Problem 1 *Determine if the limit approaches a finite number, $\pm\infty$, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x\to -7} \frac{x+7}{x^2-7\,x-98} = \boxed{?}$$

Problem 2 *Determine if the limit approaches a finite number, infinity, or does not exist. (If the limit does not exist, write DNE)*

$$\lim_{x\to -\infty} \frac{x+5}{x-1} = \boxed{?}$$

Problem 3 *Compute the following difference quotient:*

$$\lim_{x\to -1} \frac{\frac{3}{x}+3}{x+1} = \boxed{?}$$

Problem 4 *Compute the following difference quotient:*

$$\lim_{x\to -5} \frac{\frac{3}{x}+\frac{3}{5}}{x+5} = \boxed{?}$$

Problem 5 *The limit as $x \to 9$ of $f(x) = (x-9)\cos\left(\dfrac{8}{x-9}\right)$ is 0. What is the reason why this is true?*

Multiple Choice:

(a) *The statement is in fact false:* $\lim_{x\to 9} (x-9)\cos\left(\dfrac{8}{x-9}\right) \neq 0.$

(b) *The cosine factor decreases to 0 faster than the polynomial.*

(c) *The cosine factor is bounded between -1 and 1, so the polynomial forces the function to 0.*

(d) *The cosine factor directly cancels out the polynomial factor.*

What is the name of the theorem that applies to this problem?
The $\boxed{?}$ *Theorem*

Problem 6 *Let* $f(x) = \begin{cases} x^2+3\,x+2 & , \quad x \leq -2 \\ x+1 & , \quad -2 < x \leq 1 \\ x^2-3\,x+4 & , \quad x > 1 \end{cases}$.

Find the numbers at which f is discontinuous: $x = \boxed{?}$
(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* $f(x) = \begin{cases} x+3 & , \quad x \le -1 \\ -x & , \quad -1 < x \le 1 \\ (x-2)^2 - 2 & , \quad x > 1 \end{cases}$.

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 8 *Let* $f(x) = \begin{cases} -x-6 & , \quad x < 0 \\ \sin(x) & , \quad 0 \le x \le 5 \\ x^2 + 5x - 6 & , \quad x > 5 \end{cases}$.

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* $f(x) = \begin{cases} x+3 & , \quad x < 2 \\ e^{(x-4)} & , \quad 2 \le x \le 4 \\ x^2 + 4x + 3 & , \quad x > 4 \end{cases}$.

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 10 *Let* $f(x) = \begin{cases} x & , \quad x < 1 \\ \sin(x) & , \quad 1 \le x \le 4 \\ x^2 - 6x & , \quad x > 4 \end{cases}$.

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 11 *Let* $f(x) = \begin{cases} x - 12 & , \quad x \leq 1 \\ x^2 + 2\,x - 15 & , \quad 1 < x \leq 3 \\ x^2 + 3\,x - 18 & , \quad x > 3 \end{cases}$.

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 12 *Let* $f(x) = \begin{cases} x + 4 & , \quad x \leq 0 \\ x^2 + 4\,x + 3 & , \quad 0 < x \leq 2 \\ x + 13 & , \quad x > 2 \end{cases}$.

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 13 *Let* $f(x) = \begin{cases} x^2 - 2\,x - 11 & , \quad x \leq -3 \\ -x & , \quad -3 < x \leq 2 \\ x^2 + 2\,x - 10 & , \quad x > 2 \end{cases}$.

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 14 *Let* $f(x) = \begin{cases} -x + 5 & , \quad x < 2 \\ e^x & , \quad 2 \leq x \leq 7 \\ x^2 + x - 30 & , \quad x > 7 \end{cases}$.

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 15 *Does $x^2 - 4\,x + 3$ have a root in the interval $(-3, 2)$?*

Multiple Choice:

(a) *Yes*

(b) *No*

(c) *Inconclusive*

What is the reason for this answer?

Multiple Choice:

(a) *$f(-3) < 0$ and $f(2) > 0$, so f has a root by IVT.*

(b) *$f(-3) > 0$ and $f(2) < 0$, so f has a root by IVT.*

(c) *$f(-3) < 0$ and $f(2) < 0$, so f does not have a root by IVT.*

(d) *$f(-3) > 0$ and $f(2) > 0$, 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)*

$$\lim_{x \to -11} \frac{x - 14}{x^2 - 3\,x - 154} = \boxed{?}$$

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

$$\lim_{x \to -\infty} \frac{x^2 + 6\,x + 9}{x^4 + 5\,x^3 + 2\,x^2 - 20\,x - 24} = \boxed{?}$$

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

$$\lim_{x \to +\infty} \frac{x^2 + 8\,x + 15}{x^2 - 25} = \boxed{?}$$

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

$$\lim_{x \to +\infty} \frac{x^2 - 16}{x^4 - 33\,x^2 - 8\,x + 240} = \boxed{?}$$

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

$$\lim_{x\to 15^+} \frac{12}{x-15} = \boxed{?}$$

Test question here

Problem 21 *Why won't this work?*