AP Calculus BC
Lesson 9.1 Arc Length

9.1(1) Consider $y = f(x) = x^2$ for $0 \le x \le 2$.

(a) Approximate the length of this curve by using line segments from (0,0) to (1,1) and (1,1) to (2,4).

(b) If necessary, rewrite your expression in the form $1(\sqrt{1+a} + \sqrt{1+b})$. Try to determine the relationship (if any exists) among *a*, *b*, and the slopes of the line segments.

(c) Repeat part a with four equal line segments: (0,0) to $\left(\frac{1}{2}, \frac{1}{4}\right)$, $\left(\frac{1}{2}, \frac{1}{4}\right)$ to (1,1), etc.

(d) Rewrite your expression in the form $k(\sqrt{1+a} + \sqrt{1+b} + \sqrt{1+c} + \sqrt{1+d})$. Determine any geometric significance of *k*, *a*, *b*, *c*, and *d*.

(e) Make a conjecture about how calculus can be used to find the **exact** arclength from (0,0) to (2,4).

(f) Approximate this arclength.

9.1(2) Find the length of the semicubical parabola $y^2 = x^3$ between the points (1,1) and (4,8).

9.1(3) Find the length of the arc of the curve $8y = x^4 + 2x^{-2}$ from the point where $x = 1$ to the point where $x = 2$.

9.1(4) Find the length of the arc of the curve $6xy = y^4 + 3$ from the point where $y = 1$ to the point where $y = 2$.