Derivatives for Algebra 1

Student Worksheet

Name ______________________

Class ______________________

In this activity, you will explore the changes to the slope of a tangent line as the point of tangency changes. This will be done numerically and summarized visually. The visual summary can be thought of as a new slope function called a derivative. Next you will investigate further what happens to the slope function as the original function changes.

1. Open the *Derivative.tns* document. This is the graph of $y = x^2$.

2. Drag point *X* along the *x*-axis to move the tangent line, and answer the following questions:

- When is the slope of the tangent line negative?
- When is the slope of the tangent line positive?
- When is the slope of the tangent line zero?

3. What do the *x* and *y* coordinates of the point *P* have to do with the tangent line?

4. Drag point *X*, and notice the path point *P* follows.

- You can plot a point at the current location of point *P* by pressing ctrl ..

5. Use the Hide/Show tool to hide the label (*xc,slp*) that appears when you first press ctrl ..

- When you move point *P* away, you should see a point marking the old location of *P*.

6. Pressing ctrl . to mark some of the locations of point *P* should help you see the path point *P* follows.

7. You can press ctrl ▶ to move to the next page and see the coordinates of the points you have marked.

8. Press ctrl ◀ to move back to the graph, and describe the path of point *P*.

9. Make a locus of point *P* as point *X* changes.

- Press menu 9 6 for Menu 9:Construction, 6:Locus.
- Click on point P, and then on point *X*.
- Sketch your results in the window provided (Figure 1).

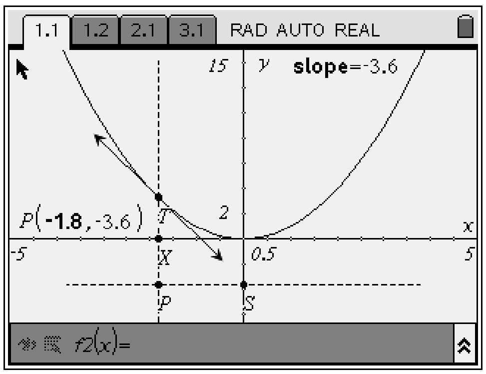

Figure 1

10. This locus is called a derivative. What does the derivative tell us about the graph of the parabola?

11. See if you can find an equation for the derivative.

- Enter the equation in *f2*(*x*) to check.
- Does it match the locus?

- Write your equation for the derivative:

12. Predict what will happen to the derivative as you make the following changes to the parabola. Don't actually make the changes to the parabola on your calculator until you have written down your predictions.

- Vertical shift

  Prediction:

  Actual:

- Vertical stretch

  Prediction:

  Actual:

- Vertical shrink

  Prediction:

  Actual:

13. Press ctrl ▶ twice to move to Problem 2.1 (Figure 2).

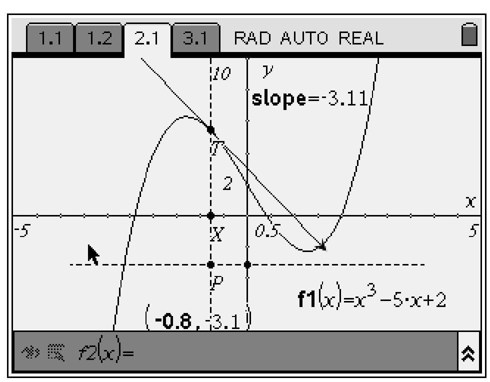

Figure 2

14. This is the graph of $y = x^3 - 5x + 2$. Consider what will happen to the slope point *P* as you drag the tangent line.

- When will point *P* be below the *x*-axis?
- When will point *P* be above the *x*-axis?
- When will point *P* be on the *x*-axis?

15. Predict the graph of the derivative of $y = x^3 - 5x + 2$.

- Sketch your prediction in the window above.
- Then check your answer by making a locus of points.

16. See if you can find an equation for the derivative.

- Enter the equation into *f2*(*x*) to check.
- Does it match the locus?
- Write your equation for the derivative:

17. Press ctrl ▶ to move to Problem 3.1 (Figure 3).

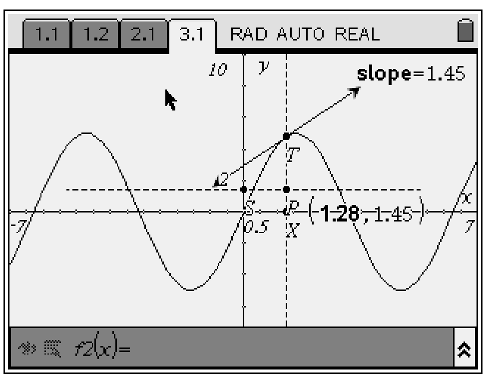

Figure 3

18. This is the graph of $y = 5\sin(x)$. Consider what will happen to the slope point *P* as you drag the tangent line.

- When will the slope be positive?
- When will the slope be negative?
- When will the slope be zero?

19. Predict the graph of the derivative of $y = 5\sin(x)$.

- Sketch your prediction in the window above.
- Then check your answer by making a locus of points.

20. See if you can find an equation for the derivative.

- Enter the equation in *f2*(*x*) to check.
- Does it match the locus?
- Write your equation for the derivative:

21. Transform the sine wave (i.e., vertical shift, vertical stretch, vertical shrink).

- What happens to the derivative?

22. Explain why sometimes when you are asked to find a derivative in a calculus book the answer is a single number and other times the answer is a function.

Extension

Add a calculator page, and use the CAS derivative command to find the derivative of $y = x^2$.

- Does your result match your equation in step 11?

- Use CAS to find the derivatives of $y = x^3 - 5x + 2$ and $y = 5\sin(x)$.
- Do your answers match the results in steps 16 and 20?