Name:______________
School:______________

Calculus Team 2018

St. Paul's Tournament

1. $\lim\limits_{h \to 0} \dfrac{\sqrt{11-(x+h)^2}-\sqrt{11-x^2}}{h}$

2. $\lim\limits_{x \to -\infty} x - \sqrt{x^2+4}$

3. $\lim\limits_{x \to -6} \dfrac{x^3+216}{x^2+2x-24}$

4. $\lim\limits_{d \to 0} (1+d)^{\frac{1}{d}}$

5. Make an equation (in slope intercept form) of the tangent line to the curve at the given x value:

$$C(x) = \ln(4x-3) \qquad x = 2$$

6. Find the derivative of the function:

$$\beta(x) = \tan\left(\frac{7x}{x+4}\right)$$

7. Use logarithmic differentiation to find the derivative function:

$$C(x) = (5x)^{x-4}$$

8. List the interval(s) where the function is concave down:

$$d(x) = \frac{2x}{1+x^2}$$

9. Compute the expression:

$$\frac{\mathrm{d}}{\mathrm{d}x} \int_{14}^{\cos(5x)} \ln(\pi + a)\,\mathrm{d}a$$

10. $\displaystyle\int x^2 \sqrt[3]{2-x}\,\mathrm{d}x$

11. $\displaystyle\int \sec(2\theta)\,\mathrm{d}\theta$

12. $\displaystyle\sum_{k=1}^{24} (7 + 5k^2)$

13. Find the x value that is contained in the interval [a, b] that satisfies the mean value theorem for the given function:

$$f(x) = \frac{10}{1-x} \quad \text{on} \quad [-4, -1]$$

14. A person can see a hot air balloon flying away. If they know that the maximum height of this particular balloon is 200 feet, and they measure the angle of elevation to the balloon to be decreasing at a rate of 2° per minute, then how fast is the balloon moving forward when the angle of elevation is 45°?

Answers

1. $-\frac{x}{\sqrt{11-x}}$
2. $-\infty$
3. -10.8
4. e
5. $y = \frac{4}{5}x - \frac{8}{5} + \ln 5$
6. $\beta'(x) = (\frac{28}{(x+4)^2}) \cdot \sec^2(\frac{7x}{x+4})$
7. $(5x)^{x-4} \cdot (\ln 5x + 1 - \frac{4}{x})$
8. $(-\infty, -\sqrt{3}) \cup (0, \sqrt{3})$
9. $-5\sin(5x) \cdot \ln(\pi + \cos(5x))$
10. $-\frac{3(2-x)^{10/3}}{10} + \frac{12(2-x)^{7/3}}{7} - 3(2-x)^{4/3} + c$
11. $\frac{1}{2} \ln|\sec(2\theta) + \tan(2\theta)| + c$
12. 24668
13. $1 - \sqrt{10}$
14. $-\frac{40\pi}{9}$ Note: You must convert your degrees to radians to solve this problem.