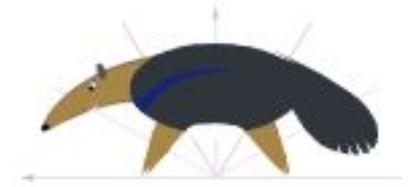


# UC IRVINE MATH CEO

Community Educational Outreach



Meeting 2 Student's Booklet

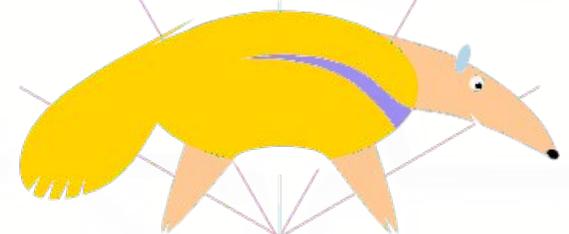
## Cardiomath

January 25 2017 © UCI

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- 1 Measuring Heartbeat
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STUDENT'S BOOKLET



UC IRVINE MATH CEO  
<http://www.math.uci.edu/mathceo/>



# 1 Measuring Heartbeat



Here is a strip of length 60



Here is a strip of length 20



Before we analyze the heartbeat, we will practice some skills related to multiplication, division and proportionality...

- a** How many strips of length 20 fit in a strip of length 60?
- b** How many strips of length 30 fit in a strip of length 60?
- c** How many strips of length 12 fit in a strip of length 60?
- d** If exactly 4 strips of the same length fit in a strip of length 60, what is the length of each strip?

## FITTING SEVERAL STRIPS IN ANOTHER STRIP

Here is a strip of length 60



Here is a strip of length 40



**Example:** How many strips of length 40 fit in a strip of length 60?

Solution:



Cut the strip of 40 in \_\_\_\_\_ strips of length 20 each. Then:

A strip of 60 equals to \_\_\_\_\_ strips, each of length “half of 40”.

60 is equal to three halves ( $3/2$ ) of 40. In other words:  $60 = (3/2)$  of 40

$$20 + 20 + 20 = 60$$

$$\text{three times } 20 = 60$$

$$\text{three times “half of 40”} = 60$$

$$\text{“three halves of 40”} = 60$$

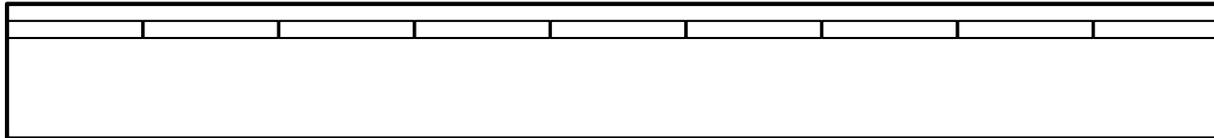


## HOW MANY STRIPS...?

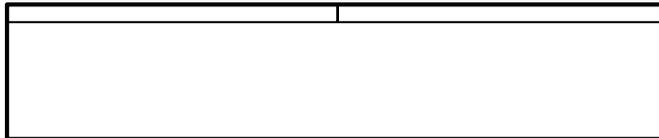
Strip of  
length 60



Strip of  
length 45



Strip of  
length 24



Strip of  
length 50



Example: How many strips of 40 fit in a strip of 60? *Answer:  $3/2$  (3 strips, each of length "one half of 40").*

- a** How many strips of 45 fit in a strip of 60?
- b** How many strips of 24 fit in a strip of 60?
- c** How many strips of 50 fit in a strip of 60?
- d** How many strips of 60 form a strip of 40?



# STRIPS WITH PICTURES

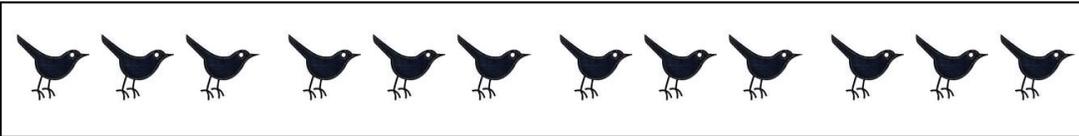
Strip of length 30



Strip of length 20



Strip of length 40



Suppose that the number of moons, stars, birds and frogs in a strip is **proportional** to the length of the strip.

For example: a strip of length 30 has 4 moons, and so a strip of length 60 has 8 moons.

*Answer the questions below based on the pictures above:*

**a** How many stars would there be in a strip of length 60?

**b** How many birds would there be in a strip of length 60?

**c** The ratio BIRDS : FROGS on a strip is of 2:3. How many frogs are in a strip of length 60?





# BPM MEASUREMENTS

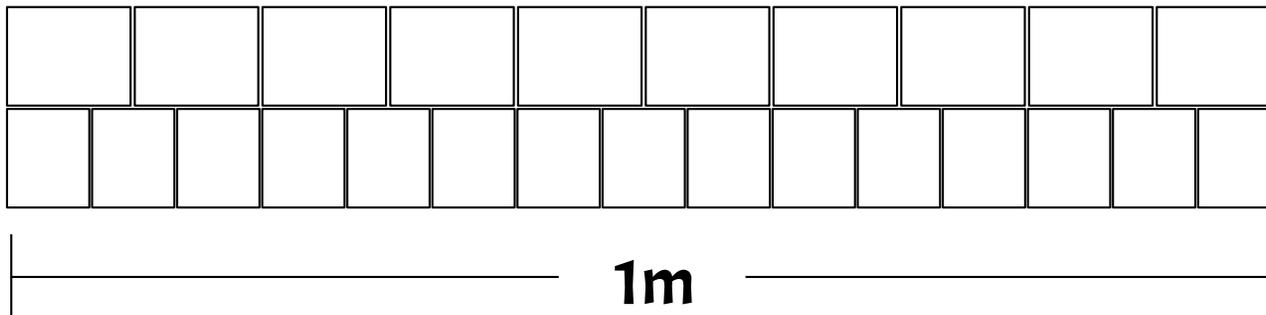
Remember that the heart rate is measured in bpm (beats per minute). If you do physical activity, your heart rate will go up, because your heart will beat faster.



**a** If we measure a total of 46 beats in 30 seconds, what is the heart rate?

**b** If we measure a total of 82 beats in 40 seconds, what is the heart rate?

**c** Hector and Gabriela measured their respective pulse: Hector counted 42 beats in a lapse of 18 seconds. Gabriella counted 20 beats in a 8 seconds interval. Who had a higher heart rate in bpm? What is the heart rate difference (in bpm)?



**AVERAGE BPM**

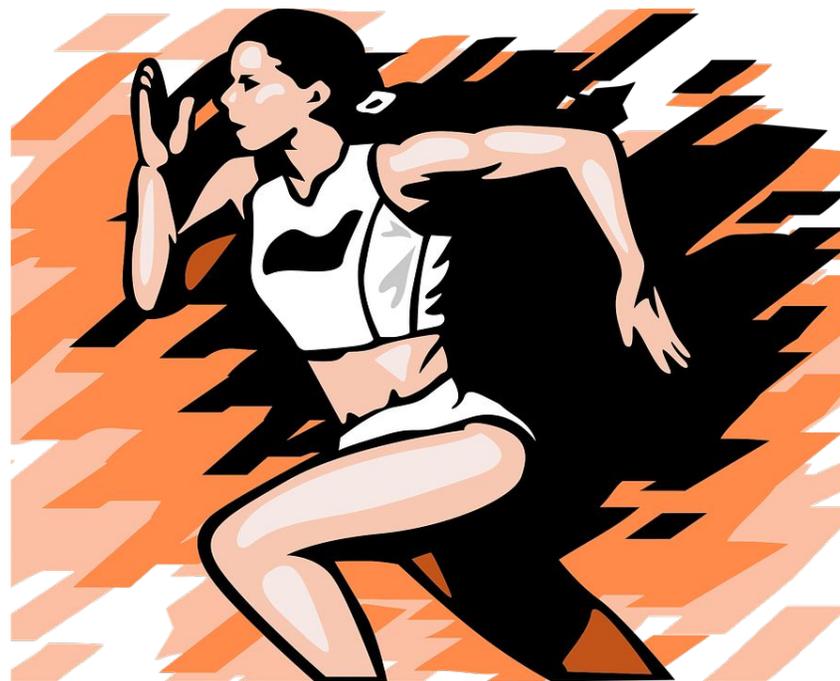
A person at rest measured his heartbeat. Each trial he measured the first 15 seconds, and multiplied by 4 to find its bpm. Then he averaged the values to obtain his resting heart beat. Can you fill in the spaces with the values required?

	15 seconds	15 seconds	15 seconds	15 seconds
TRIAL 1	22			
	bpm =			
TRIAL 2	26			
	bpm =			
TRIAL 3	21			
	bpm =			
AVE-RAGE BPM				
	AVERAGE bpm =			

## 2 Serena's training hour

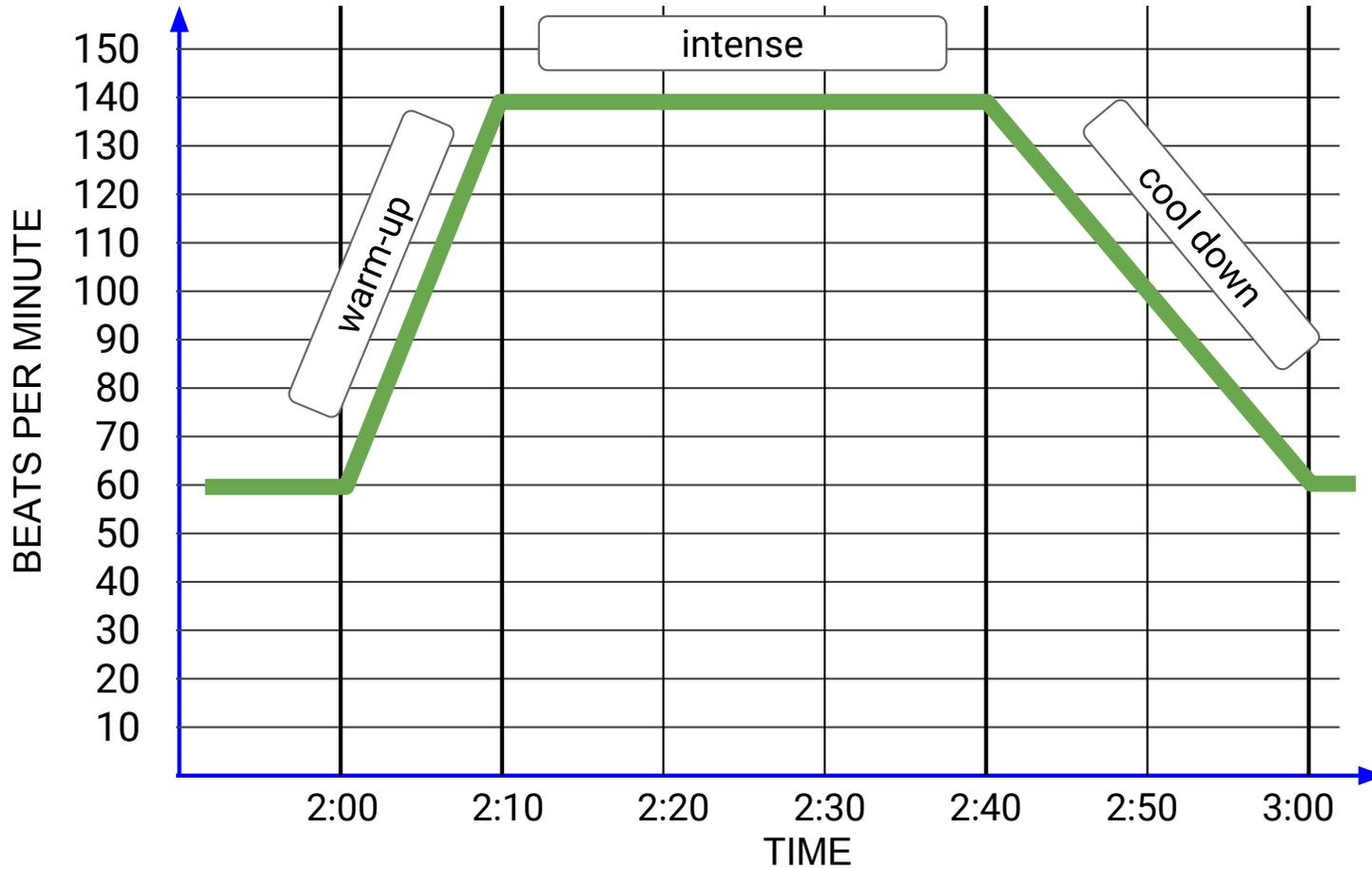
Serena will be training from 2 to 3 pm. She starts with a low heart beat rate, then warms up, and her bpm measurements grow at a constant pace, until reaching some high value. Then she stays doing intense training for a while. She finally reduces the intensity and she cools down, and her heartbeat rate decreases at a constant rate until she has the initial bpm measurement.

In the following activity, you will see a graph of how Serena's bpm changes as time changes. The horizontal axis represents time measured in minutes. The vertical axis represents the heart rate, measured in bpm.





GRAPH 1: SERENA'S TRAINING





## ANALYSIS

Complete the information below based on the graph:

**a** Before 2:00 pm, her bpm was:

**b** At 2:05 pm, her bpm was:

**c** Her bpm increased by  bpm during a total of 10 minutes.

**d** From 2:00 to 2:10, her bpm increased at a constant rate of  per minute

**e** Just by looking at the graph, at which of these activities did the bpm change at a faster pace: warmup or cooldown? Why?

**f** From 2:40 to 3:00, her bpm decreased at a constant rate of  every minute

## SPACE FOR WRITING

### COOL DOWN CHALLENGES

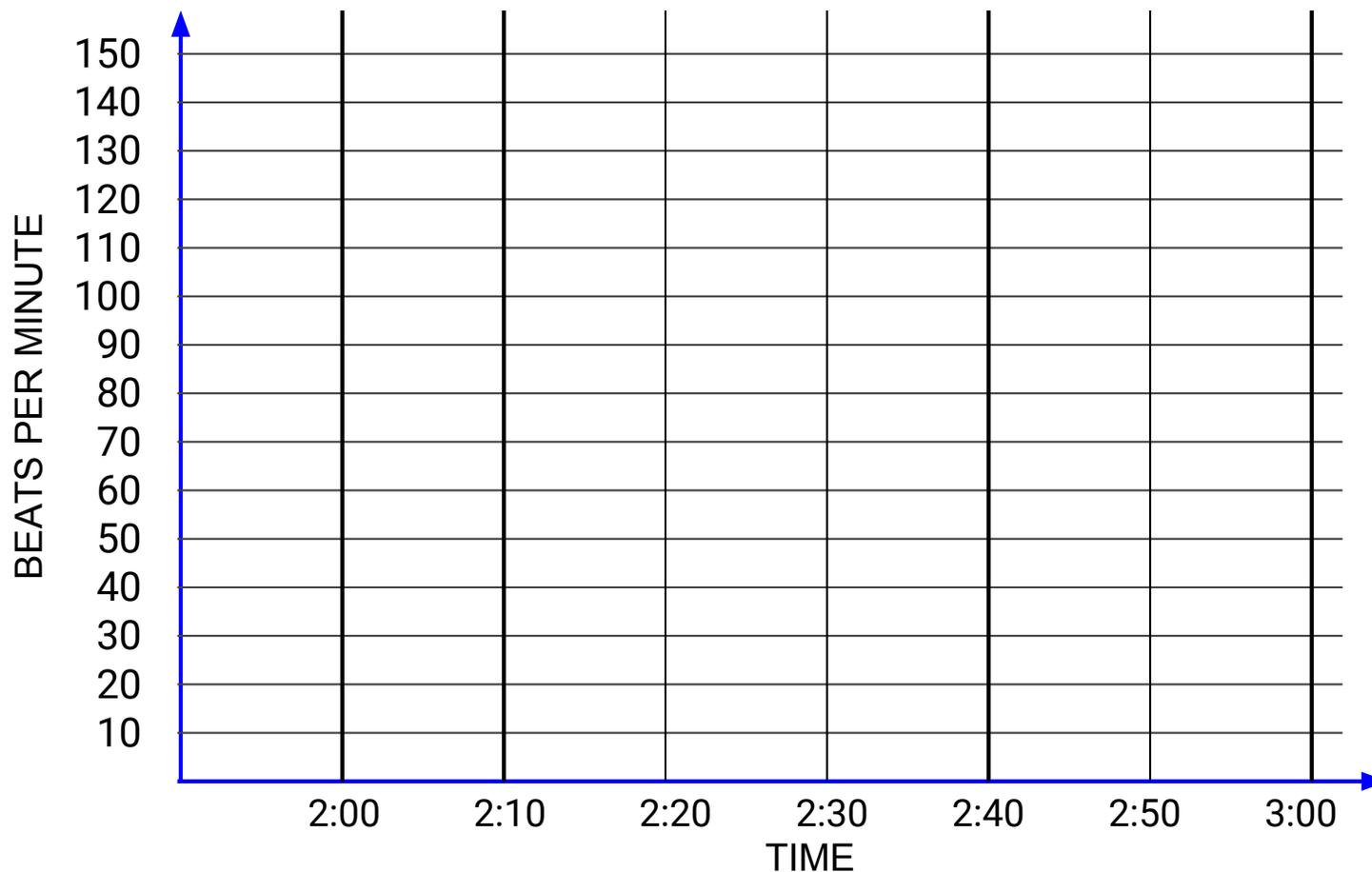
**g** Serena's training lasted 60 m. What percentage of the time was her bpm above 100?

**h** What was the total number of Serena's heartbeats from 2:00 to 2:01 pm? And from 2:00 to 2:05 pm?

**i** Discuss: How would you find the total number of heartbeats from Serena's heart from 2 to 3 pm?

## YOUR TRAINING

GRAPH 2: YOUR TRAINING



Before 2:00, your  
BMP  
was: 70

At 2:05 pm, your  
BPM  
was: 95

From 2:50 to 3:00,  
your BPM  
decreased at a  
rate twice as fast  
as the rate of  
increase during  
the warm-up

Suppose that you followed a similar training routine than Serena's. You warmed up from 2:00 to 2:20 and your bpm increased at a constant rate. Then did intense activity from 2:20 to 2:50 (you bpm did not change during that time), then you cooled down from 2:50 to 3:00 (your bpm decreased at a constant rate). Based on the information given in this page, **graph your bpm over time**