CEGEP Calculus I · Practice Worksheet · tutorinmontreal.ca

Derivatives of Transcendental Functions

Name: ____ Date: __________________

Concepts

- Derivatives of Exponential Functions
- Derivatives of Logarithmic Functions
- Derivatives of Trigonometric Functions
- Derivatives of Inverse Trigonometric Functions (theory)
- Logarithmic Differentiation (theory)

Derivatives of Exponential Functions

1. Differentiate each function. Factor your answer where a common factor appears.

a) $f(x) = x^3 e^{2x}$

b) $g(t) = 5^{t^2 - t}$

c) $h(x) = \dfrac{e^x}{1 + e^x}$

Derivatives of Logarithmic Functions

2. Differentiate each function and state the domain on which your derivative is valid.

a) $f(x) = \ln(3x^2 + 5)$

b) $g(x) = x^2 \ln(4x)$

c) $h(x) = \log_2(x^3 + 1)$

Derivatives of Trigonometric Functions

3. Differentiate and simplify as far as possible.

a) $f(x) = x \sin x + \cos x$

b) $g(x) = \tan(3x^2)$

c) $h(x) = \dfrac{\cos x}{1 - \sin x}$

Derivatives of Inverse Trigonometric Functions

4. Differentiate each function.

a) $f(x) = \arctan(3x)$

b) $g(x) = \arcsin(x^2)$; state the interval on which g' exists.

c) $h(x) = x \arctan x - \frac{1}{2}\ln(1 + x^2)$; simplify completely and comment on what you obtain.

Logarithmic Differentiation

5. Use logarithmic differentiation to find $\dfrac{dy}{dx}$.

a) $y = x^{\cos x}$, for $x > 0$.

b) $y = \dfrac{(x+2)^4\sqrt{2x-1}}{(x^2+3)^5}$, for $x > \frac{1}{2}$.

In each case, say which feature of the expression makes logarithmic differentiation the right tool.

Synthesis — drawing on several topics in this set

6. A damped oscillation is described by $f(x) = e^{-x}\sin(2x)$.

a) Find $f'(x)$ and write it with e^{-x} factored out.

b) Find the equation of the tangent line to the curve $y = f(x)$ at $x = 0$.

c) Show that $f'(x) = 0$ if and only if $\tan(2x) = 2$. Give the smallest positive solution exactly, using arctan, and then to three decimals.