Test 3

Part A: Knowledge and Understanding (20 marks)

1) *Indicate whether each statement is True or False* (5 *marks*)

a) the slope of the tangent to $f(x) = \sqrt{1 - 2x}$ *at* $(-4, 3)$ *is* $\frac{-2}{3}$

b) you can use product rule to differentiate a rational function

c) if f *and* g *are differentiable, then the derivative of* $f(x) + g(x)$ *is* $f'(x) + g'(x)$.

d) If a function is differentiable at point $(a, f(a))$, *then* $f(x)$ *is continuous at* $x = a$.

e) the derivative of $f(x) = 240(1 - \frac{x}{30})$ *is* $f'(x) = -8x$.

2) *The following limit represents the derivative of some function* $f(x)$ *at some number* a. *State* $f(x)$ *and* a. (2 *marks*)

$$f'(a) = \lim_{h \to 0} \frac{(1+h)^9 - 1}{h}$$

3) *Write an expression for* $h'(x)$ *if* $h(x) = p(x)q(x)r(x)s(x)$ (1 *marks*)

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4) $Differentiate\ f(x) = (3x + 1)^4(x^3 - x + 1)^5\ and\ express\ answer\ in\ simplified\ factored\ form.\quad (4\ marks)$

5) $Differentiate\ f(x) = \frac{3x^2(1-2x^3)}{(1+x)^3}.Do\ not\ simplify.\quad (2\ marks)$

6) $Use\ the\ chain\ rule\ in\ Leibniz\ notation\ to\ find\ \frac{dy}{dx}\ when\ x = 3\quad (5\ marks)$

$$y = 2u^3 + 3u^2 - 1 \quad u = \frac{1}{2-x}$$

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Part B: Application (20 marks)

1) *For which values of* x *is the slope of the tangent to the curve* $f(x) = \frac{5x}{x+2}$ *parallel with equation* $2x - 5y - 9 = 0$? *(6 marks)*

2) *Determine the equation of the tangent to the curve* $f(x) = (\sqrt{x^2 - 9})^3$ *at* $x = 5$. *(5 marks)*

3) *The function* $s(t) = (2t^3 + 3t^2)^{\frac{1}{2}}$ *represents the displacement* s, *in metres, of a particle after* t *seconds. Determine the velocity when* $t = 3$. *(4 marks)*

4) *Find* $h'(2)$ *given* $h(x) = f(g(x))$, $f(u) = 2u^3 - 2u$, $g(2) = 3$ *and* $g'(2) = 4$. *(5 marks)*

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Part C: Thinking (14 marks)

1) $If\ f(x)\ is\ a\ differentiable\ function,\ determine\ an\ expression\ for\ the\ derivative\ of\ g(x) = 4x^3 f(3x^2 - 2x + 1)$

2) $Find\ numbers\ a, b\ and\ c\ so\ that\ the\ graph\ f(x) = ax^2 + bx + c\ has\ x\ intercepts\ -4\ and\ 5,\ and\ a\ tangent\ with\ a\ slope\ of\ 6\ when\ x = 2.$

3) $Show\ that\ \frac{dy}{dx} = (2a + 5b)x^{2a+5b-1}\ if\ y = \frac{x^{3a+3b}}{x^{a-2b}}\ and\ a\ and\ b\ are\ integers.$

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Part D: Communication (8 marks)

1) *A classmate says "the derivative of a quartic polynomial function is a cubic polynomial function". Is this statement always true, sometimes true, or never true?* (2 *marks*)

2) *Illustrate two situations in which a function does not have a derivative at* $x = 2$. (2 *marks*)

3) *Explain when and how you would use the chain rule?* (2 *marks*)

4) *State two methods you can use to differentiate* $f(x) = (x^2 - 4x + 2)(x^4 + 2)$? (2 *marks*)

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