UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

NAMA KURSUS	:	BASIC MATHEMATICS (MATEMATIK ASAS)
KOD KURSUS	:	BBR 23603
PROGRAM	:	IJAZAH SARJANA MUDA PENDIDIKAN SEKOLAH RENDAH DENGAN KEPUJIAN
TARIKH PEPERIKSAAN	:	DECEMBER 2012 / JANUARY 2013
JANGKA MASA	:	3 HOURS
INSTRUCTION	:	ANSWER FIVE (5) QUESTIONS FROM SEVEN (7) QUESTIONS

THIS QUESTION PAPER CONSISTS OF EIGHT (8) PAGES

Q1 (a) Find $A \times B \times C$ for the given $A = \{1,2\}$, $B = \{a,b\}$ and $C = \{5,6\}$.

(5 marks)

(b) University has introduced 7 new programmess during school holiday. A group of 100 school students are invited to attend the event. The following Table Q1(b) shows the participation of the students for the school holiday programme.

Table Q1(b)

Number of students	Holiday programme
38	Science
30	Engineering
73	Foreign Language
13	Science and Engineering
23	Engineering and Foreign Language
28	Science and Foreign Language
10	All three holiday programmes

(i) Represent the above information in a Venn Diagram.
(ii) Determine the number of students who picked at least one holiday programme, exactly two holiday programmes and who did not take any holiday programme.

(15 marks)

Q2 (a) Find the value of x for the following inequalities.

(i) $|5x-2| < 5$

(ii) $|2x^2-6| < 2$

(iii) $|x-2| \leq |x+3|$

(12 marks)

(b) Solve the inequality $\dfrac{(x+4)(x+1)}{(x-3)} \leq 0$.

(8 marks)

Q3 (a) Simplify the following expression as a single logarithm.

(i) $\frac{1}{2}\log\left(\frac{x^2}{y^2}\right)-\frac{1}{3}\log\left(\frac{x^3}{y^6}\right)$

(ii) $\frac{1}{2}\log\left(\frac{a^2b^4}{c^2}\right)+2\log\left(\frac{c}{ab}\right)-\log(abc)$

(7 marks)

(b) Solve the following equations.

(i) $3\left(10^{0.5x-2}\right)=96$

(ii) $\log(x^2+2)=2.6$

(7 marks)

(c) The current, I (in Ampere) through a diode is given by the following equation

$$I=I_S\left(e^{40V}-1\right)$$

where I_S is the reverse saturation current (in Ampere) and V (in Volt) is the voltage across the diode. Given that $I=300I_S$ and $e=2.718$, calculate the voltage across the diode.

(6 marks)

Q4 Given three points $A(5,-2)$, $B(-1,6)$ and $C\left(0,\frac{1}{2}\right)$, find

(a) the distance between points A and B.

(5 marks)

(b) the equation of a line that passes through points A and B.

(7 marks)

(c) point D, given that D is the midpoint of AB. Hence, determine whether AB is parallel or perpendicular to CD.

(8 marks)

Q5 (a) Use reference angle to find the exact value for the following trigonometric function without using calculator.

(i) $\tan 150^\circ$

(ii) $\sin(-120^\circ)$

(iii) $\cos 240^\circ$

(iv) $\sec 315^\circ$

(9 marks)

(b) Verify the identity $2\sec x = \dfrac{1+\sin x}{\cos x} + \dfrac{\cos x}{1+\sin x}$.

(4 marks)

(c) A piece of stained glass is to be cut in the shape of a circular sector with a radius of 12 cm and a central angle of 126°. Give your answers in the term of π.

(i) Convert the given central angle into radian measurement.
(ii) Calculate the area of the stained glass.
(iii) Find the arc length of the stained glass subtended by the central angle.
(iv) Calculate the perimeter of the stained glass.

(7 marks)

Q6 (a) Given two vectors, $\boldsymbol{v} = -\underset{\sim}{i} + 3\underset{\sim}{j} - 2\underset{\sim}{k}$ and $\boldsymbol{w} = -2\underset{\sim}{i} + \underset{\sim}{j} + 2\underset{\sim}{k}$. Find

(i) $|\boldsymbol{v} + \boldsymbol{w}|$

(ii) $|2\boldsymbol{v} + 3\boldsymbol{w}|$

(iii) $|\boldsymbol{v}| - |\boldsymbol{w}|$

(11 marks)

(b) If $\boldsymbol{a} = 2\underset{\sim}{i} - 2\underset{\sim}{j} + 3\underset{\sim}{k}$, $\boldsymbol{b} = 5\underset{\sim}{i} + 8\underset{\sim}{j} + \underset{\sim}{k}$ and $\boldsymbol{c} = -4\underset{\sim}{i} + 3\underset{\sim}{j} - 2\underset{\sim}{k}$, find $\boldsymbol{a}\cdot\boldsymbol{b}$ and $\boldsymbol{a}\cdot(\boldsymbol{b}+\boldsymbol{c})$.

(5 marks)

(c) Find $\boldsymbol{p}\times\boldsymbol{q}$ and $\boldsymbol{q}\times\boldsymbol{p}$ for vectors $\boldsymbol{p} = 3\underset{\sim}{i} + 4\underset{\sim}{j}$ and $\boldsymbol{q} = \underset{\sim}{i} + 5\underset{\sim}{j} - 2\underset{\sim}{k}$.

(4 marks)

Q7 (a) Solve the quadratic equation $8x^2 - 2x + 1$, and write in the form of $a + bi$.

(5 marks)

(b) Given that $z_1 = 1 - 2i$ and $z_2 = 3 + i$, find the following.

(i) $\dfrac{1}{z_1}$

(ii) $\dfrac{z_1}{z_2}$

(iii) $\dfrac{1}{z_1} + \dfrac{z_1}{z_2}$

(8 marks)

(c) Given that $z_1 = 3 + 4i$, $z_2 = 5 - 2i$ and $\dfrac{1}{z_3} = \dfrac{1}{z_1} + \dfrac{1}{z_1 z_2}$, find z_3 in the form of $a + bi$.

(7 marks)

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FORMULAS

Set

Intersection: $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$

Union: $A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

Cartesian product: $A \times B = \{(a,b) : (a \in A) \text{ and } (b \in B)\}$

Real number system

Absolute value: $|x \pm a| < k \Leftrightarrow -k < x \pm a < k$, where a and k are constants

$$|x \pm a| \le |x \pm b| \Leftrightarrow |x \pm a|^2 \le |x \pm b|^2 \Rightarrow (x \pm a)^2 \le (x \pm b)^2$$

$$|x \pm a| \ge |x \pm b| \Leftrightarrow |x \pm a|^2 \ge |x \pm b|^2 \Rightarrow (x \pm a)^2 \ge (x \pm b)^2, \text{ where } a \text{ and } b \text{ are constants}$$

Exponents, logarithms and radicals

Equivalence of exponent and logarithm: $x = b^n \Leftrightarrow \log_b x = n$

Logarithmic identities:

$$\log_b x^k = k \log_b x$$

$$\log_b \left(\frac{x}{y}\right) = \log_b x - \log_b y$$

$$\log_b (xy) = \log_b x + \log_b y$$

Coordinate Geometry

Slope of a line: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Equation of a line: $y = mx + c$

The distance between two points P and Q is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

The mid-point of the straight line joining two points $P(x_1, y_1)$ and $Q(x_2, y_2)$ is $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

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Trigonometry

$$\sec\theta = \frac{1}{\cos\theta}, \quad \csc\theta = \frac{1}{\sin\theta}, \quad \cot\theta = \frac{\cos\theta}{\sin\theta} = \frac{1}{\tan\theta}$$

The exact value of trigonometric functions:

Angle θ	Angle θ (radian)	$\sin\theta$	$\cos\theta$	$\tan\theta$
0°	0	0	1	0
30°	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
45°	$\frac{\pi}{4}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$

The main basic trigonometry identities:

(1) $\sin^2\theta + \cos^2\theta = 1$

(2) $\sec^2\theta = 1 + \tan^2\theta$

(3) $\csc^2\theta = 1 + \cot^2\theta$

Conversion of radian and degree: Half a circle, π radian $= 180°$

Arc length, $s = r\theta$

Area of Sector $= \frac{1}{2} \times \theta \times r^2$ (when θ is in radians)

Area of Sector $= \frac{\theta}{360^o} \times \pi r^2$ (when θ is in degrees)

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Vector

For vectors $\boldsymbol{a} = a_1\underset{\sim}{i} + a_2\underset{\sim}{j} + a_3\underset{\sim}{k}$ and $\boldsymbol{b} = b_1\underset{\sim}{i} + b_2\underset{\sim}{j} + b_3\underset{\sim}{k}$ with any scalar λ, then

(1) $\lambda(\boldsymbol{a} \pm \boldsymbol{b}) = \lambda(a_1 \pm b_1)\underset{\sim}{i} + \lambda(a_2 \pm b_2)\underset{\sim}{j} + \lambda(a_3 \pm b_3)\underset{\sim}{k}$

(2) The length (or magnitude) for $\boldsymbol{a}$ is $|\boldsymbol{a}| = \sqrt{{a_1}^2 + {a_2}^2 + {a_3}^2}$

(3) Scalar product of $\boldsymbol{a}$ and $\boldsymbol{b}$ is $\boldsymbol{a} \cdot \boldsymbol{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$

(4) Vector product of $\boldsymbol{a}$ and $\boldsymbol{b}$ is

$$\boldsymbol{a} \times \boldsymbol{b} = \begin{vmatrix} \underset{\sim}{i} & \underset{\sim}{j} & \underset{\sim}{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = (a_2b_3 - a_3b_2)\underset{\sim}{i} - (a_1b_3 - a_3b_1)\underset{\sim}{j} + (a_1b_2 - a_2b_1)\underset{\sim}{k}$$

Complex Number

Imaginary number, i is defined as $i^2 = -1$ or $i = \sqrt{-1}$

If $z = a + bi$, then its conjugate is $\overline{z} = a - bi$

Roots of quadratic equation $ax^2 + bx + c = 0$ is given by $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For $z_1 = a_1 + b_1 i$ and $z_2 = a_2 + b_2 i$, then

(1) $z_1 \pm z_2 = (a_1 + a_2) \pm (b_1 + b_2)i$

(2) $z_1 z_2 = (a_1 + b_1 i)(a_2 + b_2 i) = a_1a_2 + (a_1b_2 + a_2b_1)i + b_1b_2i^2 = a_1a_2 - b_1b_2 + (a_1b_2 + a_2b_1)i$

(3) $\dfrac{1}{z_1} = \dfrac{1}{a_1 + b_1 i} = \dfrac{1}{a_1 + b_1 i}\left(\dfrac{a_1 - b_1 i}{a_1 - b_1 i}\right)$, $\dfrac{1}{z_2} = \dfrac{1}{a_2 + b_2 i} = \dfrac{1}{a_2 + b_2 i}\left(\dfrac{a_2 - b_2 i}{a_2 - b_2 i}\right)$