Problem 1 *Use the function to answer the following questions.*

$$f(x) = \begin{cases} \sqrt{x^2 - 16} + 5 & , x < 4 \\ \dfrac{x^2 - 3\,x - 4}{x - 4} & , x \geq 4 \end{cases}$$

Compute $\lim\limits_{x \to 4^-} f(x) =$ $\boxed{?}$

Compute $\lim\limits_{x \to 4^+} f(x) =$ $\boxed{?}$

Compute $f(4) =$ $\boxed{?}$

The function is ...

Multiple Choice:

(a) *continuous at* $x = 4$.

(b) *discontinuous at* $x = 4$.

Problem 2 *Use the function to answer the following questions.*

$$f(x) = \begin{cases} \dfrac{x^2 + 4\,x + 3}{x + 3} & , x < 1 \\ x + 1 & , x \geq 1 \end{cases}$$

Compute $\lim\limits_{x \to 1^-} f(x) =$ $\boxed{?}$

Compute $\lim_{x \to 1^+} f(x) =$?

Compute $f(1) =$?

The function is ...

Multiple Choice:

(a) *continuous at* $x = 1$.

(b) *discontinuous at* $x = 1$.

Problem 3 *Determine if the limit approaches a finite number,* $\pm\infty$*, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to -12^+} \frac{7}{(x+12)^3} =$$?

Problem 4 *Determine if the limit approaches a finite number,* $\pm\infty$*, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{h \to 0} \frac{-5(h+3)^3 + 135}{h} =$$?

Problem 5 *If you know that* $\lim_{x \to -1} f(x) = -5$ *and* $\lim_{x \to 0} g(x) = 4$*, then evaluate the following limit:*

$$\lim_{x \to 0} f(x-1) + g(x) =$$?

Problem 6 *Let* $f(x) = \begin{cases} x+6 & , \quad x \leq 2 \\ x+5 & , \quad 2 < x \leq 7 \\ x+5 & , \quad x > 7 \end{cases}$.

Find the numbers at which f *is discontinuous:* $x =$?
(If no such numbers exist, enter "None")

At which of these points of discontinuity is f continuous from the right?
$x =$? *(If no such numbers exist, enter "None")*

At which of these points of discontinuity is f continuous from the left?
$x =$? *(If no such numbers exist, enter "None")*

Problem 7 *Let* $f(x) = \begin{cases} x^2 + 3x + 16 & , \quad x \leq 2 \\ (x+3)^2 & , \quad 2 < x \leq 6 \\ x^2 - 3x + 63 & , \quad x > 6 \end{cases}$.

Find the numbers at which f is discontinuous: $x =$?
(If no such numbers exist, enter "None")

At which of these points of discontinuity is f continuous from the right?
$x =$? *(If no such numbers exist, enter "None")*

At which of these points of discontinuity is f continuous from the left?
$x =$? *(If no such numbers exist, enter "None")*

Problem 8 *Let* $f(x) = \begin{cases} -x + 1 & , \quad x < 0 \\ e^x & , \quad 0 \leq x \leq 4 \\ x - 1 & , \quad x > 4 \end{cases}$.

Find the numbers at which f is discontinuous: $x =$?
(If no such numbers exist, enter "None")

At which of these points of discontinuity is f continuous from the right?
$x =$? *(If no such numbers exist, enter "None")*

At which of these points of discontinuity is f continuous from the left?
$x =$? *(If no such numbers exist, enter "None")*

Problem 9 *Let* $f(x) = \begin{cases} x - 4 & , \quad x < -1 \\ \cos(x) & , \quad -1 \leq x \leq 1 \\ (x-4)^2 & , \quad x > 1 \end{cases}$.

Find the numbers at which f is discontinuous: $x =$?
(If no such numbers exist, enter "None")

At which of these points of discontinuity is f continuous from the right?
$x =$? *(If no such numbers exist, enter "None")*

At which of these points of discontinuity is f continuous from the left?
$x =$? *(If no such numbers exist, enter "None")*

Problem 10 *Let* $f(x) = \begin{cases} -x & , \quad x < 3 \\ \cos(x) & , \quad 3 \leq x \leq 7 \\ x & , \quad x > 7 \end{cases}$.

Find the numbers at which f is discontinuous: $x =$?
(If no such numbers exist, enter "None")

At which of these points of discontinuity is f continuous from the right?
$x =$? *(If no such numbers exist, enter "None")*

At which of these points of discontinuity is f continuous from the left?
$x =$? *(If no such numbers exist, enter "None")*

Problem 11 *Determine if the limit approaches a finite number, infinity, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to -3} -2\,(x+2)(x-5)\cos\left(\frac{5}{2}\,\pi x\right) = \boxed{?}$$

Problem 12 *Determine if the limit approaches a finite number, infinity, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to 2} -5\,(x+5)(x+3)(x-2)\tan\left(\pi x\right) = \boxed{?}$$

Problem 13 *Let* $f(x) = \begin{cases} x^2 - 4\,x & , \quad x < -1 \\ \cos\left(x\right) & , \quad -1 \le x \le 3 \\ x & , \quad x > 3 \end{cases}$.

Find the numbers at which f is discontinuous: $x =$?
(If no such numbers exist, enter "None")

At which of these points of discontinuity is f continuous from the right?
$x =$? *(If no such numbers exist, enter "None")*

At which of these points of discontinuity is f continuous from the left?
$x =$? *(If no such numbers exist, enter "None")*

Problem 14 *Let* $f(x) = \begin{cases} x - 3 & , \quad x < -3 \\ \sin\left(x\right) & , \quad -3 \le x \le 2 \\ \left(x-3\right)^2 & , \quad x > 2 \end{cases}$.

Find the numbers at which f is discontinuous: $x =$?
(If no such numbers exist, enter "None")

At which of these points of discontinuity is f continuous from the right?
$x =$? *(If no such numbers exist, enter "None")*

At which of these points of discontinuity is f continuous from the left?
$x =$? *(If no such numbers exist, enter "None")*

Problem 15 *Does $x^2 - 10\,x + 24$ have a root in the interval $(2, 5)$?*

Multiple Choice:

(a) *Yes*

(b) *No*

(c) *Inconclusive*

What is the reason for this answer?

Multiple Choice:

(a) $f(2) < 0$ *and* $f(5) > 0$, *so* f *has a root by IVT.*

(b) $f(2) > 0$ *and* $f(5) < 0$, *so* f *has a root by IVT.*

(c) $f(2) < 0$ *and* $f(5) < 0$, *so* f *does not have a root by IVT.*

(d) $f(2) > 0$ *and* $f(5) > 0$, *so* f *does not have a root by IVT.*

(e) *The answer could not be determined.*

Problem 16 *Determine if the limit approaches a finite number, $\pm\infty$, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to -4} \frac{x^2 - 3\,x - 28}{x + 4} = \boxed{?}$$

Problem 17 *Determine if the limit approaches a finite number, $\pm\infty$, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to -5} \frac{x^2 + 4\,x - 5}{x + 5} = \boxed{?}$$

Problem 18 *Determine if the limit approaches a finite number, infinity, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to +\infty} \frac{x - 3}{x^2 - 7\,x + 12} = \boxed{?}$$

Problem 19 *Determine if the limit approaches a finite number, $\pm\infty$, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to 8^+} -3\,x \log\left(x - 8\right) = \boxed{?}$$

Problem 20 *Determine if the limit approaches a finite number, $\pm\infty$, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x \to \infty} \frac{\sqrt{x^6 - 2} - 3}{5\,x^3 + 2} = \boxed{?}$$

Test question here

Problem 21 *Why won't this work?*