Chapter 2.1: Average Speeds
Calculus I
College of the Atlantic. October 7, 2024

Figure 1: A cat runs away from you in a straight line. Image source: `https://pxhere.com/en/photo/816819`.

1. A cat is running away from you in a straight line. At time $t = 2$ seconds, it is 2 meters away from you. At $t = 4$ seconds it is 32 meters away from you. What is the average speed of the cat during this time interval?
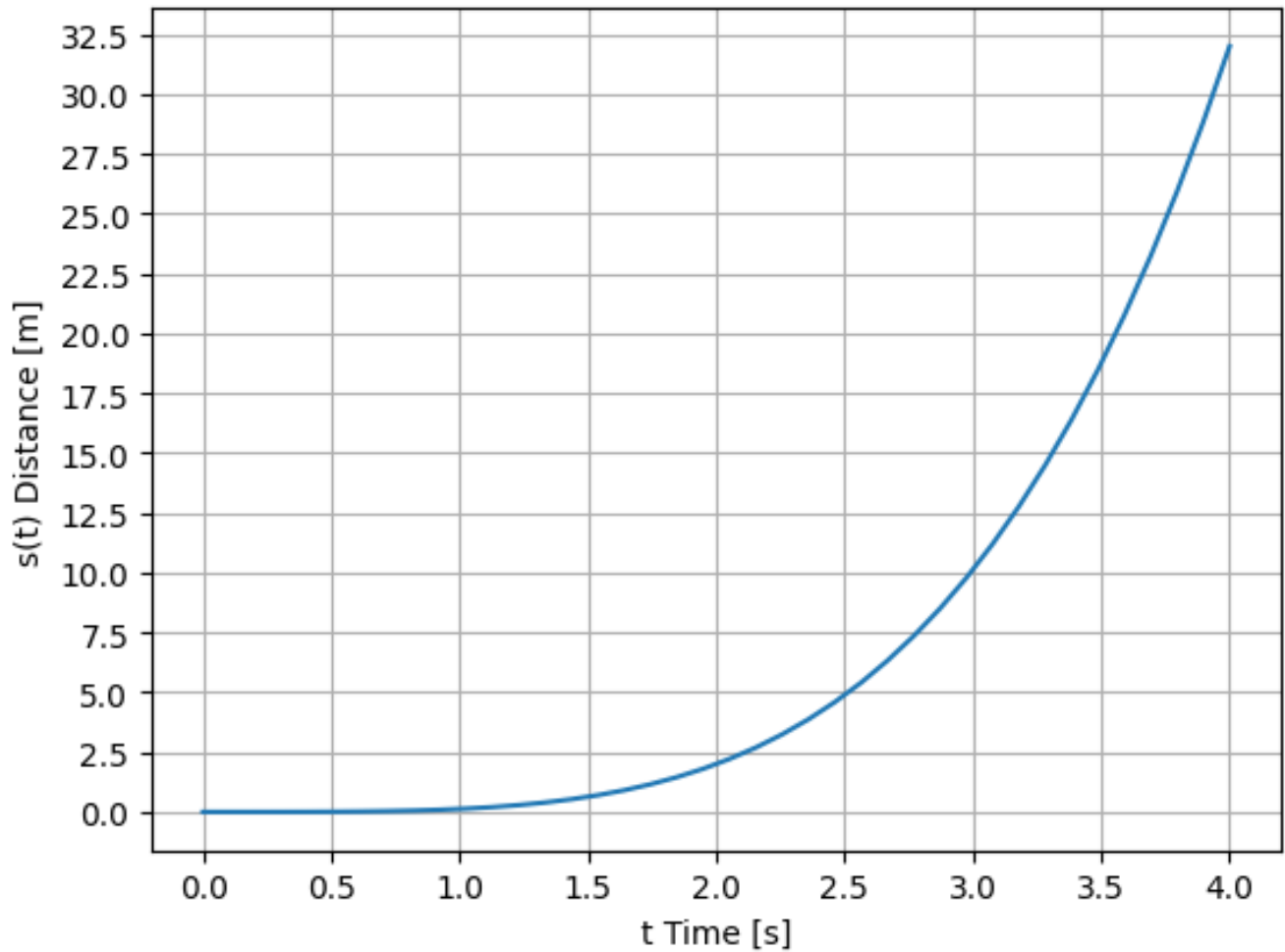
Figure 2: A cat runs away from you in a straight line. Its position is given by $s(t)$, graphed above.

1. On the graph above, show how you can represent the following quantities:

   (a) $s(2)$

   (b) $s(4)$

   (c) The average velocity between $t = 2$ and $t = 4$.

2. What is the average velocity of the cat between $t = 2$ and $t = 4$?

3. What is the average velocity of the cat between $t = 2$ and $t = 3$? Show how to represent this on the graph.

4. What is the average velocity of the cat between $t = 2$ and $t = 2.5$? Show how to represent this on the graph.

5. How would you represent on the graph the velocity of the cat at *exactly* $t = 2$?
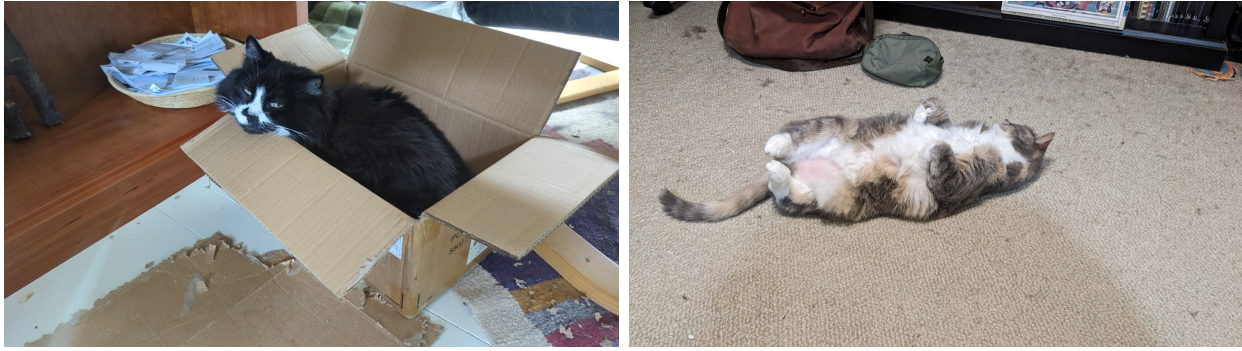
Figure 3: Two zero-velocity cats: Panda (left) and Apple (right).

Suppose a cat moves in a straight line such that its distance from its starting point is given by the function

$$s(t) = 3\sqrt{t} \ . \tag{1}$$

1. What is the average speed of the cat between times $t = 2$ and $t = 6$?

2. What is the average speed of the cat between times $t = 6$ and $t = 10$?

3. (Which of the two average speeds is larger? Why? What does a graph of $s(t)$ look like?)

4. What is the average speed of the cat between times $t = 2$ and:

   (a) $t = 3$
   (b) $t = 2.5$
   (c) $t = 2.05$

5. What do you think is the speed of the cat at *exactly* $t = 2$?

6. Write down a formula for the average speed of the cat between times $t = 2.0$ and $t = 2 + h$.