UNIVERSITY OF BOLTON

SCHOOL OF THE BUILT ENVIRONMENT & ENGINEERING – RAK CAMPUS

BSc (HONS) CIVIL ENGINEERING

SEMESTER ONE EXAMINATION 2010/2011

MATHEMATICS A

MODULE NO: BLT1009

Date: Monday 17 January 2011 **Time: 2.00 pm – 4.00 pm**

INSTRUCTIONS TO CANDIDATES:

There are FOUR questions.

Answer THREE complete questions out of the FOUR.

All questions carry a Total of 20 marks.

Marks for parts of questions are shown in brackets.

This examination paper carries a maximum total of 60 marks.

All working must be shown. A numerical solution to a question obtained by programming an electronic calculator will not be accepted.

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1. a) Transpose the following formulae for "b".

i) $P = \sqrt{\frac{4d}{2bx}}$ (2 marks)

ii) $9x = \frac{4am^3}{5 + 3b^2}$ (3 marks)

b) Solve the following quadratic equations:

i) $x^2 + 4x - 21 = 0$ By factorisation (3 marks)

ii) $x^2 + x - 6 = 0$ By factorisation (3 marks)

iii) $3x^2 - 4x - 8 = 0$ By formula (3 marks)

c) Separate the following into partial fractions:

$\frac{5x + 6}{3x^2 + 3x - 4}$ (6 marks)

Total 20 marks

2. a) Differentiate the following functions to find the first derivative:

i) $y =$ — — (2 marks)

ii) $y = 3\cos 2x - 5e^{-2x}$ (2 marks)

b) Differentiate the following function to find —

i) $y = 3x^2 \cos 2x$ using the "product rule" (3 marks)

ii) $y = \frac{4x}{3x + 2}$ using the "quotient rule" (3 marks)

iii) $y = \cos(4x^2 + 3)$ using the "function of a function rule": (3 marks)

c) Find the maximum and minimum points of the following function:

$y = 2x^3 - 3x^2 - 5x + 6$ (7 marks)

Total 20 marks

Please turn the page

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Q3 a) Find the following indefinite integrals:

i) $\int \left(3x^3 + \frac{3}{x^5}\right) dx$ (3 marks)

ii) $\int (6\cos 2x)\, dx$ (3 marks)

b) Evaluate the following definite integrals:

i) $\int_2^4 \left(2x + \frac{1}{x^2}\right) dx$ (3 marks)

iii) $\int_{\pi/12}^{\pi/6} (\sin 2t + 4\cos t)\, dt$ (3 marks)

c) Determine:

(i) using algebraic substitution

(4 marks)

(ii) The area enclosed by the x axis from x = -1 to x = 2 and the curve $y = 3x^2 - 3x - 6$. (4 marks)

Total 20 marks

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4. a) Solve the following simultaneous equations:

i) $3x - 2y = 8$
$3x + 2y = 16$

(2 marks)

(ii) $4x + 3y = 5$
$x - 5y = 7$

(3 marks)

b) Use Pascal's triangle to solve the following:

i) $(x + 1)^3$ (2 marks)

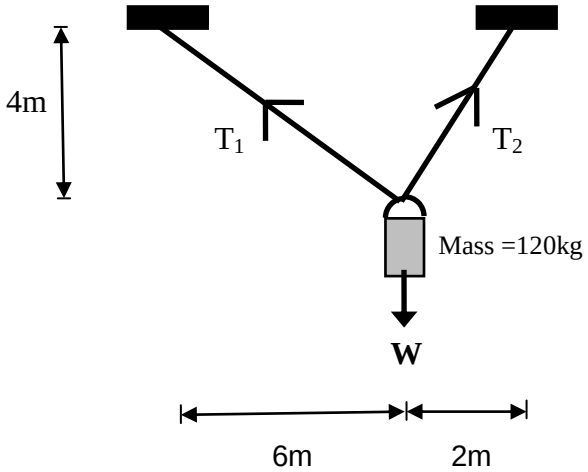
ii) $(2x - 5)^4$ (3 marks)

c) Expand each of the following using the binomial theorem:

i) $(1 + x)^4$ (2 marks)

ii) $(2 + x)^3$ (2 marks)

d) Calculate the tension (T_1 and T_2) in the cables due to the weight of the bucket shown below; assuming the system is in equilibrium.



(6 marks)

Total 20 marks

END OF QUESTIONS

Please turn the page for formulae sheet

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Formulae sheet (1 of 2)

y = *f*(x)	$\frac{\mathbf{dy}}{\mathbf{dx}}$
Constant (k)	0
x	1
x^2	2x
x^n	nx^{n-1}
e^x	e^x
e^{kx}	ke^{kx}
sin x	cos x
cos x	- sin x
sin kx	k cos kx
cos kx	-k sin kx
ln x	$\frac{1}{x}$
ln x	$\frac{1}{x}$

f(x)	**$\int$f(x) *dx* all '+c'**
2x	x^2
x	½ x^2
k (constant)	k x
x^n	$\frac{1}{n+1} x^{n+1}$
$\frac{1}{x}$	ln x
e^x	e^x
e^{kx}	$\frac{e^{kx}}{k}$
sin x	- cos x
cos x	sin x
sin kx	$-\frac{\cos kx}{k}$
cos kx	$\frac{\sin kx}{k}$

Please turn the page

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Formula sheet (2 of 2)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $y = u * v$, then $\frac{dy}{dx} = v * \frac{du}{dx} + u * \frac{dv}{dx}$

If $y = \frac{u}{v}$, then $\frac{dy}{dx} = \frac{v * \frac{du}{dx} - u * \frac{dv}{dx}}{v^2}$

If y is a function of u, where u is a function of x, then $\frac{dy}{dx} = \frac{dy}{du} * \frac{du}{dx}$

Coefficients in the expansion														
							1							
						1		1						
					1		2		1					
				1		3		3		1				
			1		4		6		4		1			
		1		5		10		10		5		1		
	1		6		15		20		15		6		1	

$$(a + b)^n = a^n + na^{n-1}b + \frac{n(n-1)}{2!}a^{n-2}b^2 + \frac{n(n-1)(n-2)}{3!}a^{n-3}b^3 + \ldots\ldots\ldots + b^n$$