MATHEMATICS QUESTIONS BANK FOR S2ALL

UNIT 1: INDICES AND SURDS

Q1.a) Simplify without using calculator

$$\left(\frac{5^6}{5^2}\right)\frac{\frac{1}{3}\left(5^3\times2^3\times5^{-2}\times2^{-3}\right)}{5^2}$$ **(2marks)**

b)Solve for x; $32^{x-3}.\,8^{x+4}=\frac{64}{2^x}$ **(2marks)**

Q2. Use the general method to find the square root of :

a) 9144576 **(2marks)**

b) 18.800896 **(2marks)**

Q3.simplify the following completely:

a)$\left(\frac{125\times64}{343\times216}\right)^{\frac{-2}{3}}:\left(\frac{7}{5}\right)^2$ **(2marks)**

b)$\sqrt{\frac{180x^3y^{-4}z}{128z^{-3}\,y^2}}\sqrt{\frac{18z^{-4}y^2}{20x^3}}$ **(2marks)**

Q4.a)calculate the numerical value of the expression

E=$x^4-\left(1+\sqrt{2}\right)x^3+\left(1+\sqrt{2}\right)x^2-\left(1+\sqrt{2}\right)x+\sqrt{2}$ for $x=\sqrt{2}$ **(4marks)**

b) Given that : , $27^{3x}\times81^{x+2}=1$ find the value of x **(4marks)**

Q5.a)Expand and Simplify

$$\frac{9xy}{16ab}\left(\frac{4a^4b^6}{3x^3y^5}-\frac{96a^4b^6}{72x^3y^5}\right)$$ **(2marks)**

$b)if\ \frac{\sqrt{56}}{\sqrt{14}}+\frac{\sqrt{72}}{\sqrt{12}}$=a+$\sqrt{b}$, find a and b **(2marks)**

Q6. Given x=-3 , y=2 , a=$\frac{3}{2}$ and b=$\frac{-1}{4}$

Evaluate, $\frac{(ax+by)^2+(ay-bx)^2}{(ay+bx)^2+(ax-by)^2}$ **(4marks)**

Q7. Without using a calculator ,find the exact value of :

a)$(3-2\sqrt{2})^{40}(3+2\sqrt{2})^{40}$ **(2marks)**

b)$\sqrt{\frac{8^{10}+4^{10}}{8^{4+}4^{11}}}$ **(2marks)**

Q8. Let A=$\frac{\sqrt{3}}{2-\sqrt{3}}+\frac{1}{2}(16-2\sqrt{3})-\frac{3}{\sqrt{3}}$ and B=$\frac{\sqrt{5}+\sqrt{11}}{\sqrt{11}-\sqrt{5}}$ -$\frac{\sqrt{55}}{3}+\frac{28}{3}$ be the marks obtained by two students Andre and Birori without using calculator, show which of the two students got the best mark.

(4marks)

Q9. Simplify the following as far as possible :

a) $3\sqrt{729}-3\sqrt{192}+10\sqrt{7500}+3\sqrt{432}$ **(3marks)**

b)$\sqrt{5}\times\sqrt{6}\times\left(\frac{1}{3}\sqrt{3}\right)^{3}\times\sqrt{10}\times\sqrt{12}\times(\sqrt{2})^{5}$ **(3marks)**

Q10. a)Given that $\frac{6}{3\sqrt{2}-2\sqrt{3}}=a\sqrt{3}+b\sqrt{2}$ $,find\ a\ and\ b$. **(4marks)**

b) Calculate and simplify :$(\sqrt{3}+\sqrt{2})^{3}-(\sqrt{3}-\sqrt{2})^{3}$ **(4marks)**

Q11.a)simplify the following completely

$\frac{9\sqrt{24}\times5\sqrt{27}\times\sqrt{63}\times\sqrt{270}}{\sqrt{126}\times6\sqrt{243}\times\sqrt{45}\times\sqrt{252}}$ **(3marks)**

b) Use the prime factor method to find the square root of 20070400. **(3marks)**

Q12. Simplify completely $\frac{\sqrt{180}+\sqrt{500}}{\sqrt{320}-\sqrt{800}}$ **(2marks)**

Q13.Evaluate without using a calculator $\sqrt{27}-\sqrt{3}-\sqrt{12}$ - $\sqrt{2}.\sqrt{8}+\frac{\sqrt{75}}{\sqrt{3}}$ **(2marks)**

Q14. Solve the: $125^{x}:(25)^{2x+1}=1$ the value of x. **(2marks)**

Q15. a) Expand and Simplify

$\frac{36nm}{64td}\left(\frac{20m^{4}n^{6}}{15t^{3}d^{5}}-\frac{96m^{4}n^{6}}{72t^{3}d^{5}}\right)$ **(2marks)**

$b)if\ \frac{\sqrt{224}}{\sqrt{56}}+\frac{\sqrt{288}}{\sqrt{48}}$=x+$\sqrt{y}$, find x and y **(2marks)**

Q16 . Without using a calculator, find the exact value of:

a)$(7-5\sqrt{2})^{1000}(7+5\sqrt{2})^{1000}$ **(3 marks)**

b) $\sqrt{\frac{27^{20}-9^{20}}{9^{22}-27^{8}}}$ **(3marks)**

Q18. Simplify the following as far as possible

$5\sqrt{2187} - 6\sqrt{768} + 2\sqrt{30000} - 8\sqrt{1728}$ **(5 marks)**

Q19. Simplify the following as far as possible

$\sqrt{500}\ x\ \sqrt{72}\ x\ (2\sqrt{6})^3\ x\ \sqrt{20}\ x\ \sqrt{27}\ x\ (\sqrt{3})^5$ **(5 marks)**

Q20. Use the general method to find the square root of 80281600 **(5 marks)**

Q21. Given that $\frac{12}{6\sqrt{5}-4\sqrt{7}} = a\sqrt{5} + b\sqrt{7}$, $find\ a\ and\ b$. **(5marks)**

Q22. Demonstrate that A=$\frac{1}{7+\sqrt{2}} + \frac{1}{7-\sqrt{2}}$ is an integer . **(5 marks)**

2: POLYNOMIALS

Q23. Expand, factorise and simplify the expression $\frac{3(a-b)-2(a-3b)}{(a-3b)(a+3b)}$. **(2marks)**

Q24.Given that, $(x-1)(x+1)(x^2+1) = x^a - 1$ find the value of a . **(2marks)**

Q25. Consier the polynomial $P(y) = y^4 - (1+\sqrt{2})y^3 + (1+\sqrt{2})y^2 - (1+\sqrt{2})y + \sqrt{2}$

a) Calculate $P(\sqrt{2})$

b) Divide $P(y)$ by $y - \sqrt{2}$ **(4marks)**

Q26. Factorise completely: **a)** $2b + 4 + a^2 - 2ab - 5a$ **(4marks)**

b) $2pq^2 + 30 - 10pq - 6q$ **(4marks)**

Q27. **(a)** Given that $P(x) = 2x^3 + 9x^2 - 7x - 6$

i) Determine $P(-\frac{1}{2})$. **(2marks)**

ii) Factorize completely $P(x)$. **(2marks)**

iii) Solve the equation $P(x) = 0$. **(2marks)**

(b) Calculate the values of m and n if the polynomial $P(x) = 2x^3 + mx^2 + nx + 10$

has -2 as the root and also $2x - 1$ is a factor of $P(x)$. **(4marks)**

i) Factorize completely $P(x)$ **(3marks)**

ii) Deduce the roots of the equation $P(x) = 0$ **(2marks)**

Q28. a) Factorise and simplify the expression, $\frac{4x^3+24x^2+36x}{x^4-9x^2}$. **(3marks)**

b). write a simplified expression for the area of rectangle below:

(3marks)

Q29. Given the polynomial p (t) = $4t^5 + 8t^4 + 10t^3 - 20t^2 + 6t + 12$,

(i) Show that t=2 is a factor of p(t) . **(3 marks)**

(ii) Use symmetric division to find the other factor Q (t). **(4 marks)**

(iii) Use long division to find the quotient and the remainder of the division of Q(x) by $2t^2 - 3$. **(4 marks)**

(iv) Hence, factorize completely p (t).

Q30. a) Given that $x^3 - 4x^2 + x + 6 = (x-a)(x+b)(x-c)$ .Find the values of a, b and c.

b) Factorize : $4xy^2 - x^3 - yx^2 - 4y^3$ completely

Q31.a) Given that $f(n) = n^2 + 1$ and $g(n) = n - 1$, find the value of n for which $fog(n) = gof(n)$.

b) Use the substitution $y = 2^x$ to solve for x the equation $2^{2x+1} - 2^{x+1} + 1 = 2^x$.

C) Show that **:(i)** $2 - \frac{2}{1-\left(\frac{2}{2-\frac{2}{x^2}}\right)} = 2x^2$.

(ii) $\frac{x}{1-\left(\frac{1}{1+\frac{x}{y}}\right)} + \frac{\left(y+\frac{2y}{y-2}\right)}{\left(1+\frac{4}{y^2-4}\right)} = 2(1+y) + x$.

(iii) $\frac{a}{(a-b)(c-a)} + \frac{b}{(b-c)(a-b)} + \frac{c}{(b-c)(c-a)} = 0.$

UNIT 3: SIMULTANEOUS LINEAR EQUATIONS AND INEQUALITIES.

Q32. Solve the inequality $\frac{1}{6}z - (z-2) \geq 2$ and illustrate the answer on graph. **(2marks)**

Q33. Given that $x^2-y^2 = 135$, and $x-y = 9$. Find the values of x and y. **(2marks)**

Q34. Solve for X, the inequalities: **(a)** $-x^3 + 5x^2 - 7x + 3 \leq 0$ **(3marks)**

(b) $\{2x - (4x - 1) < 4 + x\} \cap \{5x + 1 < x + 9\}$ **(3marks)**

Q35. (a)solve simultaneously: $\begin{cases} 2x^2 + y^2 + 3x = 15 \\ x + y = 3 \end{cases}$.

(b) use the answer in 14(a) to solve the equation $\frac{m^2y-m+2}{4-y}$ =0.

UNIT 4: MULTIPLIER FOR PROPORTIONAL CHANGE.

Q36.A lake of area 120km^2 is represented by area of 4.8 cm^2 on a map.

Find the length (in km)of an horizontal road measuring 6cm on the map.

Q37.Paul and Mary invested RWF 600,000 each in a savings society for 2 years .
Paul opted for simple interest while Mary opted for compound interest .
Both interests were at 12% per annum.

(a) Find the interest earned by each of them

(b) Who earned more interest and by how much?

Q38.a)A variable R is inversely proportional to L and directly proportional to P. when P= 3, L = 18 and R = 18. Find R when P = 5 and L=50.

b)The ages of John and Joyce are in the ratio 4:1 . After 6 years the ratio of their ages will be 5:2. Find their present ages.

Q39.if y is inversely proportional to x and x= -3, when y=4,

Find (i)x when y=2 and (ii)y when x=6

Q40. Today a father is 30years old than his daughter .The product of their ages is 216. Find their ages in 10 years time.

Q41.In chemical reaction 22.4 litres of Chloride is liberated from 117grams of NaCl.

How many litres of Chlorine can be liberated from 200grams of NaCl

under the same conditions.

Q42. Olga bought a motor cycle and sold it to Okello at a loss of 25% .

If he sold it at Rwf 1,200,000. Find how much money Olga paid for it . **(3marks)**

UNIT 5:THALES' THEOREM.

Q43. In figure below, BE is parallel to CD, AE=5cm, AB=6cm, CD=9cm and BE=3cm.

calculate: a) BC **(3marks)**

b) AD **(3marks)**

Q44. Given that $\overrightarrow{OA} = \binom{3}{5}$, $\overrightarrow{OB} = \binom{2}{0}$, where $\overrightarrow{OA}$ and $\overrightarrow{OB}$ are the position vectors of A and B respectively, find the area of the triangle OAB.

Q45. Under an enlargement, the volume of a cube is 216 cm^3. I f the volume of the object cube is 27 cm^3 , find :

(a) The scale factor
(b) The total surface area of the enlarged cube.

Q46. Write down the similar triangles in figure below .Find BC and AD.

1. (a) Find the value of each letter x , ıre below :

UNIT 6:PYTHAGORAS' THEOREM.

Q47. In the figure below, ABC is a right- angled triangle and BD is perpendicular to AC.

Calculate $BC and BD$ if $AB = 9$ and $AC = 15$. **(4marks)**

Q48. Solve for x , y *and* z using the below figure .

Q49. Using a ruler , a pair of compasses and a protractor only , construct acculately triangle ABC in which line AB = 7 cm , line BC=5cm and line AC=8cm. 6 marks

(a) Measure angles A , B and C. Write the measurements you have got.
(b) Draw a perpendicular line from A to side BC.How long is the perpendicular line ?
(c) Calculate the area of triangle ABC.
(d) In the diagram below ,DE = 8.0cm , BC = 12.0cm and BD=5.0cm

Given that DE is parallel to BC , find length AD.

Q50.Using a ruler , pencil and a pair of compasses only ,
(i) Construct a triangle PQR with angles RPQ = 60^0 , PQR=45^0 and PQ=8.4cm , measure the length of PR and QR.

(ii) Construct the line ST 12.6cm long bisecting and perpendicular to QR and meeting PQ at T. what is the size of angle STQ.

(iii) Join S to R and Q . Draw the circle circumscribing the triangle QRS . From your diagram determine the radius of the circle. P.17Q18

Q51.A circle passes through the points A(-3.5 , 1) B(0.5 ,5) and C(4,3).
(i) Using 2cm to represent one unit , plot the points A , B and C on a graph paper.

(ii) By construction find the centre and radius of the circle.

(iii) Calculate the area of part of the sector (segment) cut off by the line segment AB. P.36Q19

1. **Q49**. Using a ruler , pencil and a pair of compasses only ,

(i) Construct a triangle ABC where BC=7.2 cm ,AC=8.4 cm and angle ABC=75^0 . Measure AB and angle ACB.

(ii) Draw a circle circumscribing triangle ABC . State the radius of the circle.P75Q12

1. **Q49**Using a ruler , pencil and a pair of compasses only ,

Construct the triangle PQR , where angle QPR=135^0 , PQ=8.4cm and QR =12.5cm .State the length of PR.

S and T are points such that TS bisects QR , where T is on QR and , S on the same side as PQ . Draw circle to circumscribe the points P , Q , R and S. Measure and state the (i) length ST (ii) Radius of the circle (iii) radius of the circle . P.127Q11

Q52 Using a ruler, pencil and a pair of compasses only,

Construct a triangle ABC where AB=8 cm , angle ABC=60^0 and BCA =45^0 . Construct the perpendicular from C onto AB to meet it at D. Measure the length CD. Draw a circle circumscribing triangle ABC.Measure its radius. Find the area of triangle ABC. P.140Q13

Q53. Using a ruler , pencil and a pair of compasses only ,

(a) Construct a triangle ABC where BC=9.2 cm ,AC=12 cm and angle ABC=105^0 . Measure and state length AB and angle BAC.

(b) Draw a circle circumscribing triangle ABC . State the radius of the circle. P150 Q11

Q54. Using a ruler , pencil and a pair of compasses only ,

Construct a triangle PQR with angles PQR = 60^0 , QR=9.0cm and PR=8.5cm , measure the length of QP.

Bisect the sides PQ and PR.Produce the line bisectors to intersect at point M. Using M as the centre , draw a circle to circumscribe triangle PQR . Measure the radius of the circle .Hence calculate the area of the circle (correct to 2 significant figure).P161Q12

Q55. Using a ruler , pencil and a pair of compasses only ,

Construct a triangle ABC where BC=10.6 cm , and angles ACB=75^0 and ABC=60^0. Draw a circumcircle of triangle ABC with O as its centre. State the radius of the circle and length AB and AC.P.173Q12

Q56 Using a ruler , pencil and a pair of compasses only ,

Construct a triangle ABC where AB=8.7 cm ,AC=10.6 cm and angle BAC=60^0 inscribe a circle on the triangle ABC. Construct a perpendicular from B onto AC to meet at point D.Measure length BC and radius of the circle.Measure BD and calculate the area of triangle ABC.P185Q13

Q57. Using a ruler , pencil and a pair of compasses only ,
a)(i) Construct a triangle ABC where AB=10.0 cm ,BC=9.2 cm and angle ABC=105^0 . (ii) Measure AC.

b) Draw an inscribed circle of triangle ABC with centre O . (ii)State the radius of the circle.P195Q13

UNIT 7:VECTORS.

. **Q58**.Given that $\overrightarrow{OA} = \binom{12}{7}$ and $\overrightarrow{OB} = \binom{4}{1}$ calculate the length of $\overrightarrow{AB}$ 4 marks

Q59. Given that vectors $\vec{u} = \binom{2}{x}$ and $\vec{v} = \binom{x+y}{3}$ are equal, find the values of x and y. Hence, calculate $\|\vec{u} + \vec{v}\|$.

Q60. Given triangle ABC, where $A(-5,-1), B(-2,-1) and\ C(-3,-4)$,

a) Plot points $A, B\ and\ C$ in the plane **(3marks)**
b) Draw :
i) triangle $A'B'C'$, the image of ABC under cetral symmetry about the origin. **(3marks)**
ii) triangle $A''B''C''$, the image of ABC under the reflection in the y −axis. **(3marks)**
iii) triangle RST under the translation of triangle ABC through vector $\vec{u} = \binom{0}{4}$.**(3marks)**
iv) Give/Write the coordinates of each point. **(3marks)**

UNIT 8:PARALLEL AND ORTHOGONAL PROJECTIONS.

Q61. **a)**Find the value of x and y in the parallelogram in figure :

b)i) Draw points $A(-3,0), B(3,6), and C(7,-2)$ to form a triangle ABC.
ii) Show that the midsegment$[ED]$ where E is a midpoint of $[AB]$ and D midpoint of $[AC]$ is parallel to side $[BC]$ and is half as long.

Q62.

In the diagram above OABC is a trapezium formed above the x-axis by the intersections of lines y=x , y=4 and y=12-x. Find the coordinates of A,B and C.

UNIT 9:ISOMETRIES

Q63.The vertices of triangle ABC are A(-3,0),B(-1,-2) and C(1,1).

(a) On a Cartesian plane plot points A, B, and C. Join the points to form triangle ABC.

(b) Find the perimeter of triangle ABC.

(c)write the coordinates of A',B' and C' the images of A,B and C under orthogonal projection on x-axis, in the direction y-axis.

(d)Plot the coordinates A',B' and C' on the same Cartesian plane .

(e) What has changed about triangle ABC after orthogonal projection?

Q64. Q(1,3) , R(4,3) and S(4,-3) are vertices of triangle QRS.
(a) Plot on a graph paper points Q , R and S. Join these points to form triangle QRS.
(b) Triangle QRS is translated by T=$\binom{-1}{-3}$.Find the coordinates of Q' , R' ,S' , the images of Q , R and S under translation T. Plot these points on the same graph as (a) and join them to form triangle Q'R'S'.
(C) Rotate Q'R'S' about the origin through -90° . Find points Q'' , R'' and S''. Plot these points on the same graph as (a) and join them.
(ii) (a) Plot on a graph paper points A , B and C. Join these points to form triangle ABC.
(b) Find the coordinates of A' , B' and C' the images of A(0,4), B(0,0) and C(4,4)

under a reflection in the line x=-1.Draw triangle A' B' C'.

Q65 .Three points P , Q and R in a plane have position vectors P=$\binom{4}{6}$, Q=$\binom{1}{2}$ and R=$\binom{12}{0}$ respectively.

a) Find : (i) The lengths of PQ ,QR and PR.
(ii) The value of $\overrightarrow{QP} \cdot \overrightarrow{PR}$ and deduce the size of angle QPR
(iii) The area of triangle PQR

b)Given that S is the midpoint of QR , find :
(i) The coordinates of S
(ii) The equation of the line through S having the same gradient as PQ.

UNIT 10:STATISTICS

Q66. In the table below , figures show the marks , in percentages , obtained by candidates in a Mathematics test :

43	70	50	35	64	62	50	53
46	62	65	83	59	54	58	64
55	54	32	59	48	54	35	48
40	58	64	40	71	74	55	70
72	48	75	45	55	40	57	55

(a) Starting with 30 as the lower class limit of the first class and using equal class intervals of 5 marks , form a frequency distribution table for the data .

(b) Calculate the mean mark , using 57 as the assumed mean .

(c) Write the modal class.

Q67.(a)A family spends its income on the following items in a month.

Item	Food	Rent	transport	others
Amount(frw)	35,000	12,000	10,000	15,000

Show the family's expenditure in a pie-chart.

(b) Twenty five students in a class obtained the following marks out of 50.

13	12	25	31	40
49	12	20	25	12
13	41	31	40	14
13	20	20	31	13
15	25	25	13	12

(i) Make a frequency distribution table.

(ii) Find the mode (iii) Find the mean (iv) Find the median and the range

(v) How many students obtained less than the median mark?

(vi) How many students obtained at least the mean mark?

(vii) How many students obtained at most the mean mark?

Q69.The following table shows the marks obtained in a mathematics test by s3 students in a certain school

50	53	31	56	38
33	39	51	38	41
69	57	63	50	54
40	41	45	48	64
59	61	55	36	52

Using class internal of 5 marks , make a frequency distribution table , starting with 30-34 , class.
Use your table in (i) above to find the mean mark. State the modal class.
Draw a histogram for the data .

Q70a)The table below shows the number of goals scored by a team in a series of football matches.

Number of goals	1	2	3	4	5
Number of matches	3	4	1	x	2

If the mean number of goals is 3 , find x 3 marks

b)The pie-chart below represents the number of students who attend various courses in a commercial college.

If the number of students studying Accountancy is 120.

(a) Determine the student population of the college
(b) Find the number of students who study marketing. 4 marks

Q71.

In the table below , figures show the marks , in percentages , obtained by candidates in an English test :

43	70	50	35	64	62	50	53
46	62	65	83	59	54	58	64
55	54	32	59	48	54	35	48
40	58	64	40	71	74	55	70
72	48	75	45	55	40	57	55

(a) Starting with 30 as the lower class limit of the first class and using equal class intervals of 5 marks , form a frequency distribution table for the data .

(b) Calculate the mean mark , using 57 as the assumed mean .

(c) Write the modal class. 15 marks.

Q72. The table below shows the frequency distribution of weights in kg of luggage for 100 passengers boarding the Rwanda air lines plane traveling from Dubai to Kigali.

Weight(kg)	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100-104	105-109
Frequency	1	2	5	11	21	20	17	10	6	4	2	1

(5marks)

Find : (i) The mean weight **(4marks)**

(ii)The median weight **(3marks)**

(iii)The modal weight **(3marks)**

UNIT 10:TREE AND VEEN DIAGRAMS AND SAMPLE SPACE.

Q73. A random experiment consists of rolling a die twice and observing the sum

Of the numbers that appear on the top faces. What is the probability of obtaining?

i) A sum of 4 when rolling a die twice? **(2marks)**

ii) At least a 4 when rolling a die twice? **(2marks)**

iii) At most a 4 when rolling a die twice? **(2marks)**

Q74.(a) One card is to be drawn from a pack of 52cards.Calculate is the probability that the card will be **(i)**a diamond **(ii)**a court card**(iii)**a black card.

(b)school has a teaching staff of 22 teachers. 8 of them teach Mathematics,7 teach Physics and 4 teach Chemistry. Three teach both Mathematics and Physics and one teaches Mathematics and Chemistry. No teacher teaches all the three subjects. The number of teachers who teach Physics and Chemistry is equal to that of those who teach Chemistry but not Physics.

i) Represent the above informations on a Venn diagram.

ii) Find the numbers of teachers who teach Mathematics only

iii) Find the numbers of teachers who teach Physics only

iv) Find the numbers of teachers who teach None of the three subjects .