

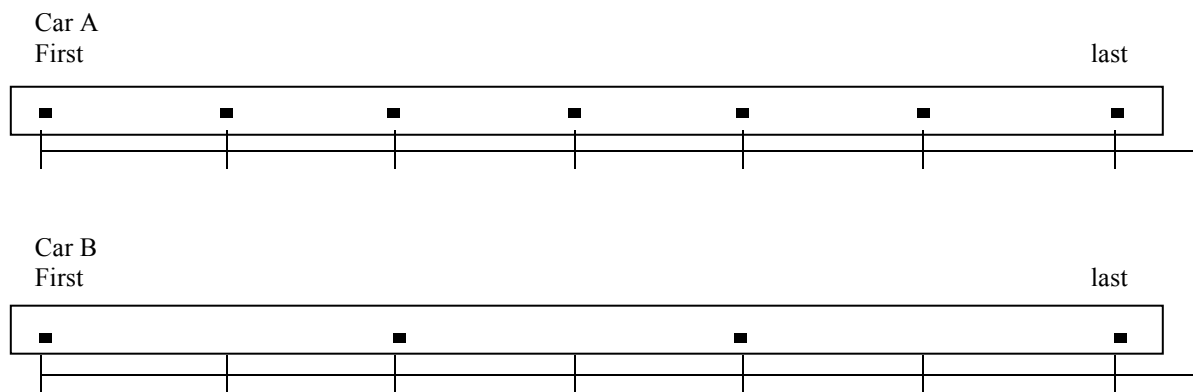
Physics

Motion Maps

Motion Maps represent the position, velocity and acceleration of an object for a given time interval (i.e. it shows where the object is every second, plus arrows representing velocity and acceleration). Think of a car that has an oil leak and it drips oil every second. The drop pattern would show the position and you could draw arrows representing velocity and acceleration with sidewalk chalk.

focus: Velocity

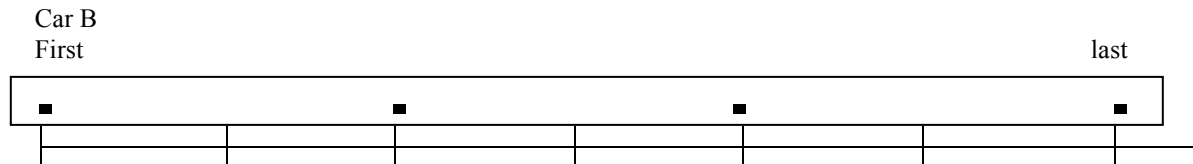
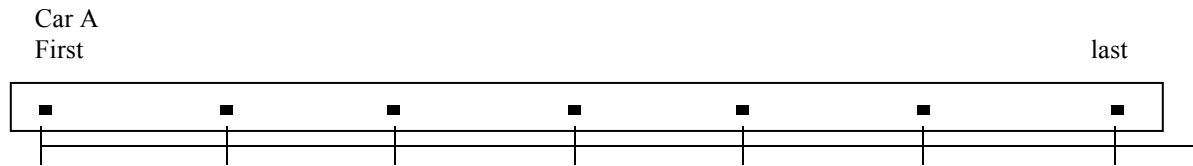
Here is a dot pattern with a time interval of once every second. Assume the motion is going from left to right.



1. Describe the motion of car A in words. Discuss the car's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
2. Describe the motion of car B in words. Discuss the car's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
3. Which car is moving faster?
4. How can you tell?
5. How much faster is the faster car?

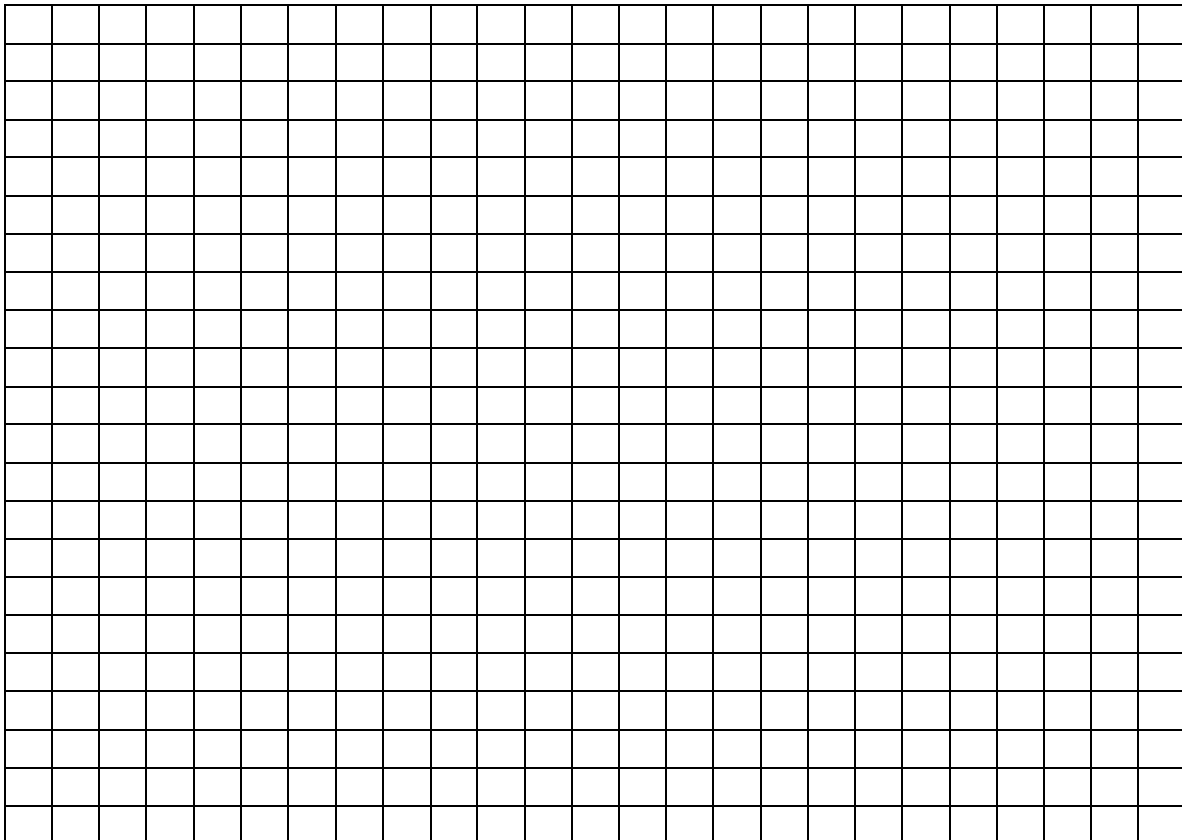
6. Are both cars moving at constant velocity?
7. How can you tell?
8. Assuming an abrupt and complete stop at the last dot, what is the displacement of the first car?
9. Assuming an abrupt and complete stop at the last dot, what is the displacement of the second car?
10. What is the average speed of the first car?
11. What is the average velocity of the first car?
12. What is the average speed of the second car?
13. What is the average velocity of the second car?
14. What is the acceleration of the first car?
15. What is the acceleration of the second car?

16. Now, you will draw arrows representing velocity on the motion map. If the length of the arrow is proportional to the magnitude of velocity (the larger the velocity, the larger the arrow), how much larger should the second motion map's arrow be than the first? Use a COLORED pencil to represent the velocity vectors.



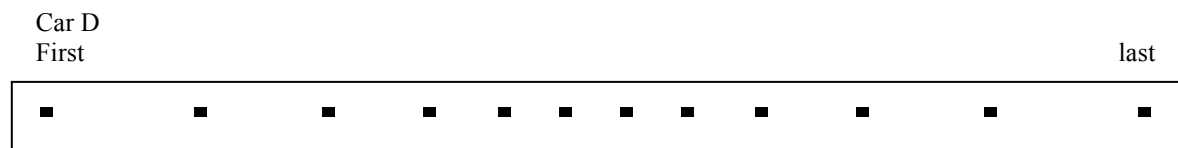
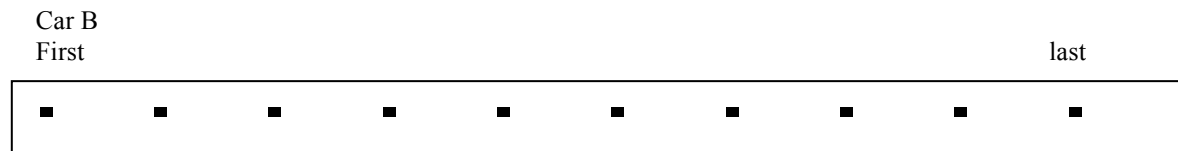
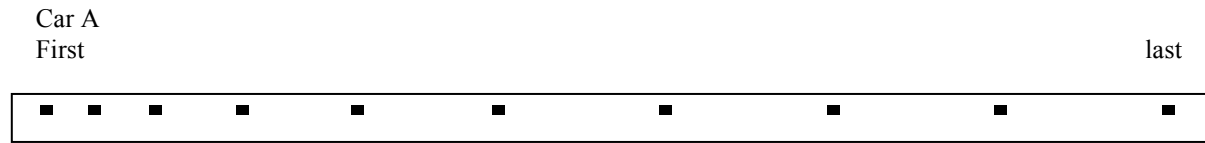
17. How long would the acceleration vector be?

18. Create a position-time graph for the cars. Remember to label everything appropriately.



focus: Acceleration

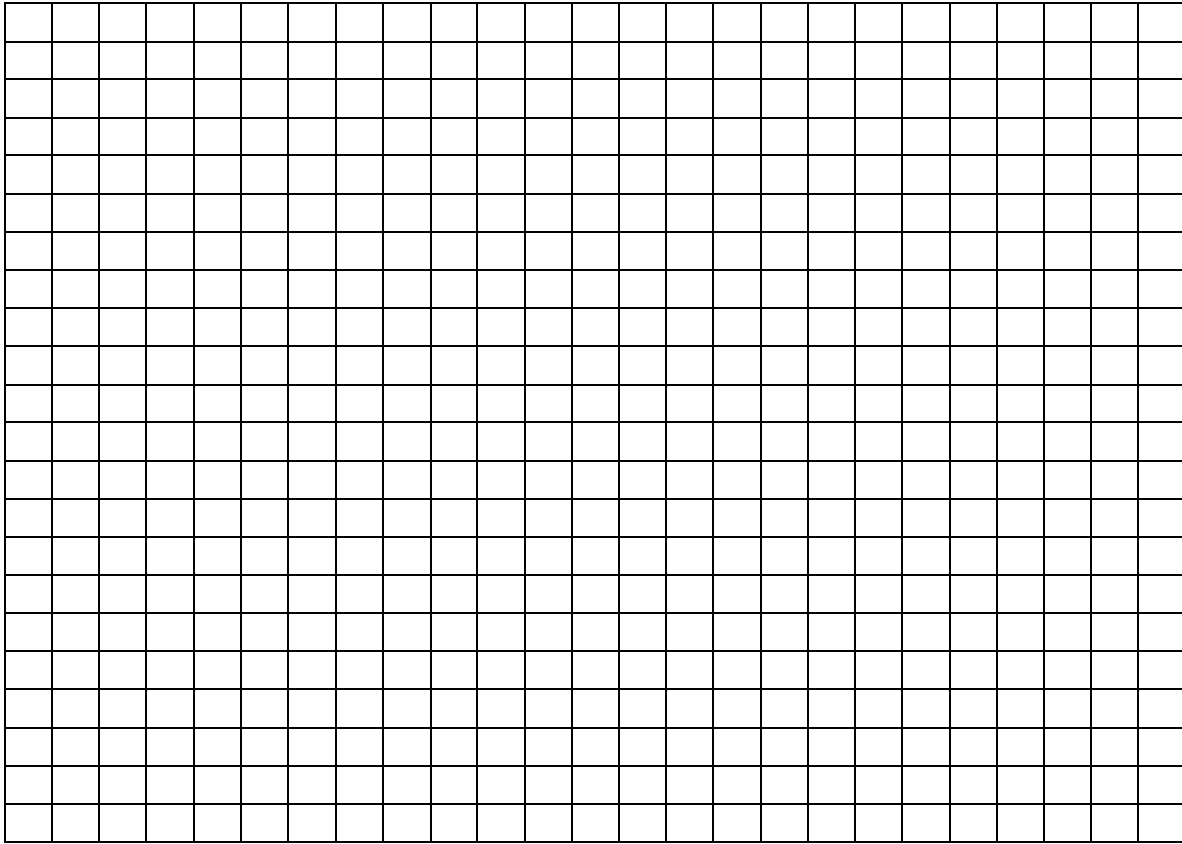
In the motion maps below, a dot is placed every second.



19. Using a COLORED pencil, draw arrows on each motion map to represent the **velocity** vector. Show the direction of the **velocity** and make the lengths proportional to the magnitude.
20. Using a *different* COLORED pencil, draw arrows on each motion map to represent the **acceleration** vector. Show the direction of the **acceleration** and make the lengths proportional to the magnitude.

21. Describe the motion of car A in words. Discuss the car's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
22. Describe the motion of car B in words. Discuss the car's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
23. Describe the motion of car C in words. Discuss the car's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
24. Describe the motion of car D in words. Discuss the car's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
25. For which time interval is the velocity the greatest for car A?
26. For which time interval is the velocity the least for Car C?
27. Which car has constant velocity for the entire run?
28. Which car has a constant velocity for at least 2 time intervals? State the time intervals for each car
29. Which car(s) had a positive acceleration?
30. Which car(s) had a negative acceleration?
31. Which car had both?
32. Which car had an acceleration equal to zero?

33. Create a position-time graph for the cars. Remember to label everything appropriately.

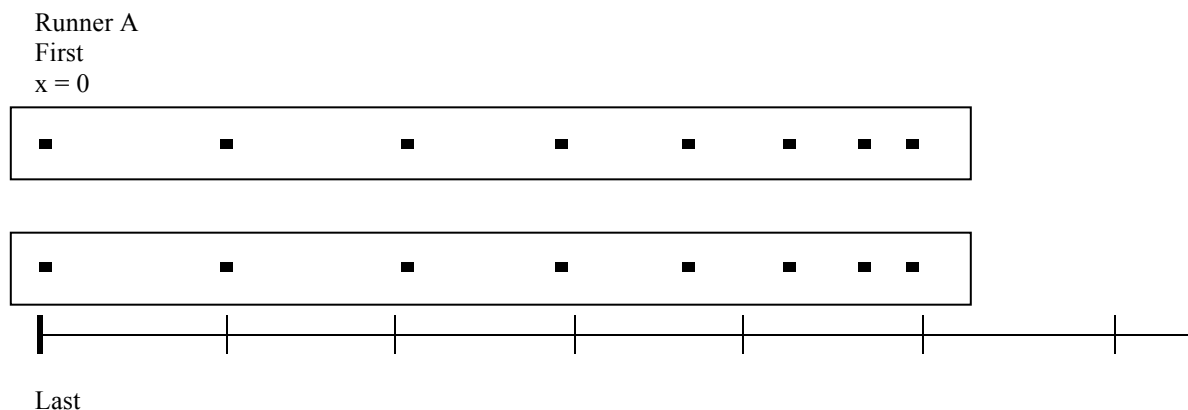


focus: Direction and Displacement

When an object goes “backwards”, shift the dots down to show the motion and avoid confusion

Runner A

The top strip shows the motion of a runner running to the right and slowing to a stop. The bottom strip shows the runner running back to the start. THIS IS ALL ONE MOTION MAP.



34. Which direction should we call positive; to the left or right?
35. Using a COLORED pencil, draw arrows on the motion map to represent the **velocity** vector. Show the direction of the **velocity** and make the lengths proportional to the magnitude.
36. Using a COLORED pencil, draw arrows on the motion map to represent the **acceleration** vector. Show the direction of the **acceleration** and make the lengths proportional to the magnitude.
37. Describe the motion of Runner A in words. Discuss the runner's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.

38. What is Runner A's total distance traveled?

39. What is Runner A's displacement?

40. What is Runner A's average **speed**?

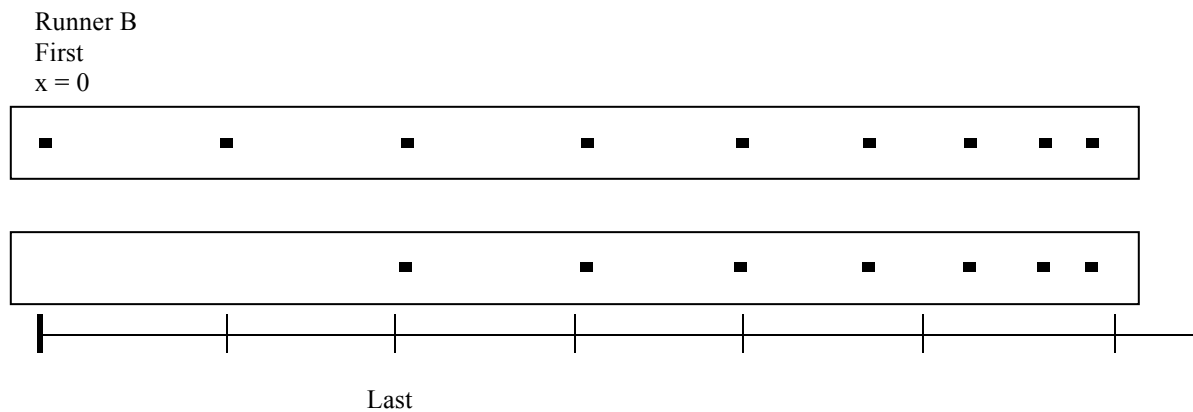
41. What is Runner A's average **velocity**?

42. Which segment(s) shows positive acceleration?

43. Which segment(s) shows negative acceleration?

Runner B

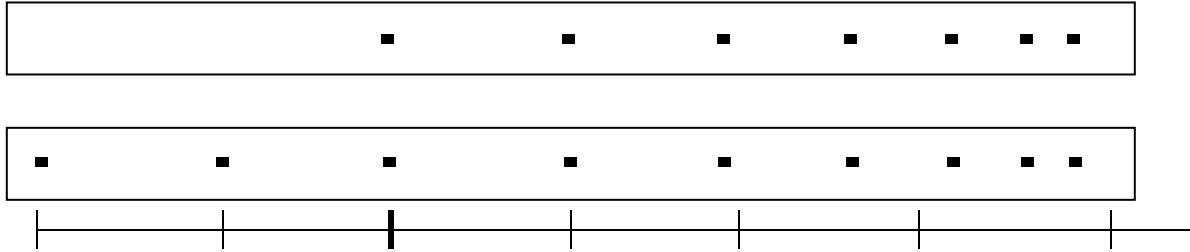
The top strip shows the motion of a runner running to the right and slowing to a stop. The bottom strip shows the runner running back toward the start. THIS IS ALL ONE MOTION MAP.



44. Which direction should we call positive; to the left or right?
45. Using a COLORED pencil, draw arrows on the motion map to represent the **velocity** vector. Show the direction of the **velocity** and make the lengths proportional to the magnitude.
46. Using a COLORED pencil, draw arrows on the motion map to represent the **acceleration** vector. Show the direction of the **acceleration** and make the lengths proportional to the magnitude.
47. Describe the motion of Runner B in words. Discuss the runner's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
48. What is the Runner B's total distance traveled?
49. What is the Runner B's displacement?
50. What is the Runner B's average speed?
51. What is the Runner B's average velocity?
52. Which segment(s) shows positive acceleration?
53. Which segment(s) shows negative acceleration?

Runer C

First
 $x = 0$



Last

54. Which direction should we call positive; to the left or right?
55. Using a COLORED pencil, draw arrows on the motion map to represent the **velocity** vector. Show the direction of the **velocity** and make the lengths proportional to the magnitude.
56. Using a COLORED pencil, draw arrows on the motion map to represent the **acceleration** vector. Show the direction of the **acceleration** and make the lengths proportional to the magnitude.
57. Describe the motion of Runner C in words. Discuss the runner's displacement, velocity, and acceleration. Use terms such as constant, increasing, and decreasing.
58. What is Runner C's total distance traveled?
59. What is Runner C's displacement?
60. What is Runner C's average speed?
61. What is Runner C's average velocity?
62. Which segment(s) shows positive acceleration?
63. Which segment(s) shows negative acceleration?

64. Create a position-time graph for the runners. Remember to label everything appropriately.

