Name:_____
School:_____
Compliments of my sister

Calculus AB Individual 2020

Brother Martin Tournament

1. Find $\lim\limits_{x\to -3} \dfrac{x^2-9}{x+3}$

2. Find $\lim\limits_{x\to \infty} \dfrac{x}{\sin(-3x)}$

3. If $y = 2x^5 + 5x^2 - x$, find $\dfrac{\mathrm{d}^4 y}{\mathrm{d}x^4}$

4. Below is a table containing some values of differentiable functions $f(x)$, $g(x)$ and their derivatives. Use the table data and the rules of differentiation to solve the problem below:

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	4	-1	3	-1
2	3	-1	2	-1
3	2	-1	1	$\frac{1}{2}$
4	1	-1	3	2

   Given $h(x) = (f(x))^2$, find $h'(2)$

5. If $y = 5^{2x^4}$, find the instantaneous rate of change when $x = -1$

6. A particle moves along a horizontal line. Its position function is $s(t) = t^3 - 15t^2$ for $t \geq 0$. Find the intervals of time when the particle is speeding up.

7. Find $\displaystyle\int \frac{5}{x}\,\mathrm{d}x$

8. Differentiate the function: $y = \sin 2x^5$

9. Find $(f^{-1})'(10)$ for the function $f(x) = 4x^5 + 5x + 1$.

10. A supermarket employee wants to construct an open-top box from a 10 by 16 in piece of cardboard. To do this, the employee plans to cut out squares of equal size from the four corners so the four sides can be bent upwards. What size should the squares be in order to create a box with the largest possible volume?

11. Find the y-value of the ordered pair where the absolute maximum occurs for the function $y = x^3 - 3x^2 + 3$ on the interval $[-1, 1]$

12. Find the equation of the line tangent to the graph of $y = \dfrac{5x^4}{2x^3 - 4}$ at the point $(1, -\frac{5}{2})$. Answer in point-slope form.

13. Use implicit differentiation to find $\frac{\mathrm{d}y}{\mathrm{d}x}$ at $(1, -1)$.

    $4x^2 + xy^2 = -2y^3 + 3$

14. Find $\displaystyle\int_{-2}^{1} 6x(x^2 - 4)^2 \,\mathrm{d}x$

15. Find the area of the region enclosed by the following curves:

    $y = 2\sqrt{x},\ y = -\sqrt{x},$

    $x = 0,\ x = 4$

Answers

1. -6
2. DNE
3. $240x$
4. -6
5. $-200 \ln 5$
6. $(0, 5) \cup (10, \infty)$
7. $5 \ln |x| + c$
8. $10x^4 \cos(2x^5)$
9. $\frac{1}{25}$
10. 2
11. 3
12. $y + \frac{5}{2} = -\frac{35}{2}(x - 1)$
13. $-\frac{9}{4}$
14. -27
15. 16