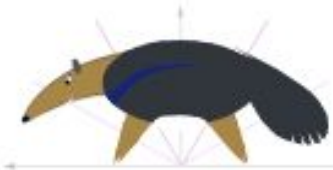
UC IRVINE MATH CEO

Community Educational Outreach

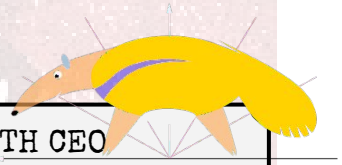


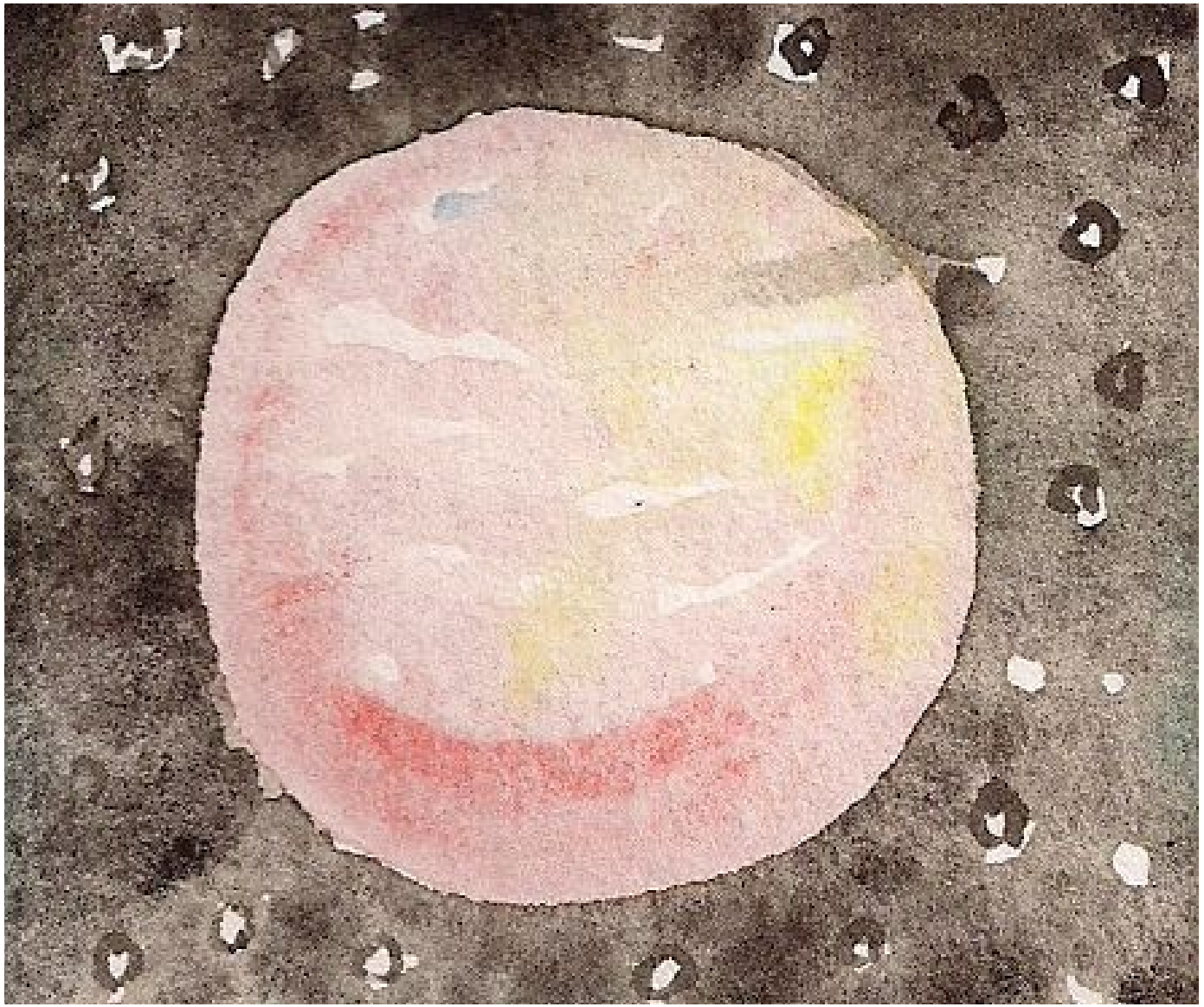
Meeting 13 Student's Booklet

CHANGE IN PLANET ARA PART 2

February 10 2016 @ UCI

Contents





1 Temperatures

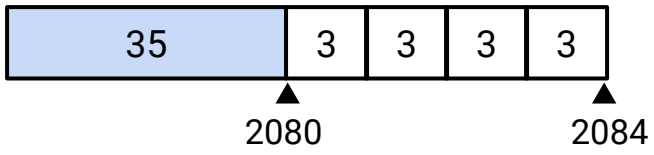
There are several regions in planet Ara where the temperature has been changing following constant change. Astronauts have been using the bar model method to answer different questions based on some data. Here are some examples:
Note: All temperatures are in Celsius.

Example 1: Region of Dhil

Temperature in 2080: 35.
Step change (change in year): +3

? Temperature in 2084?

Solution: we represent the problem with bars:



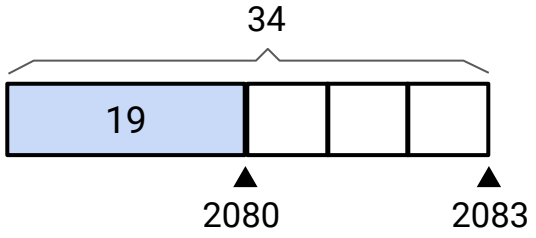
From the picture, the temperature in 2084 is:

35 + 3 + 3 + 3 + 3 = 35 + 3(4) = 47.

Example 2: Region of Erdus

The temperature in 2080 was 19. The temperature in 2083 was 34. What was the step change?

Solution: we represent the problem with bars:



From the picture, the step change (☐) is:

(34 - 19)/3 = 15/3 = 5.

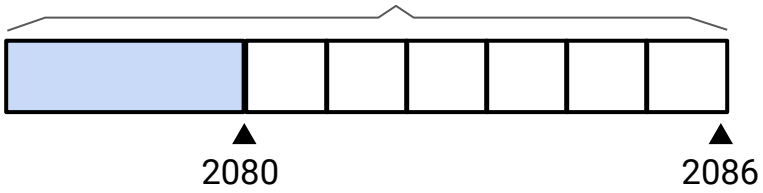
Solve the following problems using the bars method:

a Region of Faffini

Temperature in 2086: 52.
Step change (change in year): +2

? Temperature in 2080?

Model: fill the data in the right places:



Solution:

b Region of Faffini

The temperature in 2081 was 25. In 2085 the temperature was 31. What was the step change?

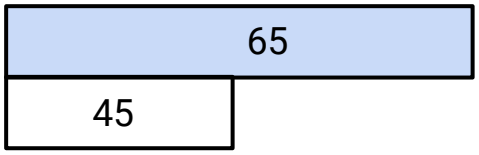
Model: draw the bar:

Solution:

c Region of Getler

The temperature in 2080 was 65. In 2084 the temperature decreased to 45. What was the step change?

Model: fill the data:



Solution:

2 The Hunks

The Astronauts study life forms in Planet Ara and they discover a weird creature called a Hunk. Each night they observe a fixed amount of Hunks come out.

If the astronauts leave breads outside, more hunks will appear, **following constant change**. This means: the change in the number of hunks is proportional to the change in the number of breads left outside.

The astronauts have created several cards relating breads with hunks. Each card shows the number of breads left outside depending on the number of hunks observed. **Example: If 2 breads are left outside, that night a total of 13 Hunks will appear.**

13
🥖 = 2

These are some cards reported by the astronauts:

13	41	361
🥖 = 2	🥖 = 9	🥖 = 89

a Complete the following two cards:

____	53
🥖 = 7	🥖 = __

b How many Hunks appear in a night with no bread? ☐

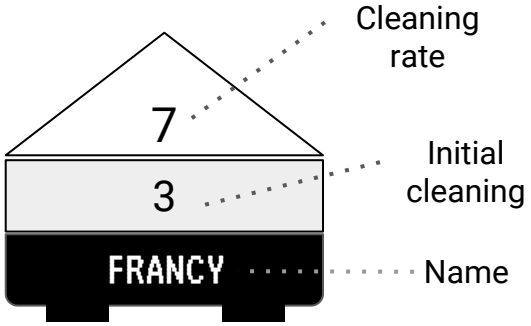
c Describe IN WORDS how an astronaut can predict how many Hunks appear in a given night, according to the number of breads. Test your prediction with the cards above.

3 The Cleaning Bots

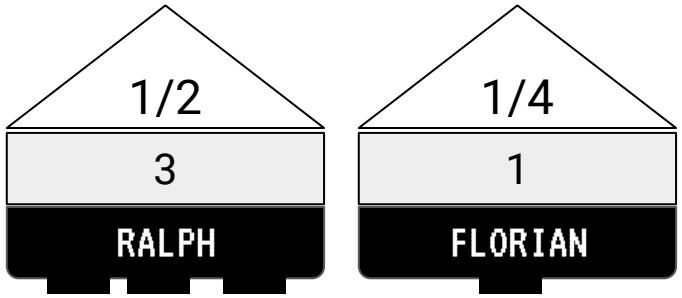
There has been an accident in planet Ara, causing lots of debris in the astronaut's station. For this, two cleaning robots have been activated: RALPH and FLORIAN.

Each robot cleans a fixed amount (**in tons**) of debris during the first day (called DAY 0), and then every following day cleans certain amount (the same each day). The first quantity is called "**initial cleaning**" and the other is called its "**cleaning rate**". We use the following picture to represent this data:

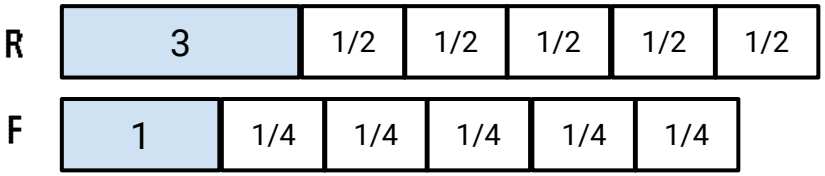
Example: FRANCY cleans 3 tons on day zero and then he cleans 7 tons each following day.



Here are RALPH and FLORIAN:

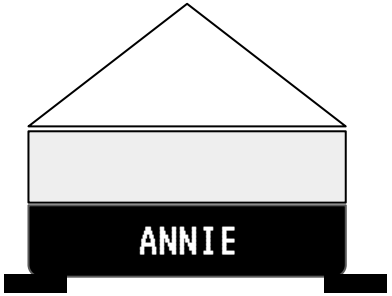


a Ralph and Florian work during DAY 0, and 5 more days after that, as the bar models show:



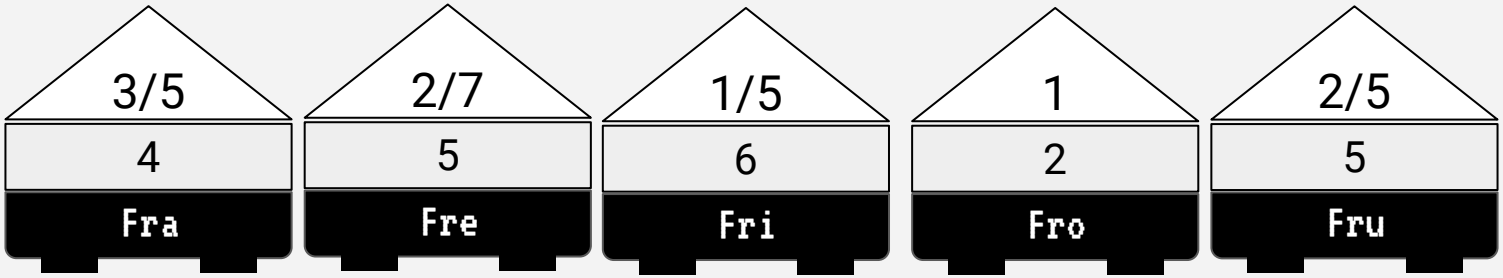
How many tons of debris do the robots clean together? ☐

b Annie the robot does the same daily job as Ralph and Florian combined. That is, every day Annie cleans the same amount of debris that Ralph and Florian combined. Fill Annie's data:



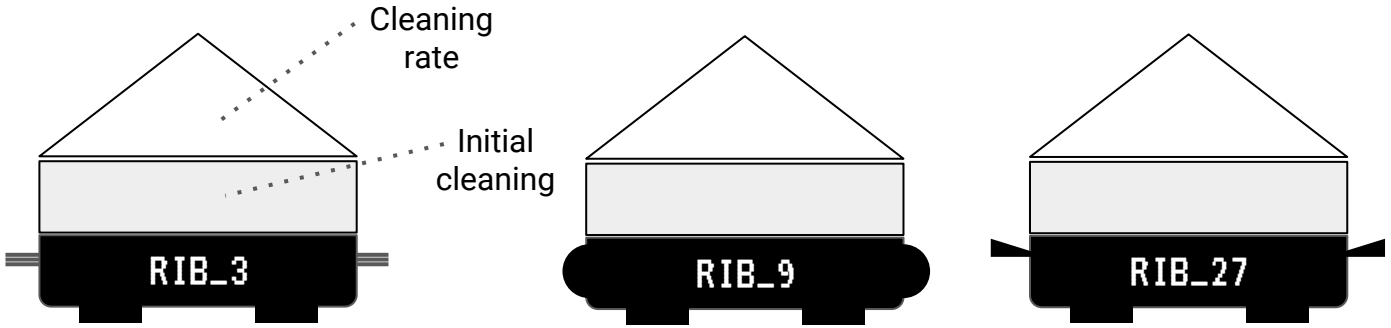
Day Zero and 4 days

c The mission dedicates 5 days (day 0 plus 4 more) to clean as much debris as possible. Unfortunately they can only send one robot from the ones shown below. Which robot is chosen?



3 tons of debris

d Build three different robots, RIB_3, RIB_9 and RIB_27, so that each one cleans 3 tons of debris in a span of 5 days (DAY 0 plus 4 more days).



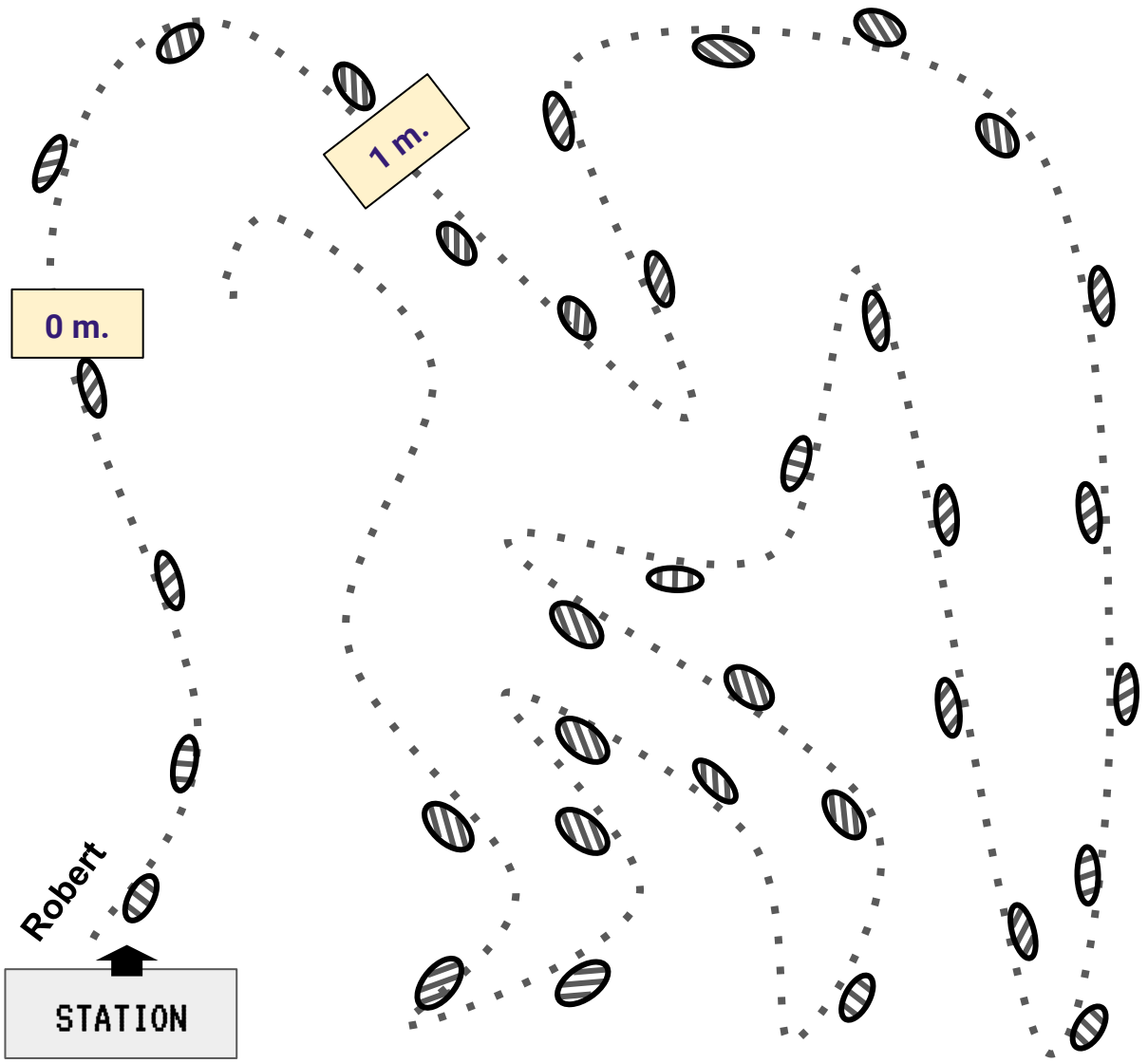
From the robots that you created, which one cleans the most if we change 5 days to 6 days?

4 Trails

The astronauts walk in planet Ara, exploring its soil. **Robert** goes first. He first takes 4 steps. Then he starts his clock and decides to take 3 steps every minute.

After 5 minutes he marks his last step with an **X** and decides to go slower, taking now 2 steps every minute. He does this for 8 more minutes. He marks his last step with a flag.
Then he continues walking.

a On the picture shown, indicate Robert's position at every minute (examples are shown). Also mark the **X** and put the flag in the right position.



Robert's walk

Recall that at 0 minutes, he has already taken 4 steps. For the next 5 minutes, he takes 3 steps every minutes.
After that, for the next 8 minutes, he takes 2 steps every minute. Then he stops, and puts his flag down.

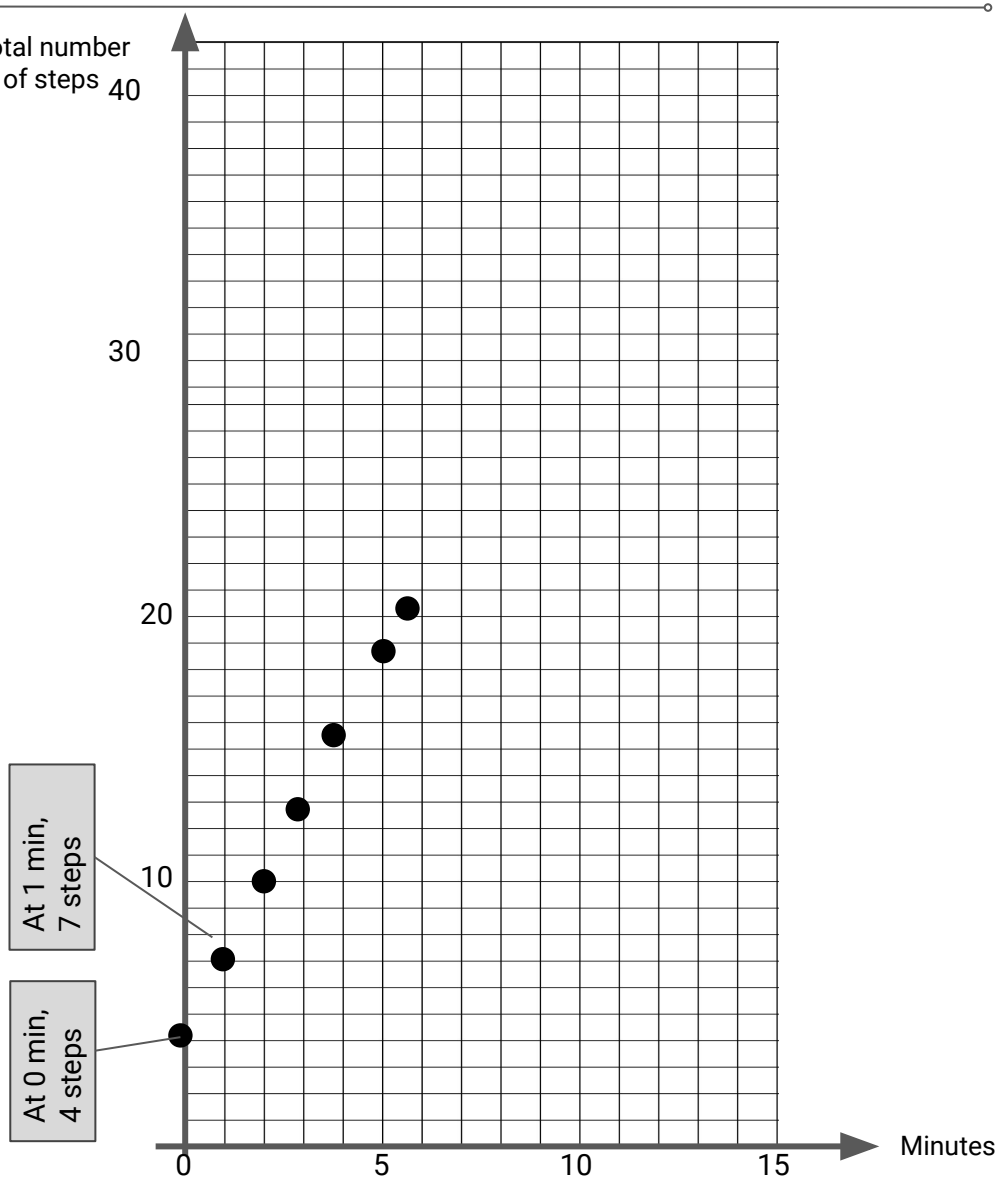
b On the graph, indicate the total number of steps taken by Robert at every minute.

Discuss: Did Robert moved with constant change in his walk? Explain using the graph

Steve follows

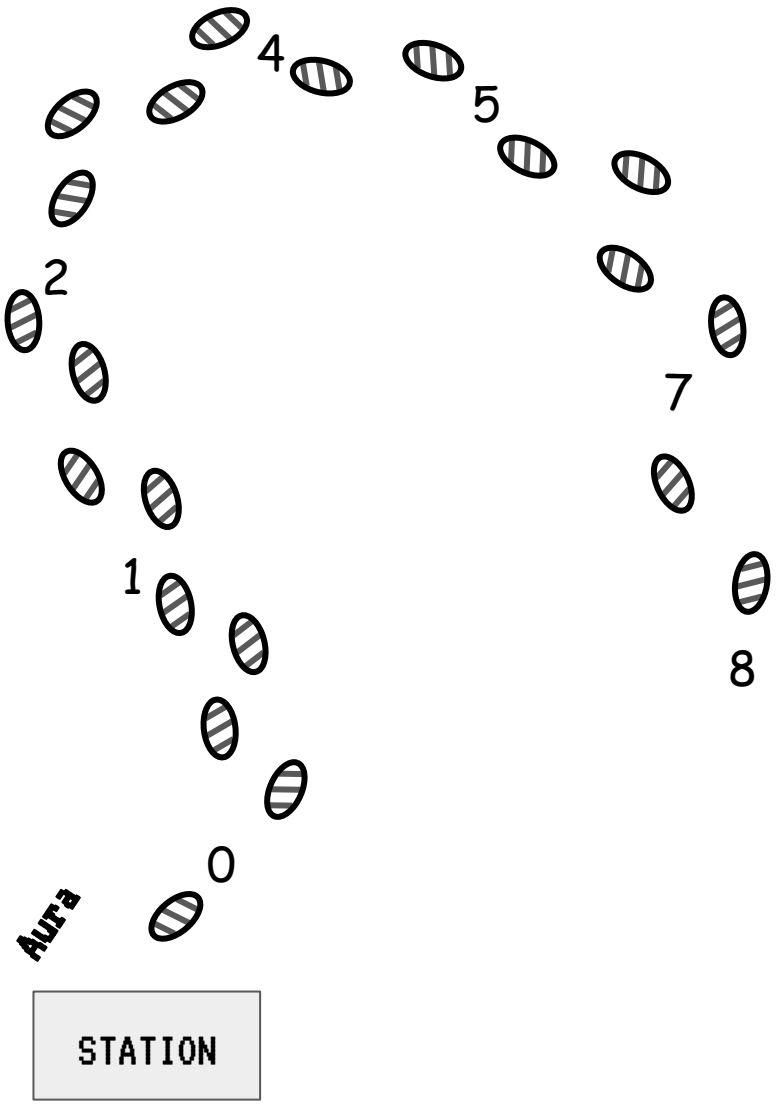
c Astronaut Steve follows Robert's steps from the station to where he put the flag. He wants to walk at constant change (same number of steps per minute) and he wants to reach the flag in exactly 10 minutes. What is his step change (number of steps per minute)?

Graph Steve's position by the minute in the graph.



Aura's walk

Astronaut Aura did a similar work to Robert's: she first took some steps, then started her clock, walked at a fixed paced for some minutes, then changed her pace for the remaining minutes. The pictures shows the time labels for Aura's position.



d Describe in your own word the precise information of Aura's exploration.

e Complete the table for Aura's motion:

Time	0	1	2	3	4	5	6	7	8
Steps									

CHALLENGES

Solve the following problem using the bars method. Remember that both planets follow constant change in tempreature.

Region of Galhum	Region of Xiuu
Temperature in 2080: 40.	Temperature in 2080: 28.
	Step change: twice as much as the step change of Galhum
	Temperature in 2083: The same as the temperature of Galhum in 2083

? What is the temperature of Xiuu in 2083?

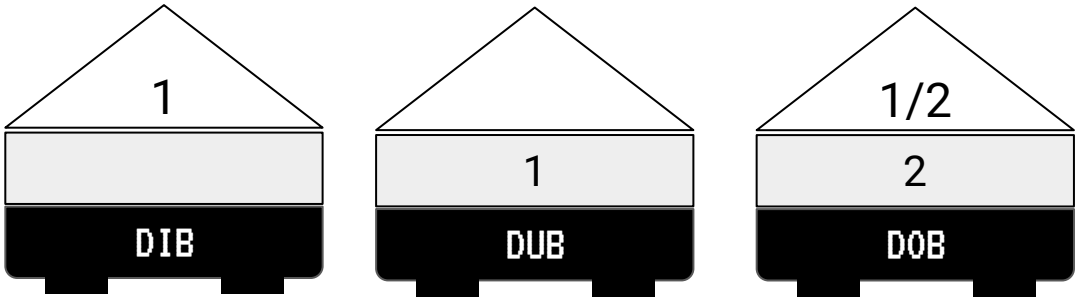
Model: draw the bars (hint: draw two bars, one for each planet)

Solution:

CHALLENGES

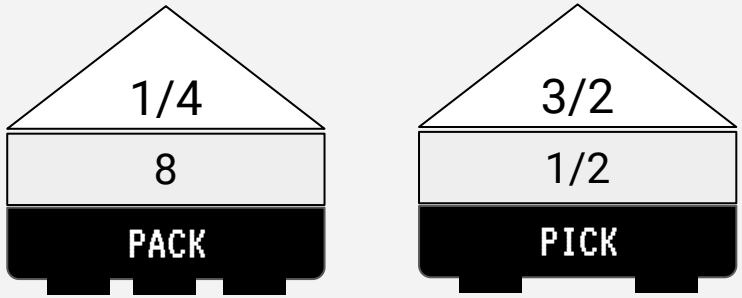
I. Dib & Dub

Fill the missing data for robots Dib and Dub so that each of the two robots cleans the same amount of debris *in 4 days* (Day 0 + 3 more) than Dob cleans *in 6 days* (DAY 0 + 5 more).



II. Same amount of debris

How many days after DAY 0 will Pack and Pick have cleaned up exactly the same amount of debris? ☐



III. Who will finish sooner?

Roby and Ruby must clean 7 tons of debris each. Who will finish sooner (or do they finish the same day)?