University of Calgary
Faculty of Science
Department of Mathematics and Statistics

Calculus 1 Fall 2009

Worksheet 5a
[Derivatives and applications]

1. a. Determine the points on the curve
$$y = 2x^3 - 9x^2 - 24x + 4$$
where the tangent line to the curve is parallel to the x-axis.

b. Determine the points on the curve
$$y = 3x^4 - 2x^3 - 9x^2 + 1$$
where the tangent line to the curve is parallel to the x-axis.

c. Find the equation of the tangent and normal lines to the curve
$$y = x + \frac{1}{\sqrt{x}}$$
at the point where x = 4.

d. Find the equation of the tangent and normal lines to the curve
$$y = x^4 + 2x^3 + x^2 + x + 1$$
at the point where the tangent lline has slope equal to 1.

e. Find the equation of the tangent and normal lines to the curve
$$y = 3x^4 + 4x^3 - 12x^2 - 22x + 1$$
at the points on the curve where the tangent line is parallel to the straight line
y = 2x - 5

2. Use the definition of the derivative as a limit to determine $f'(x)$ given that

a. $f(x) = \sqrt{x^2 + 4}$

b. $f(x) = \frac{1}{x^2 - 4}$

c. $f(x) = \frac{4x + 5}{3 - 5x}$

d. $f(x) = \frac{1}{\sqrt{4 - x^2}}$

In each case check your answer by using the rules for differentiation.

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3. In each case, determine $f'(x)$ given $f(x)$.

i. $f(x) = \sin\left(x^4 + x^3\right)$

ii. $f(x) = \tan\left(\sqrt{4 - x^3}\right)$

iii. $f(x) = \sec\left(x^{2/3} - x\right)$

iv. $f(x) = csc\left(\sqrt{x^4 + 1}\right)$

v. $f(x) = \cos\left(\cos\left(\cos x\right)\right)$

vi. $f(x) = \cot\left(\sin\left(x^3 + 1\right)\right)$

vii. $f(x) = \sqrt{x^2 + \sqrt{x^2 + \sqrt{x^2 + 1}}}$

4. Determine all points on each graph of the function given where the tangent line is parallel to the x-axis.

a $y = x^4 - x^2 + 1$

b $y = \sin 2x - 2 \sin x$

c $y = \tan x + \cot x$

5. Determine whether or not the given curve has a tangent line which is parallel to the x-axis:

a $y = 2x^3 + 3x^2 + 6x + 12$

b $y = 2x^3 - x^2 + 2x - 1$