Name: Key Date: Period: Score:

Intro to Calculus
Chapter 3 PRACTICE Test (3.4 - 3.6)
You must show work to receive full credit!

1. What is the instantaneous rate of change at $x = 3$ of the function f given by $f(x) = \frac{x-3}{2x+5}$?

$f'(x) = \frac{(2x+5)(1)-(x-3)(2)}{(2x+5)^2} = \frac{2x+5-2x-6}{(2x+5)^2} = \frac{-1}{(2x+5)^2}$

$f'(3) = \frac{-1}{(6+5)^2}$ $\frac{-1}{121}$

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2. If $f(x) = -2x^3 + 2x + \frac{1}{x^2}$, then $f'(-1) =$ $-6(-1)^2+2-2(-1)^{-3} = -6+2+2 = -2$

$f(x) = -2x^3 + 2x + x^{-2}$

$f'(x) = -6x^2 + 2 - 2x^{-3}$

$f'(-1) = -2$

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3. A particle starts at time $t = 0$ and moves along the x-axis so that its position at any time $t \geq 0$ seconds is given by $x(t) = (t+2)^2(t-3)$ meters.

(a) Write *x(t)* in standard form rather than factored form. (This will make the next steps much easier☺)

$x(t) = (t^2+4t+4)(t-3)$

t^3+4t^2+4t

$+ \quad -3t^2-12t-12$

$x(t) = t^3+t^2-8t-12$

(b) Find the velocity of the particle at any time $t \geq 0$.

$v(t) = 3t^2+2t-8$

(c) Find the acceleration at $t = 4$ seconds.

$a(t) = 6t+2$

$a(4) = 6(4)+2 = 26$ units/sec^2

(d) ~~Find the value of *t* when the particle is moving and the acceleration is zero.~~

$6t+2 = 0$

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4. Which of the following is an equation of the line tangent to the graph of $f(x) = 12x^3 - 4x$ at the point where $f'(x) = 12$ and x is positive?

$y = 12x - \frac{64}{9}$

$8/9 = 12(2/3) + b$
$8/9 = 8 + b$
$-\frac{64}{9} = b$

$f'(x) = 36x^2 - 4$
$12 = 36x^2 - 4$
$16 = 36x^2$
$x^2 = \frac{16}{36} = \frac{4}{9}$ $x = \pm 2/3$

$f(2/3) = 12(2/3)^3 - 4(2/3)$
$x = 2/3$
$f(2/3) = 8/9$

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5. If $f(x) = \sqrt{3x^2}$, then $f'(1) = \sqrt{3}$

$f'(x) = \frac{1}{2}(3x^2)^{-1/2}(6x)$ $f'(1) = \frac{1}{2}(3(1)^2)^{-1/2}(6(1)) = 3(3)^{-1/2} = \frac{3}{\sqrt{3}} = \sqrt{3}$

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6. A particle moves along a straight line with velocity given by $v(t) = (3x^2 - 1)^4$ at time $t \geq 0$. What is the acceleration of the particle at time $t = 3$?

$a(t) = 4(3x^2 - 1)^3(6x)$
$a(3) = 4(3(3)^2 - 1)^3(6(3))$
$a(3) = 1,265,472$ ← That's fast ☺

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7. If $f(x) = (2x)(x^2 - 1)^4$, then $f'(x) =$

$f'(x) = 2(x^2 - 1)^4 + 2x(4(x^2 - 1)^3(2x))$
$f'(x) = 2(x^2 - 1)^4 + 16x^2(x^2 - 1)^3$

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8. If $f(x) = \sin(3x)$, then $f'\left(\frac{\pi}{2}\right) =$

$f'(x) = 3\cos(3x)$
$f'\left(\frac{\pi}{2}\right) = 3\cos\left(\frac{3\pi}{2}\right) = 3(0) = 0$

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9. What is the slope of the line tangent to the curve $y = \sec(4x)$ at the point at which $x = \frac{\pi}{4}$?

$y' = 4\sec(4x)\tan(4x)$
$y'\left(\frac{\pi}{4}\right) = 4\sec(\pi)\tan(\pi)$
$= 4(-1)(0)$
$y'\left(\frac{\pi}{4}\right) = 0$