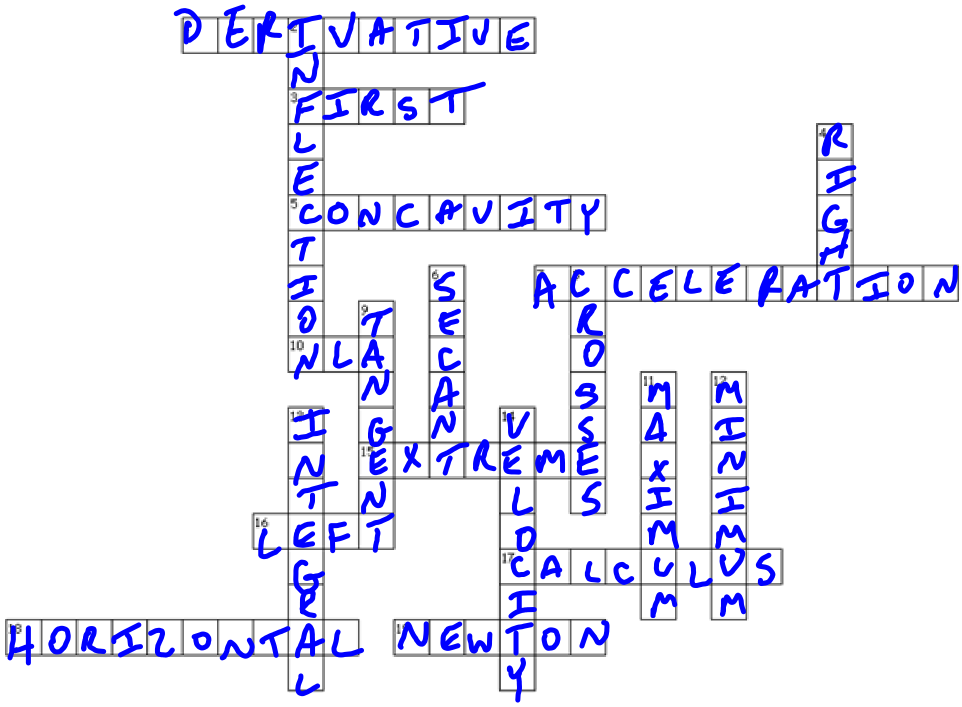
Unit 6 Vocabulary



Across

1. The slope of the tangent line for any given value of x for a real, continuous function
3. The ______ derivative of a function helps determine where the function is increasing or decreasing.
5. The second derivative of a function helps determine the function's ______.
7. _______ is the second derivative of position.
10. When solving an optimization problem, you use _______ (initials) to justify your solution.
15. When $f'(x) = 0$, there is a relative ______ point.
16. In a particle motion problem, when $f'(x) < 0$, the particle is moving to the _______.
17. The mathematics of change
18. The tangent lines are ______ at a function's extrema.
19. _______ (last name) is credited with founding calculus.

Down

2. The point where a function's concavity changes is called the point of _______.
4. In a particle motion problem, when $f'(x) > 0$, the particle is moving to the _______.
6. A line that connects two points of a function.
8. At the point of inflection, the graph ______ its tangent line.
9. The ______ lines are above the function when $f'' < 0$.
11. When f' switches from positive to negative, there is a relative _______ for f.
12. When f' switches from negative to positive, there is a relative _______ for f.
13. Taking higher powers of a function ("climbing up the ladder")
14. _______ is the first derivative of position.

Math 4 Honors
Unit 6 Test Review

Name ____________________
Date ____________________

1. Short essay questions based off of your notes & vocabulary
2. Use the average rate of change (slope) formula
3. Use the Power Rule to differentiate of a function
4. Use the derivatives and number line analysis to find the coordinates of the local extrema (max/min), the coordinates of the inflection point(s) and concavity of a function.
   Try this function: $f(x) = x^3 - 1.5x^2 - 18x$

$f'(x) = 3x^2 - 3x - 18$
$0 = 3x^2 - 3x - 18$
$0 = x^2 - x - 6$
$0 = (x-3)(x+2)$
$x = 3 \quad x = -2$
(x-3) − − : − : +
(x+2) − : + : +
+ −2 − 3 +
MAX (−2, 22) MIN (3, −40.5)

$f''(x) = 2x - 1$
$0 = 2x - 1$
$x = \frac{1}{2}$
2x−1 − : +
Down $\frac{1}{2}$ up
Inflection: $(\frac{1}{2}, -9.25)$

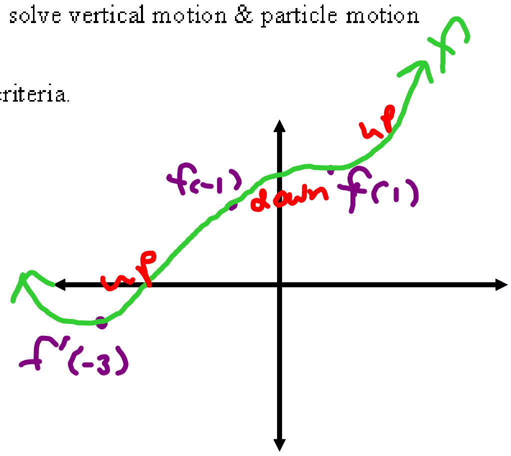
Write the equation of a tangent line to f when $x = -4$.

$f'(-4) = 42$ → slope of T.L.
$f(-4) = -16$ → P.O.T.

$y + 16 = 42(x + 4)$

5. Use the position, velocity & acceleration functions to solve vertical motion & particle motion problems.
6. Sketch & label the graph of a function given certain criteria.

   If f is a function such that:
   $f'(1) = 0$ } Horiz. T.L.
   $f'(-3) = 0$
   $f''(x) < 0$ for $-1 < x < 1$ CC ↓
   $f''(x) = 0$ when $x = -1$ and $x = 1$ Infl.
   $f''(x) > 0$ elsewhere, CC ↑
   graph f as best you can.



7. Three Optimization Problems

Calculus Applets using GeoGebra
http://webspace.ship.edu/msrenault/GeoGebraCalculus/GeoGebraCalculusApplets.html

Practice Website

The Derivative as a Function
http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_as_a_function.html

Reconstruct *f* from its **First Derivative**

http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_app_1_graph_AD.html

Derivatives and the Shape of a Graph

http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_shape_of_a_graph.html

Identify the Derivative Function
http://webspace.ship.edu/msrenault/GeoGebraCalculus/derivative_matching.html

Math 4 Honors
Unit 6 Test Review

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Date ______________________

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   If f is a function such that:
   $f'(1) = 0$
   $f'(-3) = 0$
   $f''(x) < 0$ for $-1 < x < 1$
   $f''(x) = 0$ when $x = -1$ and $x = 1$
   $f''(x) > 0$ elsewhere,
   graph f as best you can.

7. Three Optimization Problems from the Day 2 & Day 3 problem sets

Extra Practice

1.

Differentiate the following:

a. $y = 5x^3 - 4x^2 + 2x - 6$

b. $y = 5x^2 - \frac{3}{x^3}$

c. $y = \sqrt[4]{x} + \sqrt[3]{x}$

d. $y = \frac{1}{\sqrt{x}}$

2.

The table below gives the number of lawyers in the U.S. between 1960 and 1985, as reported in the Statistical Abstract of the United States 1988.

Year	Number of Lawyers
1960	285,933
1963	296,069
1966	316,656
1970	355,242
1980	542,205
1985	655,191

a. Find the average rate of change in the number of lawyers from 1960 to 1980.

b. Find the average rate of change in the number of lawyers from 1980 to 1985.

3. A cylindrical can, with a lid and a capacity of 2000π cubic feet, is to be constructed using sheet steel. What dimensions for the can should be chosen to minimize the amount of sheet steel required?

$V = Bh$ $SA = 2B + 2\pi rh$

Extra Practice Answers

1. a) $y' = 15x^2 - 8x + 2$

   b) $y = 5x^2 - 3x^{-3}$

   $y' = 10x + 9x^{-4}$

   c) $y = x^{1/4} + x^{1/3}$

   $y' = \frac{1}{4}x^{-3/4} + \frac{1}{3}x^{-2/3} = \frac{1}{4}\sqrt[4]{x^{-3}} + \frac{1}{3}\sqrt[3]{x^{-2}}$

   d) $y = x^{-1/2}$

   $y' = -\frac{1}{2}x^{-3/2} = -\frac{1}{2}\sqrt{x^{-3}} = \frac{-1}{2\sqrt{x^3}}$

2. a) 12813.6 lawyers/year

   b) 22597.2 lawyers/year

3. $2000\pi = \pi r^2 h$

   $\frac{2000}{r^2} = h$

   $SA = 2\pi r^2 + 2\pi r h$

   $= 2\pi r^2 + 2\pi r \cdot \frac{2000}{r^2}$

   $= 2\pi r^2 + \frac{4000\pi}{r}$

   $SA' = 4\pi r - 4000\pi r^{-2}$

   $r^2(0) = (4\pi r - 4000\pi r^{-2})r^2$

   $0 = 4r^3 - 4000$

   $0 = r^3 - 1000$

   $r = 10$

   $r^3 - 1000$: $-$ | $+$ at 10

   MIN

   $r = 10''$ $h = 20''$