

MATH 16  
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**SAMPLE TEST # 1**

Solve the exercises. **Show your work.**

**Ex. 1.** Find the derivatives of the following functions.

(a)  $h(x) = 2^{x^4} + \log_3(\cosh x)$

(b)  $g(u) = \arccos(e^u)$

(c)  $h(t) = \arctan^4(\ln t)$

(d)  $y(x) = (\ln x)^{x^3}$

**Ex. 2.** Evaluate the integrals.

(a)  $\int \frac{dx}{x(1 + (\ln x)^2)}$

(b)  $\int \frac{\arctan t}{1 + t^2} dt$

(c)  $\int \frac{e^{4x}}{1 + e^{4x}} dx$

**Ex. 3.** Solve for  $x$  without using a calculator.

$$\ln x + \ln(x - 1) = \ln 2$$

**Ex. 4.** Evaluate the limits.

(a)  $\lim_{x \rightarrow \infty} \frac{\ln(\ln x)}{\sqrt{x}}$

(b)  $\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3}$

(c)  $\lim_{x \rightarrow \infty} x^3 e^{-x^2}$

**Ex. 5.** Carbon extracted from an ancient skull contained only  $1/6$  as much radioactive  $C^{14}$  as carbon extracted from present day bone. How old is the skull? (The half life of radioactive carbon  $C^{14}$  is about 5700 years.)