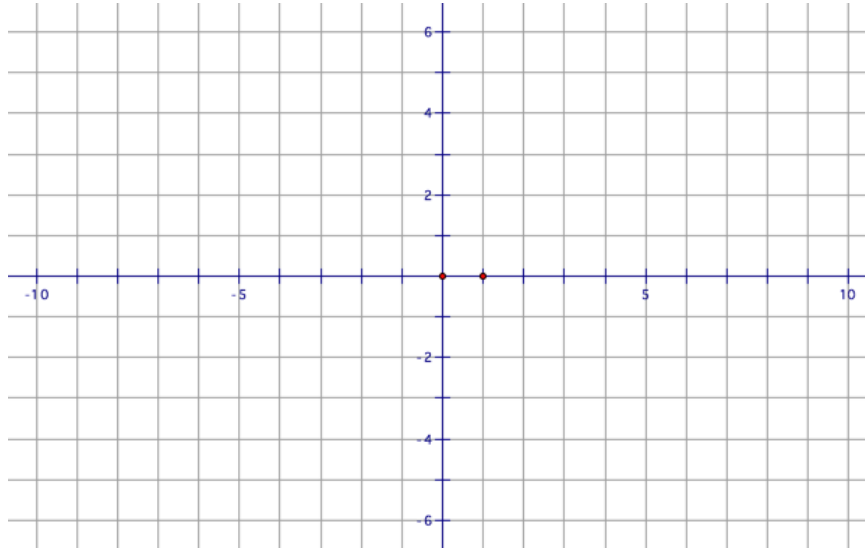| Math	Test	
2471	Final Exam Take Home	Name _____

1. State the fundamental theorem of calculus.

2. Find the equation of the tangent line to the graph of the function at the given point P.

$$f(x) = \sqrt{x - 1} \qquad P = (5,2)$$

3. $f(x) = (e^{x^2} + 3)^3$ find $f'(x)$

4.

Use the given information to sketch a graph for f(x).

X	-4	-2	0	2	4	6
f(x)	0	3	0	-2	0	3

$f'(x)>0,$ $x<-2,$ $2<x$ $f''(x)>0,$ $0<x<4$

$f'(x)<0,$ $-2<x<0$ $0<x<2$ $f''(x)<0,$ $x<0,$ $4<x$

$f'(x)=0,$ $x=-2,$ $x=2$ $f''(x)=0$ $x=4$

$f'(x)$ undefined $x=0$ $f''(x)$ undefined $x=0$

5. A farmer wants to construct a rectangular pen next to a barn that is 600 feet long (he milks a lot of cows). Using a side of the barn as part of one side of a pen, and 400' of fencing, what are the dimensions of the pen that can be built that has the greatest area. Draw a sketch of the pen.

6. A student claims that the tangent line to a graph of $g(x) = \ln(x)$ at x=3 passes through the origin. Is he correct?

7. Use implicit differentiation to help you write the equation of the line that is tangent to $x^2 - y^2 - xy + 11 = 0$ at $(1,3)$.

8. Find the integral $\int xe^{3x^2} dx$

9. Find the following anti-derivative $\int(\frac{3}{2+v} + \frac{2+v}{3})dv$

10. Use the quotient rule to differentiate $y = \sec(x)$. Recall that $\sec(x)$ is the reciprocal of $\cos(x)$.

11. Two functions, f and g, have an area between them. Find the volume of the solid generated when this region is rotated about the line y=0.

$$f(x) = x^2 \qquad\qquad g(x) = \sqrt{x}$$

12. Two functions, f and g, have an area between them. Find the volume of the solid generated when this region is rotated about the line x=-1.

$$f(x) = x^2 \qquad\qquad g(x) = \sqrt{x}$$

13. You have just found a unique investment opportunity. The Euler Credit Union will pay continuous interest to any amount you deposit with them at 8% interest.

   a. Find out how long it will take your deposit to double.
   b. You have been given $10,000. You want to retire in thirty years with at least $500,000 in your account. What is the minimum interest rate your account must have to reach this goal? (assume continuous compounding like you would get from the Euler Credit Union)

14. Use integration to find the area between the two functions f and g in the interval from $x = -\frac{\pi}{2}$ to $x = \pi$.

   a. $f(x) = \sin(x)$ $g(x) = \cos(x)$