Contracts

| Name | Domain | Range | example |
|------|--------|----------|---------|
| •• | • | ↑ | |
| : | : | ↑ | |
| •• | • | ↑ | |
| •• | | ↑ | |
| • | • | ^ | |
| •• | • | ^ | |
| •• | : | ↑ | |
| •• | : | ↑ | |
| •• | • | ^ | |
| • | • | ↑ | |
| •• | | ↑ | |
| •• | : | ↑ | |
| ; | • | ^ | |
| •• | • | ↑ | |
| • | | + | |
| •• | : | ↑ | |
| • | • | ↑ | |

Contracts

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

Reverse-Engineering: How does NinjaCat work?

| Thing in the game | What changes about it? | More specifically |
|-------------------|------------------------|-------------------|
| cloud | position | x-coordinate |
| | | |
| | | |
| | | |
| | | |
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| | | |

Finding Coordinates



| 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 x 10 | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| 8 + (5 x 10) | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| (8 + 2) - (5 x 10) | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| <u>5 x 10</u> | | |
| <u>5 x 10</u> 8 - 2 | | |
| | | |
| | | |
| | | |

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

| | Circles Co | mpetition | 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 (|) | | _) |
| (EXAMPLE (|) | |) |
| (define (|) | | _) |
| ; | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| • | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|)) | |) |
| , | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |

| Fast Functions | | | |
|----------------|--------|-------|----|
| ; | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | | _) |
| (EXAMPLE (|) | |) |
| (define (|) | | _) |
| ; | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| • | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|)) | |) |
| , | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |

| | • | • | - | |
|---|---|---|--------------|--|
| | | | | |
| · · · · · · · · · · · · · · · · · · · | - | - | - | |

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 pa | rts: | |
| | | |
| • | | -> |
| name | Domain | Range |
| • | | |
| , | What does the function do? | |
| | mad ases the function as: | |
| II. Give Examples | example of your function in action, using E | EYAMDI E |
| on the computer, write an | example of your function in action, using t | _AAMFLL. |
| / U V N M D T U / | | 1 |
| (EXAMPLE (| the user types | / |
| | 3, | |
| | | |
| | which should be some |) |
| | which should become | |
| | | |
| | | |
| (EXAMPLE (| |) |
| (| the user types | / |
| | | |
| | | , |
| | which should become |) |
| | | |
| III. Definition | giving variable names to all your input | tyaluos |
| wille the deliminon | , giving variable names to all your input | values. |
| / 1 C' / | | , |
| (define (| me variable names |) |
| TUIICLIOII IId | ne variable names | |
| | | |
| | | 1 |
| | the computer does this | <i>,</i> |

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+Purpose S | tatement | |
|------------------------------|---|----------|
| Every contract has three par | | |
| | | |
| | | -> |
| , • | Domain | Range |
| | | 5- |
| ; | | |
| | What does the function do? | |
| II. Give Examples | | |
| On the computer, write an e | example of your function in action, using E | XAMPLE |
| (EXAMPLE (| |) |
| (=>===== | the user says | / |
| | | |
| | | \ |
| | Racket replies |) |
| | <u> </u> | |
| | | |
| (EXAMPLE (| | \ |
| (LAAMPLL (| the user says |) |
| | | |
| | | |
| | Racket turns that into |) |
| | Nacket turns that into | |
| III. Definition | | |
| Write the definition, | giving variable names to all your input | values. |
| (define (| |) |
| function nam | ne variable names | / |
| | | |
| | |) |
| | the computer does 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. Contrac | t+Purpose Statement | • | | |
|---|------------------------|--|-----------------|----|
| Every contract h | | | | |
| | | | | |
| • | • | | _ | |
| name | : | Domain | > Range | |
| name | | Domain | Nulige | |
| • | | | | |
| | W | hat does the function do? | | |
| II. Give Exc | amples | | | |
| On the compute | r, write an example of | your function in action, using EXAMP | LE. | |
| (EVAMDLE (| | | \ | |
| (EXAMPLE (| Use the fu | nction here |) | |
| | | | | |
| | | | | |
| _ | | |) | |
| | fir | nd another way to get the same result here | | |
| | | | | |
| | | | | |
| (EXAMPLE (| | |) | |
| | Use the fu | inction here | | |
| | | | | |
| | | |) | |
| _ | fir | nd another way to get the same result here | / | |
| III Dofinitio | | | | |
| III. Definitio Write the | | ariable names to all your input value | 2 S. | |
| ,,,,,, | | | 70. | |
| (define (_ | | |) | |
| (====================================== | function name | variable names | <u> </u> | |
| | | | | |
| | | | |) |
| - | and the compute | er 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. Contrac | ct+Purpose Statement | | | |
|----------------|---|----------------------------|-------------|------|
| Every contract | has three parts: | | | |
| | | | | |
| • | • | | -> | |
| name | • | Domain | Ra | inge |
| _ | | | | |
| ; | What doe | es the function do? | | |
| | What doe | s the function do: | | |
| | amples er, write an example of your | function in action luci | ng EVAMDI E | |
| On the comput | | | | |
| (EXAMPLE | <u> </u> | |) | |
| | Use the function I | here | | |
| | | | | |
| _ | | | |) |
| _ | find anoth | her way to get the same re | sult here | |
| | | | | |
| | | | | |
| (EXAMPLE | <u> </u> | |) | |
| | Use the function I | here | | |
| | | | | |
| | | | |) |
| - | find anoth | her way to get the same re | sult here | |
| III. Definitio | on | | | |
| | e definition, giving variable | names to all your in | put values. | |
| | | | | |
| (define (_ | | |) | |
| | function name | variable names | i | |
| | | | | |
| | and the second of the second | thic | |) |
| | and the computer does | UIIS | | |

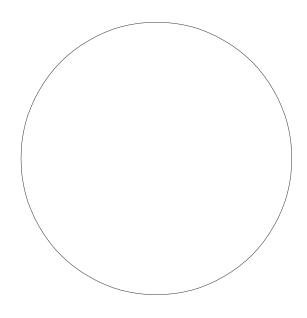
Word Problem: update-target

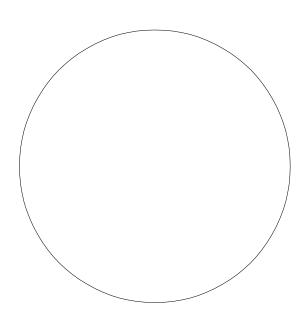
Write a function <u>update-target</u>, which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

| I. Contrac | ct+Purpose Statement | | |
|----------------|--|------------------------|-------|
| | has three parts: | | |
| | | | |
| • | • | -> | |
| name | •Domai | | Range |
| | | | |
| ; | What does the function | | |
| | what does the function | uo: | |
| II. Give Ex | amples | ection using EVAMPLE | |
| On the compute | er, write an example of your function in a | | |
| (EXAMPLE (| Use 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. Definitio | on | | |
| Write th | e definition, giving variable names to | all your input values. | |
| (| | ` | |
| (define (_ | function name val | riable names | |
| | runction name val | iante liailles | |
| | | | 1 |
| | and the computer does this | |) |
| | | | |

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.

| . Contract+Purpos | e Statement | | | |
|--|------------------|----------------------------------|---------------|---|
| very contract has thre | e parts: | | | |
| | | | | |
| : | | | -> | |
| name | | Domain | Range | |
| | | | | |
| | What de | oes the function do? | | |
| Cive Everneles | | | | |
| . Give Examples On the computer, write | an example of y | your function in action, us | sing EXAMPLE. | |
| | | | | |
| EXAMPLE (| Use the function | n here |) | |
| | | | | |
| | | | , | |
| | find and | other way to get the same result |) here | |
| | | other may to get the same result | Tiere | |
| | | | | |
| EXAMPLE (| | |) | |
| L//A//// LL (| Use the function | n here | / | |
| | | | | |
| | | | , | |
| | find and | other way to get the same result | here | |
| II. Definition | | | | |
| | n, giving variab | ole names to all your inpu | t values. | |
| | | | | |
| define (| | |) | |
| function | name | variable names | | |
| | | | | , |
| | | | | |

...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.

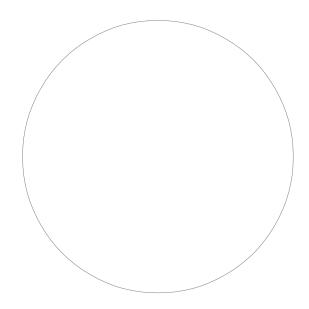
| | act+Purpose Statemer | nt | | |
|--------------|---------------------------|--|-------|---|
| | t has three parts: | | | |
| | | | | |
| • | • | | _ | |
| , | · | Domain | -> | |
| name | | Domain | Range | |
| : | | | | |
| , | | What does the function do? | | |
| U C: | | | | |
| | xamples | of your function in action, using EXAM | ADI F | |
| on the compe | itel, write all example e | or your runction in action, using EXAM | W LL. | |
| (EXAMPLE | (| |) | |
| | Use the f | function here | | |
| | | | | |
| | | | ` | |
| | | find another way to get the same result here |) | |
| | | and another way to get the same result here | | |
| | | | | |
| | | | | |
| (EXAMPLE | (| |) | |
| | Use the f | function here | | |
| | | | | |
| | | | , | |
| | f | find another way to get the same result here |) | |
| | | | | |
| III. Defini | | | | |
| write | rne definition, giving v | ariable names to all your input valu | ues. | |
| (dofina | , | | 1 | |
| (define | function name | |) | |
| | TUNCTION NAME | variable names | | |
| | | | | |
| | | | |) |
| | | | | |

...and the computer does this

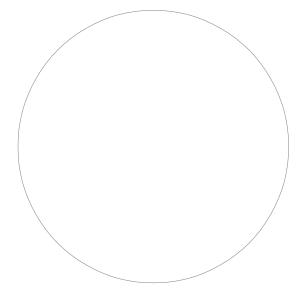
and / or

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. Contro | act+Purpose Statement | |
|--------------|--|--------------|
| | t has three parts: | |
| | | |
| • | • | |
| name | • | > Range |
| name | Domain | Kange |
| • | | |
| , | What does the function do? | |
| U. Chan F | | |
| On the compu | xamples Iter, write an example of your function in action, us | ing FXΔMPI F |
| on the compa | | |
| (EXAMPLE | Use the function here |) |
| | Use the function here | |
| | | |
| | | ` |
| | find another way to get the same re | |
| | Tind dilother way to get the sume it | 23dic nere |
| | | |
| | | |
| (EXAMPLE | (|) |
| | Use the function here | |
| | | |
| | | \ |
| | find another way to get the same re | esult here |
| | | |
| III. Definit | | |
| write i | the definition, giving variable names to all your in | nput values. |
| (dofina (| , | 1 |
| (define (| function name variable name | |
| | function name variable name | 3 |
| | | |
| | |) |
| | | |

...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 Statem | ent | |
|--------------------------------|------------------------------------|-----------------------------------|
| | | |
| , • | Domain | |
| II. Give Examples | | |
| On the computer, write an exam | iple of your function for <u>e</u> | ach topping, using EXAMPLE. |
| | "pepperoni") |) |
| Use the function | n here | What should the function produce? |
| (EXAMPLE (|) | What should the function produce? |
| (EXAMPLE (|) |) |
| Use the function | n here | What should the function produce? |
| (EXAMPLE (| | What should the function produce? |
| III. Definition | | |
| (define (| | 1 |
| function name | variable r | 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. Contra | ıct+Purpose Statemer | nt | | |
|---------------|--|-------------|-----------------|-----------------------------------|
| • | : | | | -> |
| name | · | | Domain | Range |
| | xamples examples we've star | ted for you | u, and make tv | wo more |
| (EXAMPLE | (<u>update-player</u> Use the function t | | <u>"up"</u>) _ | What should the function produce? |
| (EXAMPLE | (<u>update-player</u> Use the function t | | "down") _ | What should the function produce? |
| (EXAMPLE | Use the function h | nere |) | What should the function produce? |
| (EXAMPLE | Use the function h | nere |) | What should the function produce? |
| III. Definiti | on | | | |
| (define | function name | | variable no | ames |
| | | | | |
| | | | | |
| | | | | |

| | | |
|------|------|--|
| | | |
| | | |

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.

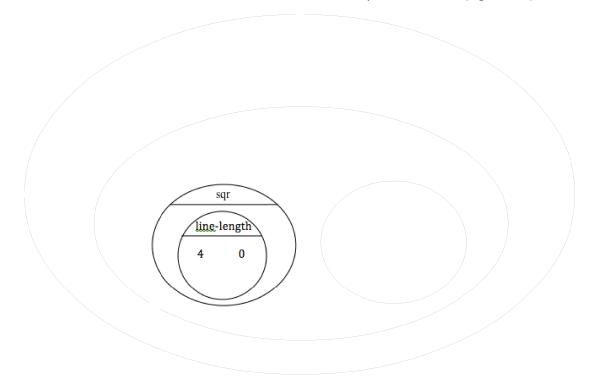
| | act+Purpose State at has three parts: | ement | | | | | |
|-------------|--|-----------------|---|--------|------------------------------------|-------|---|
| name | Examples | | | Domain | -> | Range | |
| (EXAMPLE | (line-length Use the func | 10 tion here | 5 |) | <u>(-</u> 10 What should the fu | |) |
| III. Defini | | tion here | | | (- 8 What should the fu | |) |
| (define | the definition, givi | | | • |) | | |
| | | | | | | | |
|) | | | | | | | |

The Distance Formula (an example)

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:

| Write a function distan | e, which takes | FOUR inp | outs: |
|-------------------------|----------------|----------|-------|
|-------------------------|----------------|----------|-------|

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

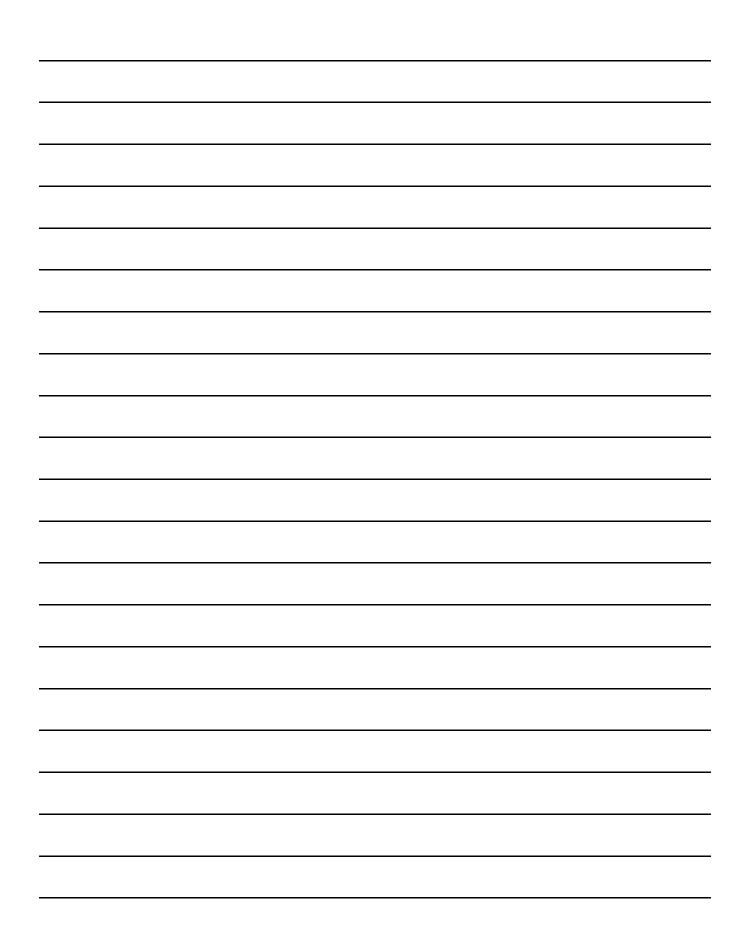
It should return the distance between the two, using the Distance formula. (HINT: look at what you did on page 27!)

| I. Contract+Pur | pose Statement | | | |
|------------------|------------------|-------------------------------|--------------|----------|
| • | | | -> | |
| name | _ • | Domain | Range | |
| • | | | | |
| , | What o | does the function do? | | |
| II. Give Example | es | | | |
| (EXAMPLE (| | on here |) | |
| | Use the function | on here | | |
| | | | | , |
| | find ar | nother way to get the same re | esult here | |
| (EXAMPLE (| | |) | |
| | Use the function | on here | , | |
| | | | | , |
| | find ar | nother way to get the same re | esult here | / |
| III. Definition | | | | |
| (define (| | |) | |
| | tion name | variable names | / | |
| | | | | |
| | | | | 1 |
| | | | | <i>!</i> |

Write a function collide?,which takes FOUR inputs:
px: The x-coordinate of the player

| Contract+Purpose Sta | lement | -> |
|----------------------|---|----------|
| name | Domain | Range |
| | What does the function do? | |
| Give Examples | | |
| EXAMPLE (| se the function here |) |
| | find another way to get the same result h |) ere |
| | | |
| XAMPLE (| se the function here |) |
| | |) |
| | find another way to get the same result h | ere |
| . Definition | find another way to get the same result h | ere |
| define (| variable names |) |

| Catchy Intro: |
|------------------------------|
| |
| |
| lame, Age, Grade: |
| Same Title: |
| ack Story: |
| |
| |
| |
| Characters: |
| |
| |
| |
| |
| xplain a piece of your code: |
| |
| |
| |
| |



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? Definitely! No way! 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.

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

| I. Contract+Purpose Staten | hent | |
|--|------------------------------|---|
| | | |
| name | Domain | -> Range |
| , | What does the function do | 0% |
| II. Give Examples Write some examples of red-shape | e below. The first one has a | lready been done for you. |
| (EXAMPLE <u>(red-shape</u> Use the function | | (circle 50 "solid" "red") What should the function produce? |
| (EXAMPLE (| on here | What should the function produce? |
| (EXAMPLE (|) on here | What should the function produce? |
| (EXAMPLE (|) on here | What should the function produce? |
| III. Definition | | |
| (define (| variable r | names |
| <u>(cond</u> | | |
| - | (cir | cle 50 "solid" "red") |
| | | |
| | | |
| | | |
| | | |

Translating into Algebra

Value Definitions

| 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)) | |

Function Definitions

| Racket Code | Algebra |
|--|--------------------------------------|
| <pre>(define (area length width) (* length width))</pre> | area(length, width) = length * width |
| (define (circle-area radius) (* pi (sqr radius))) | |
| (define (distance x1 y1 x2 y2) (sqrt (+ (sqr (- x1 x2)) | |

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

| <u>D</u> :: | | -> |
|------------------------|--------------------------------------|-------|
| name | Domain | Range |
| | What does the function do? | |
| Give Examples | | |
| an example of your fur | nction for <u>some sample inputs</u> | |
| D(1) = | | |
| function here | What should the function produce? | |
| D(2)= | | |
| function here | What should the function produce? | |
| D() = | | |
| function here | What should the function produce? | |
| = | | |
| function here | What should the function produce? | |
| Definition | | |
| | able names to all your input values. | |

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*.

| · | | > |
|---|-----------------------------------|-------|
| name | Domain | Range |
| | What does the function do? | |
| . Give Examples Write an example of your function | n for some sample inputs | |
| = | | |
| lse the function here | What should the function produce? | |
| = | | |
| lse the function here | What should the function produce? | |
| = | | |
| lse the function here | What should the function produce? | |
| = | | |
| lse the function here | What should the function produce? | |
| | | |
| II. Definition Vrite the Formula, giving variable | | |

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?

| ·· _ | : | > |
|---------------------------|---|-------|
| name | Domain | Range |
| ; | What does the function do? | |
| II. Give Examples | | |
| write an example of your | function 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? | |
| Use the function here | What should the function produce? | |
| = | | |
| Use the function here | What should the function produce? variable names to all your input values. | |
| Use the function here | | |

| • | - | > |
|---|--|-------|
| name | Domain | Range |
| | What does the function do? | |
| Give Examples rite an example of your | function for <u>some sample inputs</u> | |
| = | | |
| a tha function hara | | |
| e the function here = | What should the function produce? | |
| | What should the function produce? What should the function produce? | |
| = e the function here = | What should the function produce? | |
| = e the function here | | |
| = the function here = the function here | What should the function produce? | |