Polytechnic University

MA 1022/1322 EXAM 1 (B) NOVEMBER 22, 2004

EXAM 1: _____

EXAM 2: _____

GRADE: _____

Print Name:

Signature:

ID #:

Instructor/Section:

Directions: You have **90 minutes** to answer the following questions. ***You must show all your work*** as neatly and clearly as possible and indicate the final answer clearly. You may use only a TI-30 calculator. The last two pages contain formulas that you might find useful. You may tear these pages out.

If you are feeling ill you should inform the proctor. The proctor will note your name, Poly ID and accept any written statement(s) that you may wish to make regarding your illness.

Problem	Possible	Points
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
Total	100	

YOUR SIGNATURE:

In Problems (1)–(6) circle the correct choice. You need not show any work.

(1) (Page 126, Problem 19) If $f(x) = 5^{3x}$, then $f'(x) =$

(a) $\dfrac{5^{3x}}{3\ln(5)}$

(b) $3(5^{2x})$

(c) $(5^{3x})\ln(125)$

(d) $3(5^{3x})$

(e) $3x(5^{3x-1})$

(2) (Page 121, Problem 26) If $G(t) = \dfrac{3t^2+t}{3t^2-t}$, then $G'(t) =$

(a) 1

(b) $\dfrac{6t^2+1}{6t^2-1}$

(c) $\dfrac{-2t^2}{(t^2-t)^2}$

(d) $\dfrac{36t^3-2t}{(t^2-t)^2}$

(e) $\dfrac{-6}{(3t-1)^2}$

YOUR SIGNATURE:

(3) (Page 136, Problem 32) If $h(z) = \ln(\ln(1-z))$, then $h'(z) =$

(a) $\dfrac{-1}{\ln(1-z)}$

(b) $\dfrac{-1}{\ln(1-z)^2}$

(c) $\dfrac{1}{(1-z)\ln(1-z)}$

(d) $\dfrac{1}{(1-z)^2}$

(e) $\dfrac{-1}{(1-z)\ln(1-z)}$

(4) (Page 128, Example 1)

$$\lim_{h\to 0} \frac{\tan\left(\frac{\pi}{6}+h\right) - \tan\left(\frac{\pi}{6}\right)}{h} =$$

(a) $\dfrac{4}{3}$

(b) $\dfrac{3}{4}$

(c) $\sqrt{3}$

(d) 1

(e) $\dfrac{\sqrt{3}}{3}$

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(5) (Sample Exam) The equation of the line tangent to the graph of $y = \sin^2(x)$ at $x = \dfrac{\pi}{4}$ is

(a) $y - \dfrac{1}{2} = \dfrac{1}{2}\left(x - \dfrac{\pi}{4}\right)$

(b) $y - \dfrac{1}{2} = -\left(x - \dfrac{\pi}{4}\right)$

(c) $y - \dfrac{1}{2} = \left(x - \dfrac{\pi}{4}\right)$

(d) $y - \dfrac{1}{\sqrt{2}} = -\left(x - \dfrac{\pi}{4}\right)$

(e) $y - \dfrac{1}{\sqrt{2}} = \dfrac{1}{2}\left(x - \dfrac{\pi}{4}\right)$

YOUR SIGNATURE:

(6) (Sample Exam) A 20 foot ladder slides down a wall at 5 ft/sec. At what approximate speed is the bottom of the ladder sliding out when the top is 10 feet above the floor ?

(a) 5.774 ft/sec

(b) 4.472 ft/sec

(c) 0.346 ft/sec

(d) 2.887 ft/sec

(e) 0.224 ft/sec

Your signature:

(7) (Sample Exam) At noon, two planes set out from Chicago's O'Hare airport. The air traffic controller reports that they are traveling away from each other at an angle of 102°. The D-10 travels at 540 miles per hour (mph) and the L-1011 travels at 497 mph. How far apart are they at 12:45pm? You must show your work.

YOUR SIGNATURE:

(8) (Page 160, Problem 60) The following table gives some of the values of $g(x)$, $g'(x)$, $f(x)$ and $f'(x)$:

x	$g(x)$	$g'(x)$	$f(x)$	$f'(x)$
-1	-1	3	2	-1
1	1	5	-2	-3
2	3	2	1	-1
3	2	-1	5	-2

Fill in the blanks with exact values. You must simplify your answer. You do not need to show your work.

(a) The derivative of $h(x) = \arctan(x)g(x^2+1)$ at $x = 1$ is _____.

(b) The derivative of $\sqrt{f(x)+g(x)}$ at $x = 2$ is _____.

YOUR SIGNATURE:

(9) (Trigonometry Homework, Sample Exam) Solve for x in the interval $[0, 2\pi]$. You must show your work.

$$\frac{5}{2}\sin(x) + \cos^2(x) = 2$$

YOUR SIGNATURE:

(10) (Trigonometry Handout, Sample Exam)

(a) If $x + 1 = 5 \sin \theta$, with $0 < \theta < \pi/2$, express $\tan(\theta)$ in terms of x. You must show your work.

(b) Express $\cos(2 \sin^{-1}(x))$ in terms of x without using trigonometric functions. Here $0 < x < 1$. You must show your work.

YOUR SIGNATURE:

Useful formulas

- **The derivative of a function**

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

- **Some rules of differentiation**

$$\frac{d}{dx}(cf(x)) = cf'(x)$$
$$\frac{d}{dx}(f(x)g(x)) = f'(x)g(x) + f(x)g'(x)$$
$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$$
$$\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$$

- **Differentiation formulas**

$\frac{d}{dx}(x^n) = nx^{n-1}$	$\frac{d}{dx}(e^x) = e^x$	$\frac{d}{dx}(a^x) = (\ln a)a^x$
$\frac{d}{dx}(\ln x) = \frac{1}{x}$	$\frac{d}{dx}(\sin(x)) = \cos x$	$\frac{d}{dx}(\cos(x)) = -\sin x$
	$\frac{d}{dx}(\tan(x)) = \sec^2 x$	$\frac{d}{dx}(\cot(x)) = -\csc^2 x$
	$\frac{d}{dx}(\sec(x)) = \sec x \tan x$	$\frac{d}{dx}(\csc(x)) = -\csc x \cot x$
$\frac{d}{dx}(\arcsin(x)) = \frac{1}{\sqrt{1-x^2}}$	$\frac{d}{dx}(\arccos(x)) = \frac{-1}{\sqrt{1-x^2}}$	$\frac{d}{dx}(\arctan(x)) = \frac{1}{1+x^2}$
$\frac{d}{dx}(\sinh(x)) = \cosh(x)$	$\frac{d}{dx}(\cosh(x)) = \sinh(x)$	$\frac{d}{dx}(\tanh(x)) = \frac{1}{\cosh^2(x)}$

- **The linear approximation** of a function f at a is given by

$$y = f(a) + f'(a)(x - a)$$

- **Geometry Formulas**
  Here V is the volume, h is the height and r is the radius.
  Cylinder: $V = \pi r^2 h$
  Cone: $V = \frac{1}{3}\pi r^2 h$
  Sphere: $V = \frac{4}{3}\pi r^3$

YOUR SIGNATURE:

• Trigonometry Formulas

For a triangle with sides a, b, c and angles A, B, C opposite these sides, respectively.

- Law of Sines:
$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$
- Law of Cosines:
$$c^2 = a^2 + b^2 - 2ab\cos C$$
- Double angle:
$$\sin(2t) = 2\sin t\cos t \qquad \cos(2t) = \cos^2 t - \sin^2 t$$
- Sum-/Difference-of-angle:
$$\begin{aligned}
\sin(\theta+\phi) &= \sin(\theta)\cos(\phi) + \sin(\phi)\cos(\theta)\\
\sin(\theta-\phi) &= \sin(\theta)\cos(\phi) - \sin(\phi)\cos(\theta)\\
\cos(\theta+\phi) &= \cos(\theta)\cos(\phi) - \sin(\theta)\sin(\phi)\\
\cos(\theta-\phi) &= \cos(\theta)\cos(\phi) + \sin(\theta)\sin(\phi)
\end{aligned}$$