**Math 1A (9:30am – 10:20am)**
**Quiz 4**
**Fri Feb 6, 2009**

**SCORE: ___ / 20 POINTS**

What month is your birthday ? ___ ___
What are the first 2 digits of your address ? ___ ___
What are the last 2 digits of your zip code ? ___ ___
What are the last 2 digits of your social security number ? ___ ___
**[IF YOU DO NOT HAVE A SOCIAL SECURITY NUMBER, USE YOUR STUDENT ID NUMBER]**

# NO CALCULATORS ALLOWED

State the definition of the derivative of a function at a point. **SCORE: ___ / 2 POINTS**

THE DERIVATIVE OF $f$ AT $x=a$ IS

$$f'(a)=\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$

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Find the derivative of $f(x)=\dfrac{2x}{1-x}$ using the definition of the derivative. **SCORE: ___ / 5 POINTS**

**NOTE: You will receive 0 points if you use the differentiation shortcuts (power rule, product rule, quotient rule, chain rule etc.)**

$$f'(x)=\left[\lim_{h\to 0}\frac{\frac{2(x+h)}{1-(x+h)}-\frac{2x}{1-x}}{h}\right] \quad 2$$

$$=\lim_{h\to 0}\frac{2(x+h)(1-x)-2x(1-x-h)}{h(1-x-h)(1-x)}$$

$$=\lim_{h\to 0}\frac{2x-2x^2+2h-2hx-2x+2x^2+2xh}{h(1-x-h)(1-x)}$$

$$\overset{2}{=}\left[\lim_{h\to 0}\frac{2}{(1-x-h)(1-x)}\right]=\left[\frac{2}{(1-x)^2}\right] \quad 1$$

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The limit $\lim_{h\to 0}\dfrac{(h-1)^2-1}{h}$ equals $f'(a)$ for some function $f(x)$ and some constant $a$. Find $f(x)$ and $a$. **SCORE: ___ / 2 POINTS**

$f(x)=x^2$ ] 1
$a=-1$ ] 1

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If $g(x)=x^3 f(x)$ and $f(-1)=3$ and $f'(-1)=5$, find $g'(-1)$. **SCORE: ___ / 2 POINTS**

$g'(x)=3x^2f(x)+x^3f'(x)$ ] 1

$g'(-1)=3(-1)^2f(-1)+(-1)^3f'(-1)=3(3)-5=4$ 1

**CONTINUED ON OTHER SIDE**

**[MULTIPLE CHOICE]** If the position of an object at time $t$ is given by $s(t) = (t^3 - 4t)\sqrt{t}$, find the acceleration of the object at time $t = 1$. **SCORE: ___ / 2 POINTS**

$\leftarrow a(1) = \frac{23}{4}$

[a] $\frac{23}{4}$ [b] $\frac{13}{2}$ [c] $\frac{41}{4}$ [d] $\frac{47}{4}$

LETTER OF CORRECT ANSWER: [ ]

IF $s(t) = (t^3+4t)\sqrt{t}$, $a(1) = \frac{47}{4}$

Find the derivatives of the following functions. Do **NOT** simplify your answers. **SCORE: ___ / 7 POINTS**

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

$r'(x) = \dfrac{(12x^3+6x^2)(5x^2-2x-4) - (3x^4+2x^3-5)(10x-2)}{(5x^2-2x-4)^2}$ $\frac{1}{2}$

$+\frac{1}{2}$ POINT FOR CORRECT (ORDER OF) SUBTRACTION

$+\frac{1}{2}$ POINT FOR DIVISION

[b] $w(x) = \left(\dfrac{2}{x^2} - 1\right)\left(\sqrt[3]{x} + 3\right)\left(5 - \dfrac{1}{4\sqrt{x^7}}\right)$

**[YOU MAY USE THE SHORTCUT YOU FOUND IN YOUR HOMEWORK]**

$w(x) = (2x^{-2} - 1)(x^{\frac{1}{3}} + 3)(5 - \frac{1}{4}x^{-\frac{7}{2}})$

$w'(x) = (-4x^{-3})(x^{\frac{1}{3}} + 3)(5 - \frac{1}{4}x^{-\frac{7}{2}})$ 1

$+ (2x^{-2} - 1)(\frac{1}{3}x^{-\frac{2}{3}})(5 - \frac{1}{4}x^{-\frac{7}{2}})$ 1

$+ (2x^{-2} - 1)(x^{\frac{1}{3}} + 3)(\frac{7}{8}x^{-\frac{9}{2}})$ 1

$+\frac{1}{2}$ POINT FOR ADDING 3 PRODUCTS TOGETHER

**[1 BONUS POINT]** Simplify $r'(x)$ in part [a] of the previous question.

$r'(x) = \dfrac{60x^5 + 30x^4 - 24x^4 - 12x^3 - 48x^3 - 24x^2 - (30x^5 - 6x^4 + 20x^4 - 4x^3 - 50x + 10)}{(5x^2 - 2x - 4)^2}$

$= \dfrac{30x^5 - 8x^4 - 56x^3 - 24x^2 + 50x - 10}{(5x^2 - 2x - 4)^2}$ ] 1

NO PARTIAL CREDIT