The problems in this review are designed to help prepare you for your upcoming exam. Questions pertain to material covered in the course and are intended to reflect the topics likely to appear in the exam. Keep in mind that this worksheet was created by CARE tutors, and while it is thorough, it is not comprehensive. In addition to exam review sessions, CARE also hosts regularly scheduled tutoring hours.

1. Which of the following are equivalent to the following?

\[ \frac{1}{4 + i} \]

(a) 4 - i  
(b) i + 4  
(c) \[ \frac{4}{\sqrt{17}} - \frac{i}{\sqrt{17}} \]  
(d) \[ \frac{4}{\sqrt{17}} - \frac{i}{\sqrt{17}} \]

2. What is the simplified form of the following?

\[ \left( \frac{2 + i}{1 + 4i} \right)^2 \]

(a) \[ \frac{3}{8i - 15} \]  
(b) \[ \frac{24}{5} + \frac{7}{5}i \]  
(c) \[ -\frac{29}{46} - \frac{30}{46}i \]  
(d) \[ -\frac{13}{289} - \frac{84}{289}i \]
3. Compute the Limit:

\[
\lim_{x \to 0^+} \frac{2}{x}
\]

(a) \(-\infty\)
(b) 0
(c) does not exist
(d) \(\infty\)

4. Compute the Limit:

\[
\lim_{x \to \infty} \frac{2x + \sin(x)}{x}
\]

(a) 2
(b) 1/4
(c) \(\infty\)
(d) 0

5. Compute the Limit:

\[
\lim_{x \to \infty} \frac{\sin(5x)}{x}
\]

(a) \(\infty\)
(b) 5
(c) does not exist
(d) 0
6. Compute the Limit:

\[
\lim_{x \to \infty} \frac{9x^{6968} + 27x^{1789} + 88x^{900}}{45x^{6968} + 54x^{1789} + 264x^{900}}
\]

(a) \( \frac{1}{3} \)
(b) \( \frac{1}{2} \)
(c) \( \frac{1}{5} \)
(d) \( \infty \)

7. Compute the Limit:

\[
\lim_{x \to 3} \cos(3x)
\]

(a) does not exist
(b) \( \cos(3) \)
(c) \( \cos(9) \)
(d) 1

8. If \( f(y) = y \ln(y) - y \), compute \( f'(1) \).

(a) 0
(b) \( \infty \)
(c) 1
(d) does not exist
9. Compute $f'(x)$ where $f(x) = x \cos(x^4)$

(a) $-4x^4 \sin(x^4)$
(b) $\sin(x^4) - 4x^4 \cos(x^4)$
(c) $\cos(x^4) - 4x^4 \sin(x^4)$
(d) $\cos(x^4)$

10. If $f(x) = \left((x^2 + 1)^3 + 4x\right)^2$, then find $f'(1)$.

(a) 144
(b) 672
(c) 512
(d) 48

11. We measure the sidelength of a cube to be $L$ meters long, with a relative error of 5%. What is the absolute error in the length measurement? If we use this measurement to calculate the volume of the cube, what will be the relative error? What will be the absolute error?

12. The equation $x^6 + y^6 = 1$ looks like a rounded square centered at the origin. What is the derivative $\frac{dy}{dx}$ of this equation? What is the second derivative $\frac{d^2y}{dx^2}$?

13. 

$$\lim_{x \to 0} \frac{\cos(x) - 1}{\ln(1 + x^2)} = ?$$