TUTORS: THIS IS A TAKE HOME QUIZ

Use the Squeeze Theorem to prove that $\lim_{x\to 0} x^2 \tan^{-1}\frac{1}{x} = 0$. **NOTE: This limit can be proven without the Squeeze Theorem, but you are required to use the Squeeze Theorem to get credit.**

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For each function below, find the discontinuities and state whether each discontinuity is removable or non-removable. **Show supporting algebraic work.**

[a] $f(x) = \dfrac{x^2 - 3x - 4}{x^2 + 5x + 4}$

[b] $f(x) = \begin{cases} 3 - x & \text{if } x < -3 \\ x + 9 & \text{if } -3 < x < 2 \\ 5x + 2 & \text{if } x \geq 2 \end{cases}$

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For each function below, find the values of a and b which make the function continuous. If no such values exist, write IMPOSSIBLE. **Show supporting algebraic work.**

[a] $f(x) = \begin{cases} x + a & \text{if } x \leq 1 \\ b - x & \text{if } 1 < x < 3 \\ x^2 & \text{if } x \geq 3 \end{cases}$

[b] $f(x) = \begin{cases} \cos x & \text{if } x < \pi \\ a + \sin x & \text{if } \pi \leq x < 2\pi \\ b \tan x & \text{if } x \geq 2\pi \end{cases}$

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A table of values for a continuous function f are given below.

x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
$f(x)$	5	3	1	−1	−2	1	−2	3	−1	−3	−4	−1	2	3	1	2	−1	−2	1	4	−2

Use the method of bisections to find an interval of width 1 containing a zero of f starting with the following intervals. Show the sequence of smaller intervals generated by the method.

[a] $[1, 17]$

[b] $[3, 19]$

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