

Muybridge's Cat

(*Animals in Motion*, Eadweard Muybridge, Dover Publications.)

Details: The distance between gridlines is 5 cm. The time between successive frames is 0.031 sec.

1. Just from casually looking at the pictures, what observations can you make about the motion of the cat?
2. How big is the cat?
3. How far did the cat go? How long did it take him? What was his average speed?
4. Is this average speed the same as the cat's speed in frame 2? Why or why not?
5. In which frames do you think that the cat is probably going faster than his average speed?
6. We now ask you to gather some data and plot some points in order to draw a graph of the cat's distance from his starting point as a function of time. In other words, we want you to construct a graph with time on the horizontal axis and distance on the vertical axis. You should answer the following questions before you begin your graph.

What exactly will we use as our reference point for measuring distance?

Exactly how will we describe the cat's position at a given time?

[illegible]

Use a whole sheet of graph paper to draw your graph!

7. On your graph, draw a line whose slope represents the cat's average speed.
(Hint: Your line will connect two points on your graph. Which two? Why does the slope of this line represent the cat's average speed?)
8. What was the average speed of the cat between frame 10 and frame 20? On your graph draw a line whose slope represents the average speed of the cat between frame 10 and frame 20.
9. Estimate the speed of the cat in frame 10.
10. Estimate the speed of the cat in frame 20.
11. On your graph draw a line whose slope represents the speed of the cat in frame 10.
12. Use your graphing calculator to fit a function formula to your data.
13. Take a derivative to estimate the speed of the cat in frame 10. How does this estimate compare with your earlier estimate?
14. Your friend has a brother in the fifth grade. He wants to know the difference between average speed and instantaneous speed. In fifty words or less write an explanation for him. (He is a bright young man, but he does not yet know calculus.)
15. Sketch a graph of the cat's speed as a function of time.