MATH111-002 200630 Sample Midterm Test 1

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You have 50 minuts to do each of the following questions. The entire exam is worth 50 marks. You should be able to earn about 1 mark per minute.

1. (10 marks) Find the following derivatives:
   (a) (3 marks) y' where $y = e^{e^x}$
   (b) (3 marks) y' where $y = \log_2(x^3)$
   (c) (4 marks) y' where $y = \sqrt{1 + xe^{-2x}}$
2. (10 marks) Find the following integrals:
   (a) (3 marks) $\int_0^5 e^{-3x}\,dx$
   (b) (3 marks) $\int \frac{e^x + 1}{e^x}\,dx$
   (c) (4 marks) $\int x2^{x^2}\,dx$
3. (10 marks) Let $f(x) = 2x + \cos x$.
   (a) (2 marks) Find $f'(x)$.
   (b) (2 marks) Show that $f'(x) > 0$ for all x.
   (c) (2 marks) Show that f is invertible.
   (d) (2 marks) Find $f^{-1}(1)$.
   (e) (2 marks) Find $(f^{-1})'(1)$.
4. (10 marks) Use logarithmic differentiation to find the following derivatives.
   (a) (3 marks) y' where $y = (2x+1)^5(x^4-3)^6$
   (b) (3 marks) y' where $y = x^{\sin x}$
   (c) (4 marks) y' where $x^y = y^x$.
5. (5 marks) Find $\frac{d^3}{dx^3}(x^2 \ln x)$.
6. (5 marks) Show that $e^x \geq 1 + x$ whenever $x > 0$.