ->	Number	
name		domain	range	
examples:			J	
_	\ _=			
<u>h</u> (<u>10</u>) i	LS <u>10/2</u>		
<u>h</u> (<u>15</u>) i	Ls <u>15/2</u>		
end				
fun h (_x):	x / 2		end
	::	->		
name		domain	range	
examples:				
	\ -	i o		
	 ·	is		<u>—</u>
() i	is		<u>—</u>
end				
fun ():			end

·		

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	s:	
#:		->
name	Domain	Range
#		
#	What does the function do?	·
	What ages the fulletion ag.	
II. Give Examples On the computer, write an ex	ample of your function in action, using EX	AMDI F
on the computer, write an ex-	ample of your function in action, using LX.	AMIT LL.
/ D 32 7 M D T D /		,
(EXAMPLE (the user types)
HMHICED	- See pageswhich should become	/rockot-
ONOSED	- see pages	MOCKEL-
hoight c	which should become	
Heightis	CIDI	
(EXAMPLE (1
	the user types	/
		,
	which should become)
	willen should become	
III. Definition Write the definition	giving variable names to all your inpu	ut values
write the definition,	giving variable names to all your impo	ut values.
/ d o f i n o /		1
(define (variable names)
ranceion name	variable hames	
)
and th	ne computer does this	

Word Problem: red-square

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

		->
Name	Domain	Range
	What does the function do?	
Give Examples	mple of your function in action, using EXAM	PI F
•		
MPLE (t	ne user says)
	·	
)
NUSED	- See pages	/red-
	- See pages/	
	- See pages	
Definition	- See pages/)
quare.s	- See pages/)
Definition	- See pages/)

Word Problem: yard-area Use the Design Recipe to write a function $\underline{ward-area}$, which takes in the width and length of a yard, and returns the area of the yard.

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

name			>
Hame		Domain	Range
	What does the	function do?	
Give Examples			AMBI E
the computer, write a	n example of your func	tion in action, using EX	AMPLE.
XAMPLE (Use the function here)
	Use the function here		
	find another w	ay to get the same result he)
	Tilla allottler w	ay to get the same result he	
MAUSE	D - See	nades	:/lawn-
	D - See	pages	s/lawn-
	Use the function here	pages	s/lawn-
	Use the function here	pages	s/lawn-
	Use the function here	pages)
area.so	find another w	ay to get the same result he) re
area.so	Use the function here	ay to get the same result he) re
area.so	find another w	ay to get the same result he) re

DESIGN RECIPE

Word Problem: update-danger

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

I. Contract	+Purpose Stateme	ent	
Every contract has			
• •	·		->
name		Domain	Range
•			
,	What	does the function do?	
II. Give Exa	mnles		
		ur function in action, using	EXAMPLE.
(EVAMBLE (,
(EXAMPLE (_	Use the functi	on here)
UNUS	SED - S	ee pages	s/upda te-
aang	er.scrb		
(EXAMPLE (_			1
(LXAMI LL (_	Use the functi		/
			1
	find a	nother way to get the same result	
III. Definitio	NA CONTRACTOR OF THE CONTRACTO		
Write the		iable names to all your in	iput values.
, I			
(define ()
	function name	variable names	
			•
	and the computer do	nes this)
	and the computer at	/CJ (1113	

DESIGN RECIPE

Word Problem: update-target

Write a function $\underline{update-target}$, which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

	•		->
name	•	Domain	Range
Give Example		oes the function do?	
		r function in action, using Ex	XAMPLE.
MPLE ()
	Use the function	n here	
	find and	other way to get the same result h) ere
	- C		- / -
MOLE	:D - 5	ee pages	s/upaa
MPLL (S se le dint pr	n here)
ardet			
arget			
arget)
		other way to get the same result h	ere)
 Definition	find and	other way to get the same result he	
Definition Write the defin	find and	able names to all your inp	

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

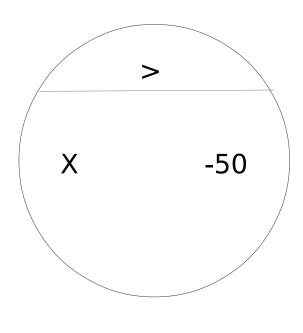
1. A piece of Sam is still visible on the left as long as...

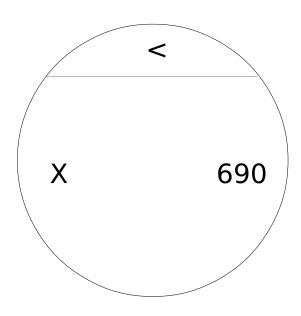
x > -50

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:





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 State	ement	
Every contract has three parts:		
•		->
, •	Domain	_ - > Range
Harric	Domain	Nange
•		
,	What does the function do?	
II. Give Examples		
On the computer, write an examp	ple of your function in action, usi	ng EXAMPLE.
		,
(EXAMPLE (function here)
ose the i	runction here	
HALLICED		1 C-
UNUSED -	See pages	/sate-
f	find another way to get the same result here	,
left.scrbl		
(EXAMPLE ()
Use the f	function here	
)
•	find another way to get the same result here	1
III. Definition		
Write the definition, giving	variable names to all your input	values.
(define (1
function name	variable names)
ranction name	variable fames	
		,
)
	and the computer does this	

Word Problem: safe-right?

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

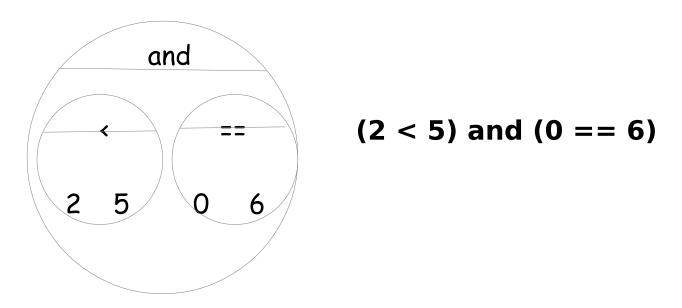
	_ :		>
name		Domain	Range
	What	t does the function do?	
Give Exam ne computer, wr		our function in action, using E	XAMPLE.
•			
AMPLE (Use the func	tion here)
			,
INIIC	ED G	a obcorav too tan some Aug	
JNUS	ED - S	aeeay t p tages	s/safe-
		ee ^{ay t} ptages	s/safe-
ight.		ace eav to the second s	s/safe-
ight.			s/safe-
ight.	scrbl		s/safe-
ight.	scrbl		s/safe-
ight.	SCrbl Use the func	tion here)
ight.	SCrbl Use the func)
Tight.S XAMPLE (Use the func	another way to get the same result h) nere
	Use the func	tion here) nere
CIGHT.SEXAMPLE (Use the func	another way to get the same result heriable names to all your in) nere

...and the computer does this

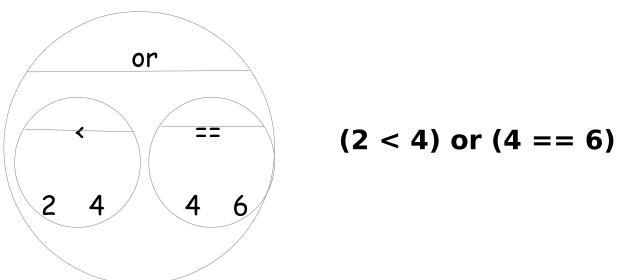
and / or

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

1. Two is less than five, <u>and</u> zero is equal to six.



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



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.

•		>
name	Domain	Range
	What does the function do?	
Give Examples	xample of your function in action, using EX	/AMDLE
EXAMPLE (Use the function here)
	use the function here	
IINIISED	fine another way to get the same result h)
OHOSED	find another way to get the same result h	ere
nages/o	nscreen.scrk	<u> </u>
EXAMPLE (Use the function here)
	Use the function here	
)
	find another way to get the same result h	ere
I. Definition		
	, giving variable names to all your inp	out values.
)
define (/

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 Stat	ement	
name •	Domain	- > Range
II. Give Examples		
On the computer, write an exam	ple of your function for <u>e</u>	ach topping, using EXAMPLE.
(EXAMPLE (cost Use the function	<u>"pepperoni"</u>)	What should the function produce?
(EXAMPLE ()) What should the function produce?
(EXAMPLE (h here) What should the function produce?
(EXAMPLE (h here) What should the function produce?
III. Definition		
(define (variable na	imes)
UNUSED -	See	
pages/cos	t.scrbl	
)		

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.

Contract+Purpose St	atement		
• name	Do		->
I. Give Examples			•
Finish the two examples we've	_		two more
EXAMPLE (<u>update-playe</u>	r 128	<u>"up"</u>)	
Use the funct	/ ion here		What should the function produce
EXAMPLE (<u>update-playe</u>	r 451 "	down")	
Use the funct	on here		What should the function produce
EXAMPLE(_)	
Use the funct	ion nere		What should the function produce
EXAMPLE (ion here	_)	What should the function produce
II. Definition			
(define ()
function name		variable na	mes
	_	I	
HMHSEF	- Soc	n n s	ages/ <mark>lipd</mark> a
		- Pc	iges/upad
dagens			

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.

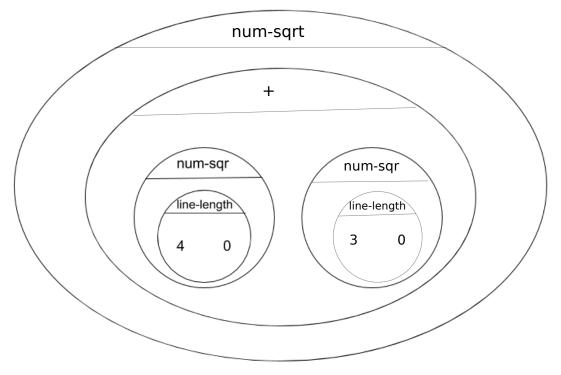
	ract+Purpose Soct has three parts:	tateme	nt				
name	:			Domain	->_	Range	
II. Give	Examples						
(EXAMPLE	(line-length Use the funct	10 ion here	5)	(- 10 What should the fu)
(EXAMPLE	(line-length Use the funct	2 ion here	8)	(- 8 What should the fu	2) unction produce?)
III. Defir	nition the definition, giv	ina vari	able na	mos to all v	our input value		
	function name			variable na)).	
_							_
	NUSEI ngth.s			-	ages/	line-	_
)							_

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)))

Write a function	distance,	which takes	<i>FOUR</i>	inputs:
------------------	-----------	-------------	-------------	---------

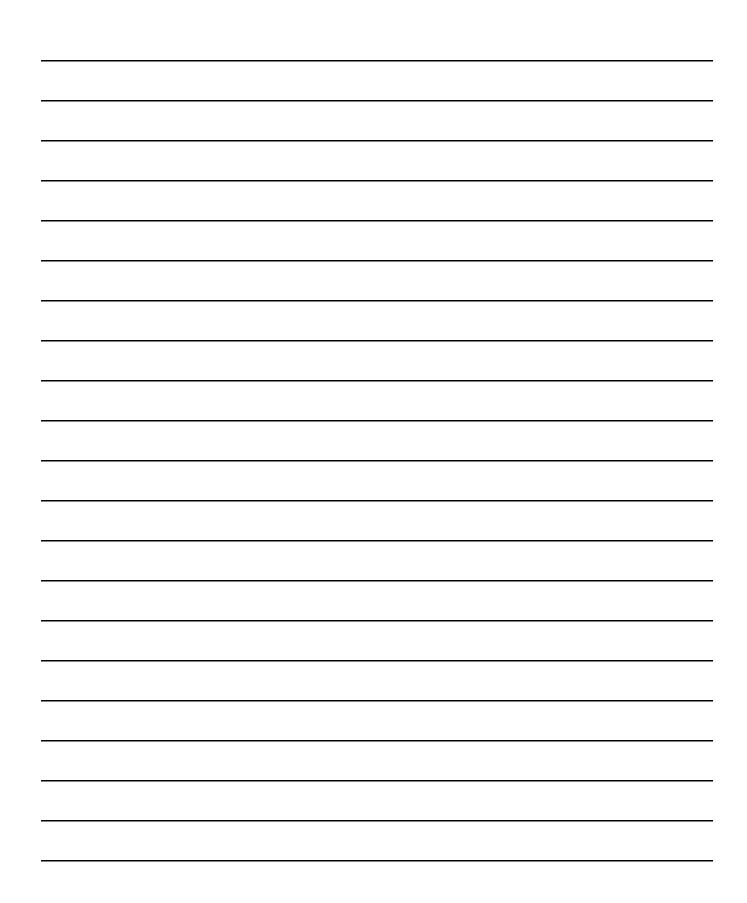
- px: The x-coordinate of the playerpy: The y-coordinate of the player
- □ cx: The x-coordinate of another game character
- □ cy: The y-coordinate of another game character

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 (se the function here)	
U	se the function here		
UNUSED	- See)
pages/di	- See find another way to get the same result here Stance-Scro		
(EXAMPLE ()	
U	se the function here		
)
	find another way to get the same result here		/
III. Definition			
(define ()	
function name	variable names	,	
			`
)

 px: The x-coordinat py: The y-coordinat cx: The x-coordinat cy: The y-coordinat It should return true 	e of the player e of another game character e of another game character le if the coordinates of the player are within 50 other character. Otherwise, false.	pixels of the
• name	Domain	-> Range
	What does the function do?	
Give Examples XAMPLE (Use the function here)
UNUSEI pages/c	D - See find another way to get the same result here)
	Use the function here)
 Definition	find another way to get the same result here)
efine (me variable names)

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, 7 th 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!

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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-sha	ре	::	String					->_	Image	
	function nan	ne			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:

```
"circle"
                                          ) is
                                                   circle(50,
                                                                    "solid",
                                                                                   "red")
red-shape
 function name
                                                              what the function produces
                            input(s)
red-shape
                       "triangle"
                                          ) is
                                                   triangle(50,
                                                                       "solid",
                                                               what the function produces
 function name
                           input(s)
                                                                            "solid",
red-shape
                      "rectangle"
                                          ) is
                                                  rectangle (5,
                                                                                           "red")
                                                                 what the function produces
 function name
                            input(s)
                          "star"
                                                   star(50,
                                                                 "solid",
                                                                                "red")
red-shape
                                          ) is
 function name
                            input(s)
                                                            what the function produces
                       "garbanzo"
                                                   text("???", 20,
                                                                             "red")
red-shape
                                          ) is
 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" ==
                                                circle(50,
                                                              "solid",
                          shape
                "triangle"
                                                                 "solid",
   else if
                                  shape
                                               : triangle(50,
                                                                            "red")
   else if
                "rectangle"
                                               : rectangle(9,
                                                                 "solid",
                                   shape
   else if
                "star"
                                               : star(50,
                                                            "solid",
                                                                        "red")
                        ==
                             shape
                               <u>"red"</u>)
           text(20, "???",
   else:
   end
end
```

Translating into Algebra

Value Definitions

Pyret Code	Algebra
x = 10	x = 10
y = x * 2	y = x*2
z = x / y	$z = x \div y$
w = num-sqrt(num-sqr(x) + 1)	$\mathbf{w} = \sqrt{x^2 + 1}$
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
<pre>fun area(length, width): length * width end</pre>	area(length, width) = length * width
<pre>pi = 3.1415926 fun circle-area(radius): pi * num-sqr(radius) end</pre>	circle-area(radius) = pi * radius²
<pre>fun distance(x1, y1, x2, y2): num-sqrt(num-sqr(x1 - x2) + num-sqr(y1 - y2)) end</pre>	distance(x1, y1, x2, y2)= $\sqrt{(x1-x2)^2+(y1-y2)^2}$

A rocket is flying from Earth to Mars at 80 miles per second. Write a function that describes the $\underline{\textbf{distance}}\ D$ that the rocket has traveled, as a function of $\underline{\textbf{time}}\ t$.

Ever	y contract ha		ose Statement e parts:	
	D	•	Number	-> Number
	name	_ `	Domain	Range
#	Given a nu	ımbe	r of seconds, produces the	height of a rocket moving at
	80mi/s		What does the function do?	
II.	Give Exam	ples		
Write			ır function for <u>some sample input</u>	<u> </u>
	D(4):-		00 . 1	
llco ti	D(1)is ne function here		80 * 1 What should the function prod	uco?
use ti	ne runction here		what should the function prod	ucer
	D(2)is		80 * 2	
Use tl	ne function here	1	What should the function prod	uce?
	D (1)			
	D(14)	<u>is</u>	80 * 14	
Use ti	ne function here		What should the function prod	uce?
	D(100)	is	80 * 100	
Use th	ne function here	13	What should the function prod	uce?
			•	
Ш.				
Write	e the function	, givin	g variable names to all your input	values.
_	. .) 00 t Li	
<u>tu</u>	n D(ti :	me) : 80 * time	
end	٦			

A rocket is traveling from Earth to Mars at 80 miles per second. Write a function that describes the <u>time</u> the rocket has been traveling, as a function of <u>distance</u>.

I. Contract Every contract h		se Statement parts:	
time	:_	Number -> Number	<u>-</u>
mame # Given the o	distance	Domain Range traveled, produce the time traveled if moving at 80)mi/s
		What does the function do?	
II. Give Exa Write an examp		function for <u>some sample inputs</u>	
time(0)	is	0 / 80	
Use the function he		What should the function produce?	
time(10)	is	10 / 80	
Use the function he	re	What should the function produce?	
time(200)	is	200 / 80	
Jse the function he	re	What should the function produce?	
time(560)	is	560 / 80	
Use the function he	re	What should the function produce?	
III. Definitio	n		
		variable names to all your input values.	
fun time	(dis	tance): distance / 80	
end			

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?

			Statement				
Every contract	it nas tn	ree pa	arts:				
colli	ie	· :	Number			-> Number	_
name				Domain		Range	
# Given the di	stance be	tween o	a rocket (moving at	80mi/sec) &	asteroid (70m	i/sec), when will they	
			What does	the function	do?		
collide?							
	xample						
Write an exa	nple of y	your fu	unction for <u>some</u>	sample in	<u>puts</u>		
collide(0) is		0 / 150				
Use the function			What should	the function i	produce?		
collide(2	000) <u>is</u>		2000 / 150				
Use the function	here		What should	the function	produce?		
collide(5	000) is		5000 / 150				
Use the function			What should	the function i	produce?		
collide(1			15000 / 150				
Use the function	here		What should	the function _l	produce?		
III. Defini	tion						
		ving v	ariable names to	all your in	nput values.		-
	, J .	<i>J</i> -		,			
fun col	lide	. (distance) :	dista	nce / 150	
_		`		, -		- ,	
end							

I. Contract+Purpos 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>	
<u>is</u>		
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		