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2. Let

$$f(x)=\begin{cases} \dfrac{x}{x^2+1} & x\le 1 \\ ax^2+bx+1 & x>1 \end{cases}.$$

Find the values of a and b so that f is differentiable everywhere.

A) $a=-\frac{1}{2}$ and $b=0$ B) $a=\frac{1}{2}$ and $b=-1$ C) $a=-1$ and $b=\frac{1}{2}$ D) $a=1$ and $b=-\frac{3}{2}$

E) $a=1$ and $b=0$ F) $a=-1$ and $b=-\frac{1}{2}$ G) $a=-\frac{3}{2}$ and $b=0$ H) No such values

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3. Values of functions f, g, f', and g' are given in the table below:

x	-1	0	1	2
f	11	7	5	5
g	-3	2	-1	1
f'	1	3	4	7
g'	2	1	5	2

Let $h(x) = f(g(x)) \cdot g(x)$. What is $h'(1)$?

A) -5 B) 0 C) 1 D) 25 E) 40 F) 50 G) 100 H) 250

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6. At how many different values of x does the curve $y = x^3 - 2x$ have a tangent line parallel to the line $y = x$?

a. 0
b. 1
c. 2
d. 3
e. 4
f. 5
g. 6
h. 7

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7. Find the slope of the tangent line to the curve $y = \frac{1}{1+2x}$ at the point $(1, \frac{1}{3})$.

a. $-\frac{1}{4}$

b. 2

c. -1

d. $\frac{1}{4}$

e. $-\frac{2}{9}$

f. -2

g. 1

h. $\frac{1}{2}$

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8. If $f(x) = \sqrt[3]{x^2 - 1}$, find $f''(3)$.

a. $\frac{1}{4}$

b. $\frac{1}{12}$

c. $-\frac{1}{12}$

d. $\frac{3}{4}$

e. $\frac{1}{3}$

f. $\frac{4}{3}$

g. $-\frac{4}{3}$

h. None of these

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8. The curve $y = x^3 + x^2 - x$ has two horizontal tangents. Find the distance between these two horizontal lines.

a) $\frac{11}{9}$ b) $\frac{22}{27}$ c) $\frac{32}{27}$ d) $\frac{5}{3}$

e) $\frac{14}{9}$ f) $\frac{4}{3}$ g) $\frac{13}{9}$ h) $\frac{7}{3}$

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9. If $f(x)=\dfrac{x}{\tan x}$, find $f'\left(\dfrac{\pi}{4}\right)$.

a) $\dfrac{2-\pi}{2}$ b) $\dfrac{1-\pi}{2}$ c) $1-\pi$ d) $\dfrac{\pi}{2}$

e) $1-2\pi$ f) $2-\pi$ g) $2-2\pi$ h) $-\pi$

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5. Suppose $f(3)=2$, $f'(3)=5$, and $f''(3)=-2$. Let $g(x)=\left[f(x)\right]^2$. Then $g''(3)=$

A) 42 C) 21 E) 5 G) -20

B) 20 D) 10 F) 38 H) None of these

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Answer Section

Fall 2010 # 2: B

Fall 2010 # 3: F

Spring 2010 # 6: C

Spring 2010 # 7: E

Spring 2010 # 8: C

Fall 2009 # 8: C

Fall 2009 # 9: A

Spring 2009 # 5: A