

RWANDA NATIONAL EXAMINATIONS COUNCIL.

Mathematics VII

113

06 Oct 2004

8h30-11h30



P.O.BOX 3817 KIGALI TEL/FAX 586871

NATIONAL EXAMINATION 2003/2004

SUJECTS : MATHEMATICS VII

LEVEL : TRONC COMMUN

DURATION : 3 HOURS

INSTRUCTIONS:

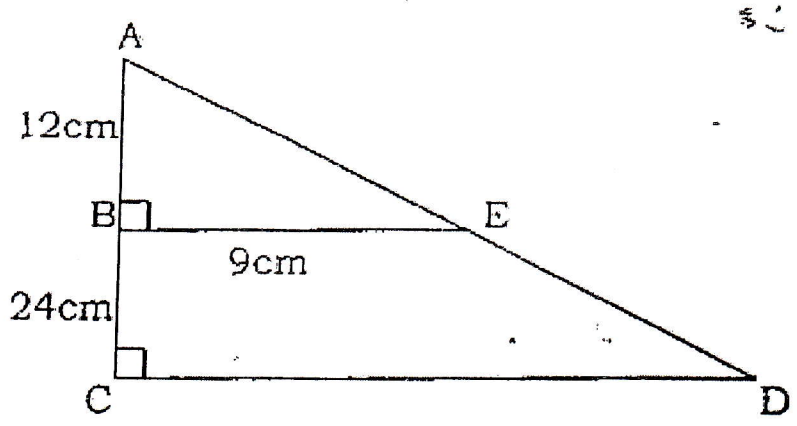
- This paper consists of **TWO** Sections **A** and **B**.
- Attempt **ALL** questions in Section **A** and any **THREE** questions in Section **B**.
- Show **ALL** working clearly.
- Calculators and mathematical instruments may be used.

SECTION A: /55 Marks

1. Evaluate the following completely: $\frac{0.5 \times 0.04 \times 0.08}{0.9 \times 0.16}$ (3 marks)

2. Determine the equation of a line which passes through points (0, -1) and (3, 5). (3 marks)

3. In the figure below calculate the length AD.



4. The surface area of a cone is 47.1 cm² and the radius of the base is 3cm. Calculate the volume of the cone. Take $\pi = 3.14$. (3 marks)

5. Solve for x: $(125)x \div (25)2x + 1 = 1$. (3 marks)

6. Solve the following simultaneous equations by elimination method:
 $x + 2y = 40$
 $y = 60 - 3x$. (3 marks)

7. \overline{AB} and \overline{CD} are two line segments such that coordinates of their terminal points are A(-2, 1), B(3, 6), C(0, -4) and D(3, -1). Use vectors to show that \overline{AB} is parallel to \overline{CD} . (3 marks)

8. The average age of 3 students is 15 years. The youngest student is $\frac{1}{2}$ times as old as the oldest student while the oldest student is $1\frac{1}{3}$ times as old as the third student. Find the age of each student. (4 marks)

9. Given that $m = 5$, $n = 1$, $x = 6$ and $y = 9$, Find the value of $\frac{m}{y} - \frac{n}{x} \div (\frac{m}{x} + \frac{n}{y})$. (4 marks)

10. Solve: $\sqrt{x^2 + 2x + 1} = 3$. (3 marks)

11. Simplify $\frac{\sqrt{45} + \sqrt{125}}{\sqrt{80} - \sqrt{20}}$ completely. (3½ marks)

12. Solve the inequality $\frac{1}{3}x - (x + 1) \geq 3$ and illustrate the answer on a graph. (3 marks)

13. In a class of 40 pupils, 26 play football and 20 play volleyball. 17 pupils play both games. How many pupils play no game at all? **(4½ marks)**
14. The size of the exterior angle of a regular polygon is 60° less than the interior angle. Find: (a) the size of the interior angle. **(2½ marks)**
(b) the number of sides of the polygon. **(2 marks)**
15. John invested a sum of money at 6%. Sally invested 2000Rwf less than John at 9%. They each earned the same interest. How much money had John invested? **(4½ marks)**
The money was invested for the same period.

SECTION B: /45 Marks

16. (a) Work out the values of y in the table below given that $y = x^2 - x - 2$. Complete the table. (7 marks)

| | | | | | | | |
|---|----|----|----|---|---|---|---|
| X | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| y | | | | | | | |

- (b) Draw the graph of the function $y = x^2 - x - 2$ for $-3 \leq x \leq 3$. Use a scale of 2cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis. (6½ marks)

(c) From the graph determine:

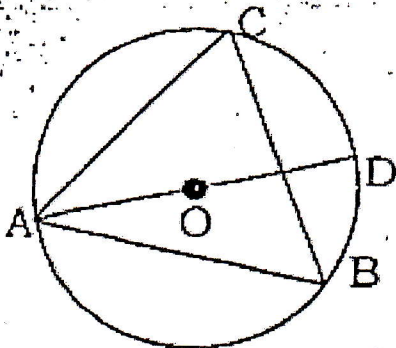
- (i) the value of y when $x = 0.5$. (½ mark)
 (ii) the values of x when $y = -1$. (1 mark)

17. (a) Given that $f(x) = 10x^3 - 3x^2 - 31x - 6$,

- (i) Show that $(x - 2)$ is a factor of $f(x)$. (3 marks)
 (ii) Find the values of x when $f(x) = 0$ (5 marks)

- (b) Solve: $\frac{5}{3x^2 + 7x + 2} + \frac{2x - 3}{x + 2} = 0$, $x \neq -2$ or $x \neq -\frac{1}{3}$. (7 marks)

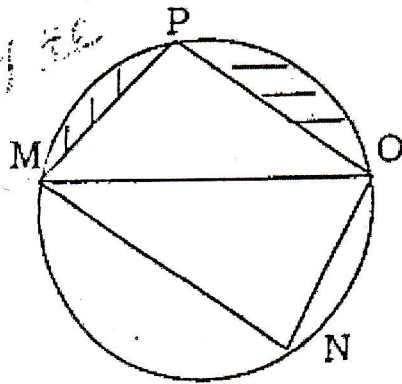
18. (a) In the figure on the left, O is the centre of the circle and line AD is the diameter. Angle $ACB = 50^\circ$.



Find the size of angle:

- (i) $\angle ADB$ (2 marks)
 (ii) $\angle DAB$. (Give reasons for your answer). (2 marks)

(b) In the figure below, line MO is the diameter of the circle.



(i) Given that line $MP = a$, line $PO = b$, line $ON = c$ and line $MN = d$. Show that

$$a = \sqrt{c^2 + d^2 - b^2}$$

(5 marks)

(ii) If $\overline{MO} = 10\text{cm}$ and $\overline{MP} = 8\text{cm}$, calculate the area of shaded part. Take $\pi = 3.14$.

(3 marks)

(iii) Show that triangle MNO is equal to triangle OPM given that line $MN =$ line OP .

(3 marks)

19. Below are the weights of 30 pupils in kilograms.

| | | | | | |
|----|----|----|----|----|----|
| 45 | 62 | 35 | 54 | 48 | 35 |
| 48 | 59 | 52 | 40 | 54 | 46 |
| 59 | 51 | 32 | 37 | 49 | 42 |
| 53 | 38 | 37 | 35 | 53 | 46 |
| 48 | 44 | 33 | 52 | 54 | 44 |

(a) Make a grouped frequency table using intervals of 5kg starting with 30 - 34. Complete the table below.

(10 marks)

| Weights (kgs) | Midpoint, x | Frequency, (f) |
|---------------|---------------|--------------------|
| 30 - 34 | 32 | |
| | | |
| | | |
| | | |
| | | |

(b) Calculate the mean weight of the pupils.

(5 marks)

END

ANSWERS FOR NATIONAL EXAMINATION 2003/2004
MATHEMATICS VII
SECTION A.

| | | |
|---|---|--|
| <p>1. $\frac{0.5 \times 0.04 \times 0.08}{0.9 \times 0.16}$</p> $= \frac{54}{100} \times \frac{4}{100} \times \frac{8}{100}$ $= \frac{9}{10} \times \frac{16}{100}$ $= \frac{54}{100} \times \frac{4}{100} \times \frac{8}{100} \times \frac{10}{9} \times \frac{100}{16}$ $= 0.012$ | <p>2. The slope coefficient of the</p> $\text{right} = \frac{5 - (-1)}{3 - 0} = 2$ <p>The equation of the line:</p> $y - 5 = 2(x - 3)$ $y - 5 = 2x - 6$ $y = 2x - 1.$ | <p>3. $\overline{AE}^2 = \overline{AB}^2 + \overline{BE}^2$</p> $= 12^2 + 9^2 = 225$ $= \overline{AE} = \sqrt{225} = 15\text{cm}$ $\frac{AB}{BC} = \frac{AE}{ED} = \frac{12}{24} = \frac{15}{ED}$ $= 12ED = 15 \times 24$ $= \overline{ED} = \frac{15 \times 24}{12} = 30$ $\overline{AD} = \overline{AE} + \overline{ED}$ $\overline{AD} = 15\text{cm} + 30\text{cm} = 45\text{cm}.$ $\overline{AD} = 45\text{cm}$ |
| <p>4. The curved surface of the cone:</p> $= 3.14 \times 3\text{cm} \times g$ $g = \frac{47.1}{3.14 \times 3} = 5\text{cm}$ <p>The height of the cone:</p> $= \sqrt{5^2 - 3^2} = 4\text{cm}$ <p>Volume of the cone:</p> $\frac{1}{3} \times 3.14 \times 3^2 \times 4$ $V = 37.68\text{cm}^3$ | <p>5. $5^{3x} \div 5^{2(2x+1)} = 1$</p> $5^{3x} = 5^{2(2x+1)}$ $3x + 2(2x + 1) = 0$ $3x - 4x = 2$ $-x = 2$ $x = -2$ | <p>6. $\begin{cases} x + 2(60 - 3x) = 40 \\ y = 60 - 3x \end{cases}$</p> $\begin{cases} x + 120 - 6x = 40 \\ y = 60 - 3x \end{cases}$ $-5x = -80$ $y = 60 - 3x$ $x = 16, y = 12.$ |

$$7. \overline{AB} = \begin{pmatrix} 3 - (-2) \\ 6 - 1 \end{pmatrix} = \begin{pmatrix} 5 \\ 5 \end{pmatrix}$$

$$\overline{CD} = \begin{pmatrix} 3 - 0 \\ -1 - (-4) \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$$

[A,B] and [C,D] are parallel

$$k = \begin{pmatrix} 3 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 5 \end{pmatrix} \text{ so } 3k = 5 = \frac{5}{3}$$

thus $\frac{5}{3} \begin{pmatrix} 5 \\ 3 \end{pmatrix}$ so the two

segments are parallel.

8. - Let x be the age of the greater student.

- the age of the youngest

will be $\frac{x}{2}$

therefore one third will be $\frac{3}{4}x$

$$\frac{x}{2} + x + 4x + \frac{3}{4}x = 15 \times 3 = 45$$

$$2x + 4x + 3x + 180$$

$$9x = 180$$

$$x = 20.$$

Years of the three students

were:

10, 15 and 20 years.

$$9. \frac{m}{y} - \frac{n}{x} = \frac{5}{9} - \frac{1}{6}$$

$$= \frac{10-3}{18} = \frac{7}{18}$$

$$\frac{m}{x} + \frac{n}{y} = \frac{5}{6} + \frac{1}{9} = \frac{15+2}{18}$$

$$= \frac{17}{18}$$

$$\text{So } \frac{\frac{m}{y} - \frac{n}{x}}{\frac{m}{x} + \frac{n}{y}} = \frac{7}{18} \times \frac{18}{17} = \frac{7}{17}$$

$$10. \sqrt{x^2 + 2x + 1} = 3$$

$$\Leftrightarrow x^2 = 2x + 1$$

$$\Leftrightarrow x^2 + 2x - 8 = 0$$

$$\Leftrightarrow x^2 + 4x - 2x - 8 = 0$$

$$\Leftrightarrow x(x+4) - 2(x+4) = 0$$

$$x = 2 \text{ or } x = -4$$

$$11. \frac{3\sqrt{5} + 5\sqrt{5}}{4\sqrt{5} - 2\sqrt{5}}$$

$$= \frac{8\sqrt{5}}{2\sqrt{5}}$$

$$= 4$$

$$12. \frac{1}{3}x - (x+1) \geq 3$$

$$\Leftrightarrow x - 3(x+1) \geq 3.3$$

$$x - 3x - 3 \geq 9$$

$$-2x \geq 12$$

$$x \leq -6$$

13. - Let x be the number of students who play football only.

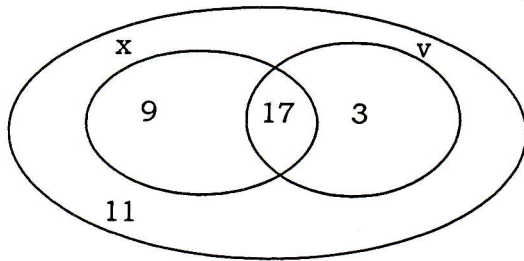
- Let y be the number of students who play volleyball only.

- Z is the number of students who don't play football or volleyball.

$$x = 17 = 26 \Rightarrow x = 9$$

$$y = 17 = 20 \Rightarrow y = 3$$

$$17 + 9 + 3 + z = 40 \Rightarrow z = 11$$



11 pupils play no game at all.

14. (a) x measure the interior angle of regular

polygon is, the exterior angle is $x-60$

$$\text{Thus } \Leftrightarrow x + (x - 60^\circ) = 180^\circ$$

$$\Leftrightarrow 2x = 240^\circ$$

$$\Leftrightarrow x = 120^\circ$$

(b) the exterior angle = $120^\circ - 60^\circ = 60^\circ$

$$\text{The number of sides} = \frac{360^\circ}{60^\circ} = 6$$

Or

$$(n-2)180 = n \times 120$$

$$180n - 360 = 120n$$

$$180n - 120n = 360$$

$$60n = 360$$

$$n = 6 \text{ sides.}$$

15. Let x (Rwf) be the investment for John

The investment of Sally is $(x-2000)$ Rwf

Consider the investment period the

$$\text{interest of John} = \frac{6}{100} x \text{ Frw}$$

$$\text{interest by Sally} = (x-2000) \frac{9}{100} t \text{ Frw}$$

$$\Leftrightarrow \frac{6}{100} x = \frac{(x-2000) 9}{1000}$$

$$\Leftrightarrow 6x = (x - 2000)9$$

$$\Leftrightarrow 6x = 9x - 18000$$

$$\Leftrightarrow 6x = 18000$$

$$x = 6000 \text{ Rwf.}$$

John had invested 6000 Rwf.

SECTION B

16. (a)

| | | | | | | | |
|---|----|----|----|----|----|---|---|
| X | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| y | 10 | 4 | 0 | -2 | -2 | 0 | 4 |

$$x = -3, y = (-3)^2 - (-3) - 2 = 10$$

$$x = -2, y = (-2)^2 - (-2) - 2 = 4$$

$$x = -1, y = (-1)^2 - (-1) - 2 = 0$$

(b) teacher's guidance

(c) i) $y = -2.3$

ii) $x = -0.6$

16. a) continuation

$$x = 0, y = 0^2 - 0 - 2 = -2$$

$$x = 1, y = (1)^2 - (-1) - 2 = -2$$

$$x = 2, y = 2^2 - 2 - 2 = 0$$

$$x = 3, y = (3)^2 - 3 - 2 = 4$$

17.

(a) i) $10x^2 + 17x + 3$

$$\begin{array}{r}
 \underline{x - 2} \overline{10x^3 - 3x^2 - 31x - 6} \\
 - 10x^3 - 20x^2 \\
 \hline
 17x^2 - 31x \\
 - 17x^2 - 34x \\
 \hline
 3x - 6 \\
 3x - 6 \\
 \hline
 0
 \end{array}$$

Since $(x - 2)$ gives a quotient with no remainder, it is a factor.

$$(10x^3 - 3x^2 - 31x - 6) \div (x - 2) = 10x^2 + 17x + 3$$

ii) $f(x) = 0$

$$10x^3 - 3x^2 - 31x - 6 = 0$$

$$10x^3 - 3x^2 - 31x - 6 = (x - 2)(10x^2 + 17x + 3)$$

$$\therefore (x - 2)(10x^2 + 17x + 3) = 0$$

$$(x - 2)(10x^2 + 15x + 2x + 3) = 0$$

(b) $3x^2 + 7x + 2$

$$= 3x^2 + 6x + x + 2$$

$$= 3x(x + 2) + (x + 2)$$

$$= (3x + 1)(x + 2)$$

$$\frac{5}{(x+2)(3x+1)} + \frac{2x-3}{x+2} = 0$$

$$= 5 + (3x + 1)(2x - 3) = 0$$

$$= 5 + 6x^2 - 7x - 3 = 0$$

$$= 6x^2 - 4x - 3x + 2 = 0$$

$$= 2x(3x - 2) - (3x - 2) = 0$$

$$= (2x - 1)(3x - 2) = 0$$

$$x_1 = \frac{1}{2}, x_2 = \frac{2}{3}$$

17. a (ii) continuation

$$(x - 2) 5x(2x + 3) + 1(2x + 3) = 0$$

$$(x - 2)(5x + 1)(2x + 3) = 0$$

$$x = 2 \text{ or } x = -\frac{1}{5} \text{ or } x = -\frac{3}{2}$$

18. (a) i) connecting B to D

ADB = ACB = 50° because they underlie the same arc

ii) ABD = 90°, CAD = Diameter

$$DAB = 180^\circ - (90^\circ + 50^\circ)$$

$$DAB = 40^\circ$$

(b) i) $\overline{MO}^2 = a + b$ and $\overline{MO}^2 = c^2 + d^2$

$$a^2 + b^2 = c^2 + d^2$$

$$a^2 = c^2 + d^2 - b^2$$

$$a^2 = \sqrt{c^2 + d^2 + b^2}$$

$$\text{ii) } \frac{1}{2} \text{ circle MPO} = \frac{1}{2} \times 3.14 \times 5 \times 5 = 39.25 \text{cm}^2$$

$$\overline{PO}^2 = \overline{MO}^2 - \overline{PM}^2 = 10 \text{cm}^2 - 8 \text{cm}^2$$

$$\overline{PO} = \sqrt{36 \text{cm}} = 6 \text{cm}$$

The area of triangle MPO:

$$\frac{1}{2} \times 6 \times 8 = 24 \text{cm}^2$$

Shaded area:

$$= 39.25 - 24 = 15.25 \text{cm}^2$$

iii) \overline{MO} is common to triangles

MPO and MNO

MPO = MNO-90 (angles are

subtended by the

diameter of the

circumference)

$$\Delta \text{ MNO} = \Delta \text{ OPM}$$

(Right angle - hypotenuse -size)

19. (a)

| Weights (kgs) | Midpoint, x | Frequency, (f) | fx | c.f |
|---------------|-------------|----------------|-------|-----|
| 30 - 34 | 32 | 2 | 64 | 2 |
| 35 - 39 | 37 | 6 | 222 | 8 |
| 40 - 44 | 42 | 4 | 168 | 12 |
| 45 - 49 | 47 | 7 | 329 | 19 |
| 50 - 54 | 52 | 8 | 416 | 27 |
| 55 - 59 | 57 | 2 | 114 | 29 |
| 60 - 64 | 62 | 1 | 62 | 30 |
| | | 30 | 1,375 | |

$$\text{(b) Mean weight} = \frac{\sum fx}{\sum f} = \frac{1375}{30} = 45.8 \text{kg.}$$