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QUIZ 20

MATH 200
November 9, 2023

1. (16 pts.) Find the following limits, be sure to show your work:

(a) $\lim_{x\to\infty} \dfrac{2x-5e^x}{3e^{2x}+4x+1} =$ $\lim_{x\to\infty} \dfrac{2-5e^x}{6e^{2x}+4} = \lim_{x\to\infty} \dfrac{-5e^x}{12e^{2x}} = \lim_{x\to\infty} \dfrac{-5e^x}{12e^x e^x}$

form $\frac{\infty}{\infty}$ — form $\frac{\infty}{\infty}$ again

$= \lim_{x\to\infty} \dfrac{-5}{12e^x} = \boxed{0}$

(b) $\lim_{x\to a} \dfrac{4a^2-4x^2}{2a-2x} = \lim_{x\to a} \dfrac{-8x}{-2} = \dfrac{-8\cdot a}{2} = \boxed{4a}$

form $\frac{0}{0}$

Another way: $\lim_{x\to a} \dfrac{4a^2-4x^2}{2a-2x} = \lim_{x\to a} \dfrac{(2a-2x)(2a+2x)}{2a-2x} = \lim_{x\to a} (2a+2x) = \boxed{4a}$

(c) $\lim_{x\to a} \dfrac{4a^2-4x^2+1}{2a-2x-3} = \dfrac{4a^2-4a^2+1}{2a-2a-3} = \boxed{-\frac{1}{3}}$

Not indeterminate!

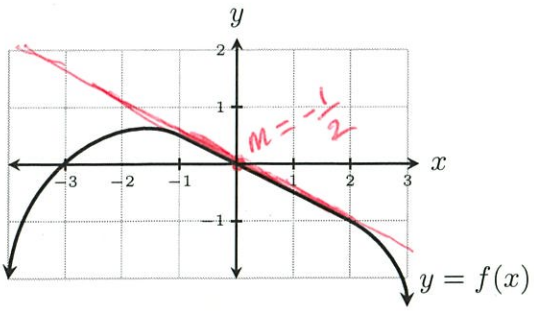
(d) $\lim_{x\to 0} \dfrac{\cos(2x)-\cos(x)}{\sin(x)+\cos(x)+x-1} = \lim_{x\to 0} \dfrac{-2\sin(2x)+\sin(x)}{\cos(x)-\sin(x)+1}$

form $\frac{0}{0}$

$= \dfrac{-2\sin(2\cdot 0)+\sin(0)}{\cos(0)-\sin(0)+1} = \dfrac{-2\cdot 0+0}{1-0+1}$

$= \dfrac{0}{2} = \boxed{0}$

2. (4 pts.) Given the function $f(x)$ graphed below, find: $\lim_{x\to 0} f(x)\cdot\cot(x)$ ← form $0\cdot\infty$



$= \lim_{x\to 0} \dfrac{f(x)}{\tan(x)}$ ← form $\frac{0}{0}$

$= \lim_{x\to 0} \dfrac{f'(x)}{\sec^2(x)} = \dfrac{f'(0)}{\sec^2(0)} = \dfrac{-1/2}{1^2}$

$= \boxed{-\frac{1}{2}}$