BINDURA UNIVERSITY OF SCIENCE EDUCATION MT015

MATHEMATICS BRIDGING COURSE

Time: $2\frac{1}{2}$ Hours AUG 2024

Candidates should attempt six questions. Marks will be allocated as indicated.

Each question should start on a fresh page.

QUESTION 1 [20 MARKS]

(a) Solve the equation $\frac{a-2}{5} = 1\frac{1}{2}$. [3]

(b) Solve the inequality $21 < 4n - 3 \leq 27$. [3]

(c) Factorise completely (i) $18t^2 - 2$. [3]

(ii) $10m^2 - tr - 2mt + 5mr$. [2]

(d) Given that $T = g + \sqrt{n^3 - m}$.

(i) Find T when $g = -4$, $n = 3$ and $m = -9$. [2]

(ii) Make m the subject of the formula. [3]

(e) Solve the equation $\frac{4-x}{x} = \frac{x}{2}$. [4]

QUESTION 2 [20 MARKS]

(a) Simplify the following expressions

(i) $P^0 \times P^4 \times P^{-3}$ [2]

(ii) $x^{a+b} \times x^{3a+b}$ [2]

(iii) $18x^{-5} \div 9x^4$ [2]

(b) Given that $\log 2 = 0.3010$ and $\log 3 = 0.4771$

Calculate

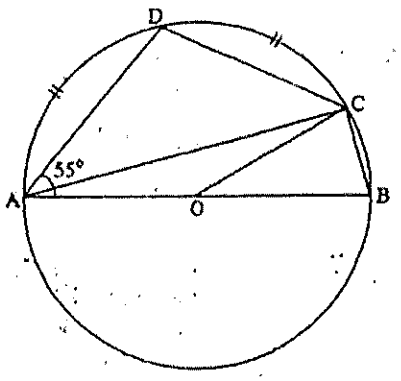
(i) $\log 6$ [2]

(ii) $\log 1.5$ [3]

(iii) $\log \sqrt{2}$ [3]

(c) In the diagram ABCD is a circle center O. Arc$AD = arc\ DC$, $D\hat{A}O = 55°$ and

AOB is a straight line



Calculate

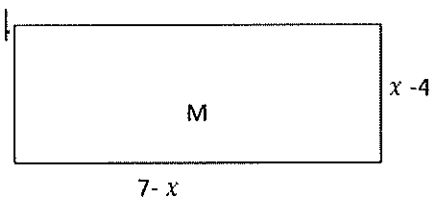
(i) $B\widehat{C}D$ [2]

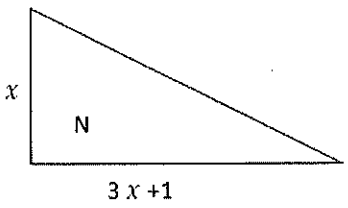
(ii) $A\widehat{C}B$ [2]

(iii) $D\widehat{A}C$ [2]

QUESTION 3 [20 MARKS]

(a)The diagram shows a rectangle and a right-angled triangle. The lengths of the sides of the rectangle M are $(x+4)$ cm and $(7-x)$ cm. The lengths of two of the sides of the triangle N are x cm and $(3x+1)$ cm as shown





Write-down an expression in terms of x, for the area of

(i) rectangle M

(ii) rectangle N [4]

(b) Given that the area of rectangle M is twice the area of triangle N, form an equation in x and shows that it reduces to $2x^2 - x - 14 = 0$. [3]

(c) Solve the equation in (b), giving your answers correct to 3 significant figures. [5]

(d) Write down the dimensions of rectangle-M correct to the nearest millimetre. [2]

(e) Three points L, M and A are on horizontal ground with M due east of L.The bearing of A from L is 048° and from M is 325°. LA= 11 km and MA= 9km. Calculate

(i) LÂM, [3]

(ii) LM. [3]

QUESTION 4 [20 MARKS]

(a) Express

(i) $\frac{1}{m} - \frac{3}{2-5m}$ as a single fraction in its lowest terms. [2]

(ii) $\frac{b}{a^2-ab} + \frac{a}{b^2-ab}$ as a single fraction in its lowest terms. [5]

(b) Factorise completely $ax - a + x - 1$. [1]

(c) If $x = \frac{3m-5}{3m+5}$, express $\frac{x-1}{x+1}$ in terms of m. [4]

(d) Expand $(g - 2h + 2)(g - h)$ giving your answer in its simplest form. [2]

(e) In a Mathematics bridging course test, x students got less than 47 marks, $2x$ students got more than 45 marks while 6 students got exactly 46 marks. Show this information on a Venn diagram. There were 30 students in the class, find the value of x. [6]

QUESTION 5 [20 MARKS]

(a) To start a new bus company, a businessman needs at least 5 buses and 10 minibuses. He does not want to have more than 30 vehicles altogether. A bus takes up 3 units of garage space, a minibus takes up 1 unit of garage space and there are only 54 units of garage space available. If x and y are the numbers of buses and minibuses respectively,

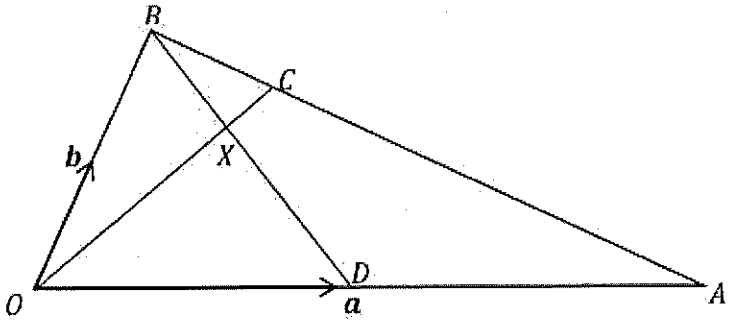
(i) Write down four inequalities which represent the restrictions on the businessman

(ii) Draw a graph which shows a region representing possible values of x and y. [5]

(b) If $M = \begin{bmatrix} 2 & 3 \\ -4 & 1 \end{bmatrix}$. Find $\boldsymbol{M^{-1}}$, the inverse matrix of **M** and hence solve the simultaneous equations

$$2x + 3y = 4 \ldots \text{(i)}$$
$$-4x + y = 6 \ldots \text{(ii)}$$ [5]

(c) In the diagram below, $\overrightarrow{OA} = \boldsymbol{a}, \overrightarrow{OB} = \boldsymbol{b}$. The point C is such that $AC = 3CB$ and the point D is such that OD = DA.



(i) Express in terms of $\boldsymbol{a}$ and/ or $\boldsymbol{b}$ the vectors $\overrightarrow{AB}$, $\overrightarrow{OD}$, $\overrightarrow{AC}$, and $\overrightarrow{OC}$.

(ii) OC and BD meet at $\overrightarrow{BX} = \overrightarrow{kBD}$, express BX in terms of $\boldsymbol{a}$, $\boldsymbol{b}$, and $\boldsymbol{k}$, hence show that $\overrightarrow{OX} = \frac{1}{2}ka + (1-k)b$.

(iii) Given also that $\overrightarrow{OX} = h\overrightarrow{OC}$, express OX in terms of $\boldsymbol{a}, \boldsymbol{b}$, and $\boldsymbol{h}$.

(iv) Using these two expressions for $\overrightarrow{OX}$, find the values of $\boldsymbol{h}$ and $\boldsymbol{k}$.

(v) Find the numerical values of the ratio $BX:XD$. [10]

QUESTION 6 [20 MARKS]

(a) When a biased coin is tossed, the probability of getting a head is 0.6. For this coin find

(i) the probability of getting a tail if it is tossed once. [1]

(ii) The probability of getting at least one head if it tossed twice, [2]

(iii) the expected number of heads if it is tossed 50 times. [2]

(b)The following entries shows the number of bicycles sold per day in nine days;

6; 10; 12; 9 14; 10; 15; 10; 12. Find;

(i) median

(ii) the next entry if the new mean of the tenth day is 12. [3]

(c) Answer the whole of this question on a sheet of graph paper.

The amount of maize sold to the grain marketing board by small scale farmers in the Hurudza area is shown in the table below.

Mass (t)	$0 < x \leq 6$	$6 < x \leq 10$	$10 < x \leq 15$	$15 < x \leq 20$	$20 < x \leq 26$	$26 < x \leq 30$
Number of farmers	0	3	7	5	3	1

(i) Using a horizontal scale of 2cm to represent 5 tonnes on the horizontal scale axis and a vertical scale of 2cm to represent 5 farmers draw a smooth cumulative frequency curve to illustrate this information. use the graph to estimate

(a) the median for this distribution.

(b) The number of farmers who sold 24 tonnes or less. [6]

(ii) A farmer is chosen at random. Calculate the probability that he sold 10 tonnes or less. [2]

(iii) Two farmers are chosen at random. Calculate the probability that each farmer sold more than 10 tonnes but less than or equal to 20 tonnes. [4]

Question 7

(a) On the plane paper provided, use ruler and compasses only to construct a 30^0 angle. Show all your constructing lines. [4]

(b) On the plane paper provided, use ruler and compasses only to construct an equilateral triangle with side length 6cm. [6]

(c) The image of P under a 2×2 matrix $N = \begin{bmatrix} 5 & 3 \\ 3 & 2 \end{bmatrix}$ is $P_1(-4; 7)$. Find P. [4]

(d) The matrix M is given by $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$.

(i) Interpret geometrically the transformation represented by matrix M. [3]

(ii) Triangle ABC has vertices $A(-2;\ 1)$, $B(0; 4)$ and $C(8; 0)$. Find the vertices of triangle $A^1B^1C^1$, the image of triangle ABC under M. [3]

END OF EXAMINATION