Graphing Secant Lines

Name________________________

The following contains 5 exercises. Each exercise asks you to graph several secant lines plus a function, usually all on one set of axes (graph). (Exercise 2 is the exception.) It will be up to you to find the equations for the secant lines.

1. Use Derive to construct a plot which simultaneously contains the graphs of all of the following:

   (a) $f(x) = x^3 - 2x^2 - x + 1$

   (b) The secant line connecting the points on the graph corresponding to the pairs of values of x.

   - $a = 0$ and $b = 2$.
   - $a = 3$ and $b = -1$.
   - $a = -2$ and $b = 1$.
   - $a = -1.5$ and $b = 1.5$.

2. In the previous exercise (for example, using $x = 3$ and $x = -1$), after one has computed the `slope` there are two options for the equation of the line. Either,

   ```
   f(x):= slope·(x-3) + f(3)
   ```

   or

   ```
   f(x):= slope·(x-(-1)) + f(-1)
   ```

   Demonstrate that these are in fact the same by graphing both (on separate graphs along with `f(x)`).

3. Now we will try a variation on #1. We will fix one value of x, let $b = 1$. Construct a plot which simultaneously contains the graphs of all of the following:

   (a) $g(x) = x^5 - 11x^3 + 2x^2 + 27x - 2$

   (b) The secant line connecting the points on the graph corresponding to the pairs of values of x.

   - $b = 1$ and $a = -3$.
   - $b = 1$ and $a = -2$.
   - $b = 1$ and $a = -1$.
   - $b = 1$ and $a = 0$.

4. Let's repeat #3 but make our work a little easier. Define a slope function as follows

```
slope(z):=(g(z)-g(1))/(z-1)
```

Now, we can define the line through $x = 2$ (for example) as

```
l(x):= slope(2)(x-1) + g(1)
```

Graph $g(x)$ and $l(x)$ on the same graph to see if this is working.

Now, construct a plot which simultaneously contains the graphs of all of the following:

(a) $g(x) = x^5 - 11x^3 + 2x^2 + 27x - 2$

(b) The secant line connecting the points on the graph corresponding to the pairs of values of x.

- $x = 1$ and $x = 2$.
- $x = 1$ and $x = 1.5$.
- $x = 1$ and $x = 1.25$.
- $x = 1$ and $x = 1.1$.

5. Now that we've got that method under control, let's do the same thing for an exponential function. Construct a plot which simultaneously contains the graphs of all of the following:

(a) $f(x) = 2e^{x/10}$

(b) The secant line connecting the points on the graph corresponding to the pairs of values of x.

- $x = 1$ and $x = 2$.
- $x = 1$ and $x = 1.5$.
- $x = 1$ and $x = 1.25$.
- $x = 1$ and $x = 1.1$.

Hint: To enter $e^{x/10}$ in Derive, use `exp(x/10)`.