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		Time: 5
	Math	Circle of Evaluation	Pyret Code
Round 1	(3 x 7) - (1 + 2)	* 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 (500) istriangle(500, "solid", "green")	
end				
fun	gt(_size	_):triangle(size, "s	olid", "green")	end
	· · ·	,	-	
#_	bc	: Number	->Image	_
	name	domain	range	
exa	amples:			
_	gt (<u>19</u>) iscircle(1	9, "solid", "blue")	
_	gt (<u>43</u>) iscircle(4	3, "solid", "blue")	
end	d			
fur	າ bc (size):circle(_size, "sol	lid", "blue")	end
	,			
#_	dot	: String	->Image	_
	name	domain	range	
exa	amples:			
_	dot("blue") iscircle(2	0, "solid", "blue")	
_	dot ("red) iscircle(2	0, "solid", "red")	
end	d			
fur	_):	d". color)	end

_	_		
Fast	Hiina	ctior) C
IUSL	ı aıı	CLIOI	2

_____ g ____ : Number ____ -> ____ Number ____ range

examples:

end

fun <u>g (q</u>): <u>20*q</u> end

h : Number -> Number

name domain range

examples:

<u>h</u> (<u>10</u>) is <u>10/2</u> <u>h</u> (<u>15</u>) is <u>15/2</u>

end

fun h(x): x/2 end

______: _____-> ______ range

examples:

end

____(____) 1

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.

 Contract+Purpose Sta 	atement	
Every contract has three parts:	:	
# .		_ \
name •	Domain	Range
		Harrige
#		
#	What does the function do?	
II. Give Examples		
On the computer, write an exa	mple of your function in action, us	ing FXAMPLE.
on the compact, mile an exa-	p.e er yeur ramenen in aenen, ae	9 =/0 ==.
/EVAMBLE /		,
)
the u	user types	
UNUSED -	- See pages	/rocket-
	which should become	<u>/ : </u>
<u>hoidht sc</u>	rh	
neightise		
/EVAMBLE /		1
•)
the u	user types	
)
	which should become	
III. Definition Write the definition givin	ng variable names to all your inpu	t values
write the definition, giving	ng variable hames to all your inpu	t values.
		_
(define ()
function name	variable names	
		_
)
and the co	omputer 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		
computer, write an ex	ample of your function in action, using	g EXAMPLE
AMPLE()
the	e user says	_ '
)
	Racket replies	
INIICED	Soo pages	rod
	- See pages/	
	- See pages/	
	us r s v .	
Quare.so	us ir : vvRacket turns that into	_)
Quare.so	us r s v .	_)
Quare.so	Racket turns that into	_)

Word Problem: yard-area

Use the Design Recipe to write a function <u>yard-area</u>, 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 Stat	ement	
Every contract has three parts:	<u>cc.</u>	
name :	>	>
name	Domain	Range
	What does the function do?	
	What does the function do.	
II. Give Examples		EVANABLE
On the computer, write an exam	ple of your function in action, usir	ng EXAMPLE.
(EXAMPLE(1
Use the	e function here	/
)
	find another way to get the same result I	nere
WINLISED -	See pages, e function here	/lawn-
Use the	e function here	
area.scrbl	Tanetion herein	
area.SCIDI		
)
	find another way to get the same result I	nere ,
III. Definition		
	g variable names to all your input	values.
g de	g variable names to an your input	values.
(define ()
function name	variable names	 ′
		\
and the same	nutor does this	J
and the com	puter does triis	

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.

	rpose Statement			
Every contract has the	rree parts:			
			_	
name	·	 Domain	-> Range	
Harrie		Domain	Kange	
<i>'</i>	What does	s the function do?		
U Circo Erromal				
On the computer, wr		our function in action	n usina FXAMPI F	
on the compater, wi	ite an example of ye	di fanction in actio	n, danig Examilee.	
(EXAMPLE(Use the function)	
` .	Use the function	here	,	
UNUSE	D - Sec	e page	s/up date	
	and anoth	er war to get the lane	result here	
danger	crh			
(EXAMPLE()	
(2/0/11/12/	Use the function	here		
)	
	find anoth	er way to get the same	result here	
III. Definition				
	nition, giving variable	e names to all your	input values.	
(define ()	
functi	on name	variable name	S	
)	
	and the computer does	s this		

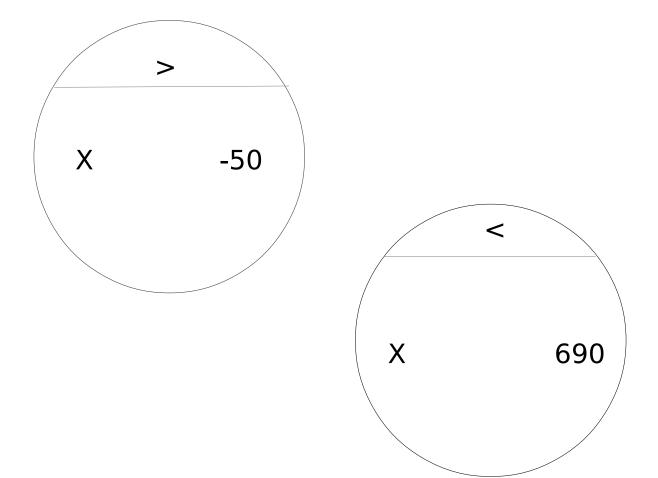
Word Problem: update-target

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

I. Contract+Purpose		
Every contract has three par	TS:	
	<u>-</u>	>
; :	 Domain	Range
		J
;		
	What does the function do?	
II. Give Examples		
On the computer, write an e	xample of your function in action, us	sing EXAMPLE.
/E\/ABADLE /		,
(EXAMPLE(se the function here)
U:	se the function here	
)
	find another way to get the same resul	t here
HMHICED	- Soo nados	/undata_
CNOSED	- see pages	/uhare-
(EXAMPLE(- See pages)
targetise	de la	
)
	find another way to get the same resul	t here
III. Definition		
Write the definition, a	iving variable names to all your inpu	t values.
, 9		
(define ()
function name	variable names	
)
and the	computer does this	

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... $\chi < 690$
- 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.

What does the function do? Give Examples In the computer, write an example of your function in action, using EXAMPLE. EXAMPLE(::		>
Give Examples In the computer, write an example of your function in action, using EXAMPLE. EXAMPLE(name	Domain	Range
n the computer, write an example of your function in action, using EXAMPLE. EXAMPLE (W() 1 1 5 1 1 2	
In the computer, write an example of your function in action, using EXAMPLE. SAMPLE(what does the function do?	
Use the function here The same result here	I. Give Examples On the computer, write an e	xample of your function in action	on, using EXAMPLE.
UNUSED – See pages/safe- find another way to get the same result here EXAMPLE(EXAMPLE()
Definition	U	se the function 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 ()	HMHICED	Soo nad	oc/cofo-
Use the function here The same result here	ONOSED	find another way to get the same	e result here
find another way to get the same result here Definition	left.scrb	inia another way to get the same	- Tesait Here
Ose the function here)	EVAMDLE/		1
II. Definition Write the definition, giving variable names to all your input values. (define ()		se the function here	/
II. Definition Write the definition, giving variable names to all your input values. (define ()			
Write the definition, giving variable names to all your input values. (define ())
Write the definition, giving variable names to all your input values. (define ()		find another way to get the same	e result here
(define ()		iving variable names to all you	r innut values
	_	iving variable names to an you	
)

Word Problem: safe-right?

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

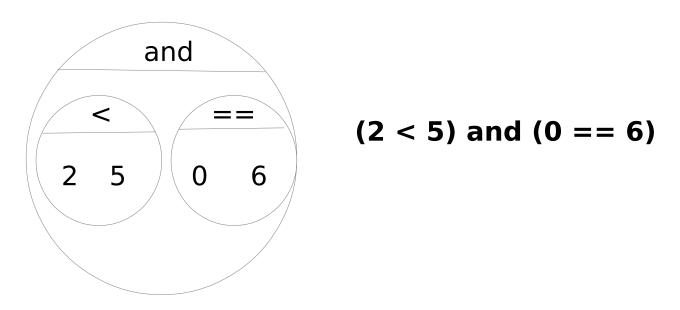
;;		>
name	Domain	Range
	What does the function do?	
Give Examples the computer, write an exa	ample of your function in action,	usina EXAMPLE.
·		_
XAMPLE (the function here)
		_)
JNUSED -	Seteway postorers	sysafe-
		<u> </u>
ight.scrb		,
XAMPLE (the function here)
		1
	find another way to get the same re	sult here
Definition		
Write the definition, giv	ring variable names to all your in	put values.
	variable names	1
lefine (1

...and the computer does this

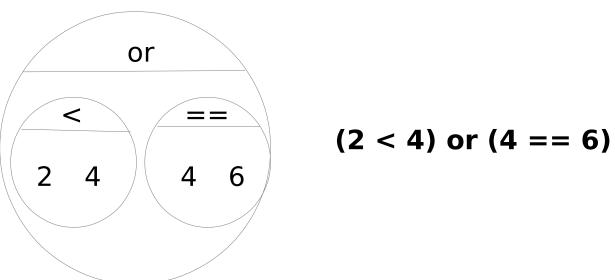
and / or

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?	
I. Give Examples On the computer, write a	an example of your function in action, u	ising EXAMPLE.
(EXAMPLE()
(270 11 11 22 (Use the function here	
UNUSE	find another way to get the same resu)
	_	<u>_</u>
pages/c	nscreen.scrk	
)
(EXAMPLE(/
(EXAMPLE(Use the function here	
(EXAMPLE(Use the function here	
(EXAMPLE ()
	Use the function here find another way to get the same resu)
		ult here
	find another way to get the same resu	ult here

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 ns	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.

Contract+Purpos Every contract has three	e Statement parts:		
•	•		->
name		Domain	Range
I. Give Examples			
(EXAMPLE <u>(line-leng</u> t 5)) Use the	th 10 5 e function here)	(- 10 What should the function produce?
(EXAMPLE <u>(line-lengt</u> 2)) Use the	th 2 8 function here)	(- 8 What should the function produce?
Write the definition (define (names to all y)
UNUSI	ED - S	ee p	ages/line-
length	.scrb		

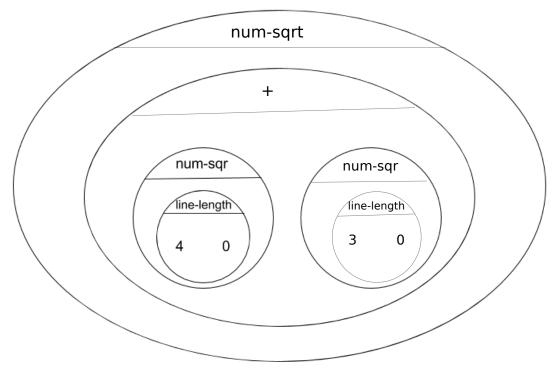
...and the computer does this

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:

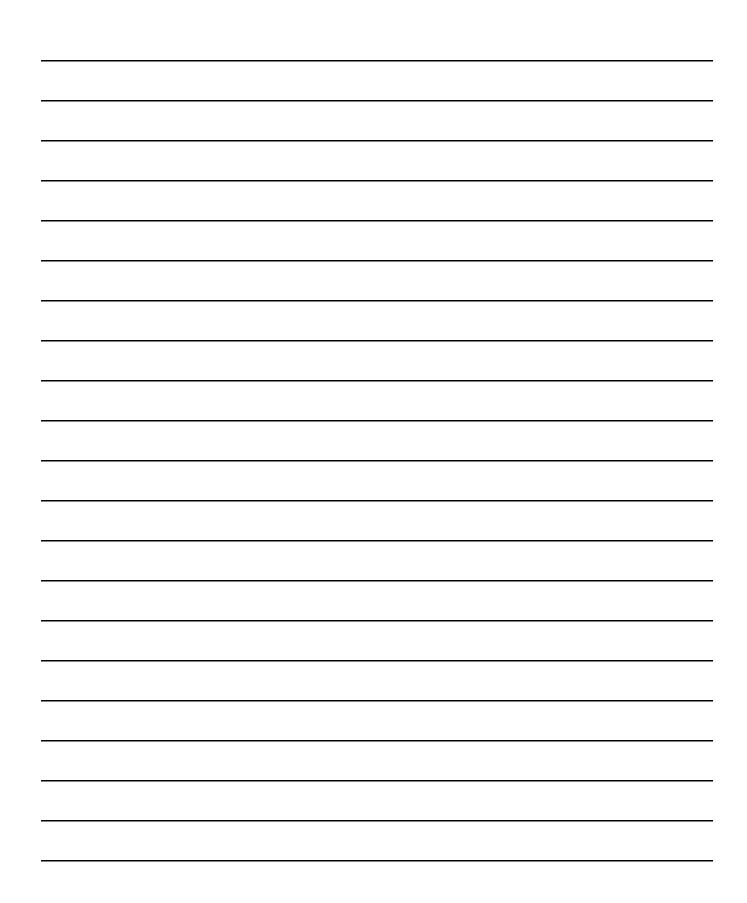
num-sqr(line-length(4, 0)) + (num-sqr(line-length(3, 0)))

Write a function distance, who px: The x-coordinate of py: The y-coordinate of cx: The x-coordinate of cy: The y-coordinate of	the player the player another game character	
It should return the distance b what you did on page 27!)	etween the two, using the Distance	e formula. (HINT: look at
I. Contract+Purpose St	atement	
name	_ Domain	>
name	Domain	Nange
,	What does the function do?	
II. Give Examples		
(EXAMPLE(the function here)
)
pages/dis	- See find another way to get the same result Lance Scro	: here
	the function here)
	find another way to get the same result	here)
III. Definition		
(define (variable names)

Write a function collide?,which takes FOUR inputs:

ayer ayer ayer er game character er game character ordinates of the player are acter. Otherwise, false.	e within 50 pixels of the
Domain	> Range
Domain	Nange
does the function do?	
ction here)
ee another way to get the same res	sult here
ie.sci bi	
ction here)
another way to get the same re	sult here
variable names)
	preserved and character for game character for game character for game character for game character. Otherwise, false. Domain Domain It does the function do? It composes the same reserved for get

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

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Word Problem: red-shape

Write a function called <u>red-shape</u>, which takes in the name of a shape ("circle", "triangle", "star" or "rectangle"), and draws that shape. All shapes should be solid and red, and can be whatever size you choose

·	D	
name	Domain	Range
	What does the function	do?
. Give Examples	ane helow. The first on	e has already been done for you.
EXAMPLE (red-shape	•	
<u>'red")</u>)	Circle	<u>lencie 30 solid</u>
Use the funct	ion here	What should the function produce?
EXAMPLE())
Use the funct	on here	What should the function produce?
EXAMPLE () _	What should the function produce?
	N N	what should the function produce.
Use the funct	on here	What should the function produce?
II. Definition		
define ()
function name (cond	variabl	e names
	(ci	rcle 50 "solid" "red")
UNUSED) - See r	pages/red-
shape.s	crbl	

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
fun area(length, width): length * width end	area(length, width) = length * width
<pre>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 $\underline{\textbf{time}}\ t$.

	D	:	Number	->	Number	
	name		Domain	_	Range	
# (Given a nu	mbe	r of seconds, produces the heig	ght o	of a rocket	moving a
	80mi/s		What does the function do?			
II.	Give Exam	ples				
Write	an example (of you	r 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	e function here		What should the function produce?			
	D(14)	is	80 * 14			
Use the	e function here		What should the function produce?			
	D(100)	:-	90 * 100			
lica the	e function here	is	80 * 100 What should the function produce?			
ose the	e fullction here		What should the function produce:			
III.	Definition					
Write	the function,	givin	g variable names to all your input valu	ues.		
_	D / ••	,				
tun	D(time	: (:	80 * time			
end						

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>.

time		Number	->	Number
name Given the di	— — stance	Domain traveled, produce the time trave	led if mov	Range /ing at 80mi/
# Given the di		What does the function do?		
II. Give Exam		function for some some in such		
write an example	or 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?	?	
B. C'				
III. Definition	aivina	variable names to all your input va	ابیمد	
write the function	i, givilig	variable flames to all your input va	iues.	
fun time	(dis	stance): distance	/ 80	
end	,		, 00	
CIIU				

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+ Every contract has		se Statement			
-	-			Necesia	
collide	: _	Number	>	Number	_
name		Domain		Range	
#Given the distance	e betw	een a rocket (moving at 80mi/sec) & aste	eroid (70	Omi/sec), when	will they
collide?		What does the function do?			
II. Give Exam	ples				
		r 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					
	, giving	y variable names to all your input valu	es.		
fun collide end	(di	istance): distance /	150	0	

I. Contract+I Every contract has			
,			
	:	->	>
name		Domain	Range
#			
		What does the function do?	
II. Give Exam	ples		
Write an example	of your fu	nction for <u>some sample inputs</u>	
	is		
Use the function here		What should the function produce?	
	<u>is</u>		
Use the function here		What should the function produce?	
	io		
Use the function here	is	What should the function produce?	
ose the function here		what should the function produce:	
	is		
Use the function here		What should the function produce?	
III. Definition			
	giving va	riable names to all your input values.	
fun	1	١.	
fun	():	
end			