Sit in your assigned seat (shown below).

Do not open this test booklet until I say START.

Turn off all electronic devices and put away all items except a pen/pencil and an eraser.

You must show sufficient work to justify each answer.

While the test is in progress, we will not answer questions concerning the test material.

Quit working and close this test booklet when I say STOP.

Quickly turn in your test to me or a TA and show your Student ID.
1. (12 points) Given that $f(x) = 2x^3 + 5$, find a formula for $f^{-1}(x)$.

2. (12 points) Suppose $f(x) = 2 - \ln x$ and $g(x) = \sqrt{x}$. Determine a formula and find the domain for $(g \circ f)(x)$. 
3. (9 points) Which one of the following equations must hold in order for a function \( f \) to be continuous at a number \( a \)?

(a) \( \lim_{x \to 0} f(x) = a \)
(b) \( \lim_{x \to 0} f(x) = 0 \)
(c) \( \lim_{x \to 0} f(x) = f(a) \)
(d) \( \lim_{x \to 0} f(x) = f'(a) \)
(e) \( \lim_{x \to a} f(x) = a \)
(f) \( \lim_{x \to a} f(x) = 0 \)
(g) \( \lim_{x \to a} f(x) = f(a) \)
(h) \( \lim_{x \to a} f(x) = f'(a) \)
(i) \( \lim_{x \to \infty} f(x) = a \)
(j) \( \lim_{x \to \infty} f(x) = 0 \)
(k) \( \lim_{x \to \infty} f(x) = f(a) \)
(l) \( \lim_{x \to \infty} f(x) = f'(a) \)

4. (6 points) Given a function \( f(x) \) for which \( \lim_{h \to 0} \frac{f(-5 + h) - f(-5)}{h} \) exists, which one of the following statements must be true?

(a) \( f \) is continuous but not differentiable at \( x = -5 \).
(b) \( f \) is differentiable but not continuous at \( x = -5 \).
(c) \( f \) is both differentiable and continuous \( x = -5 \).
(d) \( f \) is neither continuous nor differentiable at \( x = -5 \).
(e) \( f \) is continuous but not differentiable at \( x = 0 \).
(f) \( f \) is differentiable but not continuous at \( x = 0 \).
(g) \( f \) is both differentiable and continuous \( x = 0 \).
(h) \( f \) is neither continuous nor differentiable at \( x = 0 \).
(i) \( f \) is continuous but not differentiable at \( x = 5 \).
(j) \( f \) is differentiable but not continuous at \( x = 5 \).
(k) \( f \) is both differentiable and continuous \( x = 5 \).
(l) \( f \) is neither continuous nor differentiable at \( x = 5 \).
5. (12 points) Let $f(x) = x^3 - 5x$. Use the definition of a derivative as a limit to show that $f'(x) = 3x^2 - 5$. Show each step in your calculation and be sure to use proper terminology.
6. (6 points) For a given angle \( \theta \), it is known that \( \cos \theta \approx 0.927 \), \( \sin \theta \approx 0.375 \) and \( \tan \theta \approx 0.404 \).
What is the value of \( \cos \left( \frac{\pi}{2} + \theta \right) \)?

7. (6 points) Evaluate and simplify \( \tan \left( \cos^{-1} \left( \frac{2}{3} \right) \right) \).

8. (7 points) Determine real numbers \( a \) and \( b \) so that the expression \( 8 \csc^2 \theta - 5 \cot^2 \theta \) can be rewritten as \( a \csc^2 \theta + b \).
9. (5 points each) Evaluate the following limits and simplify each answer. An answer of ‘does not exist’ is not sufficient. If the limit is infinite then you must state if it is $\infty$ or $-\infty$.

(a) $\lim_{x \to 0} \frac{2}{e^x + 3}$

(b) $\lim_{x \to 2^+} (1000 + 5 \ln(x - 2))$

(c) $\lim_{x \to 3/2} \frac{4x^2 - 9}{2x - 3}$
(d) \( \lim_{x \to 2} \frac{5 - 3x}{x - 2} \)

(e) \( \lim_{x \to \infty} \frac{(2x + 1)^2}{(3x + 1)^2} \)

(f) \( \lim_{x \to 5} \left( \frac{1}{x - 5} - \frac{10}{x^2 - 25} \right) \)
Students – do not write on this page!

1 (12 points) _______________________

2 (12 points) _______________________

3 (9 points) _______________________

4 (6 points) _______________________

5 (12 points) _______________________

6 (6 points) _______________________

7 (6 points) _______________________

8 (7 points) _______________________

9a (5 points) _______________________

9b (5 points) _______________________

9c (5 points) _______________________

9d (5 points) _______________________

9e (5 points) _______________________

9f (5 points) _______________________

TOTAL (100 points) ____________