Mathematics I
009
15 Nov.2012 08.30am-11.30am

REPUBLIC OF RWANDA REPUBLIC OF RWANDA

RWANDA EDUACTION BOARD (REB)

ORDINARY LEVEL NATIONAL EXAMINATIONS 2012

SUBJECT : MATHEMATICS 1

DURATION : 3 HOURS

INSTRUCTIONS :

- This paper has **TWO** sections **A** and **B.**

  SECTION A: Answer **ALL** questions. **(55 marks)**

  SECTION B: Answer any **THREE** questions. **(45 marks)**

- You may use mathematical instruments and calculators **where necessary.**
- USE A **BLUE INK PEN ONLY**
- USE A PENCIL TO DRAW DIAGRAMS.
- SHOW CLEARLY ALL THE WORKING. **Marks will not be awarded for answers without all working steps.**

SECTION A: Attempt all questions. **(55 marks)**

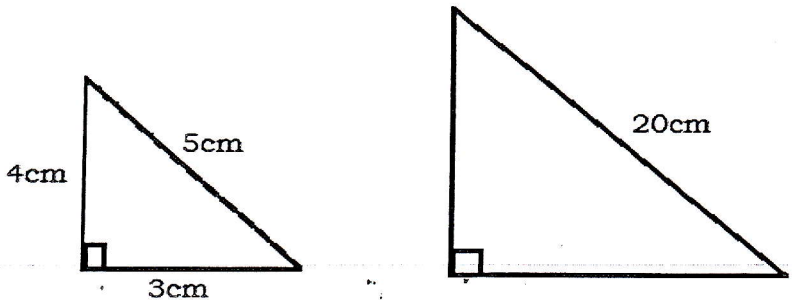
1. Express 900 as a product of its prime factors. Hence find the square root of 900. ***(3 marks)***

2. (a) Calculate without using a calculator: $3.45^2 - 1.55^2$. ***(2 marks)***
   (b) Divide without using a calculator: $0.9 \div 30$. ***(1 mark)***

3. In a school food store, there is enough food to feed 300 students for 17 days. For how long will the food last if 40 more students join the group? ***(3 marks)***

4. Solve the equation: $5x^2 + 21x - 20 = 0$ ***(3 marks)***

5. The right angled triangles below are similar. Find the area of the larger triangle. ***(3 marks)***



6. Solve the simultaneously: $x + 2y = 40$
   $3x = 60 - y$ ***(4 marks)***

4. Find the equation of the line which passes through the points (- , 3) and (4, 2). ***(4 marks)***

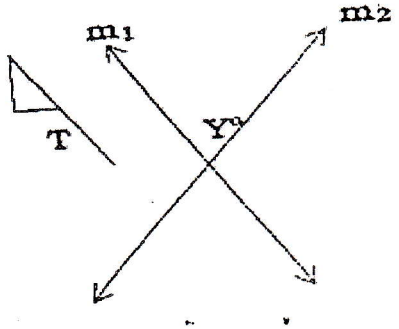
5. Given that $f(x) = ax^2 - 7$ and $f(2) = 13$, find the value of $f(-1)$. ***(4 marks)***

6. In a class of 40 students, 24 like Mathematics and 30 like Kinyarwanda. All students like at least one of the subjects. Draw a Venn diagram to represent this information. How many students like both mathematics and Kinyarwanda? ***(4 marks)***

10. Solve the equation: $\frac{3x}{2} \geq \frac{x}{4} - 10$. Illustrate the answer on a number line. **(4 marks)**

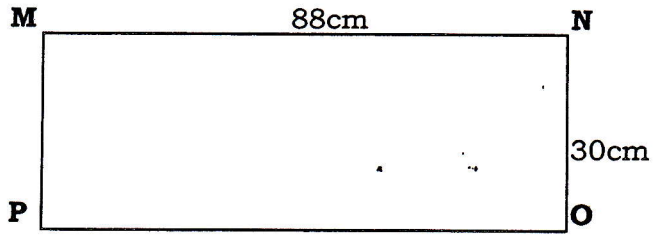
11. A point **m** divides a line segment AB, 10cm long into two parts such that one part is 4cm longer than the other. Find the length of the two parts. ***(4 marks)***

12. The diagrams below show a flag **T** and two mirrors $\mathbf{m_1}$ and $\mathbf{M_2}$ $\mathbf{M_1}$ **(T)** in intersecting at an angle **Y°**. Copy the diagram and show images **M1(T)** in $\mathbf{m_1}$ and $\mathbf{M_2}$ $\mathbf{M_1}$ **(T)** in $\mathbf{m_2}$. ***(4 marks)***



13. Given 152n = 68ten, find n. **(4 marks**

14. Find the mid – point M of the line joining the points A (1, 0) and B (9, 6). Find length $\overline{MB}$. **(4 marks**



If it is curved in such a way that **MP** and **NO** meet to form a hollow cylindrical figure, find the volume of the cylindrical figure formed. $\pi = \frac{22}{7}$. **(4 marks**

SECTION B: Attempt ONLY three questions. **(45 marks)**

16. (a) Solve for x: $\frac{1}{x^2-1} + \frac{1}{x^2-4x+3} + \frac{1}{x-3} = 0$ **(8 marks**

(b) Factorize completely: $f(x) = 2x^3 + 5x^2 + x-2$. Hence find the values of x when $f(x) = 0$ **(7 marks**

17. The table below shows the ages of 73 students.

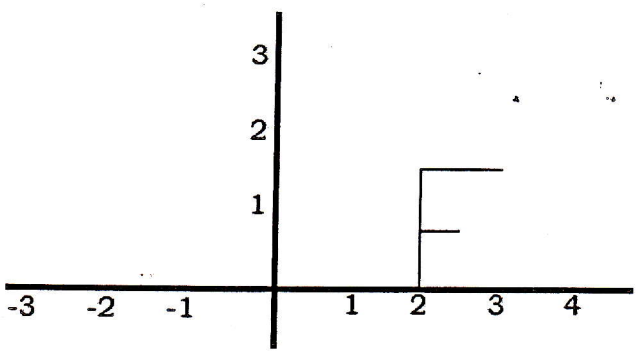
Age in years	14	15	16	17	18	19	20
Frequency	5	9	13	11	12	15	8

Make the frequency table using the above data.

(a) Find the median age. **(4 marks**

(b) Calculate the mean age. **(11 marks**

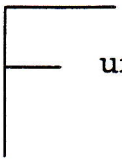
18. Use the diagram to answer (a) and (b) below.



(a) Copy the diagram and sketch the image under

(i) a + 90° rotation about origin. **(3 marks**

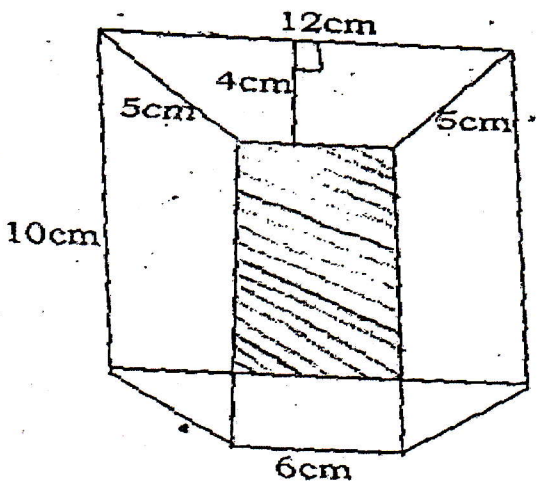
(ii) a - 180° rotation about origin. **(2 marks**

(b) Copy the diagram again and sketch the image of  under a translation. **(3 marks**

(i) $\mathbf{T} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$. **(2 marks**

(ii) $\mathbf{T} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$. **(5 marks**

19. The figure below is a right trapezoidal prism.



Calculate its (a) lateral area. **(5 marks**

(b) total surface area. **(7 marks**

(c) volume. **(3 marks**

20. (a) Rationalize the denominator: $\frac{\sqrt{2}}{2\sqrt{5}+\sqrt{3}}$. **(4 marks**

(b) Simplify: $\sqrt{12} \times 3\sqrt{60} \times \sqrt{45}$. **(4 marks**

(c) Simplify: $\sqrt{8} \times \sqrt{50} + \sqrt{121}$. **(4 marks**

(d) Simplify: $\frac{5\sqrt{7}}{\sqrt{45}} \times \frac{2\sqrt{3}}{\sqrt{21}}$ **(3 marks**

END.

ANSWERS FOR NATIONAL EXAMINATION 2012.
MATHEMATICS 009
SECTION A

1.
2 | 900
2 | 450
3 | 225
3 | 75
5 | 25
5 | 5
5 | 1

So $900 = 2^2 \times 3^2 \times 5^2$

$\sqrt{900} = \sqrt{2^2 \times 3^2 \times 5^2}$

$= 2 \times 3 \times 5 = 30$

2. a) $45^2 - 1.55^2$

$= (3.45+1.55)(3.45-1.55)$

$= (5.00)(1.90)$

$= 9.5$

b) $0.9 \div 30 = \frac{9}{10} \times \frac{1}{30}$

$= \frac{3}{100 \times 10} = 0.003$

3.

300 students ⇒ 17 days

1 student ⇒ 17×300

340 students ⇒ $\frac{17\ days \times 300}{340}$

= 15 days.

4. $5x^2 + 21x - 20 = 0$

$= 5x^2 + 25x - 4x - 20 = 0$

$= 5x(x+5) - 4(x+5) = 0$

$= (x+5)(5x-4) = 0$

$\therefore x + 5 = 0$ or $5x - 4 = 0$

$x = -5$ or $x = \frac{4}{5}$

5. Area of the small triangle

$= \frac{1}{2} \times 4 \times 3 = 6cm^2$

Linear scale factor $= \frac{20}{5} = 4$

Area scale factor $= 4^2 = 16$

Area of larger triangle

$= 16 \times 6 = 96cm^2$

6.
×3 | $x + 2y = 40$
$3x + y = 60$

$= 3x + 6y = 120$

$3x + y = 60$

$5y = 60$

$y = 12$

$x + 24 = 40$

$x = 16.$

7. Let x and y be any point on the line.

Then the gradient of the line

$= \frac{y-3}{x-(-1)} = \frac{y-3}{x+1}$

Again the gradient of the line $= \frac{2-3}{4-(-1)} = \frac{-1}{5}$

So $\frac{y-3}{x+1} = \frac{-1}{5}$ $\therefore 5(y-3) = -1(x+1) = 5y - 15 = -x - 1$

$5y + x = 14$

8. $f(x) = ax^2 - 7$

$F(2) = a(2)^2 - 7 = 13$

So $4a - 7 = 13$

$4a = 20$

$a = 5$

$\therefore f(x) = 5x^2 - 7$

$F(-1) = 5(-1)^2 - 7$

$= 5 - 7 = -2$

SECTION B

16. a) $\frac{1}{x^2-1} + \frac{1}{x^2-4x+3} + \frac{1}{x-3} = 0$

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

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

$= x - 3 + x + 1 + x^2 - 1 = 0$

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

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

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

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

$= x = -3$

(x = 1 is not valid)

b) $2x^3 + 5x^2 + x-2$

$2x^3 + x^2$

$6x^2 + x$

$6x^2 - 3x$

$4x - 2$

$4x - 2$

0

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

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

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

So $2x^3 + 5x^2 + x-2 = (2x -1)(x + 2)(x + 1)$

$x = -2$ or $x = -1$ or $x = -\frac{1}{2}$

17.

Age in years	14	15	16	17	18	19	20
Frequency	5	9	13	11	12	15	8
Cumulative frequency	5	14	27	38	50	65	73

a) Median age = the $\frac{1}{2}(N + 1)^{th}$ age

= the $\frac{1}{2}(73 + 1)^{th}$

median age = the 37^{th} age.

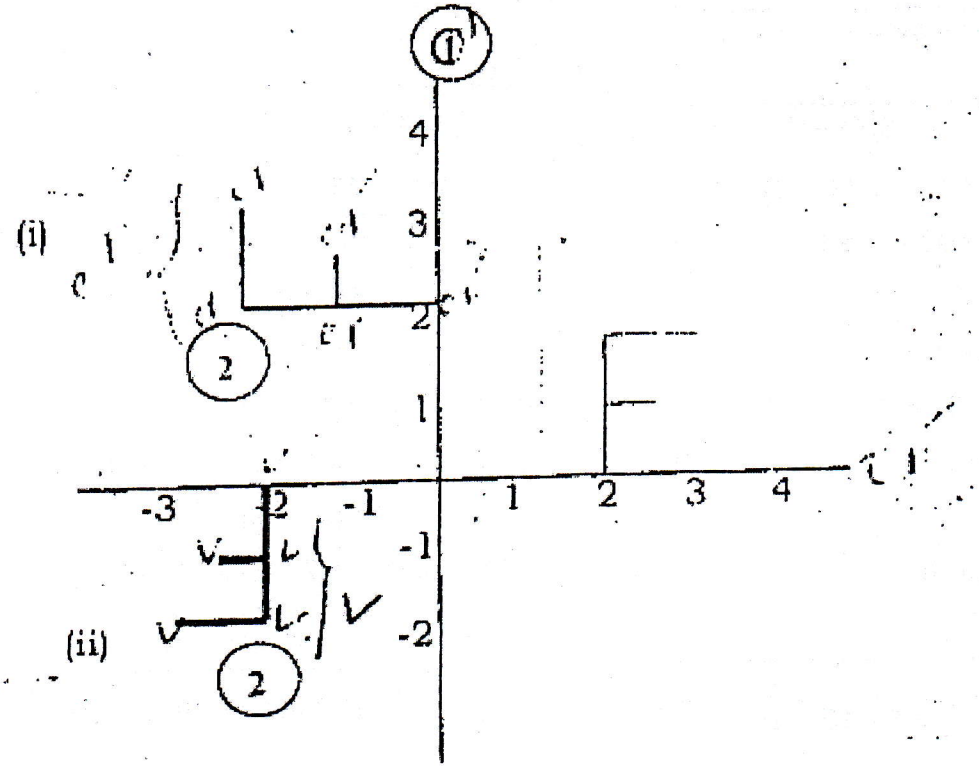
17. b)

Age (x)	Frequency (f)	Fx
14	5	70
15	9	135
16	13	208
17	11	187
18	12	216
19	15	285
20	8	160
	$\sum f = 73$	$\sum fx = 1261$

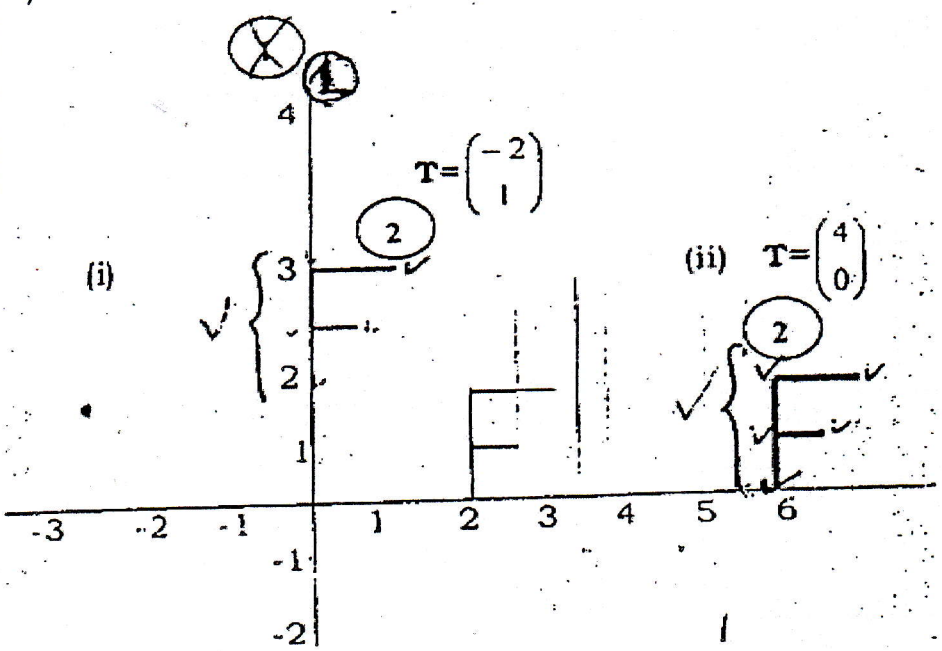
Mean age = $\frac{1261}{73} = 17.27$

18.

a)


(i)
(ii)
4
3
2
1
-1
-2
-3
-2
-1
1
2
3
4

b)


(i)
$T=\begin{pmatrix}-2\\1\end{pmatrix}$
(ii)
$T=\begin{pmatrix}4\\0\end{pmatrix}$
4
3
2
1
-1
-2
-3
-2
-1
1
2
3
4
5
6

19.

a) Lateral area

= base perimeter × height

= (5+6+5+12)×10

= 28×10 = 280cm²

b) Total surface area

= lateral area + area of 2 bases

= base area = ½ × 4 × (6+12)

= 36cm²

Area of 2 bases = 2× 36 = 72cm²

Total area = 280 + 72 = 352cm²

c) Volume

= base area × height

= 36 × 10

= 360cm³

20.

a) $\frac{\sqrt{2}}{2\sqrt{5}+\sqrt{3}} = \frac{\sqrt{2}(2\sqrt{5}-\sqrt{3}}{(2\sqrt{5}+\sqrt{3})(2\sqrt{5}+\sqrt{3}} = \frac{2\sqrt{10}-\sqrt{6}}{4\times5-3}$

$= \frac{2\sqrt{10}-\sqrt{6}}{17}$

b) $\sqrt{12} \times 3\sqrt{60} \times \sqrt{45} = \sqrt{4\times3} \times 3\sqrt{4\times15} \times \sqrt{9\times5}$

$= 2\sqrt{3} \times 6\sqrt{15} \times 3\sqrt{5} = 36\sqrt{3} \times 15 \times 5 = 36\sqrt{15} \times 15$

$= 36 \times 15$

$= 540$

c) $\sqrt{8} \times \sqrt{50} + \sqrt{121}$.

$= \sqrt{4\times2} \times \sqrt{25\times2} + \sqrt{11\times11}$

$= 2\sqrt{2} \times 5\sqrt{2} + 11$

$= 10\sqrt{2\times2} + 11$

$= 10\times2 + 11$

$= 31$

d) $\frac{5\sqrt{7}}{\sqrt{45}} \times \frac{2\sqrt{3}}{\sqrt{21}} = \frac{5\sqrt{7}\times2\sqrt{3}}{\sqrt{9\times5}\times\sqrt{7}\times\sqrt{3}} = \frac{5\times2}{3\sqrt{5}}$

$= \frac{10\sqrt{5}}{3\sqrt{5}\sqrt{5}}$

$= \frac{2\sqrt{5}}{3}$

END.