University of Michigan
Student Name:

Math 115 Quiz 5

Section 9 - Winter 2011
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Using the basic properties and the short-cuts for differentiation, find the derivative of the following function. You do not need to simplify your answers.

$$f(x) = \cos\big(\ (ln(3x^7 + 2x))^4 \cdot \sin(4^{\sqrt[3]{x}}\ )\big)$$

Hints: **(i)** Before writing your answer you might want to compute the derivatives of the following functions:

$$g(x) = (ln(3x^7 + 2x))^4$$
$$h(x) = \sin(4^{\sqrt[3]{x}})$$

(ii) Also, notice that: $f(x) = \cos(\ g(x) \cdot h(x)\ )$.

Solution

$$g'(x) = 4 \cdot (ln(3x^7 + 2x))^3 \cdot \frac{1}{3x^7 + 2x} \cdot (21x^6 + 2)$$
$$h'(x) = \cos(4^{\sqrt[3]{x}}) \cdot ln4 \cdot 4^{\sqrt[3]{x}} \cdot \frac{1}{3} \cdot x^{-2/3}$$

Since $f(x) = \cos(\ g(x) \cdot h(x)\ )$, using the chain rule and the product rule we obtain:

$$f'(x) = -\sin(\ g(x) \cdot h(x)\ ) \cdot \big(g'(x) \cdot h(x) + g(x) \cdot h'(x)\big),$$

and then we replace to obtain the answer:

$$f'(x) = -\sin(\ (ln(3x^7+2x))^4 \cdot \sin(4^{\sqrt[3]{x}})\ ) \cdot [\frac{4 \cdot (ln(3x^7 + 2x))^3 \cdot (21x^6 + 2)}{3x^7 + 2x} \cdot \sin(4^{\sqrt[3]{x}}) + (ln(3x^7+2x))^4 \cdot \cos(4^{\sqrt[3]{x}}) \cdot \frac{ln4 \cdot 4^{\sqrt[3]{x}} \cdot x^{-2/3}}{3}].$$