1 A pebble is dropped into a calm pool, causing ripples in the form of concentric circles. The radius, r, of the outer ripple is increasing at a constant rate of $\frac{1}{\pi}$ feet per second. When the radius is 4 feet, then

A) The rate is the total area A of the disturbed water increasing?
B) The rate at which the circumference, C, is increasing?
C) The rate at which the Area is increasing with respect to the Circumference?

Find ABC

2 If $f(x)=(2x+1)^3(x^3+2)^4(x^{17}+2)^6$, Find $f'(-1)+f'(0)$

3 Consider the equation $xe^{4y} + x\cos y = 2$

What is the slope of the line tangent to the curve at the point $(1,0)$?

4 Suppose $f(2)=2$, $f'(2)=\frac{3}{2}$, $g(2)=3$ and $g'(2)=-\frac{1}{4}$.

Let

$A = f(x)g(x)$

$B = \frac{f(x)}{g(x)}$

$C = f(f(x))$

$D = (g(x))^3$

Find: $A'(2)\cdot B'(2)\cdot C'(2)\cdot D'(2)$

5 Find the point on the graph of $g(x) = 2x^2 - 3x + 4$ at which the equation of the tangent line is $2x + 2y = 7$

6 The function $f(x) = x^3 + Ax^2 + Bx + C$ has both a horizontal tangent and a point of inflection at $(1,3)$.

Find ABC

7 What positive value of a satisfies this equation?

$$\int_e^{a^e} \frac{dx}{x\int_a^{ax}\frac{dy}{y}} = 1$$

8 A Norman window is constructed by adjoining a semicircle to the top of an ordinary rectangular window. Find the dimensions of a Norman window of maximum area if the total perimeter is 16 feet.

9 Given $f(x) = 3x^2 - 12x$

Let A = The value of x which is guaranteed by Rolle's Theorem on $[0,4]$

Let B = The value of x which is guaranteed by the mean value theorem on $[0,2]$

Let C = The average value of $f(x)$ on $[-2,-1]$

Let D = The least positive root of the antiderivative of f which has a y-intercept of $\frac{81}{8}$

Find ABCD

10 A revolving light stands 100 meters from a straight wall and makes 3 revolutions per second. At what rate does the light appear to be moving horizontally along the wall when the beam of light makes a $30°$ angle with the wall.

11 $A = \lim_{n\to\infty}\left(\frac{1}{n^3}+\frac{2^2}{n^3}+\frac{3^2}{n^3}+\text{L}+\frac{n^2}{n^3}\right)$

$B = \lim_{x\to 0}\frac{e^{2x}-1}{x}$

$C = \lim_{n\to\infty}\left(\frac{2}{3}+\frac{2}{15}+\text{K}+\frac{2}{4n^2-1}\right)$

Find $A+B+C$

12 In 1990, the number of armadillos in Seminole county was 100. By the year 2000, there were 900 armadillos in Seminole county. If the rate of population growth of these animals is proportional to the population size, how many armadillos might one expect to see in 2005?

13 A landowner has 300 meters of fence with which to enclose a rectangular field. One side of the field runs along a river and does not need any fence. How long should the side parallel to the river be in order to maximize the area enclosed?

14 Evaluate $\left(f\left(g\left(x\right)\right)\right)'$ when $x=6$ and

$f\left(6\right)=13 \quad f'\left(6\right)=-5$

$f\left(2\right)=-4 \quad f'\left(2\right)=8$

$g\left(6\right)=2 \quad g'\left(6\right)=-4$

$g\left(13\right)=12 \quad g'\left(13\right)=0$

15 What is the nth derivative of ln(x)?