# Graphing Functions from Derivative Information – Class Handout

Make sure you have three different colored bendable sticks. Sketch an $xy$-coordinate system your on paper for $-2 < x < 2$ and $-2 < y < 2$, with roughly $1''$ per unit, to be used throughout this activity.

1. Use bendable sticks to graph a function, $h(x)$ on your $xy$-coordinate system, that satisfies all of the following properties.

   $h(x)$ is continuous.
   $h''(0) = 0, h'(1) = 0$
   $h'(x) > 0$ when $x < 1$
   $h'(x) < 0$ when $x > 1$
   $h''(x) < 0$ when $x > 0$
   $h''(x) > 0$ when $x < 0$.

   (a) Where is $h$ increasing? Where is $h$ decreasing? How do you know from the given information?

   (b) Where is $h$ concave up? Where is $h$ concave down? How do you know from the given information?

   (c) Where does $h$ have critical points? Inflection points? How do you know?

   (d) Keep the function you just created. Now use a second bendable stick to graph its derivative.

   (e) At what point is $h'$ zero? Explain what the graph of $h$ looks like there.

   (f) What does the graph of $h'$ look like when the graph of $h$ is increasing (decreasing)?

   (g) Keeping both of the graphed functions in place, use a third bendable stick to graph the derivative of $h'$. This is also $h''$, the second derivative of $h$.

   (h) What does the graph of $h''$ look like when the graph of $h'$ is increasing (decreasing)? What can you say about the shape of $h$ at the same location?

   (i) At what point is $h''$ zero? What can you say about the graph of $h$ at this point? What can you say about the graph of $h'$ at this point?

2. Create any function on your $xy$-coordinate system using one of the bendable sticks. Then use another bendable stick to graph a function that is different from the first one but has the same derivative. How are these two graphs related? How do you know that they have the same derivative?