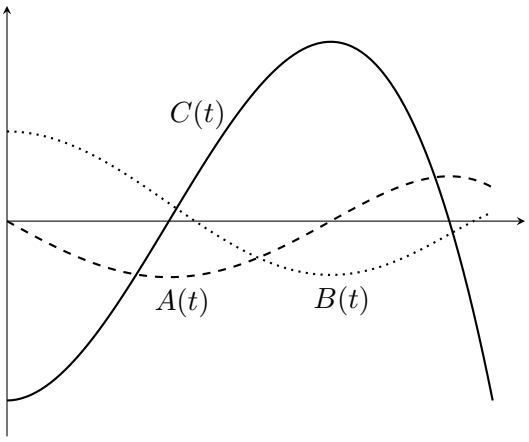
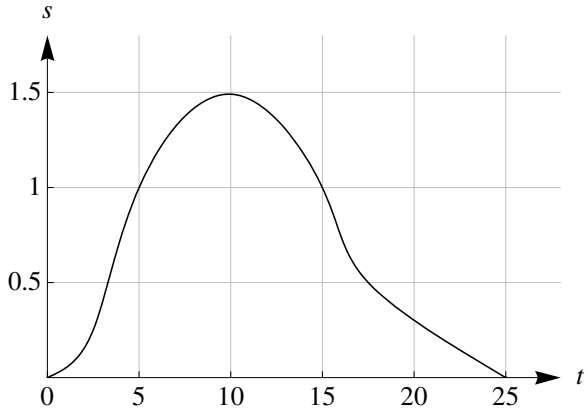
1. A mouse is moving in a narrow lane. Three graphs are shown below: one shows the mouse's position at time t, another its velocity at time t, and the last its acceleration at time t. Which is which?



2. Valeria is picking up her friends from MIT. She leaves the yard and drives down Mass. Ave., picks up her friends and heads back to Harvard. Let $s(t)$ be the car's distance in km from Harvard yard, t minutes after 9pm.



   (a) Does it take longer to get to MIT or to come back?

   (b) What is the length of the journey from Harvard to MIT and back?

   (c) At what time does Valeria reach MIT?

   (d) What is the car's average velocity over the round trip?

   (e) What is the car's average speed over the round trip?

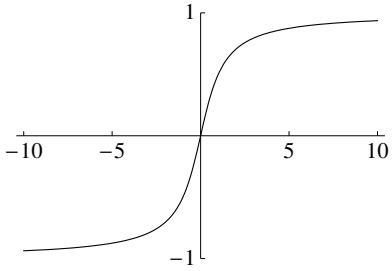
   (f) At what time does the car have positive acceleration?

(g) Sketch a graph showing the car's velocity t minutes after 9pm.

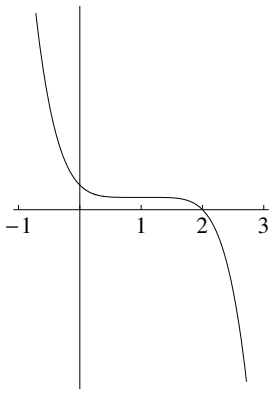
(h) Sketch a graph showing the car's speed t minutes after 9pm.

3. Below are the graph of some functions. Sketch the graph of their derivative.

(a)



(b)



If you have more time, regarding the above graphs as belonging to the derivative function, and sketch the graph of the original functions.

Interpreting the Derivative – Solutions

1. The position function is $B(t)$, the velocity function is $A(t)$ and the acceleration function is $C(t)$.

2. (a) It takes 10 minutes to go to MIT and 15 minutes to come back, so it takes longer to come back.

   (b) The total distance from Harvard to MIT and back is 3 km.

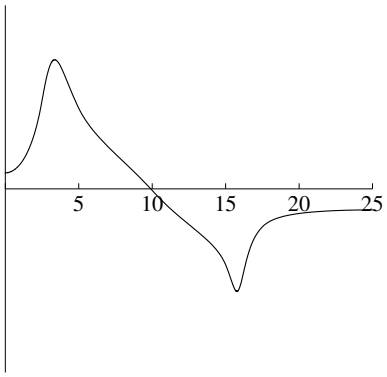
   (c) She reaches MIT at 9:10pm.

   (d) The average velocity of the car over the round trip is 0 km/min.

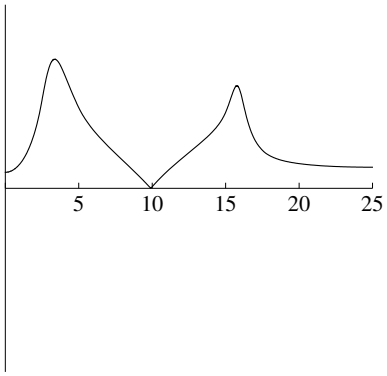
   (e) The average speed of the car over the round trip is $3/25 = 0.12$ km/min.

   (f) The car has positive acceleration when the graph is concave up, namely around $(0, 3)$ and $(17, 25)$.

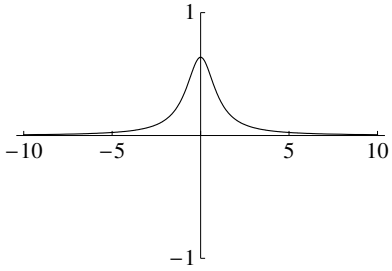
   (g)



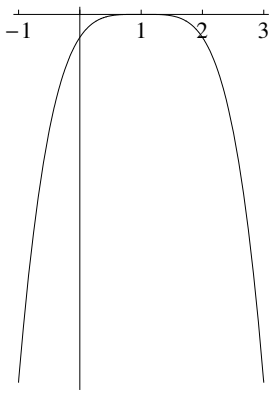
   (h)



3. (a)



(b)



Extra practice: The antiderivative of (a) is