Name: _____
ID: _____

- 17 multiple choice questions worth 4.7 points each.
- 2 hand graded questions worth 10 points each.
- 0.1 "free" points (so the total will be 100).
- Exam covers sections 2.7 through 3.10

- No graphing calculators!
  Any non-graphing, non-differentiating, non-integrating scientific calculator is fine.
- For the multiple choice questions, mark your answer on the answer card.
- Show all your work for the written problems. Your ability to make your solution clear will be part of the grade.

$\sin(A \pm B) = \sin A \cos B \pm \sin B \cos A$	$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$
$\tan(A \pm B) = \dfrac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$	$\tan(A/2) = \dfrac{1 - \cos A}{\sin A} = \dfrac{\sin A}{1 + \cos A}$
$\sin^2(A/2) = \dfrac{1 - \cos A}{2}$	$\cos^2(A/2) = \dfrac{1 + \cos A}{2}$
$\sin A \sin B = \dfrac{1}{2}\left[\cos(A - B) - \cos(A + B)\right]$	$\cos A \cos B = \dfrac{1}{2}\left[\cos(A - B) + \cos(A + B)\right]$
$\sin A \cos B = \dfrac{1}{2}\left[\sin(A + B) + \cos(A - B)\right]$	
$\sin A + \sin B = 2\sin\left(\dfrac{A + B}{2}\right)\cos\left(\dfrac{A - B}{2}\right)$	$\sin A - \sin B = 2\cos\left(\dfrac{A + B}{2}\right)\sin\left(\dfrac{A - B}{2}\right)$
$\cos A + \cos B = 2\cos\left(\dfrac{A + B}{2}\right)\cos\left(\dfrac{A - B}{2}\right)$	$\cos A - \cos B = -2\sin\left(\dfrac{A + B}{2}\right)\sin\left(\dfrac{A - B}{2}\right)$
Law of Cos: $c^2 = a^2 + b^2 - 2ab\cos C$	Law of Sin: $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$
$\dfrac{d}{dx}\left(\sin^{-1} x\right) = \dfrac{1}{\sqrt{1 - x^2}}$	$\dfrac{d}{dx}\left(\cos^{-1} x\right) = -\dfrac{1}{\sqrt{1 - x^2}}$
$\dfrac{d}{dx}\left(\tan^{-1} x\right) = \dfrac{1}{1 + x^2}$	

1. Let $f(x) = \dfrac{x^2}{x^3 + 1}$. Find $f'(1)$

     A. -1

     B. 0

     C. $1/16$

     D. $1/8$

     E. $1/4$

     F. $1/2$

     G. 1

     H. $3/2$

     I. 2

2. Let $f(x) = \ln(x^2 - 3)$. Find $f'(2)$

     A. 0

     B. $\ln 2$

     C. 1

     D. 2

     E. e

     F. 3

     G. 4

     H. 5

3. Find $\dfrac{d}{dt}(t^5 + 3t^2 - e^4)^{2/3}$

     A. $(t^5 + 3t^2 - e^4)^{2/3}$

     B. $\dfrac{2}{3(t^5 + 3t^2 - e^4)^{1/3}}$

     C. $\dfrac{5t^4 + 6t}{(t^5 + 3t^2 - e^4)^{1/3}}$

     D. $\dfrac{5t^4 + 6t - 4e^3}{(t^5 + 3t^2 - e^4)^{1/3}}$

     E. $\dfrac{2(5t^4 + 6t)}{3(t^5 + 3t^2 - e^4)^{1/3}}$

     F. $\dfrac{\pi}{e^3}$

4. Find $\dfrac{d}{dx}\sqrt{\tan x}$

    A. $\dfrac{1}{2\sqrt{\sin x \cos^3 x}}$

    B. $\dfrac{1}{\sqrt{\sin x \cos^3 x}}$

    C. $\dfrac{2\cos^2 x}{\sqrt{\sin x}}$

    D. $\dfrac{\sqrt{\cos^3 x}}{2\sqrt{\sin x}}$

    E. $\dfrac{\sqrt{\sin x}}{\sqrt{\cos x}}$

    F. $\sqrt{\sec^2 x}$

5. Find $\dfrac{d}{dx}(e^{2x}\sin 3x)$

    A. $e^{2x}(2\sin 3x + 3\cos 3x)$

    B. $e^{2x}(3\sin 3x + 2\cos 3x)$

    C. $e^{2x}(2\sin 3x - 3\cos 3x)$

    D. $e^{2x}(3\sin 3x - 2\cos 3x)$

    E. $2e^{2x}\sin 3x$

    F. $3e^{2x}\cos 3x$

    G. $5e^{2x}\cos 3x$

6. Let $f(x) = e^{(x^3 - 2x^2)}$. Find $f'(2)$

    A. 0

    B. 1

    C. 2

    D. e

    E. 3

    F. 4

    G. e^2

7. Let $y = mx + b$ be the tangent line to the graph of $f(x) = 3x^2 - 2$ at the point $(1, 1)$. What is $m + b$?

    A. -1

    B. 0

    C. 1

    D. 2

    E. 3

    F. 4

    G. 5

    H. 6

8. At the point $(1, 1)$, the parabola $y = ax^2 + bx$ has a tangent line equal to $y = 3x - 2$. Find $a - b$.

    A. -3

    B. -2

    C. -1

    D. 0

    E. 1

    F. 2

    G. 3

    H. $\pi/3$

9. If $g(2) = 3$ and $g'(2) = -1$, find $\dfrac{d}{dx}\left(\dfrac{g(x)}{x}\right)$ at $x = 2$.

   A. $-5/4$

   B. -1

   C. $-3/4$

   D. $-1/4$

   E. 0

   F. $1/4$

   G. $3/4$

   H. 1

   I. $5/4$

10. Find the value of c such that the line $y = \dfrac{3}{2}x + 6$ is tangent to the curve $y = c\sqrt{x}$.

   A. It is not possible to find such a value of c.

   B. 1

   C. 2

   D. 3

   E. 6

   F. 9

   G. 25

   H. 36

11. Let f, g, h be differentiable functions. Here is a table of values for the functions and their derivatives.

x	f(x)	f'(x)	g(x)	g'(x)	h(x)	h'(x)
-1	-2	2	-2	0	-2	0
0	3	3	-1	$1/2$	-1	1
1	0	-3	0	1	0	2
2	$1/2$	-1	$1/4$	2	2	1
3	$-1/2$	0	2	3	3	0

Find $(f \circ g \circ h)'(1)$.

    A. -3

    B. -2

    C. -1

    D. 0

    E. 1

    F. 2

    G. 3

12. If $g(x) + x \cos(g(x)) = x^2$, find $g'(0)$.

    A. It is impossible to determine $g'(0)$.

    B. 2

    C. -1

    D. $-1/2$

    E. 0

    F. 1

    G. 2

13. If $f(x) = \ln(x + \ln x)$, find $f'(1)$.

    A. 0

    B. 1

    C. 2

    D. e

    E. 3

    F. e^2

    G. 10

    H. e^3

14. Find the equation of the tangent line to the curve $x^2 - xy - y^2 = 1$ at the point $(2, 1)$.

    A. $y = 2x$

    B. $y = \frac{1}{2}x + \frac{3}{4}$

    C. $y = \frac{1}{2}x - \frac{3}{4}$

    D. $y = -\frac{1}{2}x + \frac{3}{4}$

    E. $y = \frac{3}{4}x + \frac{1}{2}$

    F. $y = \frac{3}{4}x - \frac{1}{2}$

    G. $y = -\frac{3}{4}x + \frac{1}{2}$

15. Let $L(x)$ be the linearization of $f(x) = \sqrt{x}$ at the point $x = 9$. Find $L(8)$.

    A. $3 - \frac{1}{2}$

    B. $3 - \frac{1}{3}$

    C. $3 - \frac{1}{6}$

    D. $3 - \frac{1}{9}$

    E. $3 - \frac{1}{18}$

    F. 3

    G. $3 + \frac{1}{18}$

    H. $3 + \frac{1}{9}$

    I. $3 + \frac{1}{6}$

    J. $3 + \frac{1}{3}$

    K. $3 + \frac{1}{2}$

16. Find y'' by implicit differentiation when $\sin y - x = 1$

     A. $\dfrac{1}{\cos y}$

     B. $\dfrac{1}{\sin y - x}$

     C. $\dfrac{1}{\sin y}$

     D. $\dfrac{\sin y}{x + 1}$

     E. $\dfrac{\sin y}{\cos^2 y}$

     F. $\dfrac{\sin^2 y}{\cos^2 y}$

     G. $\dfrac{\sin y}{\cos^3 y}$

     H. $\dfrac{\sin^2 y}{\cos^3 y}$

17. Suppose you have a function such that

$$f(x + h) - f(x) = h \cos h + h^2 x^2 + 3hx$$

Find $f'(-1)$.

     A. It is impossible to determine $f'(-1)$.

     B. -2

     C. -1

     D. 0

     E. 1

     F. 2

     G. 1001

     H. h

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Written Problem. You will be graded on the readability of your work. Use the back of this sheet, if necessary.

18. Use the limit definition of derivative to find the derivative of

$$f(x) = \frac{1}{\sqrt{x+1}}$$

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Written Problem. You will be graded on the readability of your work.
Use the back of this sheet, if necessary.

19. On a dark night, a 6 foot tall person is walking away from a lamp post at a rate of 10
    feet per second. The lamp post is 20 feet high. When the person is 15 feet from the
    lamp post, at what rate is the person's shadow growing or shrinking?