Mathematics VII
113
16 Nov. 2005   8h30 – 11h 30

RWANDA NATIONAL EXAMINATIONS COUNCIL

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NATIONAL EXAMINATION 2005

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

1. Simplify: $(2\frac{1}{2} \div 7\frac{1}{2}) \div \frac{1}{4}$. **(3 marks)**

2. Given that $f(x) = 2(x - 1)$, find

   a) $f(-2)$ **(1 mark)**

   b) the value of x such that $f(x) = -8$. **(2 marks)**

3. Simplify the following completely: $\dfrac{3(m-y) - 2(m-3y)}{m^2 - 9y^2}$ **(3 marks)**

7. At a certain factory, the salary of a worker for 40 hours per week is 20,000 Rwf. The worker is paid 10% of the weekly salary for every 2 hours that he works overtime. If at the end of a certain week he received 36,000Rwf, find the number of hours he worked overtime. **(3 marks)**
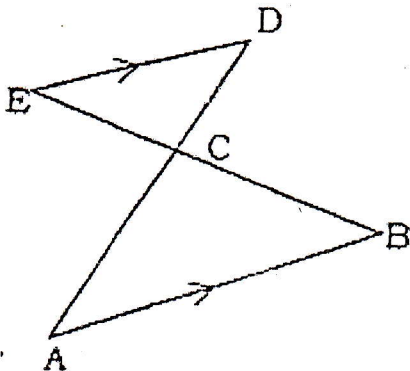
8. Solve the inequality: $2y - \dfrac{7(y-1)}{2} > 17$. **(3 marks)**

9. It is given that $\vec{x} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and $\vec{y} = \begin{pmatrix} 12 \\ 9 \end{pmatrix}$. Find: (a) the column vector of $\vec{y} - \vec{x}$. **(1 mark)**

                                              (b) the value of $|\vec{x}| + |\vec{y}|$ **(3 marks)**

7. The equation of line A is $2y = 3x + 4$. Line B passes through points $(1, 0)$ and $(a, 2)$ If A is parallel to line B, find the value of a. **(4 marks)**

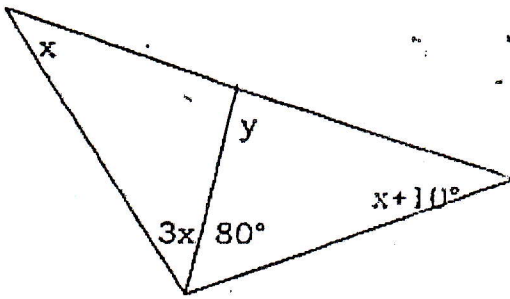8. In the diagram below show that triangle CDE is similar to triangle CAB. **(2 marks)**

9. Musa, Sarah and Peter, share 1000 kg of sugar in the ratio 2: x: 5 respectively. If Musa gets 200kg of sugar, how much sugar does Sarah get? **(4 marks)**

10. Solve $(x + 3)(x - 4) = 18$. **(4 marks)**

11. In the figure below find the value of y. **(4 marks**

12. (a) Copy the table below and complete it. **(3 marks**

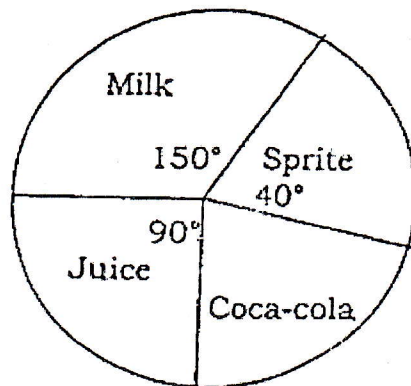| X	1	2	4	8		20
Y			5		2	1

(b) Find the equation connecting x and y. **(1 mark**

13. Determine the area enclosed by the lines x = 3, y = -1 and x + y = 5. **(4 marks**

14. The pie chart below shows the drinks popularly liked by students in a certain school.

If 60 students like sprite, determine

(a) the number of students who like each type of drink. **(3 marks**

(b) the total number of students in the school. **(1 mark**

15. A (3, 0) is a point in a Cartesian plane.

If A (3, 0) is mapped on to point B (5, 2) by a translation, find the image of C (2, -3) under the same translation. **(2 marks**

SECTION B: Answer any THREE questions   (45 Marks)

16. (a) Solve simultaneously: $x + y = 3$

$$2x^2 + y^2 + 3x = 15.$$ **(10 marks)**

(b) Use the answer from 16 (a) and solve: $\frac{m^2y - 3m + 2}{4 - y} = 0$.   **(5 marks)**

17. The table below shows the ages of 31 secondary school students.

15	14	15	16	17	18	14	20	17
15	20	17	19	19	14	15	20	14
15	19	17	20	17	14	14	15	18
20	19	14	19					

a) Copy the table below and complete it.

Ages (x)	Frequency (f)	Fx	Commutative frequency
	$\sum f =$	$\sum fx =$	

b) State the mode.   **(11½ marks)**

c) Find the median age.   **(1 mark)**

d) Calculate the average age.   **(2½ mark)**

18. (a) Solve: $2x^3 - 5x^2 - 9x + 18 = 0$, $x \in R$.   **(10 marks)**

(b) Factorize and simplify completely: $\dfrac{x^4 - 6x^3 + 9x^2}{x^3 - 3x^2}$ **(5 marks)**

19. The distance between two schools G and K is 432km. A bus transporting students leaves school G at 7.00 am for school K. The bus travels at an average speed of 72 km/hr. One and a half hours later, a mini bus leaves school G at a steady speed of 108km/hr heading for school K. All the two vehicles travel nonstop until they arrive in school k.

(a) Calculate the times when the two vehicles arrive in school K.   **(3 marks)**

(b) On a graph and on the same axes show the journey of the two vehicles.   **(8 marks)**

    Use your graph to estimate the:

i)   The time and distance from school G when the minibus overtakes the bus.   **(2 marks)**

ii)   The distance at 10.00 am between the two vehicles.   **(1 mark)**

iii)   The time when the bus is 16 km behind the minibus.   **(1 mark)**

20. A sample of 100 men was taken to find out how many were literate (L), married (M) or
    had an income generating project (P). The following were the findings: n (L) = 47,
    n (M) =59, n (P) = 52, n (L∩M) = 30, n (L∩P) = 24 and n (M∩P) = 34. 14 of the men
    were literate, unmarried and without an income generating project.

(a) Represent this information on a Venn diagram.   **(9 marks)**

(b) Determine the number of men who were

    (i)   Literate, married and had an income generating project.   **(3 marks)**

    (ii) Neither literate nor married.   **(3 marks)**

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END

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1. $(2\frac{1}{2} \div 7\frac{1}{2}) + \frac{1}{4}$

$= (\frac{5}{2} \div \frac{15}{2}) + \frac{1}{4}$

$= (\frac{5}{2} \times \frac{2}{15}) + \frac{1}{4} = \frac{10}{30} + \frac{1}{4}$

$= \frac{4+3}{12}$

$= \frac{7}{12}$

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2. a) $f(-2) = 2(-2-1)$

$= 2(-3)$

$= -6$

b) $2(x-1) = -8$

$= 2x - 2 = -8$

$= 2x = -8 + 2$

$= 2x = -6$

$x = -3$

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3. $\dfrac{3(m-y) - 2(m-3y)}{m^2 - 9y^2}$

$= \dfrac{3m - 3y - 2m + 6y)}{(m-3y)(m+3y)}$

$= \dfrac{m+2y}{m-3y}$

$= \dfrac{1}{m-3y}$

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4. 2 hours over time:

$\frac{10}{100} \times 20{,}000 = 2000$

Money he got over time:

$= 36{,}000 - 20{,}000 = 16000 Fr$

2 hrs = 2000Rwf

1 hour = 1000Rwf

$X \ hrs = \dfrac{16000}{1000} = 10 \ hrs$

∴ He worked for 16 hrs over time

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5. $2y - \dfrac{7(y-1)}{2} > 17$

$= 2y - 7y + 7 > 34$

$= -5y > 27$

$= -y > 5.4$

$= y < -5.4$

6.

a) $\vec{y} - \vec{x} = \begin{pmatrix} 12 - 4 \\ 8 - 6 \end{pmatrix} = \begin{pmatrix} 8 \\ 6 \end{pmatrix}$

b) $|\vec{x}| + |\vec{y}|$

$= \sqrt{4^2 + 3^2} + \sqrt{12^2 + 9^2}$

$= \sqrt{16 + 9} + \sqrt{144 + 81}$

$= \sqrt{25} + \sqrt{225}$

$= 5 + 15$

$= 20$

7. B stands for (1, 0) and (a, 2)

MA//BM

$2 = \dfrac{3}{2} \ a - \dfrac{3}{2}$

$4a = 3a - 3$

$4 + 3 = 3a$

$7 = 3a$

$a = \dfrac{7}{3}$

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8. Angle in C, from CDE that

CAB, has an amplitude two

opposing sides as the top C.

As ED//AB:

Angle in E = angle in B

(alternate angles)

Also angle in D = angle in A

(alternate angle)

Hence, the correspondent

angles have the same

amplitude.

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9. Lets T be the total ratio

Musa's share = $\dfrac{2}{T} \times 1000 = 200$

$\dfrac{2000}{T} = 200$

Total ratio = 10

$2 + x + 5 = 10$

$x = 3$

Sarah's share = $\dfrac{3}{10} \times 1000$

$= 300kg$

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10. $(x + 3)(x - 4) = 18$

$(x + 3)(x - 4) - 18 = 0$

$x^2 - x - 12 - 18 = 0$

$x^2 - x - 30 = 0$

$x^2 - 6x + 5x - 30 = 0$

$(x^2 - 6x) + (5x - 30) = 0$

$x(x - 6) + 5(x - 6) = 0$

$(x + 5)(x - 6) = 0$

$x + 5 = 0 \quad$ or $\quad x - 6 = 0$

$x = -5 \qquad x = 6$

11.

$= x + x + 10 + 3x + 80$

$= 180$

$= 5x + 90 = 180$

$= 5x = 90$

$x = 18$

$y + 80 + x + 10 = 180$

$y + 80 + 18 = 180$

$y = 180 - 98$

$y = 82°$

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12. a)

X	1	2	4	8	16	20
Y	$\dfrac{23}{4}$	$\dfrac{11}{2}$	5	4	2	1

b) $m = \dfrac{1-5}{20-4} = \dfrac{-4}{16} = \dfrac{-1}{4}$

$y - a_2 = m(x - a_1) \Leftrightarrow y - 5 = \dfrac{1}{4}(x - 4)$

$y - 5 = \dfrac{-1x}{4} + 1 + 5$

$y = \dfrac{-1x}{4} + 1 + 5$

$y = \dfrac{-1}{4}x + 6$

13. Area = $\dfrac{3 \times 3}{2}$ = 4.5	**14. continuation:** Milk = $\dfrac{150}{360} \times 540$ $\quad$ = 225 students Juice = $\dfrac{90}{360} \times 540$ $\quad$ = 135 students Coca Cola = $\dfrac{80}{360} \times 540$ $\quad$ = 120 students b)Total number of students: = 225+60+135+120 = 540	**15.** $\quad$ B (5, 2) image by translation $\begin{bmatrix} 5-2 \\ 2-0 \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ $t = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ For $t = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ c (2, -3) will have the image c^1 (4, -1)
14. Total number of students: $= \dfrac{40}{360} \times x = 60$ $= \dfrac{40x}{360} = \dfrac{21{,}600}{40}$ $\quad$ = 540 students		

SECTION B

16. a) x + y = 3 $\quad$ 2x² + y² + 3x =15. x = 3-y 2(3-y)² + y² + 3(3-y) = 15 2(9-6y+y²) + y² + 9-3y = 15 18-12y +2y²+y²+ 9-3y = 15	3y²-15y+27=15 $\quad$ 3y²-15y+27-15=0 $\quad$ (3y² + 5y + 4) = 0 $\quad$ 3(y-1)(y-4) = 0 $\quad$ y-4 = 0 $\quad$ y = 4 using equation x = 3 – y, $\quad$ x = 3 – 4 = -1

17.

a)

Ages (x)	Frequency (f)	Fx	Commutative frequency
14	7	98	7
15	4	60	11
16	2	32	13
17	5	85	18
18	3	54	21
19	5	95	26
20	5	100	31
	$\sum f = 31$	$\sum fx = 524$	

b) mode = 14

c) median = $\frac{20+14}{2}$ = 17

d) average age = $\frac{524}{31}$ = 17 years

18. a) $2x^3 - 5x^2 - 9x + 18 = 0$

$(x + 2$ is a factor

$= 2(-2) - 5(-2)^2 - 4(-2) + 18$

$= -10 - 24 + 18 + 18$

$= 36 + 36 = 0$

	2	-5	-9	18
		-4	18	-18
-2				
	2	-4	9	0

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

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

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

$2x(x - 3) -3(x - 3) = 0$ $x = \frac{3}{2}$ or

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

$2x - 3 = 0$ $x = 3$

b) $\dfrac{x^4 - 6x^3 + 9x^2}{x^3 - 3x^2}$

$\dfrac{x^2(x^2 - 6x + 9)}{x^2(x - 3}$

$\dfrac{x^2 - 6x + 9}{(x - 3}$

$\dfrac{(x -)(x - 3)}{(x - 3}$

$= x - 3$

19.

a) bus: $\dfrac{432}{72}$ = 6 hours

minibus: $\dfrac{432}{108}$ = 4 hours

b) i) Journey of the two vehicles on the graph paper (teacher's guidance)

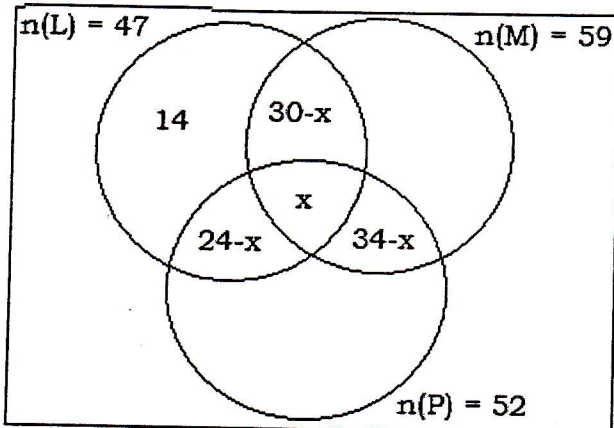The minibus overtakes the bus ± 312km from G to C between 11hrs 22 min to 4hrs 22 mins.

19. b) ii)

The distance at 10am is ± 50km between the 2 vehicles

iii) at 12 pm, the bus is 16km behind the minibus.

20.

a) $n(\textstyle\sum)$ = 100

$n(L) = 47$ $n(M) = 59$

14   30-x

x

24-x   34-x

$n(P) = 52$

b) i) $14x + x + 30 - x + 24 - x = 47$

$x = 21$

∴ Number of (LnMnP) = 21

ii) $n(LnM)^1$

$n(LnP)$ only = 24 - x

= 24 - 21

= 3 men

$n(MnP)$ only = 34 - x

= 34 - 21

= 13 men

$n(P)$ only = 52 - (3 + x + 13)

= 52 - (16 + 21)

= 52 - 37

= 15 men

∴ 15 men were neither literate nor married.