SCORE: $10\frac{1}{4}$ / 20 POINTS

NO CALCULATORS ALLOWED

SHOW PROPER ALGEBRAIC WORK (INCLUDING ALL IDENTITIES USED)
USE PROPER NOTATION & SIMPLIFY ALL ANSWERS WHERE REASONABLE

Find $\lim\limits_{x\to 0^+} \coth x$. **Do NOT use a graph. Give algebraic or numerical reasoning, as shown in class.** SCORE: $1\frac{1}{2}$ / 2 POINTS

$$\lim_{x\to 0^+} \coth x = \lim_{x\to 0^+} \frac{1}{\tanh x} = \lim_{x\to 0^+} \frac{1}{\frac{e^{2x}-1}{e^{2x}+1}} = \lim_{x\to 0^+} \frac{e^{2x}+1}{e^{2x}-1}$$

$$= \frac{e^0+1}{e^0-1} = \frac{1+1}{1-1} = \frac{2}{0} = \infty$$

* $\frac{1}{2}$ BLO

1

I SIGNED OFF WHEN THEY CAME TO MY OFFICE HOURS TO DEFEND THEIR WORK

State the definition of "area under a function" given in class. SCORE: $1\frac{1}{2}$ / 2 POINTS
Use complete sentences and proper algebra & English as shown in class.

If f is a function and non-negative on interval $[a,b]$ then the area under the function is $A = A_n = \lim\limits_{n\to\infty} \sum\limits_{k=0}^{n-1} f(a+k\Delta x)\Delta x$ where $\Delta x = \frac{b-a}{n}$

Using the definition of "area under a function" given in class, write an algebraic expression for the area under $f(x) = \sin 3x$ over the interval $[2, 9]$. **Do NOT evaluate the expression. You do NOT need to draw a graph to explain your answer.** SCORE: $\frac{1}{4}$ / 2 POINTS

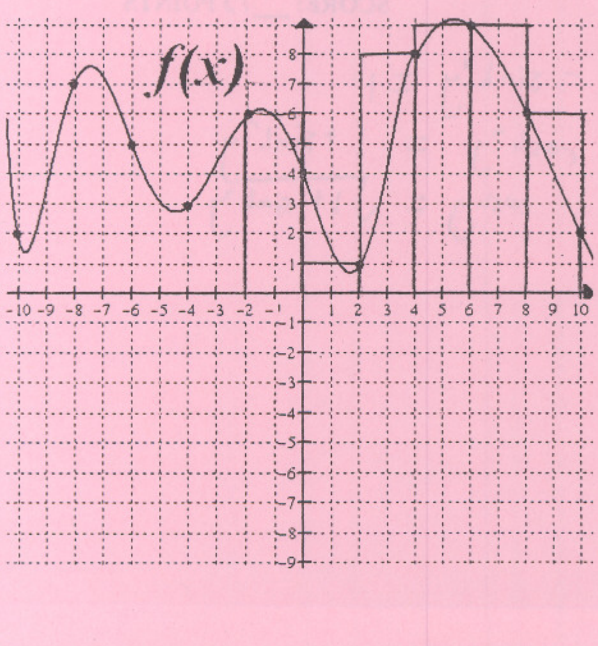
$$A = A_n = \lim_{n\to\infty} \sum_{K=2}^{n-9}$$

$\frac{1}{4}$

MULTIPLE CHOICE: CIRCLE THE CORRECT ANSWER SCORE: 0 / 2 POINTS

For the function f on the interval $[-2, 10]$, A_3 using the right hand sum (known as R_3 in your textbook) equals

[a] 48 [b] 52 [c] 56 [d] 60 [e] 64 [f] none of the above



$\Delta x = \frac{10+2}{6}$

$\Delta x = 2$

$(2\times 6) + (2\times 1) + (2\times 8) + (2\times 9) + (2\times 9) + (2\times 6)$

$= 12 + 2 + 16 + 18 + 18 + 12$

$= 78$

nd $\frac{d}{dx}\cosh^{-1}(\coth x)$. SCORE: 1 / 3 POINTS

$$\frac{\coth x}{\sqrt{(\coth^2 x - 1)}} \times \frac{1}{1-x^2} \quad * \tfrac{1}{2}\ \text{BLo}$$

$$= \frac{\coth x}{\operatorname{cosech} x} \times \frac{1}{1-x^2} \quad * \tfrac{1}{2}\ \text{BLo}$$

$$\cos x \times \frac{1}{1-x^2}$$

$$= \frac{\cos x}{1-x^2}$$

sinh $x = -4$, find $\cosh 2x$, **using identities**. SCORE: $2\tfrac{1}{2}$ / 3 POINTS

o NOT use the logarithmic formula for any inverse hyperbolic functions.

$$\cosh 2x = \cosh^2 x + \sinh^2 x$$

$$= 1 + \sinh^2 x + \sinh^2 x \quad 2$$

$$= 1 + (-4)^2 + (-4)^2$$

$$= 1 + 16 + 16$$

$$= 34 \quad * \tfrac{1}{2}\ \text{BLo}$$

$$\cosh^2 x - \sinh^2 x = 1$$

$$\cosh^2 x = 1 + \sinh^2 x$$

rove the logarithmic formula for $\tanh^{-1} x$. SCORE: $\tfrac{1}{2}$ / 3 POINTS

$$= \frac{1}{2}\ln\left(\frac{1+x}{1-x}\right) \quad \tfrac{1}{2}$$

rove the derivative of $\sinh^{-1} x$. **Do NOT use the logarithmic formula for** $\sinh^{-1} x$. SCORE: 3 / 3 POINTS

$$y = \sinh^{-1} x$$

$$x = \sinh y \quad \tfrac{1}{2}$$

$$\cosh y \frac{dy}{dx} = 1 \quad 1$$

$$\frac{dy}{dx} = \frac{1}{\cosh y} \quad \tfrac{1}{2}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{1+\sinh^2 y}} \quad \tfrac{1}{2}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{1+x^2}} \quad \tfrac{1}{2}$$

$$\cosh^2 y - \sinh^2 y = 1$$

$$\cosh^2 y = 1 + \sinh^2 y$$

$$\cosh y = \sqrt{1+\sinh^2 y}$$