MATH 181  TEST 1 SAMPLE

NOTE: The actual exam will only have 14 questions. The different parts of each question (part A, B, etc.) are variations. Know how to do all the variations on this exam.

1A.) (10 pts) Find the equation for the tangent to the curve \( y = x^3 - 2x^2 \) at the point (2, 0). Use \( \lim_{h \to 0} \frac{f(x_0 + h) - f(x_0)}{h} \).

1B.) (10 pts) Find the equation for the tangent to the curve \( y = \sqrt{x - 1} \) at the point (5, 2). Use \( \lim_{h \to 0} \frac{f(x_0 + h) - f(x_0)}{h} \).
1C. (10 pts) Find the equation for the tangent to the curve 
\[ y = \frac{4}{x-1} \] at the point (5, 1). Use \( \lim_{h \to 0} \frac{f(x_0 + h) - f(x_0)}{h} \).

2A. (7 pts) Find the limit: 
\[ \lim_{x \to 0} \left( \frac{\sin^2 x}{1 - \cos x} \right) \]
2B.) (7 pts) Find the limit: \( \lim_{x \to \frac{\pi}{2}} \left( \frac{\cos x}{\cot x} \right) \)

2B._____________________

3A.) (6 pts) Find the exact value: \( \lim_{x \to \frac{5}{2}} \left( \frac{2x^2 - 3x - 5}{2x^2 - 7x + 5} \right) \)

3A._____________________

3B.) (6 pts) Find the exact value: \( \lim_{x \to \frac{3}{2}} \left( \frac{3 - 2x}{4x^2 - 9} \right) \)

3B._____________________
4A.) (6 pts) Find the exact value:  
\[
\lim_{h \to 2} \left( \frac{h + 2}{\sqrt{h^2 + 5} - 3} \right)
\]

4B.) (6 pts) Find the exact value:  
\[
\lim_{h \to 0} \left( \frac{\sqrt{5 + h} - \sqrt{5}}{h} \right)
\]

5A.) (10 points) Find  \( \lim_{x \to 3} (3 - 4x) \). Then use the \( \varepsilon - \delta \) definition of a limit to prove your answer. Please show all steps for full credit.
5B.) (10 points) Find \( \lim_{x \to 2} \left( \frac{3x}{2} - 5 \right) \). Then use the \( \varepsilon - \delta \) definition of a limit to prove your answer. Please show all steps for full credit.

6A.) (6 pts) Use the following information to answer the questions:

\( f(x) = \sqrt{x - 3} \), \( L = 2 \), \( x_0 = 7 \), \( \varepsilon = 1 \)

i.) Find an open interval about \( x_0 \) on which the inequality \( |f(x) - L| < \varepsilon \) holds.

ii.) Give a value for \( \delta > 0 \) such that for all \( x \) satisfying \( 0 < |x - x_0| < \delta \) the inequality \( |f(x) - L| < \varepsilon \) holds:
6B.) (6 pts) Use the following information to answer the questions:

\[ f(x) = \frac{x}{4}, \quad L = 2, \quad x_0 = 8, \quad \varepsilon = 0.01 \]

i.) Find an open interval about \( x_0 \) on which the inequality

\[ |f(x) - L| < \varepsilon \]

holds.

ii.) Give a value for \( \delta > 0 \) such that for all \( x \) satisfying

\[ 0 < |x - x_0| < \delta \]

the inequality \( |f(x) - L| < \varepsilon \) holds:

7A.) (10 pts.) Find the following by using the graph of \( f(x) \) below. If it doesn’t exist, write d.n.e.

- \( f(1) : \quad \)  
- \( f(0) : \quad \)

\[ \lim_{x \to 0} f(x) : \quad \quad \lim_{x \to 1} f(x) : \quad \]

\[ \lim_{x \to 0} f(x) : \quad \quad \lim_{x \to 1} f(x) : \quad \]

\[ \lim_{x \to -2} f(x) : \quad \quad \lim_{x \to -2} f(x) : \quad \]
7B.) (10 pts.) Find the following by using the graph of \( f(x) \) below. If it doesn’t exist, write d.n.e.

\[
\begin{align*}
    f(1) & : \underline{\quad} & f(4) & : \underline{\quad} \\
    \lim_{x \to 1^-} f(x) & : \quad & \lim_{x \to 1^+} f(x) & : \underline{\quad} \\
    \lim_{x \to 4^-} f(x) & : \underline{\quad} & \lim_{x \to 4^+} f(x) & : \underline{\quad} \\
    \lim_{x \to 0^-} f(x) & : \underline{\quad} & \lim_{x \to 0^+} f(x) & : \underline{\quad}
\end{align*}
\]

8A.) (7 pts) Find the exact value: 
\[
\lim_{x \to 0} \left( \frac{x^2 - x + \sin 8x}{2x} \right)
\]
\[
8A. \underline{\quad}
\]

8B.) (7 pts) Find the exact value: 
\[
\lim_{x \to 0} \left( \frac{\sin \frac{x}{3}}{6x} \right)
\]
\[
8B. \underline{\quad}
\]
8C. (7 pts) Find the exact value: $\lim_{x \to 0} \frac{\sin x(1 - \cos x)}{x^2}$  

8C._____________________

For problem 9, on the first blank, indicate the x-values (if any) at which f is not continuous. On the second blank, indicate which discontinuity is removable (if any), and on the third blank, indicate which discontinuity is non-removable (if any). If $f$ is continuous, just write “none” in the first blank and don’t write anything in the other 2 blanks.

9A.) (6 pts) $f(x) = 2 \tan \theta \cos \theta$ on $[0, \pi]$  

9A._____________________

9B.) (6 pts) $f(x) = \frac{x + 5}{x^3 + x^2 - 20x}$  

9B._____________________
10A.) Find the limit (if possible): \[
\lim_{{x \to 5}} \frac{x - 3}{x^2 + 2x - 15}
\]

10B.) Find the limit (if possible): \[
\lim_{{x \to -10}} \frac{2x^2 + 13x + 15}{2x^2 + 23x + 30}
\]

11A.) Find the limit (if possible): \[
\lim_{{y \to 4}} \frac{y + 4}{y^2 - 10y - 24}
\]

11B.) Find the limit (if possible): \[
\lim_{{\theta \to 0}} \frac{6\sin \theta - 1}{\cos \theta + 1}
\]
12A.) (7 pts) Find the exact value: \( \lim_{\theta \to \infty} \cos \left( \frac{\sin \theta}{\theta} \right) \)  
12A.____________________

12B.) (7 pts) Find the exact value: \( \lim_{x \to \infty} \frac{x^4 - 3x^5}{7x^5 - 3x + \sin(x^5)} \)  
12B.____________________

13A.) Find the following infinite limits (if possible): \( \lim_{w \to \infty} \frac{\sqrt{5 + 36w^2}}{3w - 4} \)  
13A.____________________

13B.) Find the following infinite limits (if possible): \( \lim_{x \to \infty} \frac{10x - 1}{\sqrt{4x + 5x^2}} \)  
13B.____________________
14A.) (10 pts) Find $\frac{dy}{dx}$ if $y = \frac{1}{\sqrt{x-1}}$. Use $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$.

14A.____________________

14B.) (10 pts) Find $\frac{dy}{dx}$ if $y = 3 - 4x^2$. Use $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$.

14B.____________________
## MATH 181 TEST 1 REVIEW PROBS

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The test will be closed-book, and no notes are allowed (no notecards are allowed either). The exam will consist of problems similar to the ones on the sample test and the above list of review problems, which are problems from the homework sections of the e-book. The e-book can be accessed in MyMathLab by hitting the “Online Textbook” button on the left panel and then you can select the exact section.