Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	BASIC MATHEMATICS
COURSE CODE	:	BBR 23603
PROGRAMME	:	4 BBR, 3BBR
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Given $X = \{a, e, i, o, u\}$ and $Y = \{a, b, c, d, e\}$. Find $Y - X$.

(2 marks)

(b) Given
P = The set of whole numbers less than 5
Q = The set of even numbers greater than 3 but less than 9
R = The set of factors of 6

(i) List the sets P, Q and R.
(ii) Calculate $(P \cap Q) \cup (Q \cap R)$
(iii) Draw conclusions of $(P \cap Q) \cup (Q \cap R)$

(10 marks)

(c) Given the Venn diagram in Figure Q1(c).

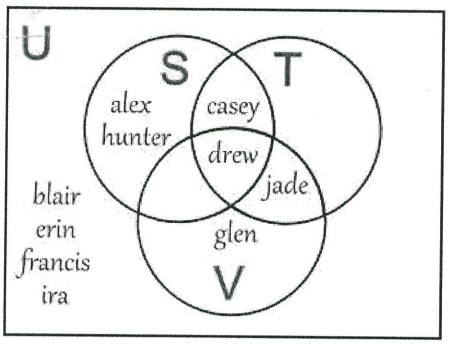

Figure Q1(c)

Find the relationship between the set $(S \cap T) \cup V$ and $(S \cap T) \cup V$.

(8 marks)

Q2 (a) Find the solution of x which satisfy the following inequalities.

$$1 - \frac{7x-1}{8} > \frac{3x-2}{4}$$

(5 marks)

(b) Find the set values of x for which $\frac{x^2 - 5x + 4}{(2x+3)} \geq 0$. Draw the conclusion of your answer.

(15 marks)

Q3 (a) Simplify the following expressions and justify your answer

(i) $\sqrt[3]{16y^3x^4} - \sqrt[3]{54y^3x^4}$

(ii) $\left(\frac{(2xz^{-3})^4(x^{-2}z)^2}{(2xz^2)^3}\right)^5$

(6 marks)

(b) Solve the following equations

(i) $\log(x) + \log(x-1) = \log(8x-12) - \log(2)$.

(ii) $\log_2(x+3) + \log_2(x-3) = 4$.

(8 marks)

(c) Calclulate

$$\frac{\log\sqrt{27} + \log 8 - \log\sqrt{1000}}{\log 12 - \log 10}$$

(4 marks)

Q4 (a) The coordinates of the points P and Q are $(-4, 6)$ and $(5, 3)$ respectively. If the point $A(p, q)$ is equidistant from the point P and Q, justify that $q = 3(p+1)$

(5 marks)

(b) Find the equation of the straight line that has

(i) a gradient of -2 and passes through the point $(6, 2)$

(ii) a gradient of $\frac{3}{4}$ and passes through the point $(-7, 3)$

(8 marks)

(b) Determine whether PQ is parallel or perpendicular to TU, given $P(2, 19)$, $Q(6, 9)$, $T(0, -1)$ and $U(-4, 9)$.

(7 marks)

Q5 (a) State which quadrant and find the reference angle for

(i) 114.55°

(ii) $227^{\circ}\,18'$

(6 marks)

(b) Solve for all values in the region of 0° and 360° :

(i) $\sin x = \sin 18^{\circ}\,35'$

(ii) $\cos y = -\cos 56^{\circ}\,15'$

(8 marks)

(c) By using Table Q5, solve the trigonometric functions given.

Table Q5

Angle θ	$\sin\theta$	$\cos\theta$	$\tan\theta$
0°	0	1	0
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
45°	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$

(i) $\sin 30^{\circ} + \cos 45^{\circ}$

(ii) $3\cos 60^{\circ} - 2\sin 45^{\circ}$

(6 marks)

Q6 (a) Given three vectors, $\boldsymbol{u} = 3\boldsymbol{i} + 5\boldsymbol{j} - 4\boldsymbol{k}$, $\boldsymbol{v} = -2\boldsymbol{i} + 3\boldsymbol{k}$ and $\boldsymbol{w} = 4\boldsymbol{i} - \boldsymbol{j} + 2\boldsymbol{k}$.

(i) Find $\boldsymbol{v} + 3\boldsymbol{w} - 2\boldsymbol{u}$ and hence $|\boldsymbol{v} + 3\boldsymbol{w} - 2\boldsymbol{u}|$

(ii) Find $\boldsymbol{u} \cdot \boldsymbol{w}$ and $\boldsymbol{u} \times \boldsymbol{w}$. Hence, determine the difference between $\boldsymbol{u} \cdot \boldsymbol{w}$ and $\boldsymbol{u} \times \boldsymbol{w}$.

(10 marks)

(b) Find the equation of a line that passes through $P(2, 5, -3)$ and $Q(1, -4, -2)$.

(5 marks)

(c) Find the equation of a plane containing $P(1, 3, -1)$, $Q(-1, -1, 2)$ and $R(-2, 0, 4)$.

(5 marks)

Q7 (a) Simplify the following

(i) $i(4i)(-3i)$

(iii) $i^{101}(1-3i)$

(5 marks)

(b) If $z_1 = 1+i$ and $z_2 = 1+i$, find

(i) z_2^2

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

(5 marks)

(b) Given $z_1 = 3 + 4i$ and $z_2 = 1 - \sqrt{3}\,i$,

(i) Find the modulus and argument for z_1 and for z_2 in polar form

expression.

(iii) Hence conclude the expression of $z_1 z_2$ in polar form.

(10 marks)

- END OF QUESTION -

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FORMULA

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

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 $Q(x_2, y_2)$ i $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

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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 $\boldsymbol{a} \bullet \boldsymbol{b} = a_1\, b_1 + a_2\, b_2 + a_3\, b_3$

(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 $\overline{z} = a - bi$

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