University of Bahrain
Department of Mathematics
MATHS101: Calculus I
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Worksheet: Differentiation Rules

Students' Name: _____

1. Find the derivative of the following functions:
   1. $y = x^5 + x^3 + x + 8$
   2. $y = \sqrt[7]{x^{99}} - \dfrac{1}{x^{200}} + 55x$
   3. $y = 2(\sqrt{x} + 5x - 3)(\sqrt[4]{x} - 4\sqrt{x})$
   4. $f(x) = \dfrac{e^x}{x}$

5. $f(x) = \dfrac{ax+b}{cx+d}$

2. Find an equation of the tangent line to the curve $f(x) = \dfrac{\sqrt{x}(2-x^2)}{x}$ at $x = 4$.

3. Show that the function

$$f(x) = \begin{cases} -x, & x < 0 \\ \frac{x^2}{x+1}, & x \geqslant 0 \end{cases}$$

is differentiable at $x = 0$.

4. For which value(s) is the function defined by

$$f(x) = \begin{cases} ax + b, & x < 1 \\ x - x^6, & x \geqslant 1 \end{cases}$$

differentiable at $x = 1$?

5. Find $\frac{d^3y}{dx^3}$ for

$$y = x^4 e^x$$