Integer Darts

In this project, you will create an integer dart game. Part of the code has already been written in the "DARTS.8xv" file. You will write the code to generate integer addition, subtraction, multiplication and division problems. You will also write the code to determine the score. Each correctly answered integer question will earn a dart.

Objectives:

Programming Objectives:

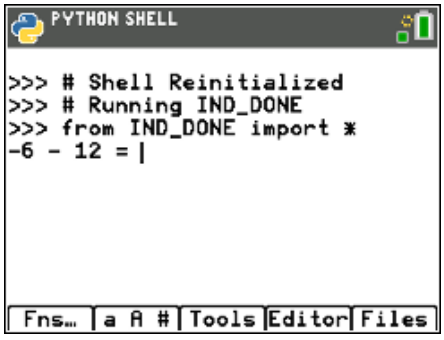
- Use variables to store values
- Use the randint() function to generate integers
- Use the print() function to display
- Use a while loop to repeat code.
- Use an if..elif statements to make decisions

Math Objectives:

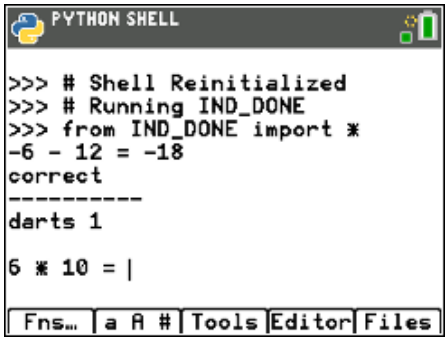
- Add and subtract integers
- Multiply and divide integers.
- Use Pythagorean Theorem to find distance between two points (May be omitted. To skip, give students Template2 and stop coding after step 13.)

Math Course Connections: Middle School Mathematics

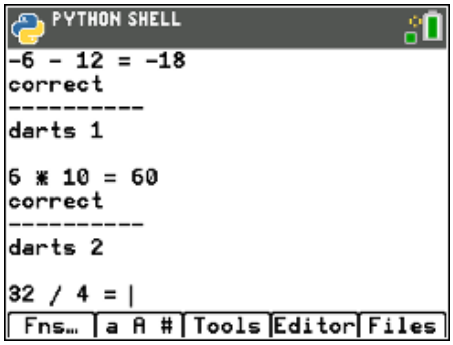
In this project, you will create an integer dart game. Part of the code has already been written in the "DARTS.8xv" file. You will write the code to generate integer addition, subtraction, multiplication and division problems. You will also write the code to determine the score. Each correctly answered integer question will earn a dart.



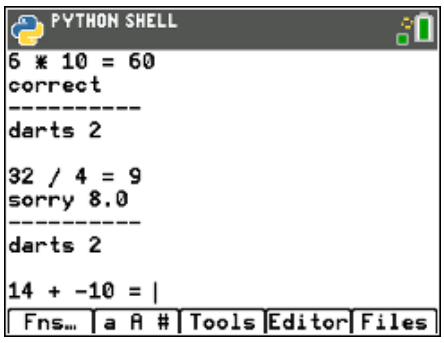
Ask an integer addition, subtraction, multiplication or division problem



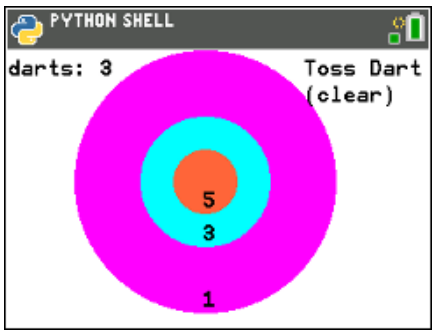
Correct answer earns a dart.



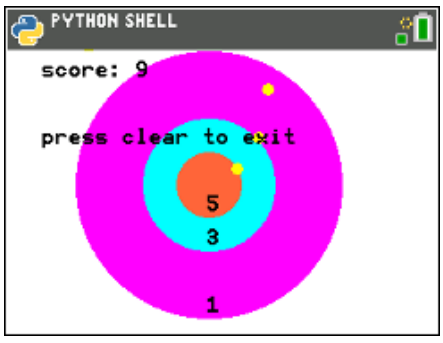
Another correct answer, another dart earned.



Incorrect answer. Correct answer displayed. Doesn't earn a dart.



After 5 questions, the dart board appears. Player throws darts.



After all the darts are played, the final score is displayed.

1. Obtain the "DARTS.8xv" from your teacher. Part of the programming code has been coded for you.

> **Teacher Note:**
> Give students "DARTS2.8xv" if skipping Pythagorean theorom. End project at step 13.

2. Let's examine the code template.

```
EDITOR: DARTS
PROGRAM LINE 0001
```

Libraries needed for the project

```
from ti_draw import *
from random import *
from math import *
from time import *
from ti_system import *

darts=0

for i in range(5):
```

*You write code to create two random integers. Randomly determine an operation. Display the question. Check the answer. Add darts if the answer is correct.

Display earned darts each round

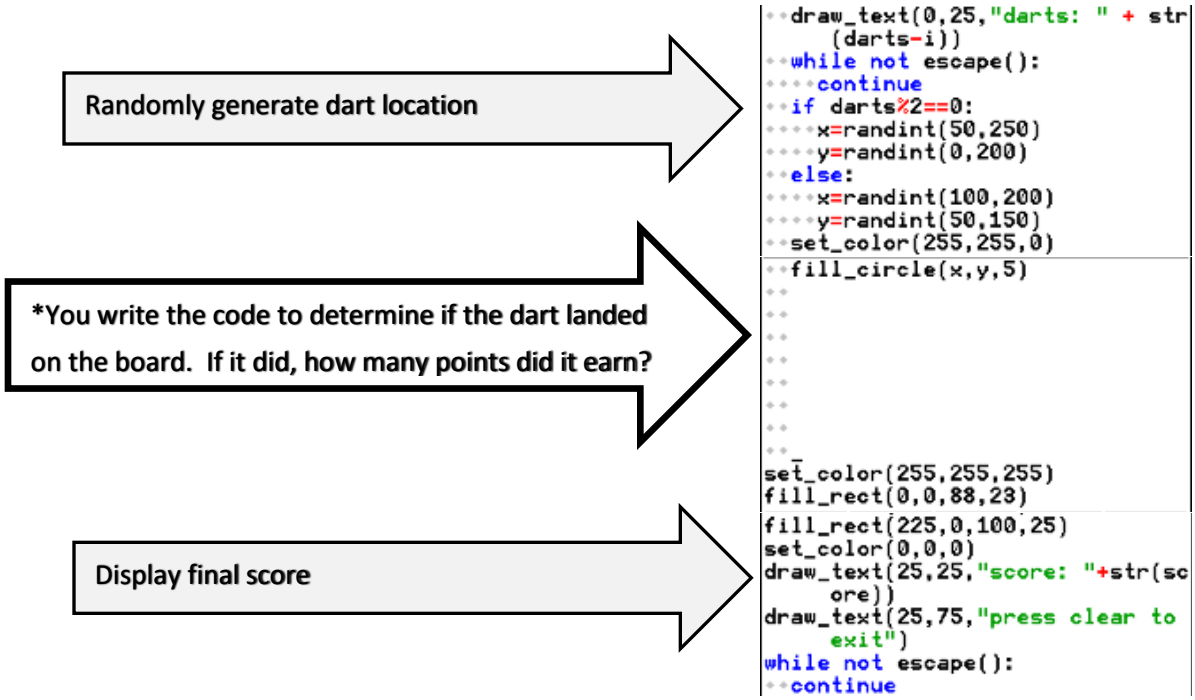
```
  print("----------")
  print("darts",darts)
  print("")

print("You earned", darts,"darts")
sleep(4)
```

Create the dart board.

```
clear()
set_color(255,0,255)
fill_circle(150,100,100)
set_color(0,255,255)
fill_circle(150,100,50)
set_color(255,100,55)
fill_circle(150,100,25)
set_color(0,0,0)
draw_text(148,200,"1")
draw_text(148,150,"3")
draw_text(148,125,"5")
```

For each round, display the darts left, wait for the player to press "clear" to toss

```
score = 0
draw_text(225, 25, "Toss Dart")
draw_text(225, 45, "(clear)")
for i in range(darts):
  set_color(255,255,255)
  fill_rect(0,0,88,23)
  set_color(0,0,0)
```

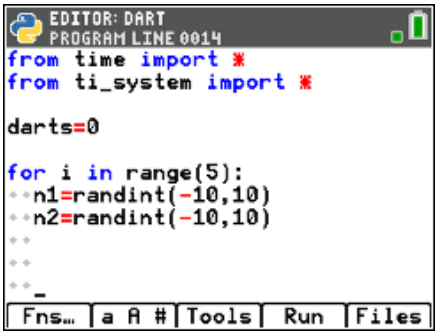


3. Below are examples of all the types of equations your game will create.

a. -20 / -5	b. 13 - -8	c. -3 * -7	d. -7 – 15	e. 8 * -3
f. 8 * 3	g. 9 + -8	h. -48 / 6	i. 42 / 6	j. -1 + -18
k. 3 – 17	l. -10 * 4	m. -8 + 6	n. -6 - -10	o. 72 / -8

4. Evaluate equation expression above without a calculator. Use your calculator to verify your answers.

5. The first two lines of code will generate two random integers n1 and n2. Initially, they will be any integer between -10 and 10.



Add the lines:

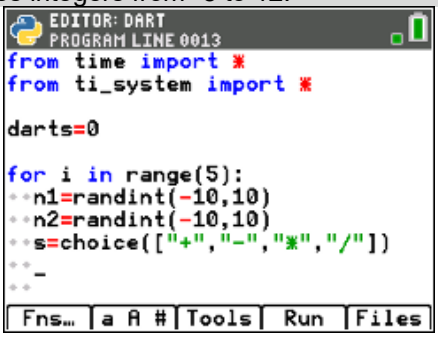
n1 = randint(-10,10)
n2 = randint(-10,10)

**randint -- You can type randint or you can find it in the menu
Fns → Modul → random → randint

**You can copy and paste lines. Tools → 6 Copy Line
Tools → 7 Paste Line Below

Teacher Note:
For differentiation enter different boundaries. For example n1=randint(-8, 12) generates integers from -8 to 12.

6. Next, randomly select the operation. The function choice() lets you enter a list of possibilities. It then selects one item from the list. Notice the function has parenthesis (), the list starts and ends with square brackets [].



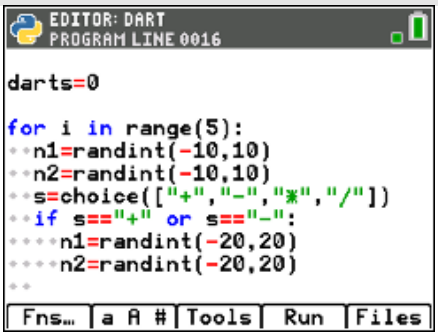
Add the line:

s = choice([“+”, “-“, “*”, “/”])

**choice -- You can type choice or you can find it in the menu
Fns → Modul → random → choice

Teacher Notes:
For differentiation this list can be shortened. For example s = choice([“*’, “/”])

7. If the choice is an addition or subtraction, we’ll make a wider range of integers possible. We’ll let **n1** and **n2** be anything from -20 to 20. This will require an if statement.

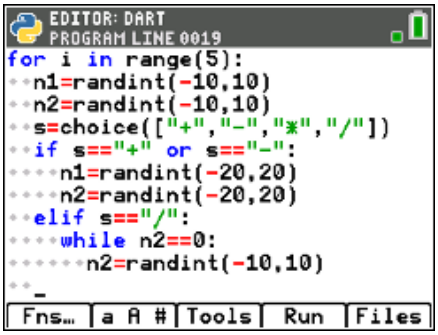


Python uses == to check IF two quantities are equivalent. By itself, the = sign assigns the variable on the left the value on the right. Notice how == and = are used in the statements below.

```
if s == “+” or s == “-”:
    n1 = randint(-20,20)
    n2 = randint(-20,20)
```

**if Fns → Ctl → if
**You can copy and paste lines. Tools → 6 Copy Line
Tools → 7 Paste Line Below

8. If the sign was a division sign, you need to ensure you don’t divide by 0. While n2 is a zero, you will generate a new integer value.



You only need to worry about 0 if the sign is “/”.

Therefore, the code will be

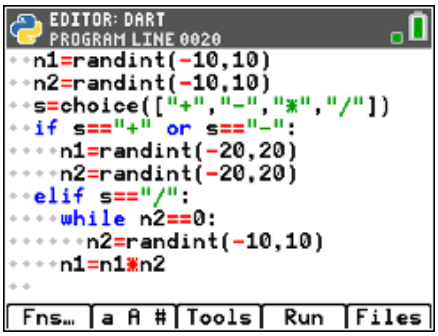
```
elif s == “/”:
    while n2 == 0:
        n2 = randint(-10,10)
```

**elif Fns → Ctl → elif
**while Fns → Ctl → while

9. If the sign was a division sign, we want to ensure the answer will be an integer. For example, we don't want questions like -12 / -7 or -8 / 3.
We want questions like -12 / -4 or 42 / -6 because they result in an integer.

   Notice the n2=randint(-10,10) is indented from the while.
   The n1 = n1*n2 line lines up below the w in the while.

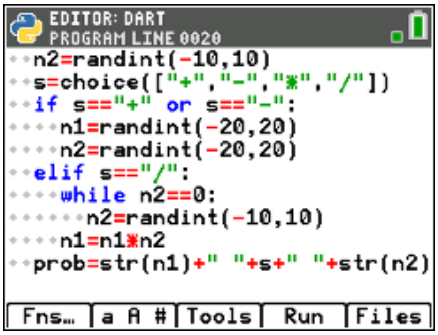
   n1 = n1*n2



10. Now to construct the question. We will *concatenate*, put together, the *integers* n1 and n2 with the *string* symbol. To put items together, they must all be of the same data type. You will use str(n1) and str(n2) to convert the *integers* to *string.*

    prob = str(n1) + " " + s + " " + str(n2)

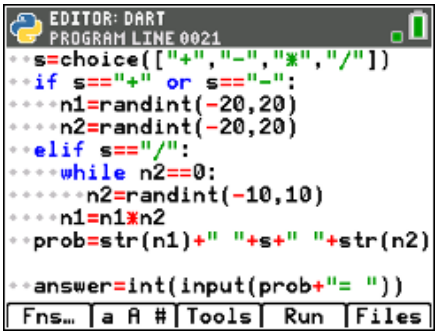
    **str() Fns → type → str



11. You are now ready to ask the user for the answer. Python uses the function *input* to get information from the user and store it as a string. You will use *int(input())* to get information and store it as an integer.

    answer = int(input(prob + "= "))

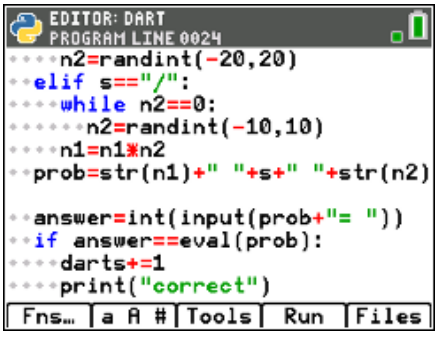
    **int() Fns → type → int
    **input() Fns → I/O → input



12. If the user's answer matches the evaluated problem, the user will earn a dart. To add one to the darts total you could write darts = darts + 1. Python has a shortcut however, that is easier to type darts += 1. Print "correct".

    if answer == eval(prob):
    **   darts += 1**
    **   print("correct")**

    **eval Fns → I/O → eval



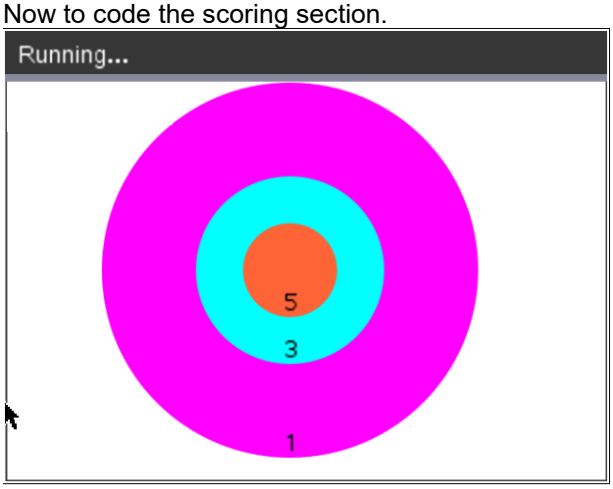
13. If the answer isn't true, the only option is false. Instead of using an elif like you did a few steps ago, use an else.

```
else:
    print("sorry, ", eval(prob))
```

```
EDITOR: DART
PROGRAM LINE 0026
      n2=randint(-10,10)
    n1=n1*n2
  prob=str(n1)+" "+s+" "+str(n2)

  answer=int(input(prob+"= "))
  if answer==eval(prob):
    darts+=1
    print("correct")
  else:
    print("sorry, ",eval(prob))
  
Fns… | a A # | Tools | Run | Files
```

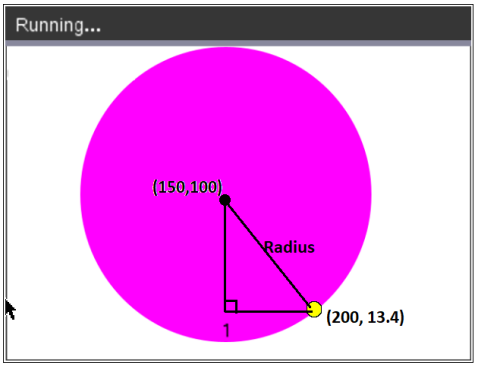
Teacher Notes:
If students were given DARTS2.8xv, their program is complete stop here.
DARTS.8xv is missing the Pythagorean Theorem (distance formula) code, continue.

14. Now to code the scoring section.

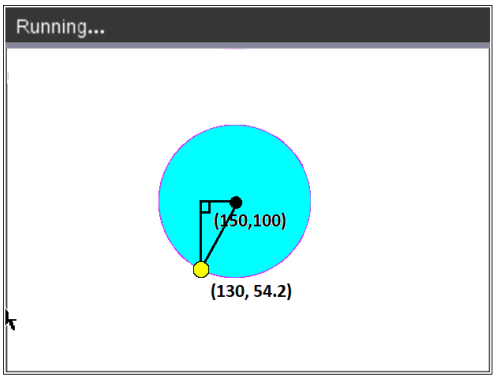


The target is centered at (150,100).

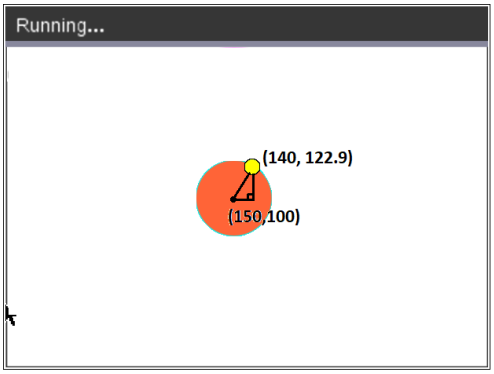
If a dart lands at (200,13.4), it is barely inside the target. Find the radius for the largest region. (You can use the scratchpad for calculations.)



15. If a dart lands at (130, 54.2), It is barely inside the middle target. Find the radius for the middle region.



16. If a dart lands at (140, 122.9). It is barely inside the smallest target. Find the radius for the smallest region.



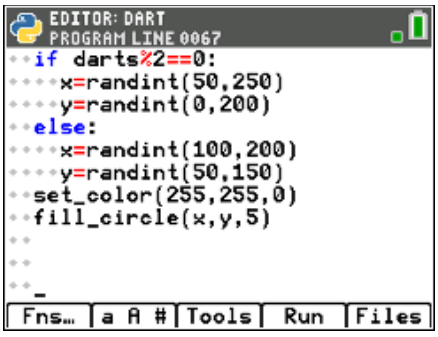
17. Fill in the blanks below with words or numbers.

To find the distance the dart lands from the center use _____

if the distance is less than or equal to _____
give 5 points because it is in the ***smallest*** circle
elif the distance is less than or equal to _____
give 3 points because it is in the ***middle*** circle
elif the distance is less than or equal to _____
give 1 point because it is in the ***largest*** circle

18. Now to put the words called *pseudo code* from step 16 into Python syntax.

Scroll down to the next missing section of code.



19. To find the missing radius for each circle you used the Pythagorean Theorem:

$$leg1^2 + leg2^2 = hypotenuse^2$$
$$(x - 150)^2 + (y - 100)^2 = radius^2$$
$$\sqrt{(x-150)^2 + (y-100)^2} = radius$$

The distance the dart lands from the center needs to be less than or equal to the radius of the circle.
Python uses **2 instead of ^2 to square numbers. The function sqrt() is used for square root.

Add

dist = sqrt((x-150)2+(y-100)**2)**

**sqrt Fns → Modul → math → sqrt

```
EDITOR: DART
PROGRAM LINE 0065
if darts%2==0:
    x=randint(50,250)
    y=randint(0,200)
else:
    x=randint(100,200)
    y=randint(50,150)
set_color(255,255,0)
fill_circle(x,y,5)
dist=sqrt((x-150)**2+(y-100)**
    2)

Fns… | a A # | Tools | Run | Files
```

20. Your *pseudo* code found above said:

if the distance is less than or equal to ***25:***
    give 5 points because it is in the ***smallest*** circle
elif the distance is less than or equal to ***50:***
    give 3 points because it is in the ***middle*** circle
elif the distance is less than or equal to ***100:***
    give 1 point because it is in the ***largest*** circle

The dart has a width of 2.5 pixels. This gives 2.5 more pixels to the scoring region. Therefore, add the following:

```
EDITOR: DART
PROGRAM LINE 0072
set_color(255,255,0)
fill_circle(x,y,5)
dist=sqrt((x-150)**2+(y-100)**
    2)
if dist<=27.5:
    score+=5
elif dist<=52.5:
    score+=3
elif dist<=102.5:
    score+=1

Fns… | a A # | Tools | Run | Files
```

```
if dist <= 27.5:
    score += 5
elif dist <= 52.5:
    score += 3
elif dist <= 102.5:
    score += 1
```

21. Congratulations! You have typed all the code. Press Run [Trace] to execute the code. If you don't have any errors, you should be able to play the game. If your code has errors, fix the errors, then play the game.

Teacher Notes:

```
from ti_draw import *
from random import *
from math import *
from time import *
from ti_system import *
```

```
darts=0

for i in range(5):
  n1=randint(-10,10)
  n2=randint(-10,10)
  s=choice(["+","-","*","/"])
  if s=="+" or s=="-":
    n1=randint(-20,20)
    n2=randint(-20,20)
  elif s=="/":
    while n2==0:
      n2=randint(-10,10)
    n1=n1*n2
  prob=str(n1)+" "+s+" "+str(n2)
  answer=int(input(prob+"= "))
  if answer==eval(prob):
    darts+=1
    print("correct")
  else:
    print("sorry, ",eval(prob))
  print("----------")
  print("darts",darts)
  print("")

print("You earned", darts,"darts")
sleep(4)

clear()
set_color(255,0,255)
fill_circle(150,100,100)
set_color(0,255,255)
fill_circle(150,100,50)
set_color(255,100,55)
fill_circle(150,100,25)
set_color(0,0,0)
draw_text(148,200,"1")
draw_text(148,150,"3")
draw_text(148,125,"5")

score = 0
draw_text(225, 25, "Toss Dart")
draw_text(225, 45, "(clear)")
for i in range(darts):
```

```
 set_color(255,255,255)
 fill_rect(0,0,88,23)
 set_color(0,0,0)
 draw_text(0,25,"darts: " + str(darts-i))
 while not escape():
  continue
 if darts%2==0:
  x=randint(50,250)
  y=randint(0,200)
 else:
  x=randint(100,200)
  y=randint(50,150)
 set_color(255,255,0)
 fill_circle(x,y,5)
 dist=sqrt((x-150)**2+(y-100)**2)
 if dist<=27.5:
  score+=5
 elif dist<=52.5:
  score+=3
 elif dist<=102.5:
  score+=1

set_color(255,255,255)
fill_rect(0,0,88,23)
fill_rect(225,0,100,25)
set_color(0,0,0)
draw_text(25,25,"score: "+str(score))
draw_text(25,75,"press clear to exit")
while not escape():
 continue
```