

RK.1 The Popping Index

Using the same popcorn machine and the same amount of kernels to begin with we can see how long each type of popcorn takes to fill the same bowl. We need to assume that the size of the popcorn between brands will be relatively regular so that we can compare.

At given time intervals we can also count the number of kernels that have popped. The popping index will then be the rate at which popcorn is popped, the number of kernels that are popped per second.

Poppomatic Popcorn:

Time Elapsed	Popcorn Popped
12s	6
18s	9
24s	12

Popping Index: 0.5 popcorn/second

Hot Pops:

Time Elapsed	Popcorn Popped
20s	10
30s	15
50s	25

Popping Index: 0.5 popcorn/second

HipHop Popping Corn:

Time Elapsed	Popcorn Popped
6s	6
12s	12
20s	20

Popping Index: 1 popcorn/second

RK.2 Fastness Index

We can develop a fastness index in much the same way that we did with the balls in Lesson 2. Its like dropping a sugar packet every one second next to these cars. If we can measure the distance between the oil drops and know that they drop every 1 second we can figure out how far a car goes in one second, which is a measure of its fastness.

There are 3 companies:

Cars 1 and 5 are from the same company.

Cars 2 and 6 are from the same company.

Cars 3 and 4 are from the same company.

We can tell from the spacing of their oil dots.

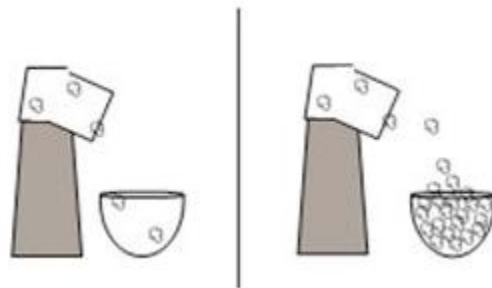
RK.3 Reason

1. HipHop Popping Corn was the fastest. Compared to the other two it had a popping index of 1 popcorn/second compared to 0.5 popcorn/second. It would produce more popcorn in a given time interval than its competitors.
2. Cars 1 and 5 are the fastest. Their oil drops are spaced the furthest a part. Since the oil drops every one second we know that the distance between oil drops is how far the car moved in that second. Cars 1 and 5 cover the most distance in a single second than the other cars. Therefore compared to the other cars, 1 and 5 were the fastest.
3.
 - $60 \text{ popcorn} / (1 \text{ popcorn/second}) = 60 \text{ seconds}$
 - Assuming those 15 blocks are the ones drawn on the diagram Cars 1 and 5 move about 1.5 blocks/second: $15 \text{ blocks} / (1.5 \text{ blocks/second}) = 10 \text{ seconds}$
 - $(70 \text{ seconds})(1 \text{ popcorn/second}) = 70 \text{ popcorn}$
 - $(20 \text{ seconds})(1.5 \text{ blocks/second}) = 30 \text{ blocks}$

4.

a) A popping index of 2.5 means that using our test in 2 seconds “Acme” popcorn should have produced about 5 popped kernels. 25 popcorn in 10 seconds.

b) Sketch:



2 Seconds

10 Seconds

c) A fastness index of 2.5 means that the car should travel 2.5 blocks in one second. This is 5 blocks in two seconds or 25 blocks in 10 seconds.

d) Oil Drip Sketch:



5. Since we knew that cars from the same company had the same fastness and they all drip oil once a second we could determine from the spacing of the oil drops that there were only 3 companies since there were only 3 distinct oil patterns produced between all 6 cars.

RK.4 The Steepness Index

A ratio of the tallness of the slide compared to the longness horizontally should give us a steepness ratio assuming that they are the same steepness all the way down and the slides stand straight.

Rocks Ur Socks:

$$16\text{ft}/12\text{ft} = 1.33$$

Splash Attack:

$$18\text{ft}/18\text{ft} = 1.00$$

Super Soaker:

$$7\text{ft}/5\text{ft} = 1.40$$

Tsunami:

$$20\text{ft}/24\text{ft} = 0.83$$

RK.5 Reason

1. The *Super Soaker* is the steepest with an index of 1.40. A slide that is much taller than it is long horizontally should be steeper than a slide that is much longer horizontally than it is tall. The ratio of tallness to longness gives us the steepness index, which is the largest for *Super Soaker*.

2.

- A steepness index of 1.4 means that for every 1.4ft the slide drops vertically the slide should move 1 foot horizontally.

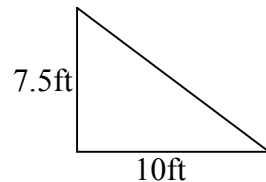
$$(14\text{ft vertically})/(1.4\text{ft vertically}/1\text{ft horizontally}) = 10\text{ft horizontally}$$

You can also look at the picture. The slide goes 5ft horizontally for every 7ft vertically meaning that in 14ft vertically it should go 10ft horizontally.

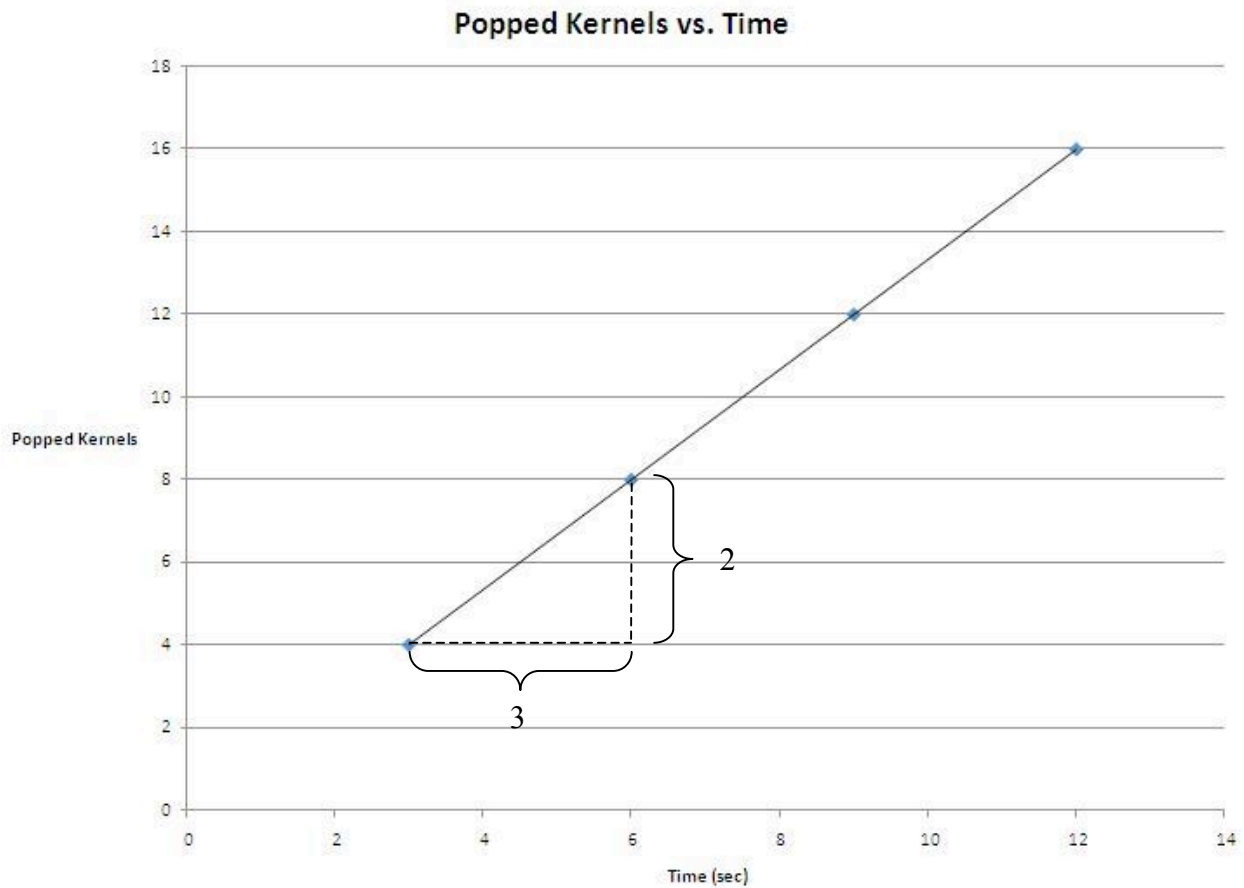
- $(5\text{ft horizontally})(1.4\text{ft vertically}/1\text{ft horizontally}) = 7\text{ft vertically}$

3.

- a. A steepness index of 0.75 for the acme slide means that on their slide for every $\frac{3}{4}$ of a foot that the slide drops in the vertical direction the slide goes horizontally 1 foot. Therefore if you built an “Acme” slide that was 7.5 ft tall it would be 10ft long horizontally.
- b. 7.5ft portion of “Acme” Slide to scale:



4.



b. The steepness index of this graph is:

$$2/3 = 0.67$$

The steepness of the best-fit line tells us the popping index of *Hop-On Popcorn*: 0.67 popped kernels/second.

c. The *HipHop Popping Corn* still pops faster since it has a popping index of 1 popped kernel/second