13) Determine the constants a and b that make the following function continuous.

$$f(x) = \begin{cases} 2x - 4a, \; x < -3 \\ 3ax + b, \; -3 \le x < 2 \\ 4x - 5b, \; x \ge 2 \end{cases}$$

14) If $f(x) = \dfrac{x-1}{x}$ and $g(x) = 1 - x$, then $f(g(x)) =$

$$f(g(x)) = \frac{g(x)-1}{g(x)} = \frac{1-x-1}{1-x} = \frac{-x}{1-x}$$

~~A)~~ -1 ~~B)~~ $\dfrac{1}{1-x}$ C) $\dfrac{1}{x}$

D) $\dfrac{x}{x-1}$ ~~E)~~ $\dfrac{x}{1-x}$

$$\frac{+x}{+(x-1)}$$

15) What is the $\boxed{\text{point of discontinuity}}$, c for the function $h(x) = \dfrac{2x^2 + x - 6}{6 - 4x}$?

$$6 - 4x = 0$$
$$-4x = -6$$
$$x = \frac{-6}{-4} = \frac{3}{2}$$

A) $-\dfrac{3}{2}$ B) $-\dfrac{2}{3}$ C) $\dfrac{2}{3}$ D) 6 E) $\dfrac{3}{2}$

16) What value should be assigned to $h(c)$ to make the function continuous?

$$\frac{\cancel{(2x-3)}(x+2)}{-2\cancel{(2x-3)}}$$

$$\frac{\frac{3}{2}+2}{-2} \rightarrow \frac{\frac{7}{2}}{-2} = \frac{7}{-4}$$

A) $\dfrac{4}{7}$ B) $-\dfrac{7}{4}$ C) 2 D) $-\dfrac{1}{6}$ E) $\dfrac{3}{2}$

17) $\lim\limits_{d \to 6} 5 =$

A) Does Not Exist B) 5
C) -5 D) 1
E) 6

18) $\lim\limits_{x \to 3} \dfrac{x}{x-3} =$ $\dfrac{3}{0}$

A) Does Not Exist ~~B)~~ $-\infty$
~~C)~~ -3 ~~D)~~ 1
~~E)~~ ∞

19) Determine the points of discontinuity of $f(x) = \frac{3}{x} + \frac{x-3}{2x-5}$

A) $0, \frac{5}{2}, 3$ B) $0, \frac{5}{2}$ C) No points of discontinuity

D) 0 E) $\frac{5}{2}$

20) Is the function $h(x)$ continuous at $x = 0$? Justify your answer.

$$h(x) = \begin{cases} \frac{\sin 5x}{x}, & x \neq 0 \\ (x-5)(x-1), & x = 0 \end{cases}$$

$(0-5)(0-1) = 5$

$\lim_{x\to 0} \frac{\sin(5x)}{x} \cdot \frac{5}{5}$ $\left(\lim_{x\to 0} \frac{\sin *}{*} = 1\right)$

$\lim_{x\to 0} \frac{\sin(5x)}{5x} \cdot \frac{5}{1} = 5$

$\boxed{\lim_{x\to 0} h(x) = 5 = h(0)}$

continuous

$\frac{0}{0}$

21) $\lim_{x\to 2^+} \frac{2+5x-3x^2}{|2-x|}$

$-(3x^2-5x-2)$

$\frac{-(3x+1)\cancel{(x-2)}}{\cancel{x-2}}$

*since x=3 is a value to the right of 2 and 2−3=−1, so |2−3|=1 changes the sign..

$-(3x+1)$

$-(3\,2+1)$

$-(6+1) = -7$

22) $\lim_{x\to 2^-} \frac{2+5x-3x^2}{|2-x|}$

$\frac{-(3x+1)(x-2)}{2-x}$

$\frac{+(3x+1)\cancel{(x-2)}}{+\cancel{(x-2)}}$

$3(2)+1 = 7$

23) $\lim_{x\to 2} \frac{2+5x-3x^2}{|2-x|}$ Does not exist

24) Without graphing, provide a written explanation using the IVT to explain why the function $f(x) = x^2 - 2x - 8$ has a zero in the interval [2,5]. Then, state the value of the zero that is guarenteed.

25) $f(x) = \begin{cases} \dfrac{2x-3}{x^2}, & x > 4 \\ 3^x - 1, & x \le 4 \end{cases}$

$\frac{2(4)-3}{4^2} = \frac{5}{16}$

$3^4 - 1 = 81 - 1 = 80$

a.) $\lim_{x \to 4} f(x)$ Does not exist

b.) $\lim_{x \to 2} f(x)$ $3^2 - 1 = 8$

c.) $\lim_{x \to \infty} f(x)$

Right End Behavior of $\frac{2x-3}{x^2} = \frac{2x}{x^2} = \frac{2}{x} \to 0$

d.) $\lim_{x \to -\infty} f(x)$

Left End Behavior of $3^x - 1 \to 0 - 1 = -1$

Evaluate each limit.

26) $\lim_{x \to 3} -\frac{2}{x^2 - 6x + 9}$ $-\infty$

$-\frac{2}{9-18+9}$

$-\frac{2}{0}$

$-\frac{2}{(x-3)^2}$

27) $\lim_{x \to \infty} \frac{6x^2 - 2x^3 + 10}{5 + 3x^2} \to \frac{-2x^3}{3x^2} \to \frac{-2x}{3}$

Right End Behavior

$-\infty$

28) $\lim_{x \to 2} \frac{\frac{1}{(x-3)} - \frac{2}{(x-4)}}{x-2}$

$\frac{(x-4)}{(x-4)} \cdot \frac{1}{(x-3)} - \frac{2}{(x-4)} \cdot \frac{(x-3)}{(x-3)}$

$\frac{\frac{1}{-1} - \frac{2}{-2}}{2-2} = \frac{-1+1}{0} = \frac{0}{0}$ (Indeterminate)

$\frac{x-4-2(x-3)}{(x-4)(x-3)(x-2)} \to \frac{x-4-2x+6}{(x-4)(x-3)(x-2)} \to \frac{-x+2}{(x-4)(x-3)(x-2)} \to \frac{-\cancel{(x-2)}}{(x-4)(x-3)\cancel{(x-2)}} \to \frac{-1}{(2-4)(2-3)} \to \frac{-1}{-2 \cdot -1} = -\frac{1}{2}$

29) $\lim_{x \to 0} \frac{\sin 2x}{4x^2 + 8x}$ $\frac{\sin 2x}{2x(2x+4)}$

$\lim_{x \to 0} \frac{\sin(2x)}{2x} = 1$

Now, $\lim_{x \to 0} \frac{1}{2x+4} = \frac{1}{4}$