# Contracts

Name	Domain	Range	example
••	•	<b>^</b>	
••	•	<b></b>	
••	•	<b></b>	
••	•	<b>↑</b>	
••		<b>↑</b>	
••	•	<b>↑</b>	
••	•	<b>↑</b>	
••	:	<b>↑</b>	
••		<b>^</b>	
••		<b>↑</b>	
••	•	<b></b>	
••	:	<b>↑</b>	
••		<b>^</b>	
••	•	<b>↑</b>	
••	•	<b>↑</b>	
••		<b>↑</b>	
••	••	<b>↑</b>	

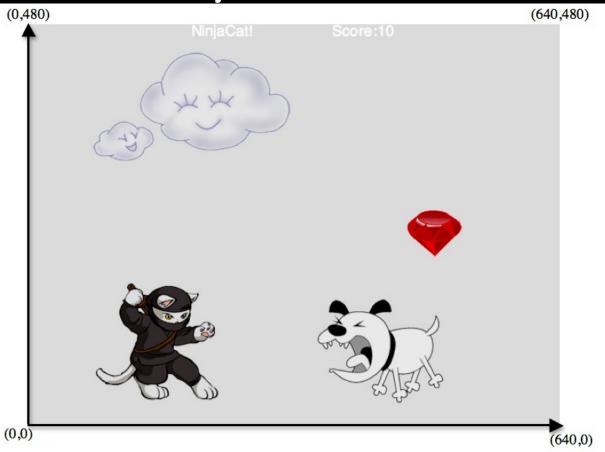
# **Contracts**

example																	
Range	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>↑</b>	<b>↑</b>	<b>1</b>	<b>↑</b>	<b>^</b>	<b>↑</b>	<b>↑</b>	<b>↑</b>	<b>^</b>	<b>↑</b>	<b>^</b>	<b>1</b>	<b>↑</b>
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
	•	

## Game Parts - NinjaCat!



The coordinates for the PLAYER (NinjaCat) are	e:	( ,	)	
		x-coordinate	y-coordinate	
The coordinates for the DANGER (Dog) are:	(	,	)	
The coordinates for the TARGET (Ruby) are:	(	,	)	

### Our Videogame

Created by (write your names):
Background
Our game takes place:(In 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
The Target moves only to the left and right.
The Danger 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	Racket Code
5 10		
5 x 10		
8 + (5 x 10)		
(8 + 2) - (5 x 10)		
<u>5 x 10</u> 8 - 2		

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

	Circles Tric		Time: 5 minutes
	Math	Circle of Evaluation	Racket 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 Functions!**

;	:	>	
name	domain	range	
(EXAMPLE (	)		)
(define (	)		)
·	:	>	_
name	domain	range	
(EXAMPLE ( (EXAMPLE ( (define (	)		) )
,name	domain	>range	_
;	domain))	> range	) )
(EXAMPLE (	)		) )

### Fast Functions!



	_:	
name	domain	range
(EXAMPLE (	)	)
(EXAMPLE (	)	)
(define (	)	)
	_:	
name	domain	range
_(EXAMPLE (	)	)
(EXAMPLE (	)	)
(define (	)	)
;	<u>;</u>	
(EXAMPLE (	)	)
(EXAMPLE (	)	)
(define (	)	)
;	<u>:</u>	
(EXAMPLE (	)	)
(EXAMPLE (	)	)
(define (	)	)

### 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.

Contract+Purpose State	ment	
ery contract has three parts:		
•		->
• name	Domain	/ Range
name	53a	nange
	What does the function do?	
Give Examples		
the computer, write an example	ole of your function in action, using E	XAMPLE.
,	,	
EXAMPLE (		1
EXAMPLE (the_	user types	/
		,
	which should become	)
	Willen should become	
EXAMPLE (		1
EXAMPLE (the	user types	/
		,
	which should become	)
	willen should become	
Definition		
Write the definition, givin	ng variable names to all your input	values.
define (function name	variable names	)
tunction name	variable flames	·
<del></del>		
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.

I. Contract	t+Purpose Statement			
Every contract h				
•	•		->	
,Name	·	 Domain	/ Range	
Name		Domain	Kange	
•				
,	What	does the function do?		
II. Give Exc	ımnles			
On the computer	r, write an example of yo	our function in action, using EXA	AMPLE	
(EXAMPLE (_	the user says.		)	
	the user says.	<del>.</del>		
_			)	
_		Racket replies	,	
(EXAMPLE (_			)	
(_,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	the user says.	••	/	
			,	
_		Racket turns that into	)	
		Racket turns that into		
III. Definition				
Write the	e definition, giving varia	ible names to all your input v	alues.	
(dofina (			1	
(define (_	function name	variable names	)	
	TUNCTION HAME	variable names		
				`
		Al-2-		)
	and the computer d	oes this		

### 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. Contra	ct+Purpose Statemei	nt	
<b>Every contract</b>	has three parts:		
•	·	<u>-</u>	>
name	•	Domain	Range
			J
;			
	· ·	What does the function do?	
	xamples		
On the comput	ter, write an example o	of your function in action, using EXAMP	LE.
(EXAMPLE	(		)
(		function here	
			,
		find another way to get the same result here	)
		, 5	
(EXAMPLE	1		,
(LXAMPLL	Use the	function here	)
		Conditional to the condition of the cond	)
		find another way to get the same result here	
III. Definiti			
Write ti	ne definition, giving v	rariable names to all your input value	es.
(define (			1
(derine (	function name	variable names	<b></b> )
			,
	and the compu	ter does this	

### 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. Contro	ıct+Purpose Stateı	ment		
	has three parts:			
•	•		->	
name	•	Domain	Range	
•				
,		What does the function do?		_
		What does the function do.		
	xamples	ole of your function in action, using EXAM	ADI F	
			Ar LL.	
(EXAMPLE	(	the function here	)	
	Use	the function here		
			)	
		find another way to get the same result here		
(EXAMPLE	(		)	
	Use	the function here		
			)	
		find another way to get the same result here		
III. Definiti	on			
Write t	he definition, givir	ng variable names to all your input val	ues.	
(dofina (			1	
(define (	function name	variable names	)	
	ranction name	variable names		
				,
-	and the co	omputer does this		<i>'</i>

### Design Recipe: update-target

### Word Problem: update-target

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

I. Contract+Purp	ose Statement			
Every contract has thre	e parts:			
·	•		->	
name		Domain	Range	
•				
,	What doe	es the function do?		_
II. Give Examples				
		function in action, using E	XAMPLE.	
(EXAMPLE (			,	
(LXAMI LL (	Use the function	here	)	
			)	
	find anot	her way to get the same result	nere	
(EXAMPLE (		here	)	
	Use the function	here		
			)	
	find anot	her way to get the same result	nere	
III. Definition	ition oiving vericles		velue	
		e names to all your input	values.	
(define (	on name		)	
function	on name	variable names		
				)

.....and the computer does this

### **Protecting Sam**

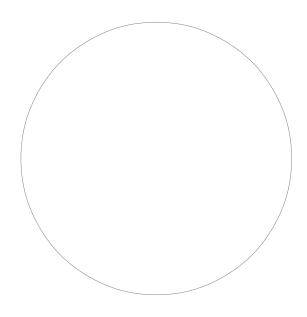
Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

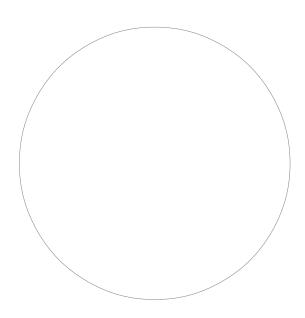
1. A piece of Sam is still visible on the left as long as...

(> 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: safe-left?

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

•		->
name	Domain	Range
	What does the function do?	
Give Examples		
n the computer, write an e	example of your function in action, using	EXAMPLE.
EXAMPLE (		)
l	Use the function here	
		)
	find another way to get the same result here	
EVAMBLE /		`
EXAMPLE (	Use the function here	)
		`
	find another way to get the same result here	<i>)</i>
Definition		
	iving variable names to all your input val	ues.
Write the definition, g	iving variable names to all your input val	ues.

...and the computer does this

Word Problem: safe-right?

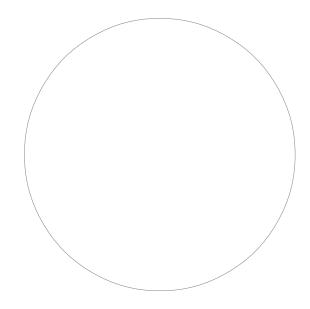
Use the Design Recipe to write a function <u>safe-right?</u>, which takes in an x-coordinate and checks to see if it is less than 690.

name	Domain	Range
	What does the function do?	
Give Examples		
the computer, write an exar	mple of your function in action, using E	XAMPLE.
EXAMPLE (		)
U	se the function here	,
		)
	find another way to get the same result h	nere
EXAMPLE (		)
U	se the function here	,
		,
	find another way to get the same result h	ere
Definition		
. <b>Definition</b> Write the definition, given	ving variable names to all your input	values
, , , , , , , , , , , , , , , , , , ,		, d. 6 6 6 .
define (		)

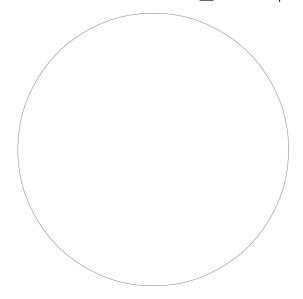
### and / or

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

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

I. Contract+I	Purpose Statement			
Every contract has				
•	•		->	
name	•	Domain	Range	_
,	Wha	t does the function do?		_
		te does the function do:		
II. Give Exam		our function in action, using	FYAMDI F	
on the computer, v				
(EXAMPLE (		ction here	)	
	Use the func	ction here		
			)	
	find	another way to get the same result	t here	
(EXAMPLE (		ction here	)	
	Use the func	ction here		
			)	
	find	another way to get the same result	t here	
III. Definition				
Write the c	definition, giving vari	able names to all your inpu	ıt values.	
( d - <b>C</b> ' (			`	
(define (	function name	voriable names	)	
Г	function name	variable names		
				`
				)

...and the computer does this

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 Sto	atement	
name •	Domain	<b>-&gt;</b> Range
II. Cive Evennentee		
II. Give Examples  On the computer, write an e	example of your function for	each topping, using EXAMPLE.
	"pepperoni" )	1
	unction here	What should the function produce?
(EXAMPLE (	)	)
Use the f	unction here	What should the function produce?
(EXAMPLE (	unction here	What should the function produce?
(EXAMPLE (	unction here	What should the function produce?
III. Definition		
(define (		)
function nam		e names

### Word Problem: update-player

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

I. Contract+P	urpose Statement			
,	_:		Domain	> Range
II. Give Example Finish the two examples	<b>ples</b> mples we've started f	or you	, and make tw	vo more
(EXAMPLE (up	date-player Use the function here	128	<u>"up"</u> ) _	What should the function produce?
(EXAMPLE ( <u>up</u>	date-player Use the function here	451	"down") _	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 (	nction name		variable na	mes

)

Lesson 8					

### Word Problem: line-length

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.

•	•				->		
name	• <u></u>			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		8	)	(- 8 What should the fu	2) nction produce?	)
III. <b>Defini</b> Write	tion the definition, givin	na variah	ole nam	es to all you	r input values		
(define	_		no mann	os ro an you	)		
(define	function name			variable na	mes /		
)							

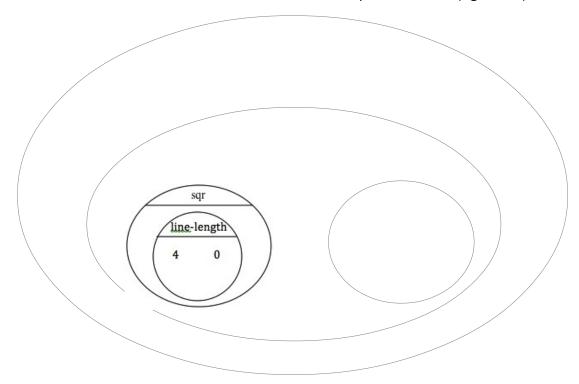
...and the computer does this

### The Distance Formula, with Numbers

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

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

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



Convert the Circle of Evaluation into Racket code:

### Word Problem: distance

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

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

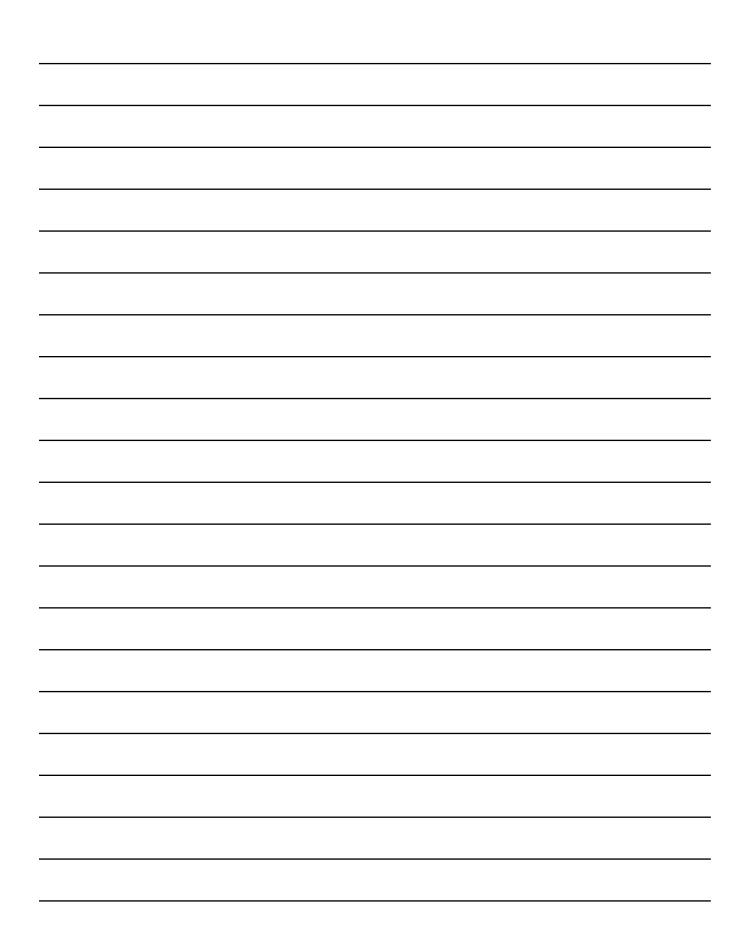
It should return the distance between the two, using the Distance formula. (HINT: look at what you did on page 27!)

I. Contract+Purpo	ose Statement			
name	•	Domain	> Range	_
;	What de	oes the function do?		
II. Give Examples				
		n here	)	
	ose the function	n nere		
				)
	find and	other way to get the same re	esult here	
(EXAMPLE (	Use the function	n here	)	
	ose the function	ii nere		
				)
	find and	other way to get the same re	esult here	
III. Definition				
(define (			)	
functio	n name	variable names	S	
				)

### WORD PROBLEM: COLLIDE?

□ py □ cx □ cy lt	c: The x-coording: The y-coording: The x-coording: The y-coording should return toordinates of the	ate of the player ate of the player ate of another gar ate of another gar rue if the coordin e other character.			of the
l. C	ontract+Purpos	se Statement			
•na	me •		Domain	>	Range
;			pes the function do?		
II. G	ive Examples LE (		n here other way to get the same		)
(EXAMP	'LE (	Use the function	n here	)	
III. De	efinition	find and	other way to get the same	eresult here	)
(defin	e (	name	variable nan	nes )	)

Catchy Intro:
Name, Age, Grade:
Game Title:
Back Story:
Characters:
xplain a piece of your code:



### **Presentation Feedback**

For each question, circle the answer that fits best.

Definitely! Was the introduction catchy? No way! A little. 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! Definitely! A little. 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	For each	question,	circle	the	answer	that	fits best.
---	----------	-----------	--------	-----	--------	------	------------

Was the introduction catchy? No way! A little. Definitely!

Did they talk about their characters? No way! A little. Definitely!

Did they explain the code well? No way! A little. Definitely!

Did they speak slowly enough? No way! A little. Definitely!

Did they speak loudly enough? No way! A little. Definitely!

Were they standing confidently? No way! A little. Definitely!

Did they make eye contact? No way! A little. Definitely!

### Word Problem: red-shape

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

Write some examples of red-shape below. The first one has already been done for you.  (EXAMPLE (red-shape "circle" ) (circle 50 "solid" "red") What should the function produce?  (EXAMPLE ( ) What should the function produce?	I. Contr	act+Purpose Statement		
Write some examples of red-shape below. The first one has already been done for you.  (EXAMPLE (red-shape "circle" ) (circle 50 "solid" "red") What should the function produce?  (EXAMPLE (	•	•		->
Write some examples of red-shape below. The first one has already been done for you.  (EXAMPLE (red-shape "circle") (circle 50 "solid" "red") (what should the function produce?  (EXAMPLE () (by the function here) (cond (cond (circle 50 "solid" "red") (by the function produce? (circle 50 "solid" "red") (circle	name	•	Domain	
Write some examples of red-shape below. The first one has already been done for you.  (EXAMPLE (red-shape "circle") (circle 50 "solid" "red") (what should the function produce?  (EXAMPLE () (by the function here) (cond (cond (circle 50 "solid" "red") (by the function produce? (circle 50 "solid" "red") (circle	II. Give I	Examples		
Use the function here  What should the function produce?  (EXAMPLE (	Write some ex	xamples of red-shape below. The fi	rst one has alr	eady been done for you.
(EXAMPLE (	(EXAMPLE		)	<del></del>
Use the function here  What should the function produce?  (EXAMPLE ()  Use the function here  What should the function produce?  Variable names  (cond	(EXAMPLE	(Use the function here	)	
Use the function here  What should the function produce?  What should the function produce?  What should the function produce?  III. Definition  function name  variable names  (cond	(EXAMPLE	Use the function here	)	What should the function produce?
(define ()  function name variable names  (cond	(EXAMPLE	(Use the function here	)	What should the function produce?
function name variable names  (cond	III. Defini	tion		
function name variable names  (cond	(define (	(		)
(circle 50 "solid" "red")	`	function name	variable na	ames ,
			(circ	cle 50 "solid" "red")

### Translating into Algebra

Values: Translate the F	acket Code into Algebra					
Racket Code	Algebra					
(define x 10)	x = 10					
(define y (* x 2))	y = x*2					
(define z (+ x y))						
(define age 14)						
(define months (* age 12))						
(define days (* months 30))						
(define hours (* days 24))						
(define minutes (* hours 60))						
Functions: Translate the Racket Code into Algebra						
Tunctions. Iranstate the	Racket Code into Algebra					
(define (double x)  (* x 2))	double(x) = $x*2$					
(define (double x)						
<pre>(define (double x)   (* x 2))  (define (area length width)</pre>	double(x) = x*2					

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+P Every contract has				
; <u>D</u>	:	Domain	-> Range	-
II. Give Exam Write an example o		cion for <u>some sample inputs</u>		
D(1) Use the function here	=	What should the function produce?		
D(2) = Use the function here		What should the function produce?		
D()	=.			
Use the function here	=	What should the function produce?		
Use the function here		What should the function produce?		
III. Definition Write the fo	ormula, givi	ng variable names to all your input va	ilues.	
<u>D(</u> ) =				

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*.

<ol> <li>Contract+Purpe</li> </ol>	ose Statemen	t		
Every contract has the	ree parts:			
:			->	
name		Domain	Rai	nge
II. Give Examples				
Write an example of y	our function f	or some sample inputs		
=	<u> </u>			
Use the function here	V	hat should the function produce?		
=	<b>=</b>			
Use the function here	<b>V</b>	/hat should the function produce?		
=	=			
Use the function here		/hat should the function produce?		
=	=			
Use the function here	W	/hat should the function produce?		
III. Definition				
Write the Form	ula, giving var	riable names to all your input	values.	
	=			

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?

<ol> <li>Contract+Purp</li> </ol>	ose Staten	nent		
Every contract has three	e parts:			
•	:		->	
name		Domain	Range	
II. Give Example:				
Write an example of yo	our function	n for <u>some sample inputs</u>		
=	=			
Use the function here		What should the function produce?		
=	=			
Use the function here		What should the function produce?		
=	=			
Use the function here		What should the function produce?		
=	=			
Use the function here		What should the function produce?		
III. Definition				
Write the Form	ula, giving	variable names to all your input vo	alues.	
	_			
	<b>=</b>			

<ol> <li>Contract+Purp</li> </ol>	oose Statement				
Every contract has thre	ee parts:				
;	•		->		
name		Domain		Range	
II. Give Example	S				
Write an example of yo	our function for <u>so</u>	me sample inputs			
=	=				
Use the function here	What	should the function produce?			
=	=				
Use the function here	What	should the function produce?			
=	=				
Use the function here	What	should the function produce?			
=	=				
Use the function here	What	should the function produce?			
III. Definition					
Write the Form	ıula, giving varial	ole names to all your inpu	ut values.		
	=				