Name: _____

Clear your desk of everything except pens, pencils and erasers. Show all work clearly and in order. No notes, phones and calculators. You have 10 minutes to finish the test for 10 points.

The one on the back worth two extra points. Maximum of 10 points will be recorded for each quiz.

Formulas:

$$\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$$

1. **Compute the derivatives $f'(x)$ for the following functions $f(x)$**

   (a) (3 points)

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

Method 1. Quotient rule $\left(\frac{\square}{\triangle}\right)' = \frac{\square' \cdot \triangle - \square \cdot \triangle'}{\triangle^2}$

$f'(x) = \frac{(3-\sin x)' \cdot x^2 - (3-\sin x)\cdot (x^2)'}{(x^2)^2}$, $(3-\sin x)' = 3' - (\sin x)' = -\cos x$.

$(x^2)' = 2x$.

$= \boxed{\frac{-\cos x \cdot x^2 - (3-\sin x)\cdot(2x)}{x^4}}$

Method 2. Product rule: $f(x) = \frac{3-\sin x}{x^2} = (3-\sin x)\cdot x^{-2}$, $(\square \cdot \triangle)' = \square' \cdot \triangle + \square \cdot \triangle'$

$f'(x) = (3-\sin x)' \cdot x^{-2} + (3-\sin x)\cdot (x^{-2})'$, $(x^{-2})' = -2 \cdot x^{-3}$

$= \boxed{-\cos x \cdot x^{-2} + (3-\sin x)(-2x^{-3})}$.

   (b) (3 points) $f(x) = 2\sqrt{x}\tan x$

Product rule:

$f'(x) = (2\sqrt{x})' \cdot \tan x + 2\sqrt{x} \cdot (\tan x)'$

$= \boxed{x^{-\frac{1}{2}} \cdot \tan x + 2\sqrt{x} \cdot \sec^2 x}$.

$(2\sqrt{x})' = 2(x^{\frac{1}{2}})' = 2 \cdot \frac{1}{2} \cdot x^{-\frac{1}{2}} = x^{-\frac{1}{2}}$

$(\tan x)' = \sec^2 x$.

2. Let $h(t) = F(t) \cdot G(t)$. Suppose $F(2) = -2, F'(2) = 1, G(2) = 1, G'(2) = -3$.

(a) (2 points) Find $h'(t)$.

$h'(t) = (F(t) \cdot G(t))' = F'(t) \cdot G(t) + F(t) \cdot G'(t)$

(b) (2 points) Find $h'(2)$.

$h'(2) = F'(2) \cdot G(2) + F(2) \cdot G'(2)$

$= 1 \cdot 1 + (-2) \cdot (-3)$

$= 1 + 6 = 7$

(★ Finish the problems above first. No more than 10 points may be earned on the quiz. [2 extra points] Evaluate the following limit.

$$\lim_{x \to 2} \frac{\sin(x-2)}{4-x^2}$$

$\lim_{x \to 2} \frac{\sin(x-2)}{x-2} \cdot \frac{x-2}{4-x^2}$

$= \lim_{x \to 2} \frac{x-2}{4-x^2}$ $\frac{0}{0}$-type. $4-x^2 = (2-x)(2+x) = -(x-2)(x+2)$

$= \lim_{x \to 2} \frac{x-2}{-(x-2)(x+2)}$

$= \lim_{x \to 2} \frac{-1}{x+2} = \frac{-1}{2+2} = \frac{-1}{4}$

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