THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

141 BASIC APPLIED MATHEMATICS

(For Both School and Private Candidates)

Time: 3 Hours **ANSWERS** **Year: 2013**

Instructions

1. This paper consists of **Ten (10)** questions.
2. Answer all questions.
3. **All** work done and answers of each question must be shown clearly.
4. NECTA'S Mathematical tables and Non-programmable calculations may be used
5. All writing must be in **black** or **blue** ink, **except** drawing which must be in pencil.

Prepared by: Maria Marco for TETEA

1. (a) By using a non-programmable calculator: Compute the value of $\sqrt{(3.141\times2.751)/(47\times39.8)}$ and write your answer in 6 decimal places

First, compute the numerator: $3.141 \times 2.751 = 8.640891$

Compute the denominator: $47 \times 39.8 = 1870.6$

Fraction: $8.640891 / 1870.6 \approx 0.004619$

Square root: $\sqrt{(0.004619)} \approx 0.067963$

To 6 decimal places: 0.067963

Answer: 0.067963

(b) Find the sum of the finite series [1/2 + 1/3 + 1/5 + 1/7 + 1/9 + 1/11] and write your answer in 4 decimal places

Sum = 1/2 + 1/3 + 1/5 + 1/7 + 1/9 + 1/11

= 0.5 + 0.3333 + 0.2 + 0.1429 + 0.1111 + 0.0909

≈ 0.5 + 0.3333 = 0.8333

0.2 = 1.0333

0.1429 = 1.1762

0.1111 = 1.2873

0.0909 = 1.3782

To 4 decimal places: 1.3782

Answer: 1.3782

(c) Find the mean length of 200 engine components that were measured and recorded as follows:

Length (mm) | 198 | 199 | 200 | 201 | 202

Frequency | 8 | 30 | 132 | 24 | 6

Mean = Σ (length × frequency) / total frequency

Total frequency = 8 + 30 + 132 + 24 + 6 = 200

Sum = (198×8) + (199×30) + (200×132) + (201×24) + (202×6)

= 1584 + 5970 + 26400 + 4824 + 1212 = 45990

Mean = 45990 / 200 = 229.95

Answer: Mean = 229.95 mm

(d) Find the value of $^{15}P_6 \times {}^{10}P_2$

$^{15}P_6$ (Permutations of 15 items taken 6 at a time):

$^{15}P_6 = 15! / (15 - 6)! = 15! / 9!$

$= 15 \times 14 \times 13 \times 12 \times 11 \times 10$

$15 \times 14 = 210$

$210 \times 13 = 2730$

$2730 \times 12 = 32760$

$32760 \times 11 = 360360$

$360360 \times 10 = 3603600$

So, $^{15}P_6 = 3603600$

$^{10}P_2$ (Permutations of 10 items taken 2 at a time):

$^{10}P_2 = 10! / (10 - 2)! = 10! / 8!$

$= 10 \times 9$

$= 90$

Multiply:

$^{15}P_6 \times {}^{10}P_2 = 3603600 \times 90$

$3603600 \times 90 = 324324000$

Answer: 324324000

(e) Compute the value of $C_{5,1} \times C_{5,0} \times 91$

$C_{5,1} = 5! / (1! \times 4!) = 5$

$C_{5,0} = 5! / (0! \times 5!) = 1$

$C_{5,1} \times C_{5,0} \times 91 = 5 \times 1 \times 91 = 455$

2. (a) The functions f and g are defined by f: x → ln x and g: x → e^x

(i) Sketch the graphs of f on $0.5 < x \leq 3$ and g on $-3.5 < x \leq 3$ on the same x and y plane

For $f(x) = \ln x$:

Domain: $0.5 < x \leq 3$

At $x = 0.5$, $f(0.5) = \ln 0.5 \approx -0.693$

At $x = 1$, $f(1) = \ln 1 = 0$

At $x = 3$, $f(3) = \ln 3 \approx 1.099$

Graph: Starts at (0.5, -0.693), crosses (1, 0), ends at (3, 1.099), increasing logarithmically.

For g(x) = e^x:

Domain: $-3.5 < x \leq 3$

At x = -3.5, g(-3.5) = e^(-3.5) ≈ 0.030

At x = 0, g(0) = e^0 = 1

At x = 3, g(3) = e^3 ≈ 20.085

Graph: Starts at (-3.5, 0.030), passes through (0, 1), ends at (3, 20.085), exponential growth.

(ii) State the domain and range of f and g

$f(x) = \ln x$:

Domain: $0.5 < x \leq 3$ (given)

Range: f(0.5) to f(3) → (-0.693, 1.099]

g(x) = e^x:

Domain: $-3.5 < x \leq 3$ (given)

Range: g(-3.5) to g(3) → (0.030, 20.085]

Answer: f: Domain (0.5, 3], Range (-0.693, 1.099]; g: Domain (-3.5, 3], Range (0.030, 20.085]

(iii) Identify the asymptotes for f, g and describe briefly how f and g behave near the asymptotes

$f(x) = \ln x$:

Asymptote: As $x \to 0^+$, $\ln x \to -\infty$ → vertical asymptote at $x = 0$ (just outside the domain).

Behavior: As x approaches 0.5 from the right, f(x) decreases rapidly toward -∞.

g(x) = e^x:

Asymptote: As $x \to -\infty$, $e^x \to 0 \to$ horizontal asymptote at $y = 0$.

Behavior: As x approaches -3.5 from the right, g(x) gets closer to 0 but never reaches it.

Answer: f: Vertical asymptote at $x = 0$, f decreases rapidly as $x \to 0.5^+$; g: Horizontal asymptote at $y = 0$, g approaches 0 as $x \to -3.5$.

(b) Given f(a) = (a - 1)/(a + 1), show that f(a) = -f(a)

The equation f(a) = -f(a) seems to imply a typo. Let's assume the intended problem is to show f(a) = -f(-a) (a common property to verify).

$f(a) = (a - 1)/(a + 1)$

$f(-a) = (-a - 1)/(-a + 1) = -(a + 1)/(1 - a) = (a + 1)/(a - 1)$

$-f(-a) = -(a + 1)/(a - 1)$

3. arithmetic series, one is a geometric series and the remaining is neither

A: 4 + 128 + 64 + 32 + …

B: 4 + 8 + 12 + 24 + …

C: 38 + 35 + 32 + 29 + …

(i) State the value of the common difference of the arithmetic series and calculate the 21st term of the series

A: 4, 128, 64, 32 → Differences: 124, -64, -32 (not constant); Ratios: 32, 1/2, 1/2 (geometric).

B: 4, 8, 12, 24 → Differences: 4, 4, 12 (not constant); Ratios: 2, 1.5, 2 (not geometric).

C: 38, 35, 32, 29 → Differences: -3, -3, -3 (arithmetic).

Common difference of C: -3

21st term of C: $a_n = a_1 + (n-1)d$

$a_1 = 38$, $d = -3$, $n = 21$

$a_{21} = 38 + (21-1)(-3) = 38 + 20(-3) = 38 - 60 = -22$

Answer: Common difference = -3, 21st term = -22

(ii) Find S_{10} of the geometric series

Geometric series A: 4, 128, 64, 32 → $a = 4$, $r = 128/4 = 32$ (but $64/128 = 1/2$, so correct $r = 1/2$ from the 2nd term onward; first term seems off). Let's correct: 128, 64, 32 → $a = 128$, $r = 1/2$.

Assume A starts at 128: $S_n = a (1 - r^n) / (1 - r)$

$S_{10} = 128 (1 - (1/2)^{10}) / (1 - 1/2)$

$(1/2)^{10} = 1/1024$

$1 - 1/1024 = 1023/1024$

$S_{10} = 128 (1023/1024) / (1/2) = 128 \times 1023/1024 \times 2 = 255.75$

Adjust for A starting at 4: $r = 1/2 \rightarrow S_{10} = 4 (1 - (1/2)^{10}) / (1 - 1/2) = 4 (1023/1024) / (1/2) = 7.992$

Answer: $S_{10} = 7.992$

(b) If the length of a paper in a roll of given dimensions varies inversely as the thickness of the paper, find the increase in length when the thickness of a paper in a 100 m roll is decreased from 0.25 mm to 0.20 mm

Length L varies inversely with thickness t: $L = k/t$

At $L = 100$ m, $t = 0.25$ mm: $100 = k/0.25 \rightarrow k = 100 \times 0.25 = 25$

New thickness $t = 0.20$ mm: $L = 25/0.20 = 125$ m

Increase = 125 - 100 = 25 m

Answer: Increase = 25 m

4. (a) Differentiate with respect to x the functions:

(i) $f(x) = x^{(\ln x)}$

Let $y = x^{(\ln x)}$

Take ln: $\ln y = \ln x \times \ln x = (\ln x)^2$

Differentiate: $(1/y)\, dy/dx = 2 \ln x \times (1/x)$

$dy/dx = y \times 2 \ln x / x = x^{(\ln x)} \times (2 \ln x / x)$

Answer: $dy/dx = x^{(\ln x)} \times (2 \ln x / x)$

(ii) $y = (x^3 - 1)/(x^2 - 2x)$

Quotient rule: $(u/v)' = (u'v - uv')/v^2$

$u = x^3 - 1$, $v = x^2 - 2x$

$u' = 3x^2$, $v' = 2x - 2$

$dy/dx = [(3x^2)(x^2 - 2x) - (x^3 - 1)(2x - 2)] / (x^2 - 2x)^2$

$= [3x^4 - 6x^3 - (2x^4 - 2x^3 - 2x + 2)] / (x^2 - 2x)^2$

$= [3x^4 - 6x^3 - 2x^4 + 2x^3 + 2x - 2] / (x^2 - 2x)^2$

$= [x^4 - 4x^3 + 2x - 2] / (x^2 - 2x)^2$

Answer: $dy/dx = (x^4 - 4x^3 + 2x - 2) / (x^2 - 2x)^2$

(iii) $x^2 + y^2 + x^2y - 2x + 3y = 0$

Implicit differentiation:

$2x + 2y\, dy/dx + (2xy + x^2\, dy/dx) - 2 + 3\, dy/dx = 0$

$(2y + x^2 + 3)\, dy/dx = -2x - 2xy + 2$

$dy/dx = (-2x - 2xy + 2) / (2y + x^2 + 3)$

Answer: $dy/dx = (-2x - 2xy + 2) / (2y + x^2 + 3)$

(b) Find the turning points of the polynomial function $y = x^3 - x^2$ and hence sketch the graph of this function

$y = x^3 - x^2$

$dy/dx = 3x^2 - 2x = x(3x - 2)$

Set $dy/dx = 0$: $x = 0$ or $3x - 2 = 0 \rightarrow x = 2/3$

Second derivative: $d^2y/dx^2 = 6x - 2$

At $x = 0$: $d^2y/dx^2 = -2 < 0 \rightarrow$ local maximum

At $x = 2/3$: $d^2y/dx^2 = 6(2/3) - 2 = 4 - 2 = 2 > 0 \rightarrow$ local minimum

Turning points:

$x = 0$: $y = 0 \rightarrow (0, 0)$

$x = 2/3$: $y = (2/3)^3 - (2/3)^2 = 8/27 - 4/9 = 8/27 - 12/27 = -4/27 \rightarrow (2/3, -4/27)$

Sketch:

x-intercepts: $x^2(x - 1) = 0 \rightarrow x = 0, x = 1$

Passes through (0, 0) (max), (2/3, -4/27) (min), (1, 0).

Answer: Turning points: (0, 0) maximum, (2/3, -4/27) minimum.

5. (a) Evaluate the integrals:

(i) $\int \sin(4x + 6)\, dx$

$\int \sin(4x + 6)\, dx$

Substitute $u = 4x + 6 \rightarrow du = 4\, dx \rightarrow dx = du/4$

$\int \sin u\, (du/4) = (1/4) \int \sin u\, du = (1/4)(-\cos u) + C$

$= -(1/4) \cos(4x + 6) + C$

Answer: $-(1/4) \cos(4x + 6) + C$

(ii) $\int (x^2 - 1/x)\, dx$

$\int (x^2 - 1/x)\, dx = \int x^2\, dx - \int (1/x)\, dx$

$= (x^3/3) - \ln|x| + C$

Answer: $(x^3/3) - \ln|x| + C$

(b) The graph of $y = 4/(x - 1)$ is shown in the sketch below together with the line $y = 4$

Graph shows $y = 4/(x - 1)$ with a vertical asymptote at $x = 1$, and the line $y = 4$. Shaded area is between $x = 2$ and $x = 3$.

Find the volume generated when the shaded area is rotated completely about the x-axis, leaving your answer in terms of π

Shaded area: Between $y = 4/(x - 1)$ and $y = 4$ from $x = 2$ to $x = 3$.

At $x = 2$, $y = 4/(2 - 1) = 4$; at $x = 3$, $y = 4/(3 - 1) = 2$.

$y = 4/(x - 1)$ is below $y = 4$ in this interval.

Volume by washers: $V = \pi \int$ (from 2 to 3) [(outer radius)^2 - (inner radius)^2] dx

Outer radius = 4, inner radius = $4/(x - 1)$

$V = \pi \int$ (from 2 to 3) $[4^2 - (4/(x - 1))^2]\, dx$

$= \pi \int$ (from 2 to 3) $[16 - 16/(x - 1)^2]\, dx$

$= \pi [16x + 16/(x - 1)]$ (from 2 to 3)

At $x = 3$: $16(3) + 16/(3 - 1) = 48 + 8 = 56$

At $x = 2$: $16(2) + 16/(2 - 1) = 32 + 16 = 48$

$V = \pi (56 - 48) = 8\pi$

Answer: Volume = 8π

6.The scores of 40 students in a mathematics test are given below

Scores | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 | 81-90

Number of students | 3 | 6 | 10 | 8 | 6 | 4 | 3

(a) Represent the students' scores in a histogram and then use it to calculate the mode

Histogram:

Class widths: 10 (e.g., 21-30, 31-40, etc.)

Heights = frequencies: 3, 6, 10, 8, 6, 4, 3

Mode:

Modal class: 41-50 (highest frequency = 10)

Mode = $L + [(f_m - f_{(m-1)}) / (2f_m - f_{(m-1)} - f_{(m+1)})] \times w$

$L = 41$, $f_m = 10$, $f_{(m-1)} = 6$, $f_{(m+1)} = 8$, $w = 10$

Mode = $41 + [(10 - 6) / (2\times10 - 6 - 8)] \times 10$

$= 41 + (4 / (20 - 14)) \times 10 = 41 + (4/6) \times 10 = 41 + 20/3 \approx 47.67$

Answer: Mode ≈ 47.67 (Histogram: bars at 21-30: 3, 31-40: 6, 41-50: 10, 51-60: 8, 61-70: 6, 71-80: 4, 81-90: 3)

(b) Find:

(i) Variance of the scores

Midpoints: 25.5, 35.5, 45.5, 55.5, 65.5, 75.5, 85.5

Mean = Σ (midpoint × frequency) / total frequency

Total frequency = $3 + 6 + 10 + 8 + 6 + 4 + 3 = 40$

Sum = (25.5×3) + (35.5×6) + (45.5×10) + (55.5×8) + (65.5×6) + (75.5×4) + (85.5×3)

= 76.5 + 213 + 455 + 444 + 393 + 302 + 256.5 = 2140

Mean = 2140 / 40 = 53.5

Variance = Σ (frequency × (midpoint - mean)²) / n

$(25.5 - 53.5)^2 = 28^2 = 784$

$(35.5 - 53.5)^2 = 18^2 = 324$

$(45.5 - 53.5)^2 = 8^2 = 64$

$(55.5 - 53.5)^2 = 2^2 = 4$

$(65.5 - 53.5)^2 = 12^2 = 144$

$(75.5 - 53.5)^2 = 22^2 = 484$

$(85.5 - 53.5)^2 = 32^2 = 1024$

Sum = (784×3) + (324×6) + (64×10) + (4×8) + (144×6) + (484×4) + (1024×3)

= 2352 + 1944 + 640 + 32 + 864 + 1936 + 3072 = 10840

Variance = 10840 / 40 = 271

Answer: Variance = 271

(ii) The standard deviation of the scores

Standard deviation = √Variance = √271 ≈ 16.462

Answer: Standard deviation ≈ 16.462

7. (a) Draw 2 possible venn diagrams representing two events A and B in a sample space S

Venn Diagram 1 (A and B overlapping):

Sample space S is a rectangle.

A and B are two circles inside S, with some overlap (A ∩ B).

Regions: A only, B only, A ∩ B, and outside both (S - (A ∪ B)).

Venn Diagram 2 (A and B disjoint):

Sample space S is a rectangle.

A and B are two non-overlapping circles inside S.

Regions: A only, B only, and outside both $(S - (A \cup B))$.

Answer: (I can confirm if you'd like to generate sketches for the Venn diagrams.)

(i) and then write down the formulae corresponding to $P(A \cap B)$

If A and B overlap:

$P(A \cap B)$ is the probability of the overlapping region.

General formula: $P(A \cap B) = P(A)P(B)$ if A and B are independent, or use $P(A \cap B) = P(A) + P(B) - P(A \cup B)$ if not independent.

If A and B are disjoint (mutually exclusive):

$P(A \cap B) = 0$ (since they don't overlap).

Answer: For overlapping: $P(A \cap B) = P(A)P(B)$ (if independent) or $P(A) + P(B) - P(A \cup B)$; for disjoint: $P(A \cap B) = 0$

(ii) Given that A and B are mutually exclusive events with probabilities $P(A) = 1/4$ and $P(B) = 2/3$, find $P(A \cap B)$

Since A and B are mutually exclusive, $P(A \cap B) = 0$.

Answer: $P(A \cap B) = 0$

(b) Ntibagomba is going on holiday. He has 6 different shirts and has decided that he only needs to take 3 shirts. Find the number of different selections that he can make

Number of ways to choose 3 shirts from 6: $C(6, 3)$

$C(6, 3) = 6! / (3! \times 3!) = (6 \times 5 \times 4) / (3 \times 2 \times 1) = 20$

Answer: 20 selections

(c) Find the number of ways that six children Kauki, John, Tito, Ben, Kato and Sara can stand in a line outside the canteen waiting for lunch

Number of ways to arrange 6 distinct children: $6!$

$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

Answer: 720 ways

8. (a) If A is an acute angle such that $\tan A = 3/4$, find without using tables or calculator, the values of (i) $\cos 2A$ and (ii) $\sin A/2$

Given $\tan A = 3/4$, A is acute.

$\tan A$ = opposite/adjacent = 3/4 → hypotenuse = $\sqrt{(3^2 + 4^2)} = \sqrt{25} = 5$

$\sin A = 3/5$, $\cos A = 4/5$

(i) $\cos 2A$:

$\cos 2A = \cos^2 A - \sin^2 A = (4/5)^2 - (3/5)^2 = 16/25 - 9/25 = 7/25$

(ii) $\sin A/2$:

$\sin A/2 = \pm\sqrt{[(1 - \cos A)/2]}$

$\cos A = 4/5 \rightarrow 1 - \cos A = 1/5$

$\sin A/2 = \pm\sqrt{[(1/5)/2]} = \pm\sqrt{(1/10)} = \pm\sqrt{10}/10$

Since A is acute, A/2 is also acute → $\sin A/2 = \sqrt{10}/10$

Answer: (i) $\cos 2A = 7/25$, (ii) $\sin A/2 = \sqrt{10}/10$

(b) Solve the equation $2 \sin (x + 60°) = \cos (x - 30°)$ in the range $0° \le x \le 360°$ by expanding the sine and the cosine terms

Expand: $2 \sin(x + 60°) = 2 [\sin x \cos 60° + \cos x \sin 60°] = 2 [\sin x (1/2) + \cos x (\sqrt{3}/2)] = \sin x + \sqrt{3} \cos x$

$\cos(x - 30°) = \cos x \cos 30° + \sin x \sin 30° = \cos x (\sqrt{3}/2) + \sin x (1/2) = (\sqrt{3}/2) \cos x + (1/2) \sin x$

Equation: $\sin x + \sqrt{3} \cos x = (\sqrt{3}/2) \cos x + (1/2) \sin x$

Rearrange: $\sin x + \sqrt{3} \cos x - (\sqrt{3}/2) \cos x - (1/2) \sin x = 0$

$(\sin x - (1/2) \sin x) + (\sqrt{3} \cos x - (\sqrt{3}/2) \cos x) = 0$

$(1/2) \sin x + (\sqrt{3}/2) \cos x = 0$

$(1/2) \sin x = -(\sqrt{3}/2) \cos x$

$\tan x = -\sqrt{3}$

$x = 180° - 60° = 120°$, $360° - 60° = 300°$ (in the range $0° \le x \le 360°$)

Answer: $x = 120°, 300°$

9.(a) Given that A = [3 1] and B = [-4 3], verify that $(AB)^T = B^T A^T$

[5 2]   [-5 2]

AB:

A × B = [3 1] [-4 3] = [(3×-4 + 1×-5) (3×3 + 1×2)]

[5 2] [-5 2]   [(5×-4 + 2×-5) (5×3 + 2×2)]

= [-17 11]

[-30 19]

$(AB)^T$:

[-17 -30]

[11   19]

$B^T A^T$:

B^T = [-4 -5]

[3   2]

A^T = [3 5]

[1 2]

$B^T A^T$ = [-4 -5] [3 5] = [(-4×3 + -5×1) (-4×5 + -5×2)]

[3   2] [1 2]   [(3×3 + 2×1) (3×5 + 2×2)]

= [-17 -30]

[11   19]

$(AB)^T = B^T A^T$, verified.

Answer: $(AB)^T = B^T A^T$ = [-17 -30]

[11   19]

(b) Show whether the following system of equations has a common solution or not: 7x - 3y - 3z = 7, 2x + 4y + z = 0, x - 2y - z = 2

Write in matrix form: AX = B

A = [7 -3 -3]

[2 4 1]

[1 -2 -1], X = [x]

[y]

[z], B = [7]

[0]

[2]

Det(A) = 7(4×-1 - 1×-2) - (-3)(2×-1 - 1×1) + (-3)(2×-2 - 4×1)

= 7(-1 + 2) - (-3)(-2 - 1) + (-3)(-4 - 4)

= 7(1) - (-3)(-3) + (-3)(-8) = 7 - 9 + 24 = 22

Since Det(A) ≠ 0, A is invertible, and the system has a unique solution.

Answer: The system has a common (unique) solution (Det(A) ≠ 0).

(c) The results of three soccer teams Simba (S), Yanga (Y) and Mtiwa Sugar (M) are shown in matrix R and the points awarded for each team in matrix P

R = [6 2 4] W D L Points

[4 3 1] S P = [5]

[7 1 4] Y D [1]

M L [0]

Multiply the matrices and hence state which team has many points

R × P = [6 2 4] [5]

[4 3 1] [1]

[7 1 4] [0]

S: 6×5 + 2×1 + 4×0 = 30 + 2 = 32

Y: 4×5 + 3×1 + 1×0 = 20 + 3 = 23

M: 7×5 + 1×1 + 4×0 = 35 + 1 = 36

Result: [32]

[23]

[36]

Mtiwa Sugar (M) has the most points (36).

Answer: [32]

[23]

[36]; Mtiwa Sugar has the most points (36).

10.

The data for M & P Company, which manufactures tables and chairs, is given in the table below:

Assembly Department | 16 | 4 | 800

Finishing Department | 4 | 2 | 240

Profit per Item | Shs. 10,000/= | Shs. 40,000/=

(a) How many tables and chairs should be manufactured to realize a maximum profit?

Let x = number of tables, y = number of chairs.

Objective: Maximize $P = 10000x + 40000y$

Constraints:

Assembly: $16x + 4y \leq 800 \rightarrow 4x + y \leq 200$

Finishing: $4x + 2y \leq 240 \rightarrow 2x + y \leq 120$

$x \geq 0, y \geq 0$

Graph:

$4x + y \leq 200 \rightarrow (50, 0), (0, 200)$

$2x + y \leq 120 \rightarrow (60, 0), (0, 120)$

Vertices:

(0, 0)

(0, 120) (from $2x + y = 120, x = 0$)

(50, 0) (from $4x + y = 200, y = 0$)

Intersection: $4x + y = 200, 2x + y = 120 \rightarrow 2x = 80 \rightarrow x = 40, y = 120 - 2(40) = 40 \rightarrow (40, 40)$

Evaluate P:

(0, 0): P = 0

(0, 120): P = 10000(0) + 40000(120) = 4800000

(50, 0): P = 10000(50) + 40000(0) = 500000

(40, 40): P = 10000(40) + 40000(40) = 400000 + 1600000 = 2000000

Maximum at (0, 120).

Answer: 0 tables, 120 chairs

(b) What is the maximum profit?

From (a), maximum at (0, 120): P = 4800000 Shs.

Answer: Maximum profit = 4800000 Shs.