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KCSE F3 MATHS TOPICALS

Prefer Calling Sir Obiero Amos

@ 0706 851 439

for Marking Schemes

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0706 851 439



QUADRATIC EQUATIONS

1. 1989 Q 1 P2

The length of a rectangular mat is $1^1/_2$m longer than its width. Find the length of the mat if its area is $4^1/_2 m^2$ (2 marks)

2. 1990 Q5 P2

The sum of two numbers is 24. The difference of their squares is 144. What are the two numbers? (3 marks)

3. 1990 Q3 P2

Find the coordinates of the points of intersection of the straight line $x-y = 5$ and the hyperbola $xy = 9$ (4 marks)

4. 1991 Q1 P1

Solve for x $2x^2 + x - 36 = 0$ (4 marks)

5. 1993 Q6 P1

Solve the simultaneous equations

$$x^2 + y^2 = 26$$
$$x - y = 4$$

(4 marks)

6. 1994 Q16 P1

When the price of an item was increased by sh 5, I bought 2 items fewer with sh 200. What is the current price of the item? (3 marks)

7. 1995 Q2 P2

Solve the simultaneous equations (4 marks)

$$2x - y = 3$$
$$x^2 - xy = -4$$

8. 2001 Q7 P1

The length of a room is 4 metres longer its width. Find the length of the room if its area is $32m^2$ (3 marks)

9. 2004 Q20 P1

The simultaneous equations below, are satisfied when x = 1 and y = p

$$-3x + 4y = 5$$
$$qx^2 - 5xy + y^2 = 0$$

a) Find the values of p and q. (4 marks)

b) Using the value of q obtained in (a) above, find the other values of x and y which also satisfy the given simultaneous equations. (4 marks)

10. 2006 Q6 P1

The length of a rectangle is (3x + 1) cm, its width is 3 cm shorter than its length. Given that the area of the rectangle is $28cm^2$, find its length. (3 marks)

11. 2007 Q20 P1

A retailer planned to buy some computers form a wholesaler for a total of Kshs 1,800,000. Before the retailer could buy the computers the price per unit was reduced by Kshs 4,000.

This reduction in price enabled the retailer to buy five more computers using the same amount of money as originally planned.

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(a) Determine the number of computers the retailer bought (6 marks)

(b) Two of the computers purchased got damaged while in store, the rest were sold and the retailer made a 15% profit
Calculate the profit made by the retailer on each computer sold
(4 marks)

12. 2008 Q23 P1

A group of people planned to contribute equally towards a water project which needed Ksh 2,000,000 to complete. However, 40 members of the group withdrew from the project. As a result, each of the remaining members were to contribute Ksh 2,500 more.

a) Find the original number of members in the group. (5 marks)

b) Forty five percent of the value of the project was funded by Constituency Development Fund (CDF). Calculate the amount of contribution that would be made by each of the remaining members of the group. (3 marks)

c) Member's contributions were in terms of labour provided and money contributed. If the ratio of the value of labour to the money contributed was 6:19; calculate the total amount of money contributed by the members.
(2marks)

13. 2009 Q19 P2

A school planned to buy x calculators for a total cost of Ksh 16,200.The supplier agreed to offer a discount of Ksh 60 per calculator. The school was then able to get three calculators for the same amount of money.

(a) Write an expression in terms of x for the
(i) Original price of each calculator (1 mark)
(ii) Price of each calculator after the discount. (1 mark)

(b) Form an equation in x and hence determine the number of calculators the school bought (5 marks)

(c) Calculate the discount offered to the school as a percentage (3 marks)

14. 2009 Q2 P2

Find a quadratic equation whose roots are $1.5+\sqrt{2}$ and $1.5-\sqrt{2}$, expressing it in the form $ax^2 + bx + c = 0$, where a, b, and c are integers (3 marks)

15. 2010 Q21 P1

Motorbike A travels at 10 km/h faster than motorbike B whose speed is x km/h. Motorbike A takes $1^{1}/_{2}$ hours less than the motorbike B to cover a 180 km journey.

(a) Write an expression in terms of x for the time taken to cover the 180 km journey by:
i. Motorbike A; (1 mark)
ii. Motorbike B; (1 mark)

(b) Use the expressions (a) above to determine the speed, in km/h, of motorbike A. (6 marks)

(c) For a journey of 48 km, motorbike B starts 10 minutes ahead of motorbike A. Calculate in minutes, the difference in the time of their arrival at the destination.

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(2 marks)

16. 2010 Q5 P2

The length of flower garden is 2m less than twice its width. The area of the garden is $60m^2$. Calculate its length. (3 marks)

17. 2010 Q21 P2

A hall can accommodate 600 chairs arranged in rows. Each row has the same number of chairs. The chairs are rearranged such that the number of row is increased by 5 but the number of chairs per row is decreased by 6.

a) Find the original number of rows of chairs in the hall. (6 marks)

b) After the re-arrangement 450 people were seated in the hall leaving the same number of empty chairs in each row. Calculate the number of empty chairs per row. (4 marks)

18. 2011 Q20 P2

A parent has two children whose age difference is 5 years. Twice the sum of the ages of two children is equal to the age of the parent .

(a) Taking x to be the age of the elder child, write an expression for:
(i) the age of the younger child (1 mark)
(ii)the age of the parent. (1 mark)

(b) In twenty years time, the product of the children's age will be 15 times the age of their parents
(i) Form an equation in x and hence determine the present possible ages of the elder child. (4 marks)

(ii) Find the present possible ages of the parent (2 marks)
(iii) Determine the possible ages of the younger child in 20 years time (2 marks)

19. 2012 Q20 P1

(a) Express $\frac{1}{x-2} - \frac{2}{x+5} = \frac{3}{x+1}$ in the form $ax^2 + bx + c = 0$ where a, b and c are constants hence solve for x.

(b) Neema did y tests and scored a total of 120 marks. She did two more tests which she scored 13 and 14 marks. The mean score of the first y tests was 3 marks more than the mean score for all the tests she did. Find the total number of tests that she did. (6 marks)

20. 2012 Q9 P2

Solve the equations

$$x + y = 17$$
$$xy - 5x = 32$$

(4 marks)

21. 2013 Q18 P1

(a) Solve the equation, $\frac{x+3}{24} = \frac{1}{x-2}$

(b) The length of a floor of a rectangular hall is 9m more than its width. The area of the floor is $136m^2$.

i. Calculate the perimeter of the floor. (4 marks)

ii. A rectangular carpet is placed on the floor of the hall leaving an area of $64m^2$. If the length of the carpet is twice its width, determine the width of the carpet. (2 marks)

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22. 2013 Q2 P2

A quadratic curve passes through the points (-2, 0) and (1, 0). Find the equation of the curve in the form $y = ax^2 + bx + c$, where a, b and c are constants (2 marks)

23. 2014 Q11 P1

A cow is 4 years 8 months older than a heifer. The product of their ages is 8 years.

Determine the age of the cow and that of the heifer. (4marks)

24. 2014 Q11 P2

Solve the simultaneous equations;

$3x - y = 9$

$x^2 — xy =$ (4marks)

25. 2015 Q6 P2

The length and width of a rectangular signboard are (3.x +12) cm and (x — 4) cm respectively.

If the diagonal of the signboard is 200cm, determine its area. (4 marks)

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QUADRATIC AND CUBIC GRAPHS

1. 1989 Q22 P1

(a) Using the grid provided below draw the graph of $y = -2x^2 + x + 8$ for values of x between -3 and 4 (4 marks)

(b) From your graphs find the roots of $-2x^2 + x + 8 = 0$ (1 mark)

(c) By drawing a suitable straight line graph on the same axes, find the roots of $-2x^2 + 4x + 12 = 0$ (3 marks)

2. 1991 Q19 P2

Complete the table given below for the equation $y = 5 + 3x - 2x^2$ by filling in the blank spaces.

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5
y	-9			3		6	6				-4	

(2 marks)

Use the values from the table above to draw the graph of

$y = 5 + 3x - 2x^2$

Use your graph to determine the ranges of values of x which satisfy the inequality $5 + 3x - 2x^2 \leq -2$ (3 marks)

3. 1992 Q19 P1

On the grid provided, draw the graph of $y = 2x^2 - 3x - 5$ for $-2 < x < 3$. (4marks)

In order to solve graphically the equation $2x^2 - x - 3 = 0$, a straight line must be drawn to intersect the curve $y = 2x^2 - 3x - 5$.

Obtain the equation of this straight line, draw the straight line and hence obtain the graphical solution to the equation $2x^2 - x - 3 = 0$ (4 marks)

4. 1993 Q20 P1

On the grid provided, plot the graph of $y = -2x^2 + 3x + 6$ for values of x and y from $x = -3$ to $x = 4$. Use your graph to find the roots of the equation $-2x^2 + x + 9 = 0$ (8 marks)

5. 1994 Q20 P1

Draw the graph of the function $y = 2x^2 + 6x - 5$ by taking the integral values of x in $-4 \leq x \leq 3$. (4 marks)

Use the graph to solve the following equations.

(i) $2x^2 + 6x - 5 = 0$ (4 marks)

(ii) $2x^2 - x - 6 = 0$

6. 1995 Q21 P1

(a) Construct a table of values for the function $y = x^2 - x - 6$ for $-3 \leq x \leq 4$ (2 marks)

(b) By drawing a suitable line on the same grid estimate the roots of the equation $x^2 + 2x - 2 = 0$ (3 marks)

7. 1997 Q20 P1

(a) Draw the graph of $y = 6 + x - x^2$, taking integral value of x in $4 \leq x \leq 5$.

(The grid is provided. Using the same axes draw the graph of $y = 2 - 2x$

(4 marks)

(b) From your graphs, find the values of X which satisfy the simultaneous

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equations $y = 6 + x - x^2$

$y = 2 - 2x$ (1 mark)

(c) Write down and simplify a quadratic equation which is satisfied by the values of x where the two graphs intersect. (2 marks)

8. 1999 Q20 P1

(a) Complete the following table for the equation $y = x^3 - 5x^2 + 2x + 9$ (2 marks)

x	-2	-1.5	-1	0	1	2	3	4	5
x^3		-3.4	-1	0	1		27	64	125
$-5x^2$	-20	-11.3	-5	0	-5	-20	-45		
2x	-4	-3		0	2	4	6	8	10
9	9	9	9	9	9	9	9	9	9
y		-8.7		9	7		-3		

(b) On the grid provided draw the graph of $y = x^3 - 5x^2 + 2x + 9$ for $-2 \leq x \leq 5$ (3 marks)

(c) Using the graph estimate the root of the equation $x^3 - 5x^2 + 2x + 9 = 0$ between x = 2 and x = 3 (1 mark)

(d) Using the same axes draw the graph of $y = 4 - 4x$ and estimate a solution to the equation $x^3 - 5x^2 + 6x + 5 = 0$ (2 marks)

9. 2000 Q19 P1

(a) Complete the table below for the equation $y = 2x^3 + 5x^2 - x - 6$ (2 marks)

x	-4	-3	-2	-1	0	1	2
$2x^3$	-128	-54			0	2	16
$5x^2$	80	45	20	5	0	5	20
-x	4	3				-1	
-6	-6	-6	-6	-6	-6	-6	-6
y	-50				-6	0	

(b) On the grid provided draw the graph $y = 2x^3 + 5x^2 - x - 6$ for $-4 \leq x \leq 2$
Use 2cm to represent 1 unit on the x axis and 1cm to represent 5 units on the y axis (3 marks)

(c) By drawing a suitable line use the graph in (b) to solve the equation
$2x^3 + 5x^2 - x - 4 = 0$ (3 marks)

10. 2001 Q22 P1

(a) Complete the following table for the equation $y = x^3 + 2x^2$ (2 marks)

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5
x^3	-27		-8	-3.375	-1	0.125	0	0.125		3.375
$2x^2$	18		8	4.5	2	0.5	0	0.5		4.5
y	-9		0	1.125	1	0.375	0	0.625		7.875

(b) On the grid provided draw the graph $y = x^3 + 2x^2$ for $-3 \leq x \leq 1.5$
Take the scale: 2cm for 1 unit on the X- axis and 1 cm for 1 unit on y – axis (3 marks)

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(c) By drawing a suitable line on the same grid, Estimate the roots of the equation: $x^3 + 2x^2 - x - 2 = 0$ (3 marks)

11. 2003 Q22 P1

(a) Complete the table below, for function $y = 2x^2 + 4x - 3$ (2 marks)

x	-4	-3	-2	-1	0	1	2
$2x^2$	32		8	2	0	2	
4x - 3			-11				5
y			-3		-3	3	13

(b) On the grid provided, draw the graph of the function $y=2x^2 + 4x - 3$ for $-4 \le x \le 2$ and use the graph to estimate the rots of the equation $2x^2 + 4x - 3 = 0$ to 1 decimal place. (3 marks)

(c) In order to solve graphically the equation $2x^2 + x - 5 = 0$, a straight line must be drawn to intersect the curve $y = 2x^2 + 4x - 3$.
Determine the equation of this straight line, draw the straight line hence obtain the roots of the equation $2x^2 + x - 5 = 0$ to 1 decimal place
(3 marks)

12. 2004 Q18 P1

The equation of a curve is given $y = x^3 + 4x^2 - 2$

a) Determine the coordinates of the turning points of the curve, correct to 1 decimal place. (3 marks)

b) Use the equation of the curve to complete the table below.

x	-4	-3	-2	-1	0	1
y	-2		6	1		

(1 mark)

c) i) On the grid provided, use the solutions in part (a) and the values in the table in part (b) to draw the curve for $-4 < x < 1$. (2 marks)

ii) Use the graph to solve the equation $x^3 + 4x^2 - 2 = 0$ (2 marks)

13. 2005 Q24 P1

(a) (i) Complete the table below for the function $y = x^3 + x^2 - 2x$ (2 marks)

x	-3	-2	-1	0	1	2	2.5
-2x	6	4	2	0	-2	-4	-5
x^2	9	4	1	0	1	4	6.25
x^3	-27	-8	-1	0	1	8	15.625
$Y = x^3 + x^2 - 2x$							

(ii) On the grid provided, draw the graph of $y = x^3 + x^2 - 2x$ for the values of x in the interval $-3 \le x \le 2.5$ (2 marks)

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(iii) State the range of negative values of x for which y is also negative (1 mark)

(b) Find the coordinates of two points on the curve other than (0,0) at which x-coordinate and y- coordinate are equal (3 marks)

14. 2006 Q14 P2

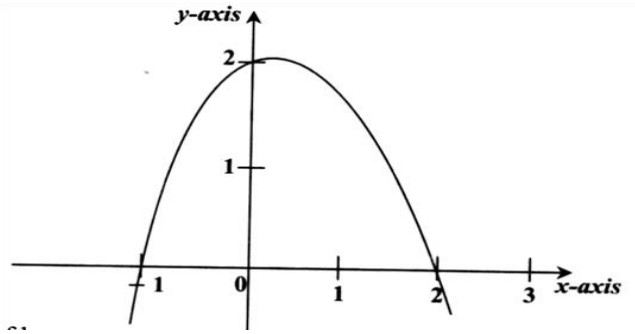
The table shows some corresponding values of x and y for the curve represented by $y = ¼ x^3 - 2$

x	-3	-2	-1	0	1	2	3
y	-8.8	-4	-2.3	-2	-1.8	0	4.8

On the grid provided, draw the graph of $y = ¼ x^3 - 2$ for $-3 \leq x \leq 3$. Use the graph to estimate the value of x when y = 2 (3 marks)

15. 2007 Q14 P2

The figure below is a sketch of the graph of the quadratic function $y = k(x+1)(x-2)$



Find the value of k (2 marks)

16. 2008 Q24 P2

The table below shows values of x and some values of y for the curve $y = x^3 + 3x^2 - 4x - 12$ in the range $-4 \leq x \leq 2$.

a) Complete the table by filling in the missing values of y. (2 marks)

x	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2.0
y		-4.1		-1.1		-2.6		-9.4		-13.1		-7.9	

b) On the grid provided, draw the graph $y=x^3 + 3x^2 - 4x - 12$ for $-4 \leq x \leq 2$.
Use the scale. Horizontal axis 2cm for I unit and vertical axis 2cm for 5 units.
(3 marks)

c) By drawing a suitable straight line on the same grid as the curve, solve the equation $x^3+3x^2-5x-6=0$ (5 marks)

17. 2011 Q21 P2

The table below shows values of x and some values of y for the curve $y=x^3 +2x^2 -3x -4$ for $-3 \leq x \leq 2$.

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y	-4.0	0.4		1.6	0		-4.0	-4.9			6

(a) Complete the table by filling in the missing values of y, correct to 1

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decimal place.

(2 marks)

(b) On the grid provided, draw the graph of $y=x^3 + 2x^2 – 3x – 4$.

Use the scale: 1cm represents 0.5 units on x-axis

1cm represents 1 unit on y- axis (3 marks)

(c) Use the graph to:

(i) Solve the equation $x^3 + 2x^2 – 3x -4 = 0$; (3 marks)

(ii) Estimate the coordinates of the turn points of the curve (2 marks)

18. 2013 Q19 P2

(a) Complete the table below for $y = x^3+4x^2-5x-5$ (2 marks)

x	-5	- 4	-3	-2	-1	0	1	2
$y= x^3+4x^2-5x-5$			19			-5		

(b) On the grid provided, draw the graphs of $y = x^3 +4x^2-5x-5$ for $-5 \leq x \leq 2$ (3 marks)

(c) (i) Use the graph to solve the equation $x^3 +4x^2 – 5x – 5 = 0$ (2 marks)

(ii) By drawing a suitable straight line on the graph, solve the equation

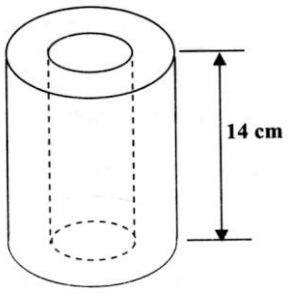
$x^3 + 4x^2 – 5x -5 = - 4x – 1$ (3 marks)

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APPROXIMATIONS AND ERRORS

1. 1996 Q 15 P1

The figure below represents a hollow cylinder. The internal and external radii are estimated to be 6 cm and 8 cm respectively, to the nearest whole number. The height of the cylinder is exactly 14 cm.



(a) Determine the exact values for internal and external radii which will give maximum volume of the material used. (1 mark)

(b) Calculate the maximum possible volume of the material used
Take the value of π to be $^{22}/_{7}$ (2 marks)

2. 1997 Q 16 P1

(a) Work out the exact value of $R = \dfrac{1}{0.003146 - 0.003130}$

(b) An approximate value of R may be obtained by first correcting each of the decimal in the denominator to 5 decimal places
(i) The approximate value
(ii) The error introduced by the approximation (3 marks)

3. 1998 Q 15 P1

The radius of circle is given as 2.8 cm to 2 significant figures
a) If C is the circumference of the circle, determine the limits between which $\frac{C}{\pi}$ lies
b) By taking π to be 3.142, find, to 4 significant figures the line between which the circumference lies. (3 marks)

4. 1999 Q 9 P1

The length and breadth of a rectangular floor were measured and found to be 4.1m and 2.2 m respectively. If possible error of 0.01m was made in each of the measurements, find the:
(a) maximum and minimum possible area of the floor (2 marks)
(b) Maximum possible wastage in carpet ordered to cover the whole floor (1 marks)

5. 2000 Q 10 P1

The length and breadth of a rectangular paper were measured to be the nearest centimetre and found to be 18cm and 12 cm respectively.
Find the percentage error in its perimeter. (3 marks)

6. 2002 Q 8 P2

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The sides of a triangle were measured and recorded as 8cm, 10cm and 15cm.
Calculate the percentage error in perimeter, correct to 2 decimal places. (3 marks)

7. 2005 Q 9 P1

In this question Mathematical Tables should not be used
The base and perpendicular height of a triangle measured to the nearest centimetre are 6 cm and 4 cm respectively.
Find
(a) The absolute error in calculating the area of the triangle (2 marks)
(b) The percentage error in the area, giving the answer to 1 decimal place (2 marks)

8. 2006 Q 4 P2

By correcting each number to one significant figure, approximate the value of 788 x 0.006. Hence calculate the percentage error arising from this approximation. (3 marks)

9. 2007 Q 8 P2

A rectangular block has a square base whose side is exactly 8 cm. Its height measured to the nearest millimetre is 3.1 cm. Find in cubic centimetres, the greatest possible error in calculating its volume. (2 marks)

10. 2008 Q 5 P2

The top of a table is a regular hexagon. Each side of the hexagon measures 50.0 cm.
Find the maximum percentage error in calculating the perimeter of the top of the table.

(3 marks)

11. 2010 Q 1 P2

The length and width of a rectangle measured to the nearest millimetre are 7.5cm and 5.2cm respectively.
Find, to four significant figures, the percentage error in the area of the rectangle.

(3 marks)

12. 2011 Q 9 P2

The radius of a spherical ball is measured as 7cm, correct to the nearest centimetre. Determine, to 2 decimal places, the percentage error in calculating the surface area of the ball. (4 marks)

13. 2012 Q11 P2

The base and height of a right angled triangle were measured as 6.4cm and 3.5cm respectively. Calculate the maximum absolute error in the area of the triangle.

(3 marks)

14. 2014 Q1 P2

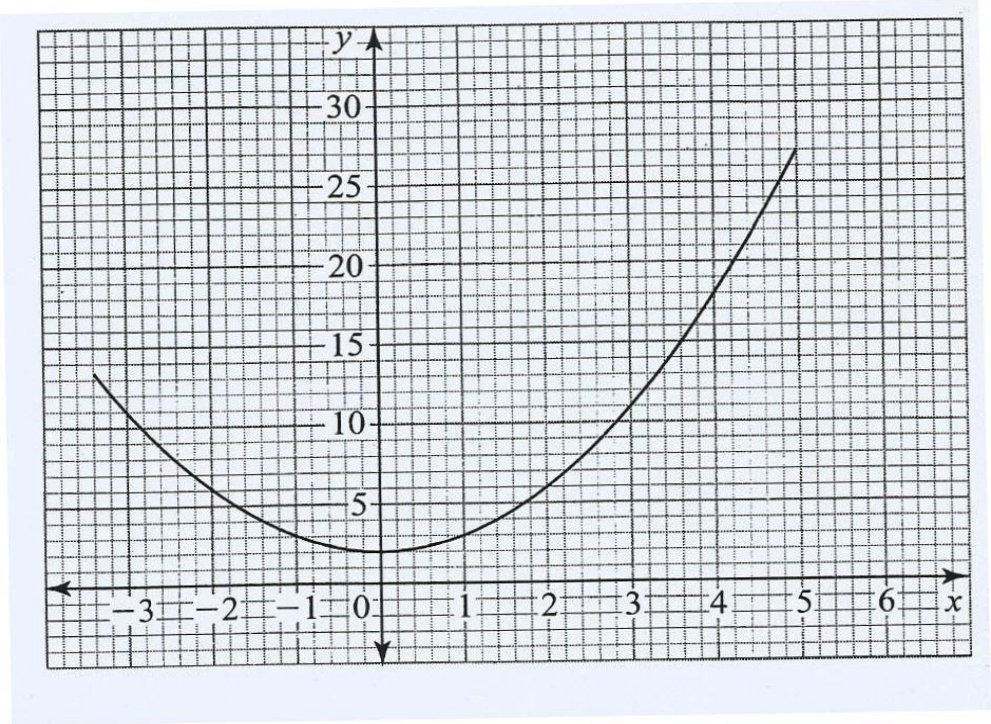
The lengths of two similar iron bars were given as 12.5m and 9.23m.
Calculate the maximum possible difference in length between the two bars.

(3 marks)

15. 2015 Q13 P1

The figure below represents the curve of an equation
Use the mid-ordinate rule with 4 ordinates to estimate the area bounded by the curve, lines y — 0, x = — 3 and x = 5. (3 marks)

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16. 2015 Q13 P1

The length and width of a rectangular piece of paper were measured as 60 cm and 12 cm respectively. Determine the relative error in the calculation of its area. (4 marks)

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TRIGONOMETRY (II)

1. 1989 Q13 P1

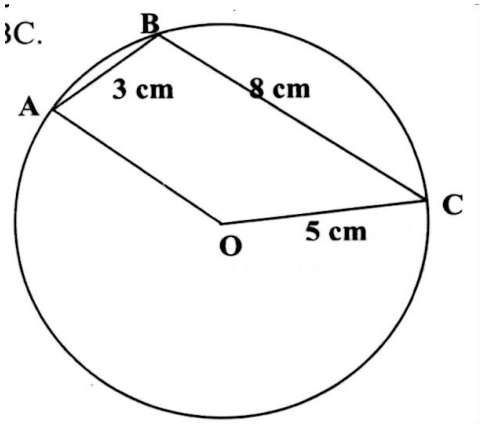
Two sides of a triangular field are 21 m and 32 m long. Its area is 240m^2.
The angle between two sides is obtuse. Determine this angle. (3 marks)

2. 1990 Q19 P2

Two sides of a triangular plot of land are 52m and 28m. Given that the angle between these two sides is an obtuse angle and that the area of the plot is 576m^2, find the perimeter of the plot. (8 marks)

3. 1991 Q7 P1

In the figure below AB and BC are chords of a circle, centre O. AB = 3cm, BC = 8cm and OC = 5cm. Calculate angle ABC. (3 marks)



4. 1991 Q14 P2

Three towns P, Q and R are such that Q is 40 km on the bearing of 290^0 from P. Town R is directly to the south of P. The distance between Q and R is 60km. Find the bearing of Q directly from R. (4 marks)

5. 1992 Q16 P1

A ship P is due south of a lighthouse L. A ship Q is 4.8km due east of L. The bearing of Q from P is 030^0. P sails directly towards Q. Find the distance of P from L when its bearing from L is 110^0. (3 marks)

6. 1994 Q7 P1

A man walks 5km on a bearing of 315^0 from a point A and then walks due south to a point B which is 8km from A. Calculate the bearing of B from A (4 marks)

7. 1994 Q12 P1

A triangle ABC is such that AB=10cm,BC=12cm and $< ABC=100^0$. Calculate

(i) The length of AC
(ii) The diameter of the circumcircle (4 marks)

8. 1994 Q22 P2

The bearing of A from P is 160^0 and the bearing of B from P is 280^0. PA is 4000km and PB is 5000km.

(a) An aeroplane flies from point B at 08 00h towards point A at 420km/h. How long does it take to reach point A?

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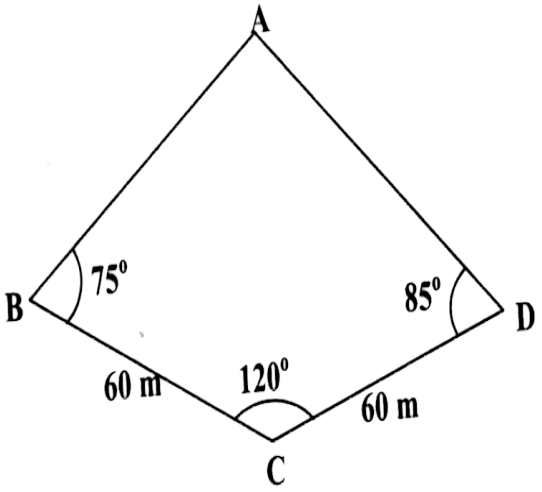
(b) Another aeroplane flies from point A at 08 15h towards point B at 500km/h

(i) How far from point B will the aeroplane cross each other? (3 marks)

(ii) At what time wil they cross each other? (2 marks)

9. 1995 Q 22 P1

The figure below represents a plot of land ABCD, where BC = CD = 60 metres, < BCD = 120^0 < ABC = 75^0 and < ADC = 85^0



(a) Calculate the distance from B to through D (5 marks)

(b) The plot is to be fenced using poles that are 3 metres apart except at corner A, where the two poles next to the corner pole are each less than 3 metres from Calculate the distance from the pole at corner at corner A to each of the poles next to it. (3 marks)

10. 1995 Q 20 P2

A hillside is in the form of a plane inclined at an angle of 30^0 to the horizontal. A straight section of road 800 metres long lies along the line of greatest slope from a point A to a point B further up the hillside.

(a) If a vehicle moves from A and B, what vertical height does it rise?

(b) D is another point on the hillside and is on the same height as B. Another height straight road joins A and D and makes an angle of 60^0 with AB. C is a point on AD such that AC = ¾ AD.

Calculate

(i) The length of the road from A to C (2 marks)

(ii) The distance of CB (2 marks)

(iii) The angle elevation of B and C (2 marks)

11. 1999 Q18 P1

A triangular plot of land ABC is such that AB= 34 m, AC=66m and BAC = 96.7^0

(a) Calculate the length of BC (3 marks)

(b) In order to subdivide the plot, a fencing post P is located on BC such that BP: PC = 1:3. Calculate the area of the plot ABC and hence find the area of the triangular subdivision APB. (3 marks)

(c) A water pipe running though the subdivision APB is parallel to AB and divides the area in the ratio 4:5 where the bigger portion is a trapezium. Calculate the distance of the pipe from P. (2 marks)

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12. 1999 Q 18 P2

A tower is on a bearing of 030^0 from a point P and a distance of 100m.From P, the angle of elevation of the top is 15^0 and the angle of depression of the foot of the tower is 1^0.

a) Find the height of the tower (3 marks)

b) A point Q is on the same horizon plane as point P. The tower is on a bearing 330^0 from Q and at a distance of 70 m

(i) Distance from P to Q (2 marks)

(ii) Bearing of P from Q (3 marks)

13. 2000 Q7 P1

Given that $\sin\theta = \frac{2}{3}$ and θ is an acute angle find:

(a) $\tan\theta$,giving your answer in surd form (2 marks)

14. 2000 Q 8 P1

Shopping centres, X, Y and Z are such that Y is 12 km south of X and Z is 15 km from X. Z is on a bearing of 330^0 from Y. Calculate the bearing of Z from X

(3 marks)

15. 2000 Q 17 P1

A triangular plot ABC is such that AB = 36m, BC = 40m and AC = 42 m

(a) Calculate the:

(i) Area of the plot in square metres (3 marks)

(ii) Acute angle between the edges AB and BC (3 marks)

(b) A water tap is to be installed inside the plot such that the tap is equidistant from each of the vertices A, B and C. Calculate the distance of the tap from the vertex. (2 marks)

16. 2000 Q 19 P2

A rally car travelled from point R to point S. S is 128 km on a bearing 060^0 from R. The car then set off S at 9.30 am towards T at an average of 150km/h. It was expected at T at 11.30 am. After travelling for I hour and 20 minutes It broke down at point P. The bearing of T and P from S is 300^0.

a) Calculate the:

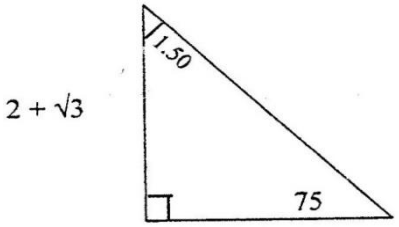
(i) Distance from R to P (4 marks)

(ii) Bearing of P and R (3 marks)

(b) The repair took 10 minutes and the car set off to complete its journey to T. Find the speed at which car must now move to reach T on time.

17. 2001 Q 13 P2

Given that $\tan 75^o = 2 + \sqrt{3}$, find without using tables $\tan 15^0$ in the form $p+q\sqrt{m}$, where p, q and m are integers.



(3 marks)

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18. 2001 Q 17 P2

A helicopter is stationed at an airport H on a bearing 060° and 800km from another airport P. A third airport is J is on bearing of 140^0 and 1,200km from H.

a) Determine:

i) Distance between P and J (3 marks)

ii) The bearing of P from J (3 marks)

b) A jet flying at a speed of 1035 km/h left J towards P. The helicopter at H also took off towards P at the same time. Find the speed at which the helicopter will fly so as to arrive at P,12 minutes later than the jet (2 marks)

19. 2002 Q 13 P1

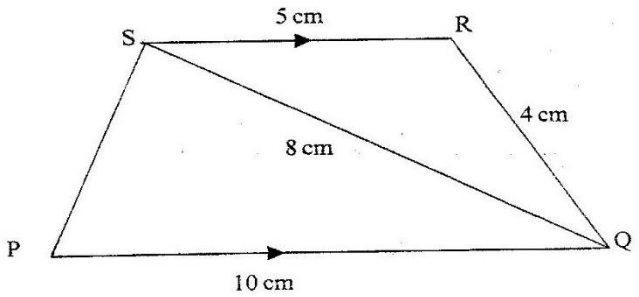
Given that $\sin \propto = \frac{1}{\sqrt{5}}$ where a is an acute angle find, without using mathematical tables:

a) $\cos \propto$ in the form of $a\sqrt{b}$, where a and b are rational numbers (2 marks)

b) tan (90-$\propto$) (1 mark)

20. 2004 Q 12 P1

In the figure below PQRS is a trapezium with SR parallel to PQ. SR = 5cm, RQ = 4cm, QS = 8cm and PQ = 10cm.



Calculate:

a) The size of angle QSR (2 marks)

b) The area of triangle PQ (2 marks)

21. 2004 Q 23 P1

A triangular plot ABC is such that the length of the side AB is two thirds that of BC. The ratio of the lengths AB: AC = 4:9 and the angle at B is obtuse.

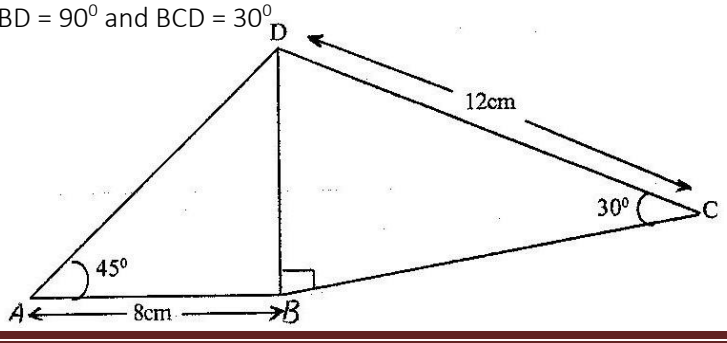
a) The length of the side BC (3 marks)

b) i) The area of the plot (3 marks)

ii) The size of <ABC (2 marks)

22. 2005 Q 14 P1

The figure below shows a quadrilateral ABCD in which AB = 8 cm, DC = 12 cm, < BAD = 45^0, < CBD = 90^0 and BCD = 30^0



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Find:

(a) the length of BD (1 mark)

(b) The size of the angle ADB (2 marks)

23. 2005 Q 22 P2

A boat at point X is 200 m to the south of point Y. The boat sails X to another point Z. Point Z is 200m on a bearing of 310^0 from X, Y and Z are on the same horizontal plane.

a) Calculate the bearing and the distance of Z from Y (3 marks)

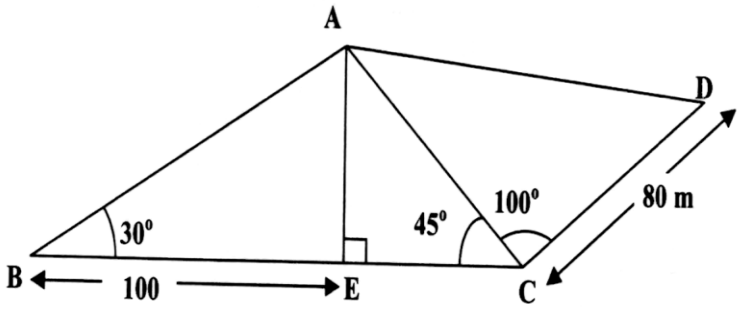
b) W is the point on the path of the boat nearest to Y.
Calculate the distance WY (2 marks)

c) A vertical tower stands at point Y. The angle of point X from the top of the tower is 6^0 calculate the angle of elevation of the top of the tower from W (3 marks)

24. 2006 Q 21 P1

The figure below represents a quadrilateral piece of land ABCD divided into three triangular plots The lengths BE and CD are 100m and 80m respectively.

Angle ABE = 30^0 ∠ACE = 45^0 and ∠ ACD = 100^0



Find to four significant figures:

(i) The length of AE (2 marks)

(ii) The length of AD (3 marks)

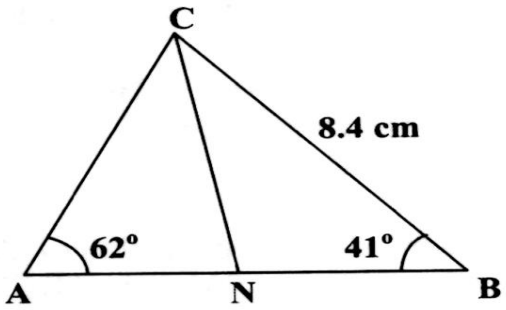
(iii) the perimeter of the piece of land (3 marks)

(b) The plots are to be fenced with five strands of barbed wire leaving an entrance of 2.8 m wide to each plot. The type of barbed wire to be used is sold in rolls of lengths 480m.Calculate the number of rolls of barbed wire that must be bought to complete the fencing of the plots (2 marks)

25. 2007 Q 10 P1

In the figure below < A = 62^0, < B = 41^0, BC = 8.4 cm and CN is the bisector of < ACB.

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Calculate the length of CN to 1 decimal place. (3 marks)

26. 2008 Q10 P1

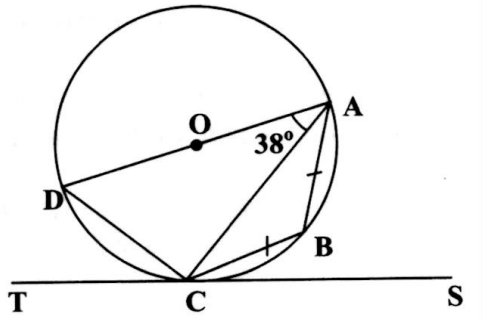
An angle of 1.8 radians at the centre of the circle subtends an arc of length 23.4cm. Find

(a) The radius of the circle (2 marks)

(b) The area of the sector enclosed by the arc and the radii. (2 marks)

27. 2008 Q 20 P2

In the figure below DA is a diameter of the circle ABCD centre O, radius 10cm. TCS is a tangent to the circle at C, AB=BC and angle DAC= 38^0



a) Find the size of the angle;

(i) ACS; (2 marks)

(ii) BCA (2 marks)

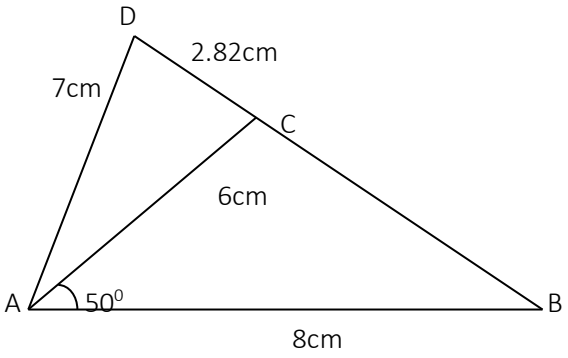
b) Calculate the length of:

(i) AC (2 marks)

(ii) AB (4 marks)

28. 2009 Q 17 P1

In the figure below (not drawn to scale) AB=8cm, AC=6 cm, AD= 7cm, CD=2.82cm and angle CAB = 50°



Calculate to 2 decimal places:

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(a) the length BC (2 marks)
(b) the size of angle ABC; (3 marks)
(c) the size of angle CAD ; (3 marks)
(d) the area of triangle ACD (2 marks)

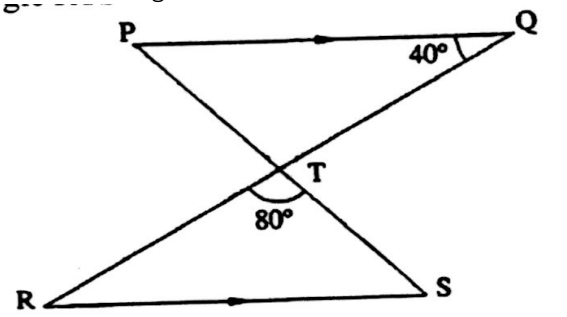
29. 2011 Q 20 P1

In a triangle ABC, BC=8cm, AC=12 cm and angle ABC=120^0

a) Calculate the length of AB, correct to one decimal place. (4 marks)
b) If BC is the base of the triangle, calculate, correct to one decimal place:
   i) The perpendicular height of the triangle; (2 marks)
   ii) The area of the triangle; (2 marks)
   iii) The size of angle ACB. (2 marks)

30. 2012 Q24 P1

In the figure below, PQ is parallel to RS. The lines PS and RQ intersect at T.
RQ = 10 cm, RT: TQ = 3.2, angle PQT= 40^0 and angle RTS = 80^0.



(a) Find the length of RT. (2 marks)
(b) Determine, correct 2significant figures:
   (i) The perpendicular distance between PQ and RS; (2 marks)
   (ii) The length of TS (2 marks)
(c) Using the cosine rule, find the length of RS correct to 2significant figures (2 marks)
(d) Calculate correct to one decimal place, the area of triangle RTS. (2 marks)

31. 2013 Q13 P1

A triangle ABC is such that AB = 5 cm, BC = 6 cm and AC = 7 cm.
a) Calculate the size of angle ACB, correct to 2 decimal places. (2 marks)
b) A perpendicular drawn from A meets BC at N. calculate the length AN correct to one decimal place. (2 marks)

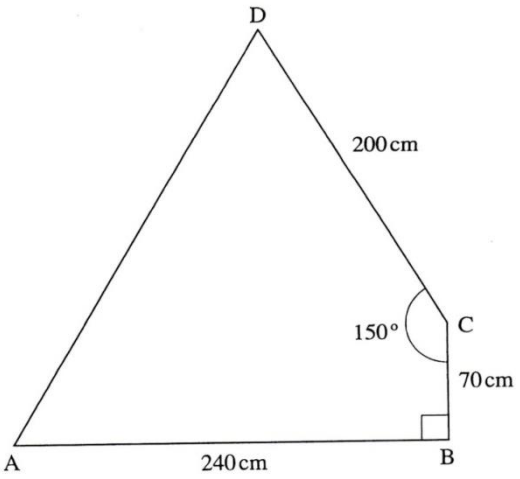
32. 2014 Q7 P1

The area of a sector of a circle, radius 2.1cm, is 2.31cm^2. The arc of the sector subtends an angle θ, at the centre of the circle. Find the value of θ in radians to 2 correct decimal places (2marks)

33. 2013 Q23 P1

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The figure below represents a piece of land in the shape of a quadrilateral in which AB =240M, BC = 70m CD = 200m $<BCD = 150^0$ $<ABC = 90^0$



Calculate

(a) The size of $<BAC$ correct to 2decimal places (2marks)

(b) The length AD correct to one decimal place (4marks)

(c) The area of the piece of land, in hectares, correct to 2 decimal places (4marks)

34. 2015 Q19 P2

The equation of a curve is given by y= 1 + 3sinx.

(a) Complete the table below for y = 1 + 3 sin x correct to 1 decimal place

x°	0	30	60	90	120	150	180	210	240	270	300	330	360
y = 1 + 3 sin x	1		3.6				1	-0.5			-1.6		

(b) (i) On the grid provided, draw the graph of y — 1 + 3 sin x for $0 \leq x \leq 360°$.

(3 marks)

ii) State the amplitude of the curve y = 1 + 3 sin x. (1 mark)

c) On the same grid draw the graph of y = tan x for $90^0 \leq x \leq 270°$. (3 marks)

d) Use the graphs to solve the equation

1+3 sin x = tan x for $90^0 \leq x \leq 270°$. (1 mark)

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SURDS

1. 1996 Q 16 P2

Simplify

$(1+\sqrt{3})(1-\sqrt{3})$ (1 mark)

Hence evaluate $\frac{1}{1+\sqrt{3}}$ to 3 s.f given that $\sqrt{3}$ =1.7321 (1 mark)

2. 1997 Q 12 P2

If

$$\frac{\sqrt{14}}{\sqrt{7}-\sqrt{2}} - \frac{\sqrt{14}}{\sqrt{7}+\sqrt{2}} = a\sqrt{7} + b\sqrt{2},$$

Find the values of a and *a* where *b* are rational numbers (4 marks)

3. 1998 Q 3 P2

Simplify as far as possible, leaving your answer in the form of surd

$$\frac{1}{\sqrt{14}-2\sqrt{3}} - \frac{1}{\sqrt{14}+2\sqrt{3}}$$

(2 marks)

4. 2003 Q 10 P2

Given that

a = $\frac{1}{\sqrt{3}}$ and b = $\sqrt{13}$, express $2\sqrt{3} - 6\sqrt{39}$

in terms of a and b and Simplify the answer. (3 marks)

5. 2004 Q 16 P2

Without using mathematical tables, simplify

$$\frac{2}{3-\sqrt{7}} - \frac{2}{3+\sqrt{7}}$$ in the form $a\sqrt{b}$

(3 marks)

6. 2005 Q 2 P2

Without using mathematical Tables, simplify

$$\frac{\sqrt{63}+\sqrt{72}}{\sqrt{32}+\sqrt{28}}$$

(3 marks)

7. 2006 Q 6 P2

Without using a calculator or mathematical tables, simplify

$$\frac{3\sqrt{2}-\sqrt{3}}{2\sqrt{3}-\sqrt{2}}$$

(3 marks)

8. 2007 Q 15 P2

Simplify

$$\frac{3}{\sqrt{5}-2}+\frac{1}{\sqrt{5}}$$

leaving the answer in the form $a+b\sqrt{c}$, where a , b and c are rational numbers (3 marks)

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9. 2008 Q 13 P2

Without using a calculator or mathematical tables, express

$$\frac{\sqrt{3}}{1-\cos 30^0}$$

in surd form and simplify

(3 marks)

10. 2009 Q 10 P2

Simplify

$$\frac{\sqrt{3}}{\sqrt{3}-\sqrt{2}}$$ (2 marks)

11. 2010 Q 2 P2

Simplify

$$\frac{4}{\sqrt{5}+\sqrt{2}}-\frac{3}{\sqrt{5}-\sqrt{2}}$$ (3 marks)

12. 2011 Q 8 P2

Write $\sin 45^0$ in the form $\frac{1}{\sqrt{a}}$ where a is a positive integer.

Hence simplify

$$\frac{\sqrt{8}}{1+\sin 45^0}$$

leaving the answer in surd form. (3 marks)

13. 2012 Q10 P2

Simplify

$$\frac{\sqrt{5}}{\sqrt{5}-2},$$

leaving the answer in the form a+ b√c where a, b and c are integers. (2 marks)

14. 2013 Q13 P2

Simplify the expression $\frac{\sqrt{48}}{\sqrt{5}+\sqrt{3}}$ leaving the answer in the form $a\sqrt{b}+c$

where a, b and c are integers (3 marks)

15. 2015 Q2 P2

Simplify $\frac{\sqrt{11}}{\sqrt{11-\sqrt{7}}}$

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LOGARITHMIC NOTATIONS

1. 1992 Q10 P2

Without using logarithm tables, solve for x in the equation below:

$$\log\left(\frac{11}{2}\right) + 2\log\left(\frac{4}{11}\right) - \log\left(\frac{5}{22}\right) = 2\log 4 - \log x$$ (3 marks)

2. 1993 Q4 P2

Solve for x in the equation

$$2\log_{10}x + \log_{10}5 = 1 + 2\log_{10}4$$ (4 marks)

3. 1994 Q14 P2

Find the value of x that satisfies the equation

(4 marks)

$$\log(2x - 11) - \log 2 = 5\log 2 - \log\frac{2}{5}$$

4. 1995 Q 13 P2

Without using logarithm tables, find the value of x in the equation

$\log x^3 + \log 5x = 5 \log 2 - \log \frac{2}{5}$ (3 marks)

5. 1998 Q 12 P2

Find x if

$-3 \log 5 + \log x^2 = \log \frac{1}{125}$ (3 marks)

6. 1999 Q 6 P2

Solve for x

$$(\log_3 x)^2 - \frac{1}{2}\log_3 x = \frac{3}{2}$$ (4 marks)

7. 2000 Q 5 P1

Find the value of x that satisfies the equation

$$\log(x + 5) = \log 4 - \log(x + 2)$$ (3 marks)

8. 2001 Q 8 P2

Solve the equation

$$\log(x + 24) - 2\log 3 = \log(9 - 2x)$$ (3 marks)

9. 2003 Q 5 P2

Solve the equation

$$\log_{10}(6x - 2) - 1 = \log_{10}(x - 3)$$ (3 marks)

10. 2004 Q 5 P2

Evaluate without using mathematical tables, the expression

$$2\log_{10} 5 - \frac{1}{2}\log_{10} 16 + 2\log_{10} 40$$ (3 marks)

11. 2005 Q 7 P2

Find, without using Mathematical Tables the values of x which satisfy the equation

$$\log_2(x^2 - 9) = 3\log_2 2 + 1$$ (4 marks)

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12. 2006 Q 10 P1

Without using mathematical tables or a calculator evaluate

$$6\log_2 \sqrt[3]{64} + 10\log_3 \sqrt[5]{243}$$ (3 marks)

13. 2008 Q 14 P1

Given that log 4=0.6021 and log 6=0.7782, without using mathematical tables or a calculator, evaluate log 0.096. (3 marks)

14. 2008 Q 12 P2

Solve for y in the equation

$$\log_{10}(3y + 2) - 1 = \log_{10}(y - 4)$$ (3 marks)

15. 2010 Q 15 P2

Find the value of *x* give that

$$\log(15 - 5x) - 1 = \log(3x - 2)$$ (3 marks)

16. 2012 Q 1 P2

Evaluate

$$\frac{\log 4^5 - \log 5^4}{\log 4^{\frac{1}{5}} + \log 5^{\frac{1}{4}}}$$

giving the answer to 4 significant figures. (2 marks)

17. 2012 Q12 P1

Without using mathematical tables or a calculator, solve the equation

$$2\log_{10} x - 3\log_{10} 2 + \log_{10} 32 = 2$$

(3 marks)

18. 2013 Q4 P2

Solve the equation

$2 \log x - \log (x-2) = 2 \log 3$. (3 marks)

19. 2014 Q9 P2

Solve the equation;

$2 \log 15 - \log x = \log 5 + \log (x - 4)$.

(2 marks)

20. 2015 Q7 P2

Find the value of x given that $\log (x - 1) + 2 = \log (3x + 2) + \log 25$. (3 marks)

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COMMERCIAL ARITHMETIC II

(a) HIRE PURCHASE

1. 1989 Q2 P2

If a cupboard is to be bought on hire purchase, the buyer pays a deposit equal to 10% of the cash price plus 12 equal monthly instalments. John the cupboard by hire purchase and ended up paying a total of sh. 3240, which was 20% above the cost price. Determine the monthly instalments. (4 marks)

2. 1995 Q15 P1

The cash prize of a television is Kshs 25000. A customer paid a deposit of Kshs 3750. He repaid the amount owing in 24 equal monthly instalments.
If he was charged simple interest at the rate of 40% p.a, how much was each instalment? (4 marks)

3. 2007 Q6 P2

The cash price of a T.V set is Kshs 13, 800. A customer opts to buy the set on Hire purchase terms by paying a deposit of Kshs 2, 280
If simple interest of 20% p.a is charged on the balance and the customer is required to repay by 24 equal monthly instalments, calculate the amount of each instalment. (3 marks)

4. 2011 Q17 P2

The cash price of a laptop was Ksh. 60,000. On hire purchase terms, a deposit of Ksh 7500 was paid followed by 11 monthly instalments of Ksh 6000 each.

a) Calculate :
   i) The cost of a laptop on hire purchase terms; (2 marks)
   ii) The percentage increase of hire purchase price compared to the cash price. (2 marks)

b) An institution was offered a 5% discount when purchasing 25 such laptops on cash terms. Calculate the amount paid the institution (2 marks)

c) Two other institutions, X and Y bought 25 such laptops each. Institution X bought the laptops on hire purchase terms. Institution Y bought the laptops on cash terms with no discount by securing a loan from a bank. The bank charged 12% p.a compound interest for two years.

Calculate how much more money institution Y paid than institution X (4 marks)

5. 2013 Q17 P2

The hire purchase (H.P) price of a public address system was Kshs 276000. A deposit of Kshs 60000 was paid followed by 18 equal monthly installments. The cash price of the public address system was 10% less than the H.P price.

(a) Calculate
   (i) The monthly installments (2 marks)
   (ii) The cash price (2 marks)

(b) A customer decided to buy the system in cash and was allowed a 5% discount on the cash price. He took a bank loan to buy the system in cash. The bank charged compound interest on the loan at the rate of 20% p.a. The loan was repaid in 2 years. Calculate the amount repaid to the bank by the end of the second year (3 marks)

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(c) Express as a percentage of the Hire Purchase price, the difference between the amount repaid to the bank and the Hire Purchase price (3 marks)

6. 2015 Q17 P2

In a retail shop, the marked price of a cooker was Ksh 36 000. Wanandi bought the cooker on hire purchase terms. She paid Ksh 6400 as deposit followed by 20 equal monthly installments of Ksh 1750.

(a) Calculate:

(i) The total amount of money she paid for the cooker. (2 marks)

(ii) The extra amount of money she paid above the marked price. (1 mark)

(b) The total amount of money paid on hire purchase terms was calculated at a Compound interest rate on the marked price for 20 months. Determine the rate, per annum, of the compound interest correct to 1 decimal place. (4 marks)

c) Kaloki borrowed kshs 36000 form a financial institution to purchase a similar cooker. The financial institution charged a compound interest rate equal to the rate in (b) above for 24 months. Calculate the interest kaloki paid correct to the nearest shilling. (3marks)

(b) SIMPLE AND COMPOUD INTERESTS

1. 1989 Q7 P1

Omondi deposited sh 4500 in a bank which paid compound interest of 12% per annum. Calculate the amount after 2 years (2 marks)

2. 1990 Q22a P1

A man wants to buy a residential house valued at sh 500,000. A housing finance company advances him 90% of the amount. He repays by equal monthly instalments of sh. 6500 for 15 years. Calculate the total interest paid to the finance company.

(4 marks)

3. 1991 Q20 P2

An insurance company has a target of raising sh. 100,000 in a period of three years. At the beginning of each year the company invests sh. 30,000 at a compound interest of 15% in a financial institution. By how much does the company exceed its target at the end of three years? (8 marks)

4. 1992 Q10 P1

Find the compound interest on sh 21000 in 5years at 15% p.a (4 marks)

5. 1993 Q17 P2

Pauline deposited sh 1500 in a savings account at the beginning of the year. Compound interest on the money is calculated at the rate of 15% per annum. At the beginning of each subsequent year she deposited sh 1500 in the same account. Calculate the amount of money she will have in her account at the end of the 5^{th} year

(8 marks)

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6. 1994 Q6 P1

A businesswoman withdrew sh 67845 from a financial institution which both the principal and the compound interest which accrued within 3years. If the compound interest rate was 25% per annum, calculate the principal (3 marks)

7. 1995 Q15 P2

The cash price of a television is Kshs 25000. A customer paid a deposit of Kshs 3750. He repaid the amount owing in 24 equal monthly instalments. If he was charged simple interest at the rate of 40% p.a, how much was each instalment? (4 marks)

8. 1995 Q17 P2

At the beginning of every year, a man deposited Kshs 10,000 in a financial institution which paid compound interest at the rate of 20% p.a. He stopped further deposits after three years. The money remained invested in the financial institution for a further eight years.

(a) How much money did he have at the end of the first three years (4 marks)

(b) How much interest did the money generate in the entire period (4 marks)

9. 1996 Q7 P1

Mr. Ngeny borrowed Kshs. 560,000 from a bank to buy a piece of land. He was required to repay the loan with simple interest for a period of 48 months. The repayment amounted to Kshs 21000 per month.

Calculate

(a) The interest paid to the bank (2 marks)

(b) The rate per annum of the simple interest (4 marks)

10. 1998 Q13 P1

A financial institution charges compound interest on money borrowed. A business woman borrowed Kshs. 16, 000 from the financial institution. She paid back Kshs 25,000 after 2 years. Find the interest rate per annum. (4 marks)

11. 1999 Q10 P1

A business woman opened an account by depositing Kshs. 12,000 in a bank on 1st July 1995. Each subsequent year, she deposited the same amount on 1st July. The bank offered her 9% per annum compound interest. Calculate the total amount in her account on

a) 30th June 1996 (1 mark)

b) 30th June 1997 (3 marks)

12. 2000 Q12 P1

A tailor intends to buy a sewing machine costs Kshs. 48,000. He borrows the money from a bank the loan has to be repaid at the end of the second year. The bank charges an interest at the rate of 24% per annum compounded half - yearly. Calculate the total amount payable to the bank. (4 marks)

13. 2002 Q17 P1

A house is to be sold either on cash basis or through a loan. The cash price is sh. 750, 000. The loan conditions area as follows: there is to be down payment of 10% of the cash price and the rest of the money is to be paid through a loan at 10% per annum compound interest.

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A customer decided to but the house through a loan.

a) (i) Calculate the amount of money loaned to the customer.

(ii) The customer paid the loan in 3 years. Calculate the total amount paid for the house.

b) Find how long the customer would have taken to fully pay for the house if she paid a total of sh 891,750. (8 marks)

14. 2005 Q15 P1

A bank either pays simple interest as 5% p.a or compound interest 5% p.a on deposits. Nekesa deposited Kshs P in the bank for two years on simple interest terms. If she had deposited the same amount for two years on compound interest terms, she would have earned Kshs 210 more.
Calculate without using Mathematics Tables, the values of P (4 marks)

15. 2006 Q17 P2

A certain sum of money is deposited in a bank that pays simple interest at a certain rate. After 5 years the total amount of money in an account is Kshs 358 400. The interest earned each year is 12 800

(a) Calculate

(i) the amount of money which was deposited (2 marks)

(ii) the annual rate of interest that the bank paid (2 marks)

(b) A computer whose marked price is Kshs 40,000 is sold at Kshs 56,000 on hire purchase terms.

(i) Kioko bought the computer on hire purchase term. He paid a deposit of 25% of the hire purchase price and cleared the balance by equal monthly instalments of Kshs 2625. Calculate the number of instalments (3 marks)

(ii) Had Kioko bought the computer on cash terms he would have been allowed a discount of 12 ½ % on marked price. Calculate the difference between the cash price and the hire purchase price and express as a percentage of the cash price . (3 marks)

16. 2012 Q7 P2

Kago deposited Ksh 30 000 in a financial institution that paid simple interest at the rate of 12% per annum. Nekesa deposited the same amount of money as Kago in another financial institution that paid compound interest. After 5 years, they had equal amounts of money in the financial institutions.
Determine the compound interest rate per annum, to 1 decimal place, for Nekesa's deposit. (4 marks)

17. 2010 Q7 P2

When Ksh. 40 000 was invested in a certain bank for 5 years it earned a simple interest of Ksh.3 800. Find the amount that must have been invested in the same bank at the same bank at the same rate for 7 ½ year to earn a simple interest of Ksh. 3 420 (3 marks)

18. 2012 Q17 P2

Amaya was paid an initial salary of Ksh 180 000 per annum with a fixed annual increment. Bundi was paid an initial salary of Ksh 150 000 per annum with a 10% increment compounded annually.

(a) Given that Amaya's annual salary in the 11^{th} year was Ksh 288 000,determine:

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(i) His annual increment; (2 marks)

(ii) The total amount of money Amaya earned during the 11 years. (2 marks)

(b) Determine Bundi's monthly earnings, correct to the nearest shilling, during the eleventh year. (2 marks)

(c) Determine, correct to the nearest shilling:

(i) The total amount of money Bundi earned during the 11 years. (2 marks)

(ii) The difference between Bundi's and Amaya's average monthly earnings during the 11 years. (2 marks)

(c) APPRECIATION AND DEPRECIATION

1. 1989 Q21 P1

A farmer bought a machine at sh 110000. If the depreciation rate is 15% per annum, calculate

(a) The value of the machine after 3 years (3 marks)

(b) The number of years it will take for the value to depreciate to sh 55 000 (5 marks)

2. 1990 Q9 P2

A salesman sold a new motor cycle at sh 24000. The depreciation rate was 5% per annum. What was the value of the motor cycle after 3 years? (4 marks)

3. 1991 Q9 P2

A merchant bought a car for sh40000. Its depreciation rate is estimated at 10% per annum of its value at the beginning of each year. What will be the value of the car at the end of four years? (3 marks)

4. 1998 Q5 P2

A plot of land was valued at Kshs 50,000 at the start of 1994. It appreciated by 20% during 1994. Thereafter, every year, it appreciated by 10% of its previous years value. Find

a. The value of the land at the start of 1995 (1 mark)

b. The value of the land at the end of 1997 (2 marks)

5. 1999 Q17 P1

The cost of a minibus was Kshs. 950,000. It depreciated in value by 5% per Year for the first two years by 15% per year for the subsequent years.

a) Calculate the value of the minibus after 5 years (3 marks)

b) After 5 years the minibus was sold through a dealer at 25% more than its value to Mr. X. If the dealer's sale price was to be taken as its value after depreciation, calculate the average monthly rate of depreciation for 5 years. (3 marks)

6. 2002 Q9 P1

The average rate of depreciation in value of a water pump is 9% per annum. After three complete years its value was sh 150,700. Find its value at the start of the three – year period. (4 marks)

7. 2003 Q4 P1

A water pump costs Kshs. 21600 when new. At the end of first year its value depreciates by 25%. The depreciation by the second year is 20%

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and thereafter the rate of the depreciation is 15% yearly.

Calculate the exact value of the water pump at the end of the fourth year. (3 marks)

8. 2003 Q23 P1

A businessman obtained a loan of sh.450,000 from a bank to buy a matatu valued at the same amount. The bank charges interest at 24% per annum compounded quarterly.

a) Calculate the total amount of money the businessman paid to clear the loan in 1 ½ years. (3 marks)

b) The average income realized from the matatu per day was sh.1500. The matatu worked for 3 years at an average of 280 days year. Calculate the total income from the matatu. (2 marks)

c) During the three years, the value of the matatu depreciated at the rate of 16% per annum. If the businessman sold the matatu at its new value, calculate the total profit he realized by the end of three years. (3 marks)

9. 2004 Q10 P1

Omolo bought a new car for ksh. 800,000. After 5 years, he sold it through a second- hand car dealer. The dealer charged a commission of 4% for the sale of the car.
If Omolo received Ksh.480, 000, calculate the annual rate of depreciation of the car as a percentage. (4 marks)

10. 2008 Q23 P2

Halima deposited Ksh. 109375 in a financial institution which paid simple interest at the rate of 8% p.a. At the end of 2 years, she withdrew all the money. She then invested the money in shares. The value of the shares depreciated at 4% p.a. during the first year of investment. In the next 3 years, the value of the shares appreciated at the rate of 6% every four months

a) Calculate the amount Halima invested in shares. (3 marks)
b) Calculate the value of Halima's shares.
   (i) At the end of the first year; (2 marks)
   (ii) At the end of the fourth year, to the nearest shilling. (3 marks)
c) Calculate Halima's gain from the share as a percentage. (2 marks)

11. 2009 Q18 P2

At the beginning of the year 1998, Kanyingi bought two houses, one in Thika and theother one in Nairobi, each at Ksh. 1 240 000. The value of the house in Thika appreciated at a rate of 12% p.a.

(a) Calculate the value of the house in Thika after 9 years, to the nearest shillings (2 marks)

(b) After n years, the value of the house in Thika was Ksh 2 741 245 while the value of the house in Nairobi was Ksh. 2 197 213
   (i) Find n (4 marks)
   (ii) Find the annual rate of appreciation of the house in Nairobi (4 marks)
   (iii)

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12. 2014 Q12 P2

Muga bought a plot of land for Ksh 280,000. After 4 years, the value of the plot-was Ksh 495 000. Determine the rate of appreciation, per annum, correct to one decimal place. „ (3 marks)

(d) INCOME TAX

1. 1992 Q17 P2

Kamau's basic salary was K£5520 per annum when the rates of P.A.Y.E were as per the table below:

Salary in Pounds	Tax in sh per pound
0 – 2300	2
2301 – 4600	3
4601 – 6900	5
6901 and over	8

He claimed a personal relief of sh 220 per month. Every month sh 120 was deducted from his salary towards a pension scheme and sh 100 deducted towards local service charges. Calculate his net monthly salary to the nearest 10cents. (8 marks)

2. 1993 Q17 P1

Income tax for all the income earned was charged at the rates shown below

Total income per year in shillings	*Rates in shillings per 20 shillings*
1-39600	2
39601-79200	3
79201-118,800	5
118,801-158,400	7
158,400-198,000	9
Excess over 198,000	10

Kariuki earned salary of sh 7500 per month. In addition he was given a house allowance of sh 2500 per month. He got family relief of sh200 per month. How much income tax did he pay per month? (8 marks)

3. 1996 Q18 P1

The table below shows the income tax rates

Total income per month in Kenya	Rate in shillings per pound
1 – 325	2
326 – 650	3
651-975	4
976 – 1300	5
1301 – 1625	7
Over 1625	7.50

Mr. Otiende earned a basic salary of Kshs 13,120 and a house allowance of Kshs 3,000 per month. He claimed a tax relief for a married person of Kshs 455 per month

(a) Calculate

(i) The tax payable without the relief

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(ii) The tax paid after the relief

(b) Apart from the income tax, the following monthly deductions are made. A service charge of Kshs 100, a health insurance fund of Kshs 280 and 2% of his basic salary as widow and children pension scheme.
Calculate
(i) The total monthly deductions made from Mr. Otiende's income (2 marks)
(ii) Mr. Otiende's net income from his employment (2 marks)

4. 1998 Q18 P1

The table below shows monthly income tax rates

Monthly taxable pay K £	Rate of tax Kshs per £
1 - 342	2
343 - 684	3
685 - 1026	4
1027-1368	5
1369 - 1710	6
Over 1710	7

A civil servant earns a monthly salary of Kshs 20,000 and is provided with a house at a nominal rent of Kshs 700 per month

(a) Taxable pay is the employee's salary, plus 15% of salary, less nominal rent. Calculate the civil servant's taxable pay in K £ (3 marks)
(b) Calculate the total tax (4 marks)
(c) If the employee is entitled to a personal relief of Kshs. Per month, what is the net tax? (1 mark)

5. 2001 Q17 P1

The table shows income tax rates

Monthly taxable pay K£	Rate of tax Kshs in 1 K£
1 – 435	2
436 – 870	3
871-1305	4
1306 – 1740	5
Excess Over 1740	6

1 K£= sh.20

A company employee earn a monthly basic salary of Kshs 30,000 and is also given taxable allowances amounting to Kshs 10, 480.

(a) Calculate the total income tax (4 marks)
(b) The employee is entitled to a personal tax relief of Kshs 800 per month. Determine the net tax. (1 mark)
(c) If the employee received a 50% increase in his total income, calculate the corresponding percentage increase on the income tax. (3 marks)

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6. 2002 Q18 P2

The table below shows Kenyan tax rates in a certain year

Income (K£ per annum)	Tax rates (Sh. Per £)
1 -4,512	2
4513 -9024	3
9025 – 13536	4
13537 – 18048	5
18049 -22560	6
Over 22560	6.5

In that year Muhando earned a salary of Ksh.16510 per month. He was entitled to a monthly tax relief of Kshs 960.

Calculate:

a) Muhandos annual salary in K£ (2 marks)

b) The monthly tax paid by muhando in Kshs. (6 marks)

7. 2004 Q17 P1

The table below shows monthly income tax rates for the year 2003.

Monthly taxable income in Ksh.	Tax rates(Percentage)
1-9860	10%
9681 – 18800	15%
18801-27920	20%
27921 – 37040	25%
37041 and above	30%

In the year 2003.Ole Sanguya's monthly earnings were as follows:-

Basic salary	Ksh 20600
House allowance	ksh 12000
Medical allowance	Ksh 2880
Transport allowance	Ksh 340.

Ole Sanguya was entitled to a monthly tax relief of Ksh 1056.

Calculate:

a) His monthly taxable income (2 marks)

b) The monthly tax paid by Ole Sanguya. (6 marks)

8. 2006 Q8 P2

The table below is a part of tax table for monthly income for the year 2004

Monthly taxable income In (kshs)	Tax rate percentage (%) in each shillings
Under Kshs 9681	10%
From Kshs 9681 but under 18801	15%
From Kshs 18801 but 27921	20%

In the tax year 2004, the tax of Kerubo's monthly income was Kshs 1916

Calculate Kerubos monthly income (3 marks)

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9. 2009 Q21 P2

The table below shows the income tax rates

Monthly income in Kenya shillings (Ksh)	Tax rate percentage (%) Iin each shillings
Up to 9 680	10
From 9 681 to 18 800	15
From 18 801 to 27 920	20
From 27 921 to 37 040	25
From 37 041 and above	30

In a certain year, Robi's monthly taxable earnings amounted to Ksh. 24 200

(a) Calculate the tax charged on Robi's monthly earning (4 marks)

(b) Robi was entitled to the following tax reliefs

i. Monthly personal relief of Ksh. 1 056;

ii. Monthly insurance relief at the rate of 15% of the premium paid

Calculate the tax paid by Robi each month, if she paid a monthly premium of Ksh. 2400 towards her life insurance policy (2 marks)

(c) During a certain month. Robe received additional earning which were taxed at

(d) 20% in each shilling. Given that she paid 36.3% more tax that month, calculate the percentage increase in her earnings (4 marks)

10. 2012 Q20 P2

In June of a certain year, an employee's basic salary was Ksh 17 000.The employee was also paid a house allowance of Ksh 6 000,a commuter allowance of Ksh 2 500 and a medical allowance of Ksh 1 800. In July of that year, the employee's basic salary was raised by 2%.

(a) Calculate the employees:

(i) Basic salary for July; (2 marks)

(ii) Total taxable income in July of that year. (2 marks)

(b) In that year, the Income Tax Rates were as shown in the table below:

Monthly taxable income (Kshs)	Percentage rate of tax per shilling
Up to 9680	10
From 9681 to 18 800	15
From 18 801 to 27 920	20
From 27 921 to 37 040	25
From 37 041 and above	30

Given that the Monthly Personal Relief was Ksh 1 056, calculate the net tax paid by the employee. (6 marks)

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11. 2013 Q13 P2

The table below shows income tax rates in a certain year

Monthly income in Kenya shillings	Tax rate in each shilling
Up to 9 680 From 9 681-18 800 From 18 801 to 27 920 From 27 921 to 37 040 Over 37 040	10% 15% 20% 25% 30%

In that year, a monthly personal tax relief of kshs 1056 was allowed .calculate the monthly income tax paid by an employee who earned salary of Ksh 32 500.

(4 marks)

12. 2014 Q19 P2

The table below shows income tax rates for a certain year.

Monthly income in Kenya shillings (Ksh)	Tax rate in each shilling
0-10164	10%
10165-19740	15%
19741-29316	20%
29317-38892	25%
over 38892	30%

A tax relief of Ksh 1162 per month was allowed. In a certain month, of that year, an employee's taxable income in the fifth band was Ksh 2108.

(a) Calculate:

(i) the employee's total taxable income in that month; (2marks)

(ii) the tax payable by the employee in that month. (2marks)

(b) The employee's income included a house allowance of Ksh 15 000 per month. The employee contributed 5% of the basic salary to a co-operative society. Calculate the employees net pay for that month. (3 marks)

13. 2015 Q8 P1

A salesman is paid a salary of Ksh 15, 375 per month. He also gets a commission of $4\frac{1}{2}$ % on the amount of money he makes from his sales. In a certain month, he earned a total of Ksh 28 875

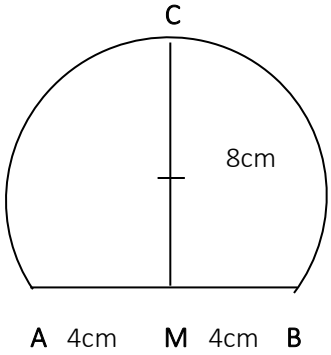
Calculate the value of his sales that month. (3 marks)

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CIRCLES, CHORDS AND TANGENTS

1. 1989 Q24 P2

The figure below represents the cross section of a metal bar. The cross section is in the form of a major segment of a circle. M is the midpoint of AB and CM is perpendicular to AB. Given that AB = CM = 8cm. Calculate the area of the cross section (8 marks)



2. 1990 Q20 P1

Two solid spherical balls with centres P and Q touch each other. The balls lie inside and in contact with a hemispherical bowl of centre R. Given that PQ = 13cm, QR = 16cm and PR = 19cm, calculate the radii of the bowl and the two spherical balls. (8 marks)

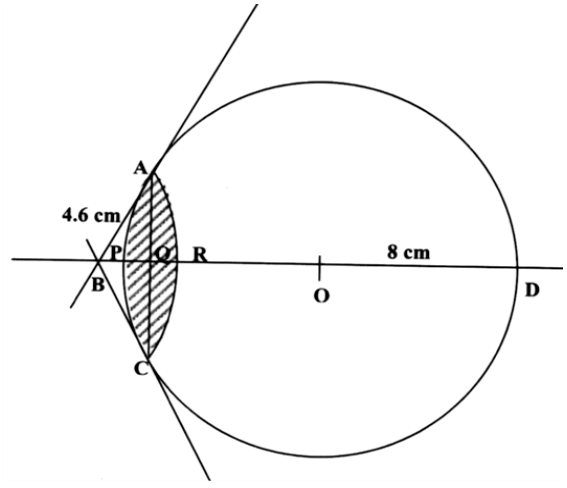
3. 1992 Q8 P2

A chord AB of length 13cm subtends an angle of 67^0 at the circumference of a circle centre O. Find the radius of the circle. (4 marks)

4. 1993 Q24 P1

In the figure below O is the centre of a circle whose radius is 8cm. BA and BC are tangents to the circle. PD is a diameter of the circle and AC is a chord of length 8cm.

Angle ABC = 120^0. ARC is of a circle centre centre B and radius 4.6 cm.

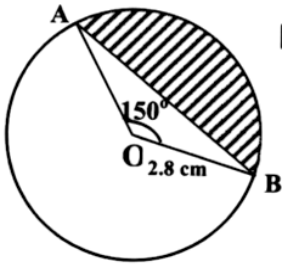


Calculate the area of the shaded region (8 marks)

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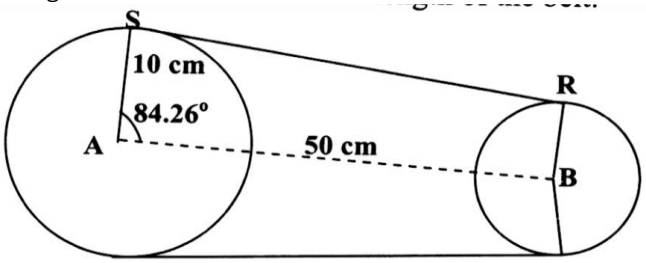
5. 1993 Q15 P2

In the figure below is the centre of the circle of radius 2.8cm. Angle AOB =150^0.
Determine the area of the shaded segment



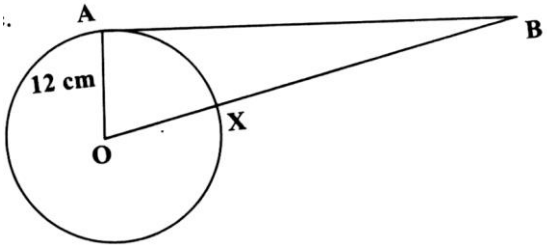
6. 1994 Q21 P1

The figure below shows two pulleys with centres A and B and of radii 10cm and 5cm respectively. S and R are contacts points of the belt with the pulleys. The distance between the centres of the two pulleys is 50cm, and < SAB = 84.26^0.
A belt is tied around the two pulleys as shown.
Calculate the total length of the belt (8 marks)



7. 1994 Q11 P2

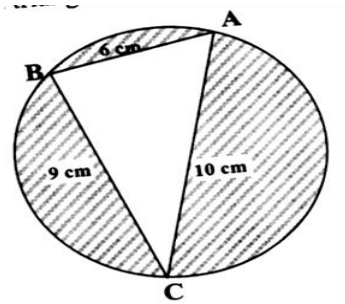
In the figure below AB is a tangent to the circle centre O and radius 12cm. The area of the triangle AOB is $120cm^2$. OXB is a straight line.



Calculate XB (4 marks)

8. 1994 Q20 P2

The figure below shows a triangle ABC inscribed in a circle. AB=6cm,BC=9cm and AC=10cm



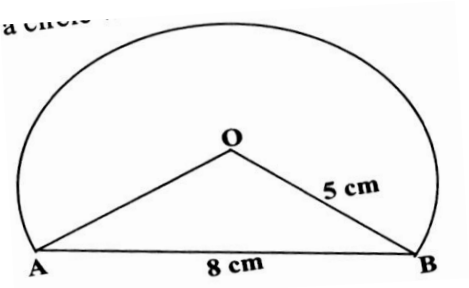
Calculate

(a) The radius of the circle (5 marks)
(b) The area of the shaded parts (3 marks)

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9. 1995 Q 19

(a) In the figure below O is the centre of a circle whose radius is 5 cm AB = 8 cm and < AOB is obtuse.

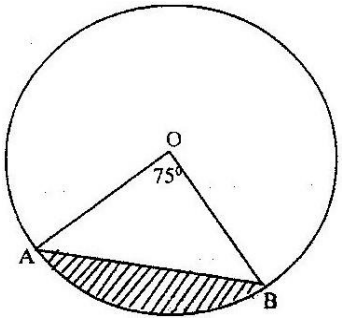


Calculate the area of the major segment (6 marks)

(b) A wheel rotates at 300 revolutions per minute. Calculate the angle in radians through which a point on the wheel turns in one second.

10. 1997 Q 5 P2

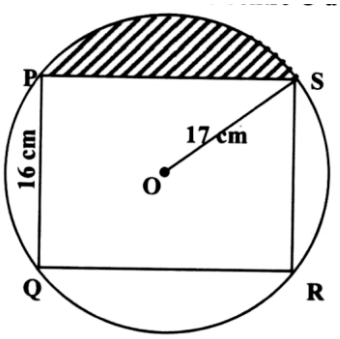
The figure below represents a circle a diameter 28 cm with a sector subtending an angle of 75^0 at the centre.



Find the area of the shaded segment to 4 significant figures (4 marks)

11. 1998 Q 23 P2

The figure below represents a rectangle PQRS inscribed in a circle centre O and radius 17cm . PQ = 16cm.



Calculate

(a) The length PS of the rectangle (2 marks)

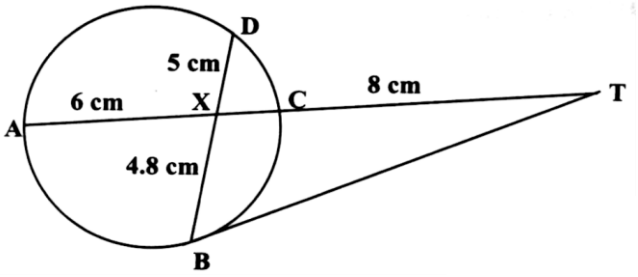
(b) The angle POS (2 marks)

(c) The area of the shaded region (4 marks)

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12. 2000 Q 14 P2

In the figure below, BT is a tangent to the circle at B. AXCT and BXD are straight lines AX = 6cm, CT = 8cm, BX = 4.8 cm and XD = 5cm.



Find the length of

(a) XC (2 marks) (b) BT (2 marks)

13. 2002 Q 12 P1

Chords XY and PQ of a circle intersect at a point M inside the circle. Given that MX = 8cm, XY = 14cm and MP = 4cm, calculate the length of MQ.

(2 marks)

14. 2002 Q 23 P1

A minor sector of a circle of radius 28cm includes an angle of 135^0 at the center.

a) (i) Convert 135^0 into radians. Hence of otherwise find the area of the sector.

(ii) Find the length of the minor arc.

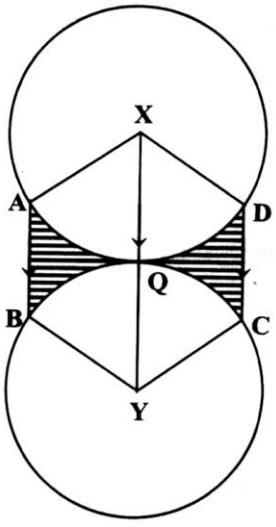
b) The sector is folded to form a right circular cone. Calculate the :

i) Radius of the cone

ii) Height of the cone. (Take the value of π to be $^{22}/_{7}$) (8 marks)

15. 2003 Q 19 P1

The figure below shows two circles each of radius 7cm, with centres at X and Y. The circles touch each other at point Q.



Give that <AXD = <BYC = 120^0 and lines AB, XQY and DC are parallel, Calculate the area of:

a) Minor sector XAQD (Take π $^{22}/_{7}$) (2 marks)

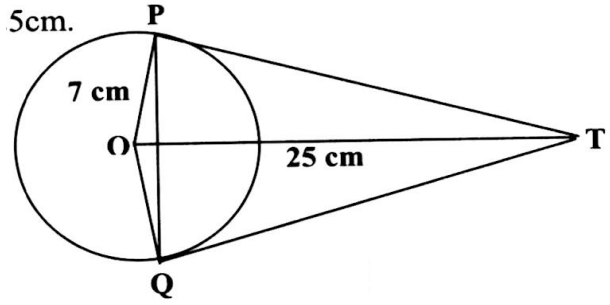
b) The trapezium XABY (4 marks)

b) The shaded regions. (2 marks)

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16. 2004 Q 14 P1

The figure below shows a circle, centre, O of radius 7cm. TP and TQ are tangents to the circle at points P and Q respectively. OT =25cm.



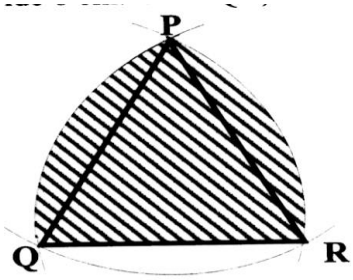
Calculate the length of the chord PQ (3 marks)

17. 2005 Q 6 P1

A point R divides a line PQ internally in the ration 3:4. Another point S, divides the line PR externally in the ration 5:2. Given that PQ = 8cm, calculate the length of RS, correct to 2 decimal places. (3 marks)

18. 2007 Q 14 P1

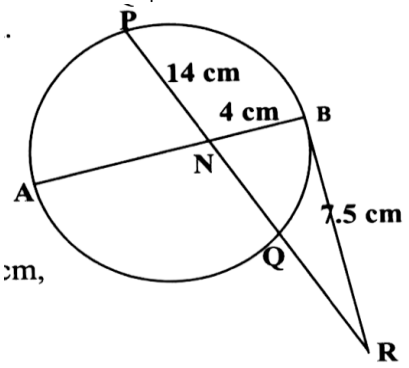
In the figure below, PQR is an equilateral triangle of side 6 cm. Arcs QR, PR and PQ arcs of circles with centers at P, Q and R respectively.



Calculate the area of the shaded region to 4 significant figures (4 marks)

19. 2007 Q 11 P2

In the figure below AB is a diameter of the circle. Chord PQ intersects AB at N. A tangent to the circle at B meets PQ produced at R.



Given that PN = 14cm, NB = 4 cm and BR = 7.5 cm, calculate the length of:

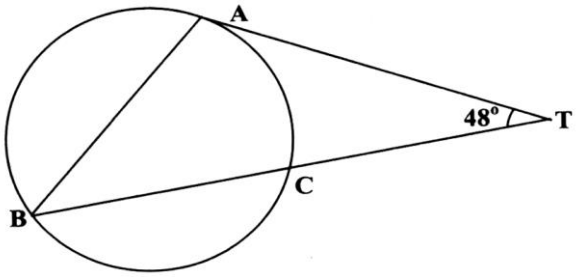
(a) NR (1 mark)

(b) AN (3 marks)

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20. 2009 Q 15 P2

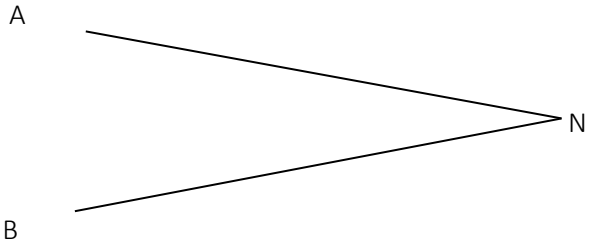
In the figure below, AT is a tangent to the circle at A. Angle ATB = 48˚, BC = 5cm and CT = 4cm



Calculate the length of AT (2 marks)

21. 2011 Q 10 P2

a. In the figure below, lines NA and NB represent tangents to a circle at points A and B. Use a pair of compasses and ruler only to construct the circle (2 marks)



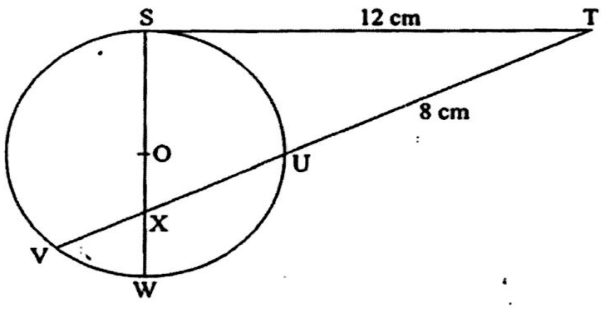
b. Measure the radius of the circle. (1 mark)

22. 2012 Q6 P2

Construct a circle centre *x* and radius 2.5cm. Construct a tangent from a point P, 6cm from *x* to touch the circle at R. Measure the length PR. (4 marks)

23. 2012 Q14 P2

In the figure below, the tangent ST meets chord VU produced at T. Chord SW passes through the centre, O, of the circle and intersects chord VU at X. Line ST =12cm and UT =8cm.



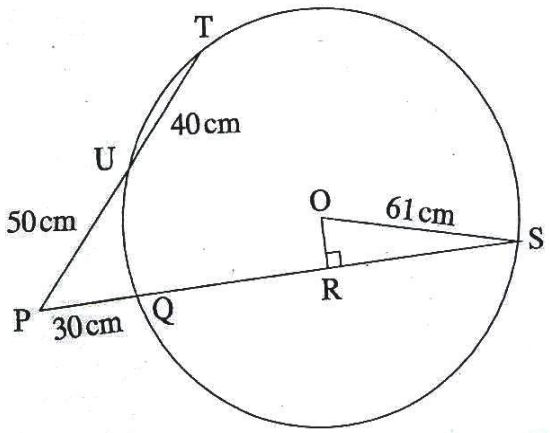
(a) Calculate the length of chord VU. (2 marks)

(b) If WX = 3cm and VX: XU = 2:3, find SX. (2 marks)

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24. 2014 Q18 P2

In the figure below OS is the radius of the circle centre O. Chords SQ and TU are extended to meet at P and OR is perpendicular to QS at R. OS = 61cm, PU=50cm, UT=40cm and PQ =30cm.



a)Calculate the lengths of:

i)QS: (2 marks)

ii)OR (3marks)

b) Calculate, correct to 1 decimal place:

i)The size of angle ROS: (2 marks)

ii) The length of the minor arc QS. (3 marks)

25. 2015 Q9 P2

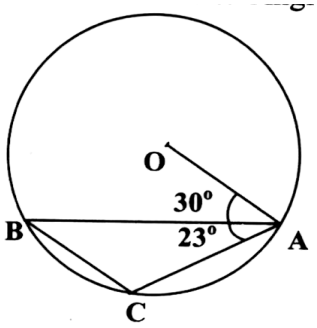
The diameter of a circle, centre O has its end points at M(— 1, 6) and N(5, —2). Find the, equation of the circle in the form $x^2+y^2 + ax + by = c$ where a, b and c are constants (4 marks)

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ANGLE PROPERTIES OF A CIRCLE

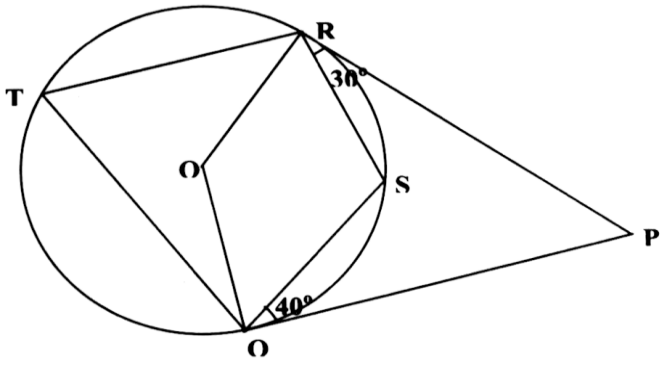
1. 1989 Q5 P1

In the figure below, O is the centre of the circle. Angle OAB = 30^0 and angle BAC = 23^0. Find angle ACB. (3 marks)



2. 1989 Q19 P2

In the figure below is the centre of the circle. PQ and PR are tangents. Angle PQS = 40^0 and angle PRS = 30^0



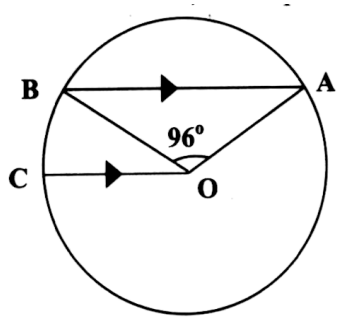
(i) RTQ (3 marks)

(ii) ORQ (2 marks)

(iii) RPQ (3 marks)

3. 1990 Q7 P1

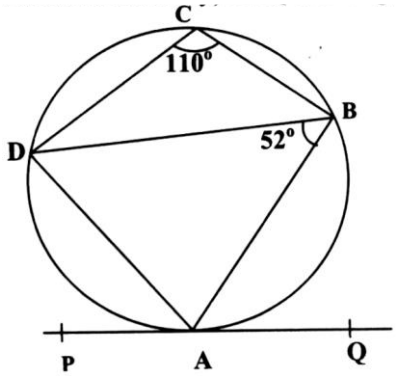
In the figure below, O is the centre of the circle, CO is parallel to BA and AOB = 960 .Calculate <CAO. (3 marks)



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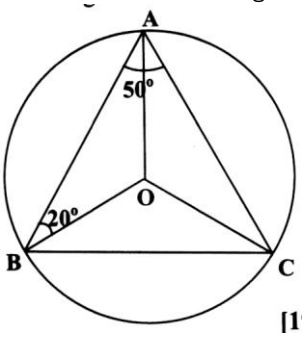
4. 1990 Q14 P2

In the figure below (not drawn accurately) PAQ is a tangent to the circle at A. Find the < DAB and < BAQ



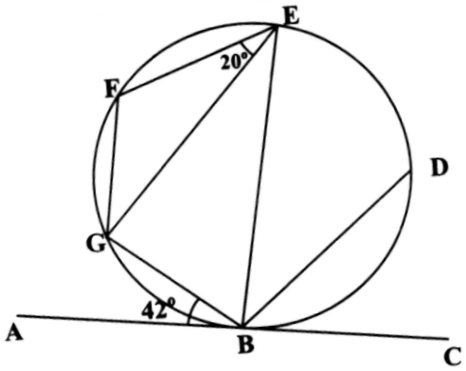
5. 1993 Q3 P1

In the figure alongside 0 is the centre of the circle. Angle BAC = 50^0 and angle ABO =20^0



6. 1993 Q21 P2

In the figure below, ABC is the tangent to the circle at B. < ABG = 42^0 and < FEG = 20^0



(a) Find

(i) < BGF (4 marks)

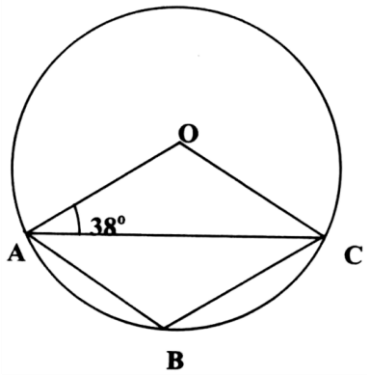
(ii) < BDF (2 marks)

(b) If BE bisects < GED, find <DBC (2 marks)

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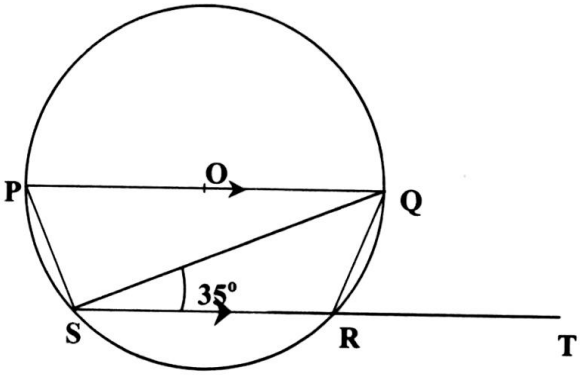
7. 1994 Q4 P1

In the figure below, O is the centre of the circle and < OAC = 38^0. Find < ABC (3 marks)



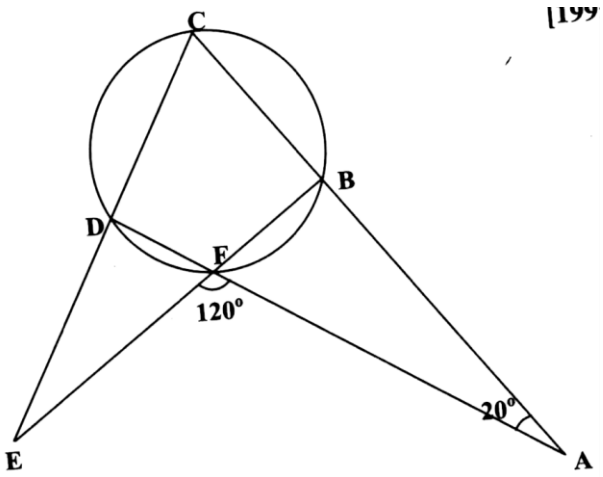
8. 1994 Q16 P2

The figure below shows a circle PQRS centre O with SR produced to T. PQ//SR and < QSR =35^0. Calculate the size of < QRT (3 marks)



9. 1995 Q 14 P1

In the diagram below < CAD, = 20^0, < AFE = 120^0 and BCDF is a cyclic quadrilateral. Find < FED. (3 marks)

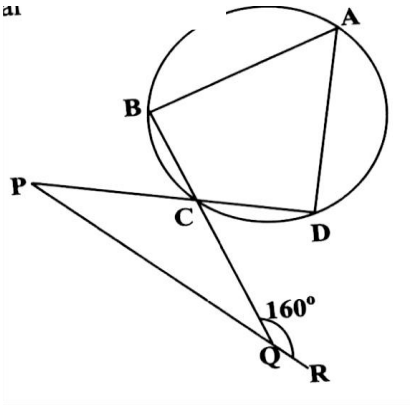


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10. 1995 Q 11 P2

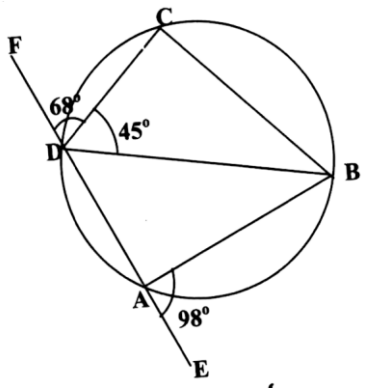
In the figure below CP= CQ and <CQP = 160^0. If ABCD is a cyclic quadrilateral, find < BAD.

(2 marks)



11. 1996 Q 5 P1

In the figure below, ABCD is a cyclic quadrilateral and BD is a diagonal. EADF is a straight line. <CDF = 68^0, < BDC = 45^0 and < BAE = 98^0.



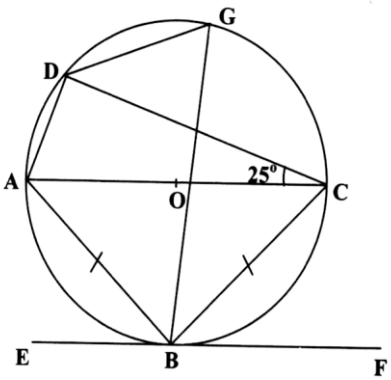
Calculate the size of

(a) < ABD (2 marks)

(b) < CBD (2 marks)

12. 1996 Q 18 P2

In the figure below AOC is a diameter of the circle centre O, AB=BC and < ACD =25^0, EBF is a tangent to the circle at B. G is a point on the minor arc CD.



(a) Calculate the size

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(i) < BAD (3 marks)

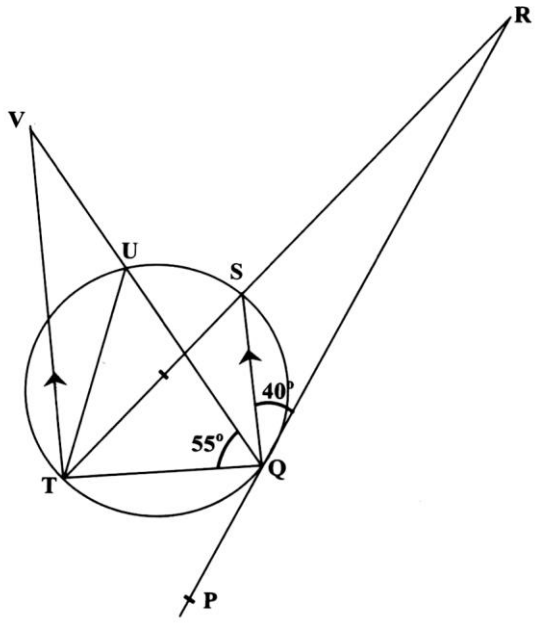
(ii) The obtuse < BOD (2 marks)

(iii) <BGD (1 mark)

(b) Show that <ABE = <CDF. Give reasons (2 marks)

13. 1997 Q 20 P2

In the figure below PQR is the tangent to circle at Q. TS is a diameter and TSR and QUV are straight lines. Q is parallel to TV. Angles SQR = 40^0 and angle TQV = 55^0



Find the following angles, giving reasons for each answer

a. QST

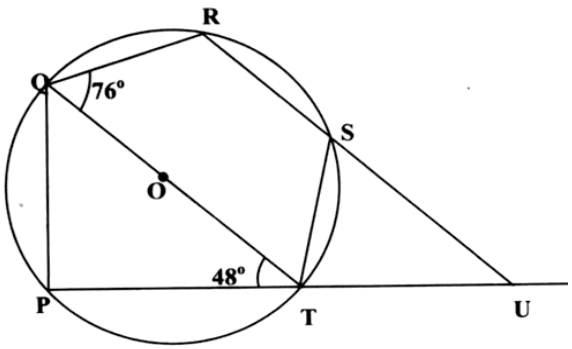
b. QRS

c. QVT

d. UTV (8 marks)

14. 1998 Q 19 P2

In the figure below, QOT is a diameter. QTR = 48^0, TQR = 76^0 and SRT = 37^0



Calculate

(a) < RST (1 marks)

(b) < SUT (3 marks)

(c) Obtuse < ROT (2 marks)

(d) < PST (2 marks)

15. 1999 Q 12 P1

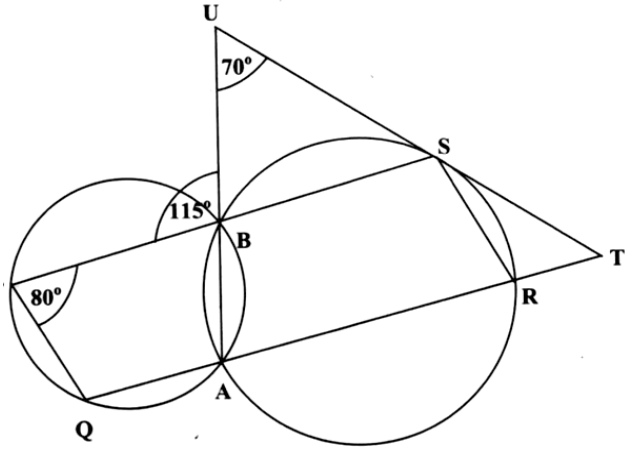
ABCD is a cyclic quadrilateral and AB is a diameter. Angle ADC = 117^0

Giving reason for each step, calculate < BAC (3 marks)

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16. 1999 Q 19 P1

The figure below shows two circle ABPQ and ABSR intersecting at A and B. PBS, QART and ABU are straight lines. The line UST is a tangent to a circle . ABSR at S. < BPQ = 80^0, < PBU = 115^0 and < BUS = 70^0



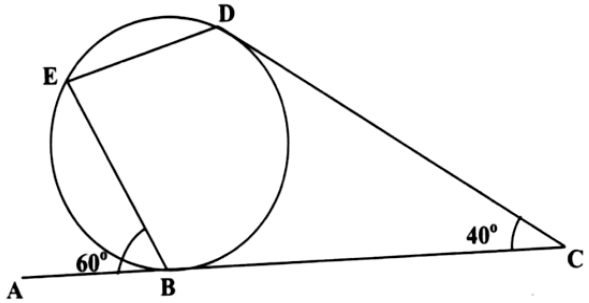
Find the values of the following angles, stating your reason in each case.

(a) < BAR (c) < BSU

(b) <STR (d) <BRS (8 marks)

17. 2000 Q 13 P1

On The figure below lines ABC and DC are tangents to the circle at B and D respectively < ACD = 40^0 and < ABE = 60^0



Giving reasons find the size of:

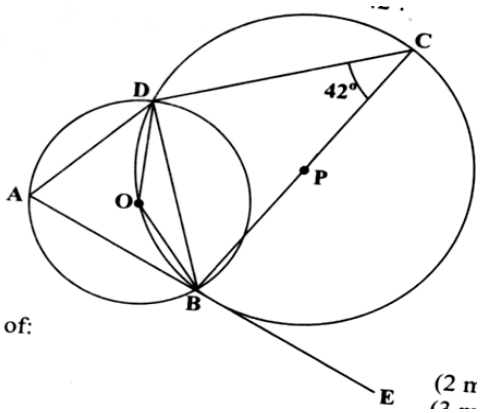
(a) < CBD (2 marks)

(b) < CDE (2 marks)

18. 2001 Q 20 P1

In the figure below, points O and P are centers of intersecting circles ABD and BCD respectively. Line ABE is a tangent to circle BCD at B. Angle BCD = 42^0

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of:

(a) Stating reasons, determine the size of

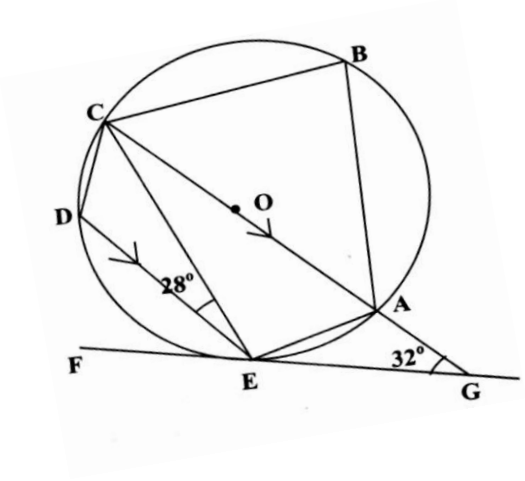
(i) < CBD (2 marks)

(ii) Reflex < BOD (3 marks)

(b) Show that Δ ABD is isosceles (3 marks)

19. 2002 Q 13 P2

The diagram below shows a circle ABCDE. The line FEG is a tangent to the circle at point E. Line DE is parallel to CG, < DEC = 28^0 and < AGE = 32^0



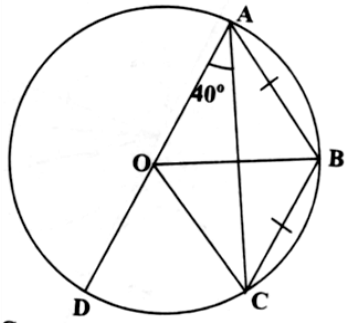
Calculate:

(a) < AEG (2 marks)

(b) < ABC (2 marks)

20. 2003 Q 5 P1

In the figure below is the centre of the circle ABCD and AOD in a straight line.

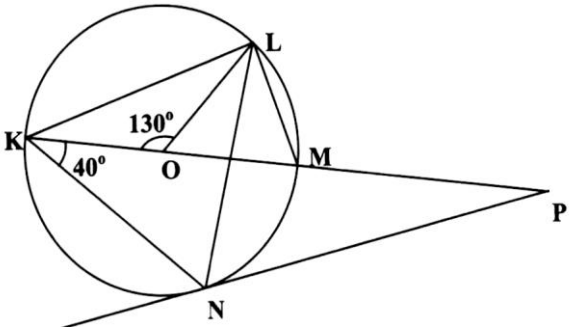


If AB = BC and angle DAC = 40^0, Calculate angle BAC. (3 marks)

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21. 2004 Q 22 P1

In the figure below, K M and N are points on the circumference of a circle centre O. The points K, O, M and P are on a straight line.
PN is a tangent to the circle at N. Angle KOL = 130^0 and angle MARKN = 40^0



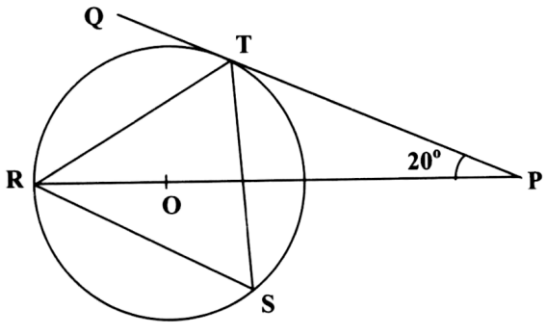
Find the values of the following angles, stating the reasons in each case:

a) <MLN b) <OLN

c) < LNP d) <MPN (8 marks)

22. 2006 Q 3 P2

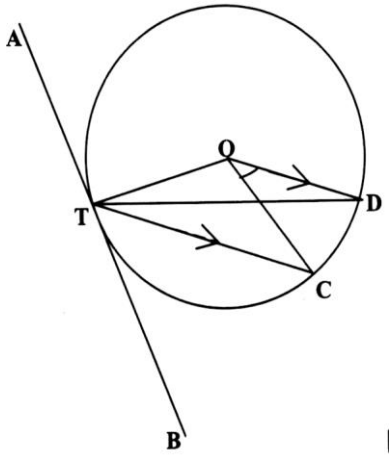
In the figure below R, T and S are points on a circle centre O. PQ is a Tangent to the circle at T. POR is a straight line and < QPR = 20^0



Find the size of ∠ RST (2 marks)

23. 2010 Q 3 P2

In the figure below, O is the centre of the circle which passes through the point T, C and D. line TC is parallel to OD and line ATB is a tangent to the angle DOC = 36^0

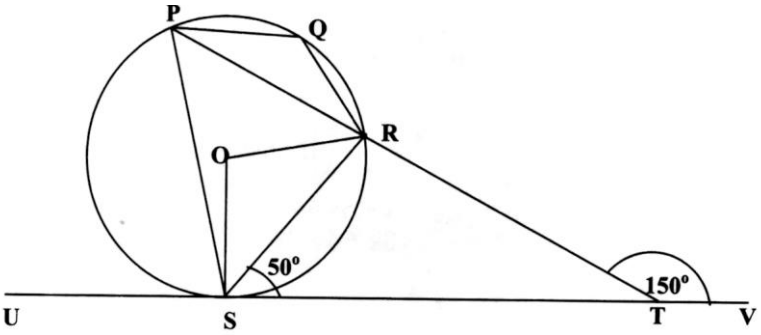


Calculate the size of angle CTB (3 marks)

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24. 2010 Q 24 P2

In the figure below, P,Q, R and S are points on the circle. Line USTV is a Tangent to the circle at S, <RST = 50^0 and <RTV = 150^0. PRT and USTV are straight lines.



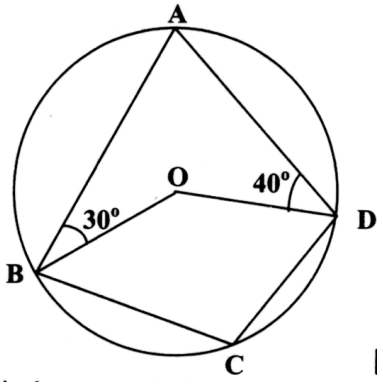
a) Calculate the size of:
   i) < ORS; (2 marks)
   ii) < USP; (1 mark)
   iii) < PQR (2 marks)

b) Given that RT = 7 cm and ST = 9 calculate to 3 significant figures:
   i) The length of line PR; (2 marks)
   ii) The radius of the circle. (3 marks)

25. 2011 Q 5 P2

In the figure below, ABCD is a cyclic quadrilateral. Point O is the centre of the circle. Angle ABO=30^0 and angle ADO=40^0

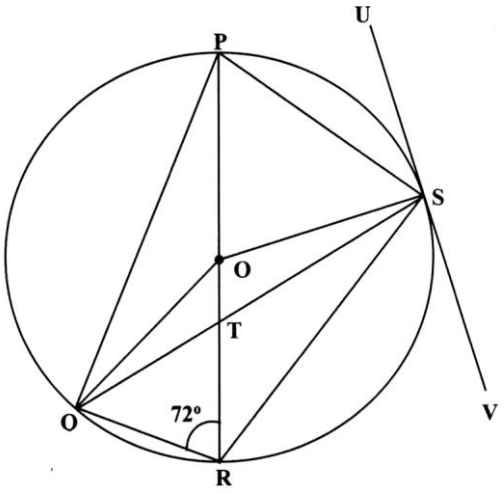
Calculate the size of angle BCD. (2 marks)



26. 2013 Q18 P2

In the figure below, PR is a diameter of the circle center O. Points P, Q, R and S are on the circumference of the circle. Angle PRQ = 72^0, QS = QP and line USV is tangent to the circle at S.

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Giving reasons, Calculate the size of

(a) < QPR (2 marks)

(b) < PQS (2 marks)

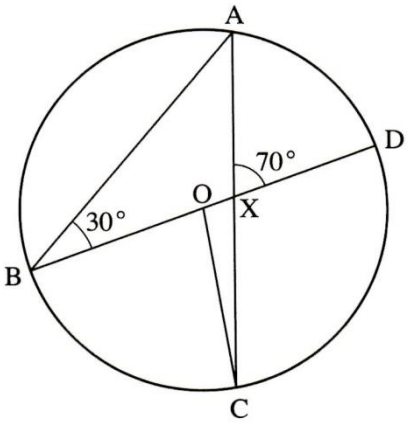
(c) < OQS (2 marks)

(d) < RTS (2 marks)

(e) < RSV (2 marks)

27. 2014 Q3 P2

In the figure below, BOD is the diameter of the circle centre O. Angle ABD = 30^0 and angle AXD = 70^0.



Determine the size of : (2marks)

a) Reflex angle BOC

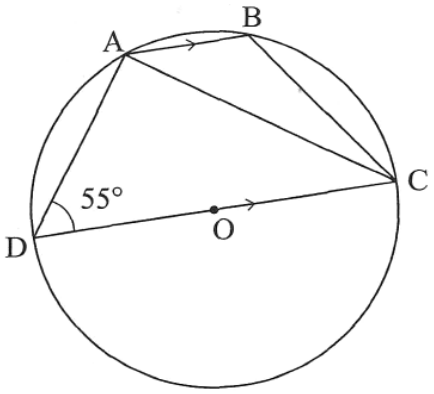
b) angle ACO. (1mark)

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28. 2015 Q4 P2

In the figure below, O is the centre of the circle. A, B, C and D are points on the circumference of the circle. Line AB is parallel to line DC and angle ADC = 55°.

Determine the size of angle ACB (3 marks)



Determine the size of angle ACB (3 marks)

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MATRICES

1. 1989 Q14 P1

Given that A = $\begin{pmatrix} 2 & 4 \\ 3 & 6 \end{pmatrix}$ and B = $\begin{pmatrix} 11 & 3 \\ 4 & 1 \end{pmatrix}$ find C such that B. C = A

(4 marks)

2. 1991 Q13 P1

Find the inverse of the matrix $\begin{pmatrix} 2 & 5 \\ 3 & 4 \end{pmatrix}$. Hence or otherwise solve the equations

2x + 5y = 9

3x + 4y = 6 (3 marks)

3. 1993 Q8 P1

Given that A = $\begin{pmatrix} -2 & 3 \\ 4 & -1 \end{pmatrix}$ and B $\begin{pmatrix} -20 & 30 \\ 40 & -10 \end{pmatrix}$

i) Find $A^{-1}B$

ii) Hence or otherwise write down the inverse of B (4 marks)

4. 1994 Q13 P1

Determine the values of x for which the matrix below has no inverse. (3 marks)

$$\begin{pmatrix} 2x & x^2 \\ 2 & 1 \end{pmatrix}$$

5. 1995 Q 12 P1

A clothes dealer sold 3 shirts and 2 trousers for Kshs. 840 and 4 shirts and 5 trousers for Kshs 1680.

Form a matrix equation to represent the above information. Hence find the cost of 1 shirt and the cost of 1 trouser. (4 marks)

6. 1996 Q 11 P1

A and B are two matrices. If A =$\begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix}$,find B given that $A^2 = A + B$ (4 marks)

7. 1997 Q 9 P1

Given that A = $\begin{pmatrix} 1 & 3 \\ 5 & 3 \end{pmatrix}$, B=$\begin{pmatrix} 3 & 1 \\ 5 & -1 \end{pmatrix}$,C =$\begin{pmatrix} p & 0 \\ 0 & q \end{pmatrix}$ and AB = BC, determine the value of P (3 marks)

8. 1998 Q 7 P1

A matrix A is given by A = $\begin{pmatrix} x & 0 \\ 5 & y \end{pmatrix}$

a) Determine A^2 (1 mark)

b) If A^2 = $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, determine the possible pairs of values of x and y (3 marks)

9. 2000 Q 23 P1

Matrix p is given by $\begin{pmatrix} 4 & 7 \\ 5 & 8 \end{pmatrix}$.

(a) Find P^{-1} (2 marks)

(b) Two institutions, Elimu and Somo, purchase beans at Kshs. B per bag and maize at Kshs m per bag. Elimu purchased 8 bags of beans and 14 bags of maize for Kshs 47,600. Somo

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purchased 10 bags of beans and 16 of maize for Kshs. 57,400

(i) Form a matrix equation to represent the information above (1 mark)
(ii) Use the matrix P^{-1} to find the prices of one bag of each item (3 marks)

(c) The price of beans later went up by 5% and that of maize remained constant. Elimu bought the same quantity of beans but spent the same total amount of money as before on the two items. State the new ratio of beans to maize. (2 marks)

10. 2001 Q 13 P1

Given that P = $\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ and Q = $\begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix}$, find the matrix product PQ

Hence, solve simultaneous equations below:

$2x - 3y = 5$ (3 marks)
$-x + 2y = -3$

11. 2002 Q 4 P2

Determine the inverse, T^{-1} of the matrix T = $\begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}$

Hence find the coordinates to the point at which the two lines $x + 2y = 7$ and $x - y = 1$ intersect (4 marks)

12. 2003 Q 17 P2

Given the simultaneous equations

$5x + y = 19$
$-x + 3y = 9$

a) Write the equations in matrix form. Hence solve the simultaneous equations. (5marks)
b) Find the distance of the point of intersection for the line $5x + y = 19$ and $-x + 3y = 9$ from the point (11,-2) (3 marks)

13. 2004 Q 7 P2

Use matrices to solve the simultaneous equations

$4x + 3y = 18$
$5x - 2y = 11$ (3 marks)

14. 2004 Q 20 P2

(a) Given that the matrix A = $\begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$ Find A^{-1} the inverse of A (1 mark)

(b) Kimtai bought 200 bags of sugar and 300 bags of rice for a total of Kshs. 850,000. Buy a bought 90 bags of sugar and 120 bags of rice for a total of Kshs. 360,000. If the price of a bag of sugar is Kshs x and that of rice is Kshs. Y,

(i) Form two equations to represent the information above
(ii) Use the matrix A^{-1} to find the prices of one bag of each item. (2 marks)

(c) Kali bought 225 bags of sugar and 360 bags of rice. He was given a total discount of Kshs. 33, 300. If the discount on the price of a bag of rice was 2%, calculate the percentage discount on the price of a bag of sugar. (3 marks)

15. 2007 Q 23 P1

(a) Find the inverse of the matrix $\begin{pmatrix} 9 & 8 \\ 7 & 6 \end{pmatrix}$ (2 marks)

(b) In a certain week a businessman bought 36 bicycles and 32 radios for total of Kshs 227 280. In the following week, he bought 28 bicycles and

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24 radios for a total of Kshs 174 960. Using matrix method, find the price of each bicycle and each radio that he bought (4 marks)

(c) In the third week, the price of each bicycle was reduced by 10% while the price of each radio was raised by 10%. The businessman bought as many bicycles and as many radios as he had bought in the first two weeks. Find by matrix method, the total cost of the bicycles and radios that the businessman bought in the third week. (4 marks)

16. 2008 Q 12 P1

Two matrices A and B are such that A=$\begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$ and B = $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$

Given that the determinant of AB = 4, find the value of k. (3 marks)

17. 2010 Q 19 P1

a).Find A^{-1},the inverse of matrix A = $\begin{pmatrix} 5 & 6 \\ 7 & 9 \end{pmatrix}$ (2 marks)

b) Okello bought 5 physics books and 6 mathematics books for a total of Ksh 2,440.Ali bought 7 physics books and 9 mathematics books for a total of ksh 3,560.

(i) Form a matrix equation to represent the above information. (1 mark)

(ii) Use matrix method to find the price of a physics book and that of a mathematics book. (3 marks)

c) A school bought 36 physics books and 50 mathematics books. A discount of 5% was allowed on each physics book whereas a discount of 8% was allowed on each mathematic book.

Calculate the percentage discount in the cost of all the books bought. (4 marks)

18. 2011 Q 19 P1

(a) The product of the matrices $\begin{pmatrix} 0 & 1 \\ 2 & p \end{pmatrix}$ and $\begin{pmatrix} -1.5 & -0.5 \\ p & p-2 \end{pmatrix}$ is a singular matrix. Find the value of *p.* (3 marks)

(b) A saleswoman earned a fixed salary of Ksh. *x* and a commission of Ksh *y* for each item sold. In a certain month she sold 30 items and earned a total of Ksh 50 000. The following month she sold 40 items and earned a total of Ksh. 56 000.

i) Form two equations in *x* and *y.* (2 marks)

ii) Solve the equations in (i) above using matrix method. (3 marks)

iii) In the third month she earned Ksh 68 000. Find the number of items sold. (2 marks)

19. 2012 Q11 P1

Given that **A** = $\begin{pmatrix} 1 & 0 \\ -2 & 3 \end{pmatrix}$, **B** = $\begin{pmatrix} 3 & 0 \\ 2 & 1 \end{pmatrix}$ and **C**= 2**AB** – $\mathbf{A}^2$. Determine matrix **C**. (4 marks)

20. 2013 Q19 P1

A trader bought 2 cows and 9 goats for a total of Ksh 98, 200. If she had bought 3 cows and 4 goats she would have spent Ksh 2,200 less.

a) Form two equations to represent the above information. (2 marks)

b) Use matrix method to determine the cost of a cow and that of a goat. (4 marks)

c) The trader later sold the animals she had bought making a profit of 30%

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per cow and 40% per goat.

i. Calculate the total amount of money she received. (2 marks)
ii. Determine, correct to 4 significant figures, the percentage profit the trader made from the sale of the animals (2 marks)

21. 2015 Q18 P1

Two shopkeepers, Juma and Wanjiku bought some items from a wholesaler. Juma bought 18 loaves of bread, 40 packets of milk and 5 bars of soap while Wanjiku bought 15 loaves of bread, 30 packets of milk and 6 bars of soap. The prices of a loaf of bread, a packet of milk and a bar of soap were Ksh 45, Ksh 50 and Ksh 150 respectively.

(a) Represent:

(i) the number of items bought by Juma and Wanjiku using a 2 x 3 matrix. (1 mark)

(ii) the prices of the items bought using a 3 x 1 matrix. (1 mark)

(b) Use the matrices in (a) above to determine the total expenditure incurred by each person and hence the difference in their expenditure. . (3 marks)

c) Juma and wanjiku also bought rice and sugar. Juma bought 36 kgs of rice and 23 kgs of sugar and paid Ksh 8160. Wanjiku bought 50 kg of rice and 32 kg of sugar and paid kshs 11340. Use the matrix method to determine the price of one kilogram of rice and one kilogram of sugar (5 marks)

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FORMULAE

1. 1989 Q3 P2

Make *x* the subject of the formula $N = \frac{P}{\sqrt{(ax+bx)}}$ (3 marks)

2. 1993 Q10 P1

Make *n* the subject of the formula (3 marks)

$$E = \sqrt{\frac{x(n-x)}{n-1}}$$

3. 1994 Q14 P1

Make *p* the subject of the formula (3 marks)

$$A = \frac{-EP}{\sqrt{P^2+N}}$$

4. 1995 Q 6 P1

The volume Vcm^3 of an object is given by

$$V = \frac{2}{3}\pi r^3\left(\frac{1}{sc^2} - 2\right)$$

Express in term of π r, s and V (3 marks)

5. 1996 Q 14 P1

Make V the subject of the formula

$$T = \frac{1}{2} m(u^2 - v^2)$$

(3 marks)

6. 1997 Q 13 P1

Given that

$$y = \frac{b - bx^2}{cx^2 - a}$$

make x the subject (3 marks)

7. 1998 Q 8 P1

Given that $\log y = \log(10x^n)$ make n the subject (3 marks)

8. 2000 Q 15 P2

Make x the subject of the formula $p = \left(\frac{xy}{z+x}\right)^{\frac{1}{2}}$

(3 marks)

9. 2001 Q 10 P1

Make x the subject of the formula

$$S = W\sqrt{a^2 - x^2}$$ (3 marks)

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10. 2002 Q 3 P1

Make y the subject of the formula $p = \frac{xy}{x-y}$ (3 marks)

11. 2003 Q 3 P1

Make c the subject of t formula: $T = x\sqrt{c^2+d^2}$ (3 marks)

12. 2004 Q 9 P2

Make b the subject $a = \frac{bd}{\sqrt{b^2-d}}$ (3 marks)

13. 2005 Q 10 P1

Make P the subject of the formula

$P^2 = (P-q)(P-r)$ (3 marks)

14. 2006 Q 2 P2

Make *s* the subject of the formula (4 marks)

$\sqrt{p} = r\sqrt{1-as^2}$

15. 2007 Q 2 P2

Given that

$$y = \frac{2x-z}{x+3z},$$

express x in terms of y and z (3 marks)

16. 2008 Q 2 P2

Make h the subject of the formula (3 marks)

$q = \frac{1+rh}{1-ht}$

17. 2010 Q 14 P2

Make x the subject of the equation: (3 marks)

$3y = y + \frac{p}{q+\frac{1}{x}}$

18. 2011 Q 3 P2

Make s the subject of the formula. (3 marks)

$W = 3\sqrt{\frac{s+t}{s}}$

19. 2012 Q2 P2

Make n the subject of the equation. (3 marks)

$\frac{r}{p} = \frac{m}{\sqrt{n-1}}$

20. 2013 Q3 P2

Make d the subject of the fomula,

$P = \frac{1}{2}mn^2 - \frac{qd^2}{n}$ (3 marks)

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VARIATION

1. 1989 Q6 P2

The force attraction between two bodies varies inversely as the square of the distance between them. When the distance between them is 2metres, the force of attraction is 0.5 newtons. Find the force when the distance between them is 0.4metres (2 marks)

2. 1990 Q2 P1

Two variables p and q are such that p is directly proportional to x and q is inversely proportional to x. When x = 2 their sum is 8 and when x = 3 their sum is 7. Find the constants of proportionality (4 marks)

3. 1990 Q22 P2

Three quantities P, Q and R are such that P varies directly as the square of Q and inversely as the square root of R. Given that Q increases by 5% and R decreases by 36%, find the percentage change in P. (5 marks)

If P = 6, when Q =12 and R = 25 find the value of P when Q = 15 and R = 81 (3 marks)

4. 1991 Q2 P1

Given that x varies directly as the square of y and $x = 2$ when $y = 1$, find x when $y = 4$

(3 marks)

5. 1992 Q13 P1

For a lifting machine the effort E required to lift a load L is partly constant and partly varies as L. when L = 2, E = 5 ½ and when L = 6, E = 6 ½ . Determine the equation connecting E and L. (4 marks)

6. 1993 Q5 P1

The mass of a certain metal rod varies jointly as its length and the square of its radius. A rod 40cm long and radius 5cm has a mass of 6kg.Find the mass of a similar rod of length 25cm and radius 8cm (4 marks)

7. 1994 Q2 P2

The frequency of vibration of a given string is directly proportional to the square root of the tension T and inversely proportional to the length l and to the diameter d . If t is increased by 50% and l is halved, calculate the percentage change in the frequency

(4 marks)

8. 1994 Q13 P2

The sides of a square are decreases by 5%. By what percentage is the area decreased?

(2 marks)

9. 1995 Q15 P2

Two variables P and L are such that P varies partly as L and partly as the square root of L.

Determine the relationship between P and L when L = 16, P = 500 and when L = 25, P = 800. (5 marks)

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10. 1996 Q2 P2

The electrical resistance, R ohms, of a wire of a given length is inversely proportion to the square of the diameter of the wire, d mm. If r=2.0 ohms when d=3mm, find the value of R when d=4mm (3 marks)

11. 1997 Q21 P2

The volume vcm^3 of a solid depends partly on r^2 and partly on r^3 where r cm is one of the dimensions of the solid

When r = 1, the volume is 54.6 cm^3 and
When r = 2, the volume is 226. $8cm^3$

(a) Find the expression for v in terms of r (4 marks)
(b) Calculate the volume of the solid when r = 4 (2 marks)

(c) Find the value of r for which the two parts of the volume are equal (2 marks)

12. 1998 Q9 P1

A quantity T is partly constant and partly varies as the square root of S.

a) Using constants a and b, write down an equation connecting T and S. (1 mark)

b) If S = 16, when T = 24 and S = 36 when T = 32, find the values of the constants a and b, (2 marks)

13. 2000 Q20 P2

The charge, C shillings per person for a certain seminar is partly fixed and partly inversely proportional to the total number N of people.

(a) Write down the expression for C in terms of N (1 mark)
(b) When 100 people attended the charge is Kshs 8,700 per person while for 35 people the charge is Ksh. 10,000 per person (3 marks)

(c) If a person had paid the full amount and does not attend, the fixed charge is refunded. A group of people paid but ten per cent of them did not attend. After the refund the organizer remained with Kshs 574,000. Find the number of people initially in the group. (4 marks)

14. 2001 Q4 P2

Two valuables A and B are such that A varies partly as the square of B. Given that A 30, when B =9, and A= 16 when 4=14, Find A and B = 36. (4 marks)

15. 2002 Q14 P1

A quantity P is partly constant and partly varies inversely as a quantity q. Given that P=10 when p = 20 when q = 1.25, find the value of p when q = 0.5. (3 marks)

16. 2003 Q16 P2

A distance s metres of an object varies with time t seconds and partly with the square root of the time. Give that s = 14 when t = 9, write an equation connecting s and t. (4 marks)

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17. 2004 Q23 P2

Three quantities P,Q and R are sure that P varies directly as the square of Q and inversely as the square root of R.

(a) Given that P = 20 when Q = 5 and R = 9, find P when Q and R = 25 (3 marks)

(b) If Q increases by 20% and R decreases by 36%, find the percentage Increase in P. (5 marks)

18. 2005 Q14 P2

The density of a solid spherical ball varies directly as its mass and inversely as the cube of its radius. When the mass of the ball is 500g and the radius is 5 cm, its density is 2 g per cm^3

Calculate the radius of a solid spherical ball of mass 540 density of 10g per cm^3 (3 marks)

19. 2006 Q12 P2

Three quantities t, x and y are such that t varies directly as x and inversely as the square root of y. Find the percentage in t if x decreases by 4% when y increases by 44% (4 marks)

20. 2007 Q18 P2

Given that y is inversely proportional to x^n and k as the constant of proportionality;

(a) (i) Write down a formula connecting y, x, n and k (1 mark)

(ii) If x = 2 when y = 12 and x = 4 when y = 3, write down two expressions for k in terms of n.

Hence, find the value of n and k. (7 marks)

(b) Using the value of n obtained in (a) (ii) above, find y when $x = 5\ ^1/_3$ (2 marks)

21. 2008 Q18 P2

Three variables p, q and r are such that p varies directly as q and inversely as the square of r.

(a) When p=9, q=12 and r = 2.
Find p when q= 15 and r =5 (4 marks)

(b) Express q in terms of p and r. (1 marks)

(c) If p is increased by 10% and r is decreased by 10%, find;

(i) A simplified expression for the change in q in terms of p and r (3 marks)

(ii) The percentage change in q. (2marks)

22. 2009 Q3 P2

The mass of a wire m grams (g) is partly a constant and partly, varies as the square of its thickness t mm. when t = 2mm, m = 40g and when t = 3mm, m = 65g.Determine the value of m when t = 4mm (4 marks)

23. 2010 Q23 P2

In a uniform accelerated motion the distance, *s* meters, traveled in time *t* seconds varies partly as the time and partly as the square of the time. When the time is 2seconds, the distance traveled is 80 meters and

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the time is 3 seconds,
The distance traveled is 135 meters.

a) Express *s* in terms of *t* (3 marks)

b) Find:

i) The distance traveled in 5 seconds; (2 marks)

ii) The time taken to travel a distance of 560 metres. (3 marks)

24. 2011 Q23 P2

The cost c, of producing n items varies partly as n and partly as the inverse of n. To produce two items it cost Ksh 135 and to produce three items it costs Kshs 140.

Find;

a) the constants proportionality and hence write the equation connecting C and in; (5 marks)

b) the cost of producing 10 items (2 marks)

c)the number of items produced at a cost of Ksh 756. (3 marks)

25. 2012 Q15 P2

Three quantities P, Q and R are such that P varies directly as Q and inversely as the square root of R. When P=8, Q=10 and R=16. Determine the equation connecting P, Q and R. (3 marks)

26. 2013 Q22 P2

Three quantities R, S, and T are such that varies directly as S and inversely as the square if T.

a) Given that R=480 when S=150 and T = 5, write an equation connecting R, S and T. (4 marks)

b)(i)find the value of R when S = 360 and T = 1.5. (2 marks)

(ii) Find the percentage change in R if S increases by 5% and T decreases by 20%. (4 marks)

27. 2013 Q22 P2

Three quantities L, M and N are such that L varies directly as M and inversely as the square of N. Given that L = 2 when M = 12 and N = 6, determine the equation connecting the three quantities. (3 marks)

28. 2013 Q22 P2

A quantity P varies partly as the square of m and partly as n. When P = 3.8, m = 2 and n = When P = -0.2, m = 3 and n = 2.

(a) Find:

(i) the equation that connects P, m and n; (4 marks)

(ii) the value of P when m = 10 and n = 4. (1 mark)

(b) Express m in terms of P and n. (2 mark)

(c) If P and n are each increased by 10%, find the percentage increase in m correct to 2 decimal places. (3 marks)

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SEQUENCE AND SERIES

1. 1989 Q6 P1

In a *jua kali* factory, the number of pans produced in the first month is 250. The number of pans produced per month increases on the average by 30. Find the expected number of pans produced for the first 12 months (3 marks)

2. 1990 Q13 P1

Find the sum of the first 30 terms of the series:

16 + 19 + 22 +..... (2 marks)

3. 1991 Q15 P1

A man deposits his money in a savings bank on a monthly basis. Each deposit exceeds the previous one by sh. 750. If he started by depositing sh 1500 how much will he have deposited in 12months? (3 marks)

4. 1992 Q14 P2

The average of the first and the fourth term of a GP is 140. Given that the first term is 64, find the common ratio (3 marks)

5. 1993 Q1 P2

A machine starts production of matchboxes at the rate of 12,000 per hour. The rate of production decreases by 40% every hour. Calculate the total number of match boxes

(i) In the first two hours (2 marks)

6. 1994 Q5 P1

Onyango and Kamau were employed on the same day and their salaries were as follows:

Onyango : sh 11,000 per month and an increment of sh 300 at the end of every year.

Kamau : sh 10.000 per month and an increment of sh 500 at the end of every year.

After how many years will they earn equal salaries (3 marks)

7. 1995 Q10 P1

The first, the third and the seventh terms of an increasing arithmetic Progression are three consecutive terms of a geometric progression. In the first term of the arithmetic progression is 10 find the common difference of the arithmetic progression. (4 marks)

8. 1996 Q6 P1

An employee started on a salary of K£ 6000 per annum and received constant annual increment. If he earned he earned a total of K£ 32,400 by the end of five years, calculate his annual increment. (3 marks)

9. 1996 Q 10 P2

The second and fifth terms of a geometric progression are 16 and 2 respectively.

Determine the common ratio and the first term (3marks)

10. 1996 Q21 P2

Kubai saved sh 2000 during the first year of employment. In each subsequent year, he saved 15% more than the preceding year until

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he retired.

a)How much did he save in the second year? (1 mark)

b) How much did he save in the third year? (1 mark)

c) Find the common ratio between the savings in two consecutive years (1 mark)

d)How many years did he take to save a sum of sh 58,000? (3 marks)

e)How much had he saved after 20years of service (2 marks)

11. 1997 Q4 P1

In geometric progression, the first is a and the common ratio is r. The sum of the first two terms is 12 and the third term is 16.

(a) Determine the ratio $\frac{ar^2}{a + ar}$ (1 mark)

(b) If the first term is larger than the second term, find the value of r. (2 marks)

12. 1997 Q 24 P2

An arithmetic progression has the first term *a* and the common difference *d*.

a) Write down the third, ninth and the twenty fifth terms of the progression. (1 mark)

b) The arithmetic progression above is such that it is increasing and that the third, ninth and twenty fifth term from the first three consecutive terms of a geometric progression. The sum of the seventh and twice the sixth terms of the arithmetic progression is 78.

Calculate

(i) The first term and the common difference of the arithmetic Progression (5marks)

(ii) the sum of the first nine terms of the arithmetic progression (2 marks)

13. 1998 Q10 P1

The third and fifth terms of an arithmetic progression are 10 and -10 respectively

a) Determine the first and the common difference (2 marks)

b)The sum of the first 15 terms (2 marks)

14. 1999 Q20 P2

(a) The first term of an arithmetic progression is 4 and the last term is 20. The sum of the term is 252. Calculate the number of terms and the common differences of the arithmetic progression (4 marks)

(b) An Experimental culture has an initial population of 50 bacteria. The population increased by 80% every 20 minutes. Determine the time it will take to have a population of 1.2 million bacteria. (4 marks)

15. 2000 Q18 P2

The eleventh term of an arithmetic progression is four times its second term. The sum of the first seven terms of the same progression is 175.

(a) Find the first term and the common difference of the progression (4 marks

(b) Given that the P^{th} term of the progression is greater than 124,find the least value of P (4 marks)

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16. 2001 Q19 P2

The n^{th} term of a sequence is given by 2n+3

a) Write the first four items of the sequence. (2 marks)

b) Find S_{50}, the sum of the first terms of the sequence. (2 marks)

c) Show that the sum of the first terms of the sequence is given by.

$Sn = n^2 + 4n$

Hence or otherwise find the first largest integral value of n such that. (4 marks)

$Sn < 725$

17. 2002 Q14 P2

Each month, for 40 months, Amina deposited some money in a saving scheme. In the first month she deposited sh 500. Thereafter she increased her deposits by sh.50 every month.

Calculate the:

a) Last amount deposited by Amina (2 marks)

b) Total amount Amina had saved in the 40 months. (2 marks)

18. 2003 Q15 P2

A colony of insects was found to have 250 insects at the beginning. Thereafter the number of insects doubled every 2 days. Find how many insects there were after 16 days. (3 marks)

19. 2004 Q3 P2

Find the number of terms of the series 2 + 6 + 10 + 14 + 18 + ... that will give a sum of 800. (2 marks)

20. 2005 Q5 P2

The first three consecutive terms of a geometrical progression are 3, x and $5^1/_3$.

Find the value of x. (2 marks)

21. 2005 Q19 P2

Abdi and Amoit were employed at the beginning of the same year. Their annual salaries in shillings progressed as follows:

Abdi: 60,000, 64 800, 69, 600

Amoit 60,000, 64 800, 69 984

(a) Calculate Abdi's annual salary increment and hence write down an expression for his annual salary in his n^{th} year of employment (2 marks)

(b) Calculate Amoit's annual percentage rate of salary increment and hence write down an expression for her salary in her n^{th} year of employment. (2 marks)

(c) Calculate the differences in the annual salaries for Abdi and Amoit in their 7^{th} year of employment (4 marks)

22. 2006 Q22 P2

The product of the first three terms of geometric progression is 64. If the first term is a, and the common ration is r.

(a) Express r in terms of a (3 marks)

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(b) Given that the sum of the three terms is 14

(i) Find the value of a and r and hence write down two possible sequence each up to the 4^{th} term.

(ii) Find the product of the 50^{th} terms of two sequences (2 marks)

23. 2007 Q10 P2

A carpenter wishes to make a ladder with 15 cross- pieces. The cross-pieces are to diminish uniformly in length from 67 cm at the bottom to 32 cm at the top.

Calculate the length in cm, of the seventh cross- piece from the bottom (3 marks)

24. 2009 Q23 P2

(a) The first term of an Arithmetic Progression (AP) is 2. The sum of the first 8 terms of the AP is 156

(i) Find the common difference of the AP (2 marks)

(ii) Given that the sum of the first n terms of the AP is 416, find n (2 marks)

b) The 3^{rd}, 5^{th} and 8^{th} terms of another AP form the first three terms of a Geometric Progression (GP). If the common difference of the AP is 3, find;

(i) The first term of the GP; (4 marks)

(ii) The sum of the first 9 terms of the GP, to 4 significant figures (2 marks)

25. 2010 Q22 P2

The first term of an Arithmetic Progression (A.P.) with six terms is p and its common difference is c. Another A.P. with five terms has also its first term as p and a common difference of d. the last terms of the two Arithmetic Progressions are equal.

a) Express d in terms of c. (3 marks)

b) Given that the 4^{th} term of the second A.P. exceeds the 4^{th} term of the first one by 1 ½, find the value of c and d. (3 marks)

c) Calculate the value of p if the sum of the terms of the first A.P. is 10 more than the terms of the second A.P. (4 marks)

26. 2011 Q18 P2

The first, fifth and seventh terms of an arithmetic progression (AP) correspond to the first three consecutive terms of a decreasing Geometric Progression (GP).The first term of each progression is 64, and the common difference of the AP is *d* and the common ratio of the G.P is *r*.

a) (i) Write two equations involving d and r (2 marks)

(ii) Find the values of *d* and *r*

b) Find the sum of the first 10 term of;

(i) The A.P

(ii) The G.P

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27. 2012 Q17 P2

Amaya was paid an initial salary of Ksh 180 000 per annum with a fixed Annual increment. Bundi was paid an initial salary of Ksh 150 000 per annum with a 10% increment compounded annually.

(a) Given that Amaya's annual salary in the 11^{th} year was Ksh 288 000,determine:

(i) His annual increment; (2 marks)

(ii) The total amount of money Amaya earned during the 11 years. (2 marks)

(b) Determine Bundi's monthly earnings, correct to the nearest shilling, during the eleventh year. (2 marks)

(c) Determine, correct to the nearest shilling:

(i) The total amount of money Bundi earned during the 11 years. (2 marks)

(ii) The difference between Bundi's and Amaya's average monthly earnings during the 11 years. (2 marks)

28. 2013 Q1 P2

The sum of *n* terms of the sequence; 3, 9, 15, 21, … is 7500. Determine the value of *n*

(3 marks)

29. 2014 Q2 P2

The first term of an arithmetic sequence is — 7 and the common difference is 3.

(a) List the first six terms of the sequence; (1 marks)

(b) Determine the sum of the first 50 terms of the sequence. (2 marks)

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VECTORS

1. 1990 Q21 P1

In a parallelogram ABCD, **AB** = 2**a** and **AD** = **b**. M is the midpoint of AB. AC cut MD at X.

i) Express AC in terms of **a** and **b** (2 marks)

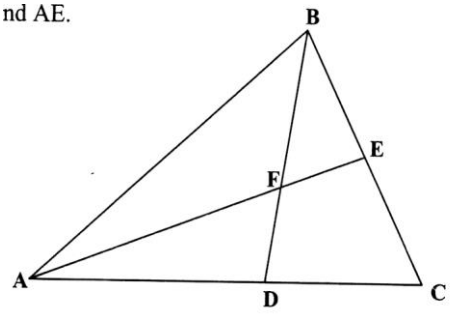
ii) Given that **AX** = m**AC** and **MX** = n**MD**, where m and n are constants, find m and n.

(6 marks)

2. 1991 Q20 P1

In the figure below E is the midpoint of BC, AD : DC = 3:2 and F is the point of intersection of BD and DE.

nd AE.



i) Given that **AB = b** and **AC = c** express **AE** and **BD** in terms of b and c (3 marks)

ii) Given further that **BF** = t**BD** and **AF** = s**AE** find the values of s and t. (5 marks)

3. 1992 Q11 P1

Three points A, B and P are in straight line such that **AP** = t**AB**. Given that the coordinates of A, B and P are (3,4) (8,7) and (x,y) respectively,express x and y in term s of t. (3 marks)

4. 1992 Q7 P2

The vectors **p, q** and y are expressed in terms of the vectors t and s as follow:

p = 3**t** + 2s

q = 5**t** – s

y = h**t** + (h – k)s

where h and k are constants. Given that y = 2**p** – 3**q**, find the values of and k.

(4 marks)

5. 1994Q12P2

Find the position vector of point R which divides line MN internally in the ratio 2 : 3. Take the position vectors of M and N to be

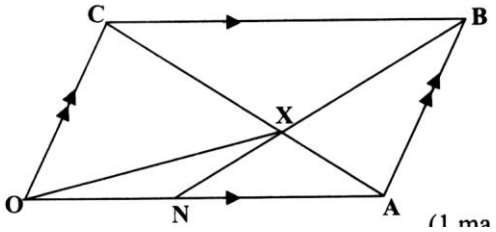
M = $\begin{pmatrix} 3 \\ 4 \\ -6 \end{pmatrix}$ and **N** = $\begin{pmatrix} -5 \\ -1 \\ 2 \end{pmatrix}$ (3 marks)

7. 1996 Q 22 P1

a) In the diagram below OABC is a parallelogram, **OA** = a and **AB** = b.

N is a point on **OA** such that **ON: NA** = 1: 2

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(b) Find

(i) **AC** in terms of **a** and **b** (1 mark)

(ii) **BN** in terms of **a** and **b** (1 mark)

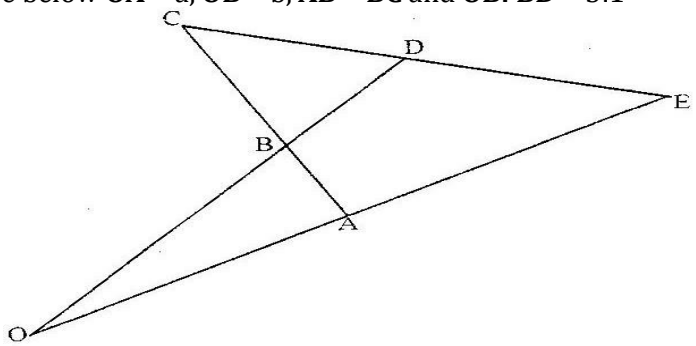
(c) The lines AC and BN intersect at X, **AX** = h**AC** and **BX** = k**BN**

(i) By expressing **OX** in two ways, find the values of h and k (4 mark)

(ii) Express **OX** in terms of **a** and **b** (1 mark)

8. 1997 Q 22 P1

In the figure below **OA** = a, **OB** = b, **AB** = **BC** and **OB: BD** = 3:1



(a) Determine

(i) AB (1 mark)

(ii) **CD**, in terms of a and b (2 mark)

(b) If CD : DE = 1:k and OA:AE = 1: m determine

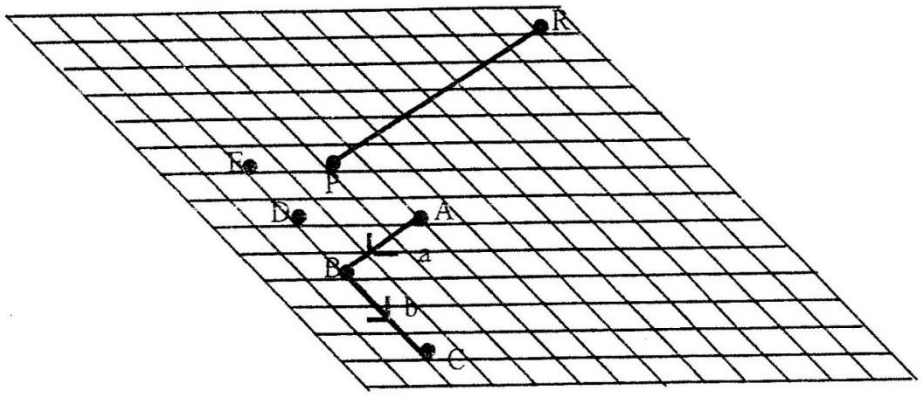
(i) DE in terms of **a, b** and k (1 mark)

(ii) The values of k and m (4 mark)

9. 1998 Q 22 P1

The figure below shows a grid of equally spaced parallel lines

$\overrightarrow{AB}$ = **a** and $\overrightarrow{BC}$ = **b**



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(a) Express

(i) $\overrightarrow{AC}$ in terms of a and b (1 mark)

(ii) $\overrightarrow{AD}$ in terms of a and b. (2 marks)

(b) Using triangle BEP, express $\overrightarrow{BP}$ in terms of a and b (2 marks)

(c) PR produced meets BA produced at X and $\overrightarrow{PR} = {}^{1}/_{9}\,\mathbf{b} - {}^{8}/_{3}\mathbf{a}$

By writing $\overrightarrow{PX}$ as k$\overrightarrow{PR}$ and $\overrightarrow{BX}$ as h$\overrightarrow{BA}$ and using the triangle BPX determine the ratio PR: RX (2 marks)

10. 1999 Q 14 P1

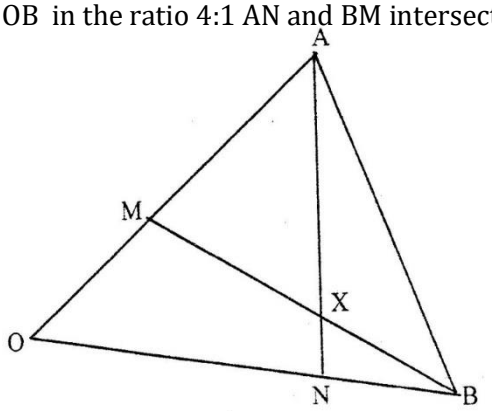
The points P. Q and R lie on a straight line. The position vectors of P and R are 2i + 2j + 13k and 5i – 3j + 4k respectively. Q divides PR Internally in the ratio 2:1. Find the

(a) Position vector of Q. (1 mark)

(b) Distance of Q from the origin (2 marks)

11. 2000 Q 21 P1

The figure below shows triangle OAB in which M divides OA in the ratio 2: 3 and N divides OB in the ratio 4:1 AN and BM intersect at X



(a) Given that OA = **a** and OB = **b**, express in terms of a and b:

(i) **AN** (1 mark)

(ii) **BM** (1 mark)

(b) If **AX** = s **AN** and **BX** = t**BM**, where s and t are constants, write two expressions for **OX** in terms of **a,b** s and t. Find the value of s Hence write **OX** in terms of a and b (6 marks)

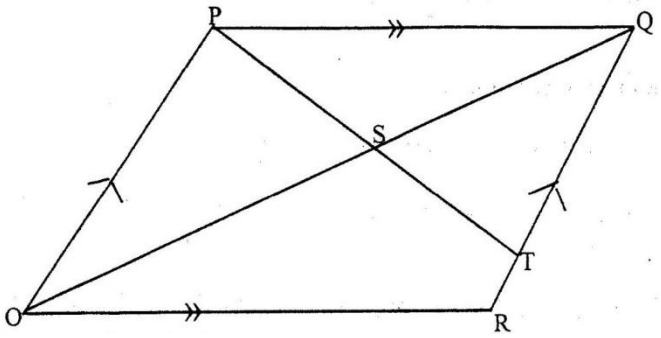
12. 2001 Q 16 P1

The position vectors for points P and Q are 4 **i** + 3 **j** + 2**k** and 3**i** – 6**j** + 6**k** respectively. Express vector **PQ** in terms of unit vectors i, j and k. Hence find the length of **PQ**, leaving your answer in simplified form. (3 marks)

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13. 2001 Q 19 P1

The figure below shows a parallelogram OPQR with O as the origin, **OP** = **p** and **OR = r**, Point T divides RQ in the ratio 1:4 and PT Meets OQ at S.



(a) Express in terms of p and r the vectors
(i) **OQ** (1 mark)
(ii) **OT** (1 mark)

(b) Vector **OS** can be expressed in two ways: m**OQ** or **OT** + n **TP**, Where m and n are constants express **OS** in terms of
(i) m, **p** and **r** (1 mark)
(ii) n, **p** and **r** (1 mark)

Hence find the:
(iii) Value on m (3 marks)
(iv) Ratio OS: SQ (1 mark)

14. 2002 Q 4 P1

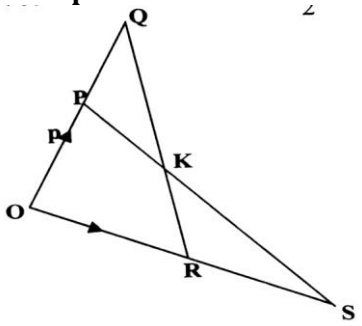
The position vectors of points X and Y are x=2**i** + **j** – 3**k** and y =3i + 2j -2k respectively. Find **XY** (3 marks)

15. 2003 Q 6 P1

Given that x = 2**i** +**j** – 2**k**,y = - 3**i** +4**j** –**k** and z = - 5**i** +3**j** +2**k** and that p = 3**x** – **y** +2**z**. Find the magnitude of vector p to 3 significant figure (4 marks)

16. 2003 Q 21 P1

In the figure below, vector OP = **p** and OR =**r**. Vector OS = 2**r** and OQ = $^3/_2$**p**.



a) Express in terms of p and r
(i) **QR** (1 mark)
(ii) **PS** (1 mark)

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b) The lines QR and PS intersect at K such that **QK** = m **QR** and **PK** = n **PS**, where m and n are scalars. Find two distinct expressions for **OK** in terms
of p,r,m and n.
Hence find the values of m and n. (5 marks)

c) State the ratio PK:KS (1 mark)

17. 2004 Q 4 P1

Given that **OA** = 3**i** -2**j** + and **OB** = 4**i** + **j** – 3**k**. Find the distance between points A and B to 2 decimal places. (2 marks)

18. 2005 Q 13 P1

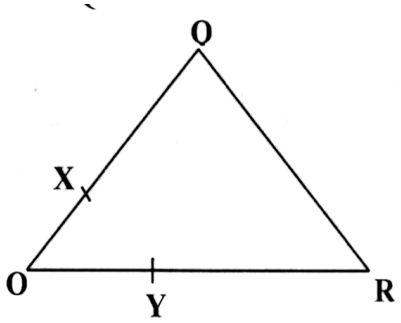
Point T is the midpoint of a straight line AB. Given the position vectors of A and T are i-j + k and 2i+ 1 ½ k respectively, find the position vector of B in terms of i, j and k. (3 marks)

19. 2006 Q 9 P2

Given that q **i** + $^1/_3$ **j** + $^2/_3$ **k** is a unit vector, find q (2 marks)

20. 2007 Q 21 P1

In the figure below, OQ = q and OR = r. Point X divides OQ in the ratio 1: 2 and Y divides OR in the ratio 3: 4 lines XR and YQ intersect at E.



(a)Express in terms of q and r

(i) XR (1 mark)

(ii) YQ (1 mark)

(b) If XE = m XR and YE = n YQ, express OE in terms of: (1 mark)

(i) r, q and m

(ii) r, q and n (1 mark)

(c) Using the results in (b) above, find the values of m and n. (6 marks)

21. 2007 Q 12 P2

Vector q has a magnitude of 7 and is parallel to vector p. Given that p= 3 **i** –**j** + 1 ½ **k**, express vector q in terms of i, j, and k. (2 marks)

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22. 2008 Q 4 P2

The position vectors of points A and B are $\begin{pmatrix} 3 \\ -1 \\ -4 \end{pmatrix}$ and $\begin{pmatrix} 8 \\ -6 \\ 6 \end{pmatrix}$ respectively.

A point P divides AB in AB it he ratio 2:3. Find the position Vector of point P.

(3 marks)

23. 2008 Q 4 P2

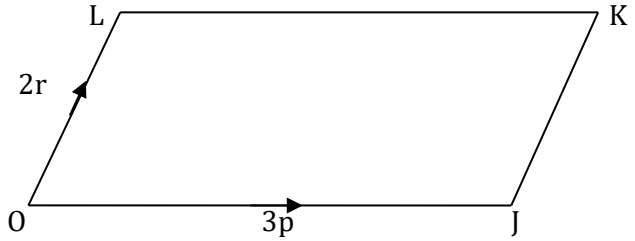
The position vectors of points A and B are $\begin{pmatrix} 3 \\ -1 \\ -4 \end{pmatrix}$ and $\begin{pmatrix} 8 \\ -6 \\ 6 \end{pmatrix}$ respectively.

A point P divides AB in AB it he ratio 2:3. Find the position Vector of point P.

(3 marks)

24. 2010 Q 18 P2

In the figure below OJKL is a parallelogram in which OJ = 3p and OL = 2r



a) If A is a point on LK such that LA = ½ AK and point B divide the line JK externally in the ratio 3:1, express **OB** and **AJ** in terms of **p** and **r.** (2 marks)

b) Line OB interests AJ at X such that **OX** = m**OB** and **AX** = n**AJ.**

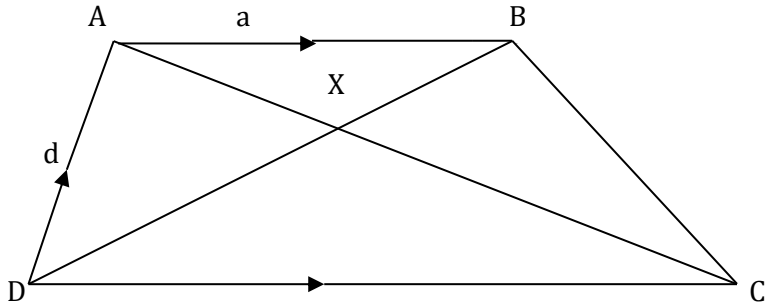
i) Express **OX** in terms of **p, r** and m. (1 mark)

ii) Express **OX** in terms of **p, r** and n (1 mark)

iii) Determine the value of *m* and *n* and hence the ratio in which point x divides line AJ. (6 marks)

25. 2011 Q 23 P1

In the figure below, ABCD is a trapezium. AB is parallel to DC, diagonals AC and DB intersect at X and DC=2AB. **AB= a, DA=d, AX=**k **AC** and **DX**= h**DB** where h and k are constants.



a) Find in terms of a and d

i) BC (2 marks)

ii) AX (2 marks)

iii) DX (1 mark)

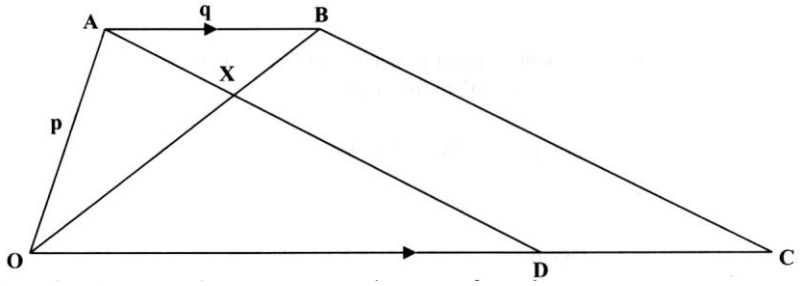
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26. 2012 Q4 P2

Given that $P=2i-3j+k$, $Q=3i-4j-3k$ and $R=3P+2Q$, find the magnitude of R to 2 significant figures. (3 marks)

27. 2012 Q19 P2

In triangle OPQ below, OP = p, OQ=q. Point M lies on OP such that OM: MP=2:3 and point N lies on OQ such that ON: NQ=5:1. Line PN intersects line MQ at X.



(a) Express in terms of p and q:

(i) PN; (1 mark)

(ii) QM; (1 mark)

(b) Given that PX= kPN and QX=rQM, where k and r are scalars:

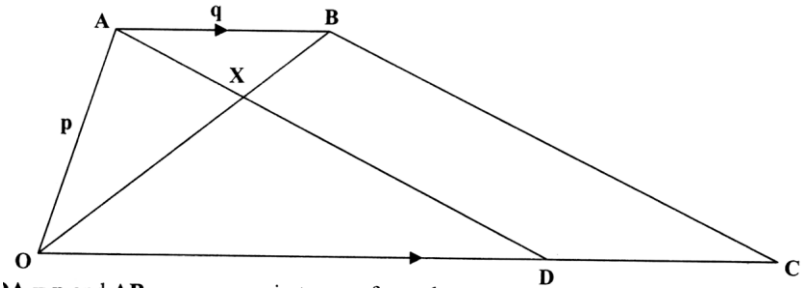
(i) Write two different expressions for OX in terms of p,q,k and r; (2 marks)

(ii) Find the values of k and r; (4 marks)

(iii) Determine the ratio in which X divides line MQ. (2 marks)

28. 2013 Q22 P1

In the figure below, OABC is a trapezium. AB parallel to OC and OC = 5 AB. D is a point on OC such that OD: DC = 3:2



a) Given that OA = p and AB = q, express in terms of p and q:

i. OB; (1 marks)

ii. AD; (2 marks)

iii. CB; (2 marks)

b) Lines OB and AD intersect at point X such that AX = kAD and OX = rOB, where k and r are scalars. Determine the values k and r. (5 marks)

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29. 2013 Q8 P2

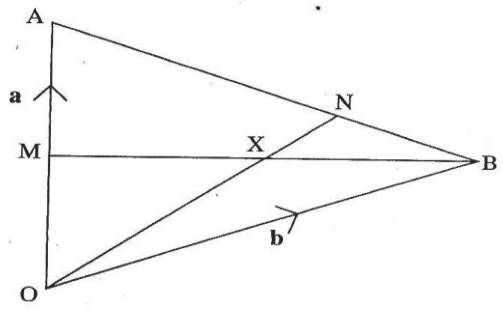
The position vectors of points F, G, and H are ***f***, ***g***, and ***h*** respectively.
Point H divides FG in the ratio 4:-1. Express ***h*** in terms of ***f*** and ***g*** (2 marks)

30. 2014 Q 14 P2

Vectors r and s are such that r = 7 i + 2 j - k and s = - i + j - k. Find | r + s |.
(3 marks)

31. 2014 Q 22 P2

In the figure below OA= a and OB= b. M is the mid point of OA and AN: NB= 2.1



a) Express in terms of a and b:

i) BA: (1 mark)

ii) BN: (1 mark)

iii) ON (2 marks)

b) Given that BX= hBM AND ox= kON determine the values of h and k.
(6 marks)

32. 2015 Q16 P2

The position vectors of points P, Q and R are $\mathrm{OP}= \begin{bmatrix} -3 \\ 6 \end{bmatrix}$, OQ $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$ = OR = $\begin{bmatrix} 4 \\ -1 \end{bmatrix}$

Show that P,Q and R are collinerar. (3 marks)

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BINOMIAL EXPANSIONS

1. 1989 Q13 P2

   Expand $\left[1+\frac{1}{2}x\right]^8$ up to term in x^3

   By putting x = 0.1, find the approximate value of $(1.05)^8$ to 2 decimal places.

   (5 marks)

2. 1990 Q16 P2

   Write down the first four terms of $(p + q)^8$ using binomial expansion. Use your expansion to evaluate $(9.99)^8$ the nearest 100 (4 marks)

3. 1991 Q16 P2

   Obtain the binomial expansion for $(1-2x)^5$ .Use your expansion to evaluate $(0.98)^5$ to five places of decimal (3 marks)

4. 1992 Q3 P2

   Use binomial theorem to expand $\left[1-\frac{1}{2}x\right]^8$ up to the forth term. Use your expansion to evaluate $(0.98)^8$ by taking $x = 0.04$ (3 marks)

5. 1993 Q7 P1

   By making use of binomial expansion, determine the value of $(2.002)^4$ to four decimal places (3 marks)

6. 1994 Q5 P2

   Expand $(1 + 2x)^{10}$ up to the term in x^3. Hence use our expansion to estimate $(0.95)^{10}$ correct to three decimal places (4 marks)

7. 1996 Q12 P2

   Expand $(1+a)^5$ use your expansion to estimate (0.8)5 correct to four decimal places (3 marks)

8. 1997 Q9 P2

   Expand and simplify $(1 – 3x)^5$, up to the term in x^3

   Hence use your expansion to estimate $(0.97)^5$ correct to 4 decimal places (5 marks)

9. 1998 Q13

   (a) Write down the simplest expansion $(1 + x)^6$ (1 mark)

   (b) Use the expansion up to the fourth term to find the value of $(1.03)^6$ to the nearest one thousandth. (2 marks)

10. 1999 Q10

    Use binomial expression to evaluate $(0.96)^5$ correct to 4 significant figures (4 marks)

11. 2000 Q13

    Expand $(1 + x)^5$, hence, use the expansion to estimate $(1.04)^5$ correct to 4 decimal Places (4 marks)

12. 2001 Q10 P2

    Expand $(2 + x)^5$ in ascending powers of x up to the term in x3

    Hence, approximate the value of $(2.03)^5$ to 4s.f. (4 marks)

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13. 2002 Q9 P2

a) Expand $(a - b)^6$ (1 mark)

b) Use the first three terms of the expansion in a (a) to find the approximate value of $(1.98)^6$ (3 marks)

14. 2003 Q11 P2

a) Expand and simplify the binomial expression $(2 - x)^6$ (2 marks)

b) Use the expansion up to the term in x2 to estimate 1.99^6 (2 marks)

15. 2004 Q8 P2

(a) Expand $(1 + x)^5$ (2 marks)

(b) Use the first three terms of the expansion in (a) to find the approximate value of $(0.98)^5$ (2 marks)

16. 2005 Q13 P2

Expand and simplify $(3x - y)^4$

Hence use the first three terms of the expansion to approximate the value of $(6\text{-}0.2)^4$ (4 marks)

17. 2006 Q11 P2

Use binomial expression to evaluate (4 marks)

$$\left(2+\frac{1}{\sqrt{2}}\right)^5+\left(2-\frac{1}{\sqrt{2}}\right)^5$$

18. 2007 Q4 P2

(a) Expand the expression $\left(1+\frac{1}{2}x\right)^5$ in ascending powers of x, leaving the coefficients as fractions in their simplest form (2 marks)

(b) Use the first three terms of the expansion in (a) above to estimate the value of

$$\left(1\frac{1}{20}\right)^5 3\sqrt{\frac{83.46\times 0.0054}{1.56^2}}$$ (2 marks)

19. 2008 Q8 P2

a) Expand and simplify the expression

$$\left(10+\frac{2}{x}\right)^5$$ (2 marks)

b) Use the expansion in (a) above to find the value of 14^5 (2 marks)

20. 2009 Q8 P2

(a) Expand and simplify the binomial expression $(2\text{-}x)^7$ in ascending powers of x (2 marks)

(b) Use the expansion up to the fourth term to evaluate $(1.97)^7$ correct to 4 decimal places (2 marks)

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21. 2010 Q12 P2

a) Expand and simplify $(2 - x)^5$ (2 marks)

b) Use the first 4 terms of the expression in part (a) above to find the approximate value of $(1.8)^5$ to 2 decimal places.

22. 2011 Q11 P2

Expand and simplify the expression.

$(a + ½)^4 + (a - ½)^4$ (3 marks)

23. 2012 Q12 P2

(a) Expand $(1+ x)^7$ up to the 4th term. (1 mark)

(b) Use the expansion in part (a) above to find the appropriate value of $(0.94)^7$ (2 marks)

24. 2013 Q7 P2

(a) Expand $(1 - x)^5$ (1 mark)

(b) Use the expansion in (a) up to the term in x^3 to approximate the value of $(0.98)^5$

(2 marks)

25. 2014 Q8 P2

Expand $(3 - x)^1$ up to the term containing x^4. Hence find the approximate value of $(2.8)^7$. (3 marks)

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PROBABILITY

1. 1989 Q10 P2

A contractor applies for two contracts:

A – building a school workshop

and

B - building a school library

The probability of getting contract A IS 0.6. The probability of getting contract B depends on whether or not A is obtained and is 0.7 if A is obtained but only 0.4 if A is not obtained. What is the probability of getting at least one contract (3 marks)

2. 1990 Q10 P1

A bag contains 10 balls which 3 are red, 5 are white and 2 are green. Another bag Contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at Random and then a ball chosen at random from the bag. Find the probability that the Ball so chosen is red. (4 marks)

3. 1990 Q18 P2

At a factory 120 candidates have to be interviewed: 48 for carpentry, 32 for Masonry and 40 for plumbing. Past experience indicates that 80% would pass Carpentry, 45% would pass masonry and 60% would pass plumbing.

a) A candidate is picked at random. Find the probability that

i) He is to be interviewed for carpentry (1 mark)

ii) He is to be interviewed for masonry (2 marks)

iii) He would pass the interview. (3 marks)

b) How many candidates are expected to pass their interviews? (2 marks)

4. 1991 Q10 P1

There are two boxes labeled A and B on a table. Box A contains 5 red balls and 3 white balls, while box B contains 2 red balls and 6 white balls. A box is chosen at random and two balls are drawn from it, one after the other without replacement.

Find the probability that the two balls chosen are of different colours. (4 marks)

5. 1991 Q18b P2

In a shooting practice three soldiers A, B and C aim at a target. The probabilities of A, B and C hitting the target are $^1/_3$, $^1/_4$ and $^1/_2$ respectively. The three soldiers shot at the target only once; one after the other. What is the probability that the target was hit only once? (6 marks)

6. 1992 Q9 P2

The probability that Kamau will e selected for his school's basketball team is $^1/_4$. If he is selected for the basketball team, then the probability that he will be selected for football is $^1/_3$. If he is not selected for basketball then the probability that he is selected for football is $^4/_5$.

What is the probability that Kamau is selected for at least one of the two games? (3 marks)

7. 1993 Q13 P1

Chicks on Onyango's farm were noted to have either brown or black

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feathers. Of those with black feathers $^2/_3$ were female while $^2/_5$ of those male. Otieno bought two chicks from Onyango. One had black tail feathers while the other one had brown.

Find the probability that Otieno's chicks were not to the same gender. (4 marks)

8. 1994 Q8 P1

The probability that a man wins a game is $^3/_4$. He plays the game until he wins. Determine the probability that he wins in the fifth round. (3 marks)

9. 1995 Q 8 P1

Two baskets A and B each contain a mixture of oranges and lemons. Basket A contains 26 oranges and 13 lemons. Basket B contains 18 oranges and 15 lemons. A child selected basket at random and picked at random a fruit from it.

Determine the probability that the fruit picked was an orange. (4 marks)

10. 1995 Q 19 P2

The probabilities that a husband and wife will be alive 25 years from now are 0.7 and 0.9 respectively. Find the probability that in 25 years time,

(a) Both will be alive (2 marks)
(b) Neither will be alive (2 marks)
(c) One will be alive (2 marks)
(d) At least one will be alive (2 marks)

11. 1996 Q 24 P1

A bag contains blue,green and red pens of the same type in the ratio 8:2:5 respectively.A pen is picked at random without replacement,and its colour noted.

a) Determine the probability that the first pen picked is
   i) Blue (1 mark)
   ii) Either green or red (1 mark)
b) Using either a tree diagram determine the probability that
   i) The first two pens picked are both green. (3 marks)
   ii) Only one of the first two pens picked is red (3 marks)

12. 1996 Q 6 P2

During inter-school competitions, football and volleyball teams from Mokagu High School took part.The probability that their football and volleyball teams would win were $^3/_8$ and $^4/_7$ respectively.

Find the probability that

a) Both their football and volleyball teams won. (2 marks)
b) At least one of their teams won (2 marks)

13. 1997 Q 21 P1

The water supply in a town depends entirely on two water pumps. A and B. The probability of pump A filling is 0.1 and the probability of pump B failing is 0.2. Calculate the probability that

(a) Both pumps are working (2 marks)
(b) There is no water in the town (2 marks)
(c) Only one pump is working (2 marks)
(d) There is some water in the town (2 marks)

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14. 1998 Q 24 P1

In a livestock research stations a new drug for a certain fowl disease is being tried. A sample of 36 fowls was diagnosed to have the disease. Twenty (20) fowls were treated with the drug and the rest were not.

(a) Calculate the probability that a fowl picked at random is
  (i) treated with the drug (1 mark)
  (ii) Not treated with the drug (1 mark)

b) If a fowl is treated, probability of dying is 1/10 while if not treated the probability is 7/10 calculate the probability that, a fowl picked at random from the 36 fowl is
  (i) treated with the drug and will die (2 marks)
  (ii) Not treated with the drug and will die (2 marks)
  (iii) Not treated with the drug and will not die (2 marks)

15. 1998 Q 14 P2

A science club is made up of 5 boys and 7 girls. The club has 3 officials. Using a tree diagram or otherwise find the probability that:
  (a) The club official are all boys (2 marks)
  (b) Two of the officials are girls (2 marks)

16. 1999 Q 7 P1

Two baskets A and B each contain a mixture of oranges and limes, all of the same size. Basket A contains 26 oranges and 13 limes. Basket B contains 18 oranges and 15 limes. A child selected a basket at random and picked a fruit at a random from it.
  (a) Illustrate this information by a probabilities tree diagram (1 mark)

  (b) Find the probability that the fruit picked was an orange (2 marks)

17. 2000 Q 18 P1

In form 1 class there are 22 girls and boys. The probability of a girl completing the secondary education course is $^3/_5$ whereas that of a boy is $^2/_3$
(a) A student is picked at random from class. Find the possibility that,
  (i) The student picked is a boy and will complete the course (2 marks)
  (ii) The student picked will complete the course (2 marks)

(b) Two students are picked at random. Find the possibility that they are a boy and a girl and that both will not complete the course. (4 marks)

18. 2000 Q 10 P2

Three representatives are to be selected randomly from a group of 7 girls and 8 boys. Calculate the probability of selecting two girls and one boy. (3 marks)

19. 2001 Q 9 P1

A poultry farmer vaccinated 540 of his 720 chickens against a disease. Two months later, 5% of the vaccinated and 80% of the unvaccinated chicken, contracted the disease. Calculate the probability that a chicken

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chosen random contacted the disease. (2 marks)

20. 2001 Q 23 P1

The probability of three darts players Akinyi, Kamau, and Juma hitting The bulls eye are 0.2, 0.3 and 1.5 respectively.

(a) Draw a probability tree diagram to show the possible outcomes (2 marks)

(b) Find the probability that:

(i) All hit the bulls eye (2 marks)

(ii) Only one of them hit the bulls eye (2 marks)

(iv) at most one missed the bull's eye (2 marks)

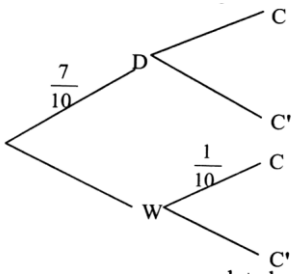
21. 2002 Q 19 P1

c) An unbiased coin with two faces, Head (H) and Tail (T),is tossed three times. List all the possible outcomes. Hence determine the probability of getting

(i) At least two heads

(ii) Only one tail (3 marks)

b) During a certain motor rally it is predicted that the weather will be either dry (D) or wet (W). The probability that the weather will be dry is estimated to be $^{7}/_{10}$. The probability for a driver to complete (C) the rally during the dry weather is estimated to be $^{5}/_{6}$. The probability for a driver to complete the rally during wet weather is estimated to be $^{1}/_{10}$ .Complete the probability tree diagram given below.



What is the probability that:-

i) The driver completes the rally (2 marks)

ii) The weather was wet and the driver did not complete the rally? (1 mark)

22. 2003 Q 9 P1

There are three cars A,B and C in a race. A is twice as likely to win as B while B is twice as likely to win as c. Find the probability that.

a) A wins the race

b) Either B or C win the race. (3 marks)

23. 2004 Q 7 P1

In the year 2003, the population of a certain district was 1.8 million. Thirty per cent of the population was in the age group 15 – 40 years. In the same year, 120,000 people in the district visited the Voluntary Counseling and Testing (VCT) centre for an HIV test.

If a person was selected at random from the district in this year. Find the Probability that the person visited a VCT centre and was in the age group 15 – 60 years. (4 marks)

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24. 2005 Q 8 P1

Two teachers are chosen randomly from a staff consisting 3 women and 2 men to attend a HIV/AIDs seminar. Calculate the probability that the two teachers chosen are:

(a) Of the same sex (2 marks)

(b) Of opposite sex (2 marks)

25. 2006 Q 20 P2

(a) Two integers x and y are selected at random from the integers 1 to 8. If the same integer may be selected twice, find the probability that

(i) $x - y = 2$ (2 marks)

(ii) $x - y$ is more (2 marks)

(iii) $x > y$ (2 marks)

(b) A die is biased so that when tossed, the probability of a number r showing up, is given by $P(r) = Kr$ where K is a constant and r = 1, 2,3,4,5 and 6 (the number on the faces of the die

(i) Find the value of K (2 marks)

(ii) if the die is tossed twice, calculate the probability that the total score is 11 (2 marks)

26. 2007 Q 24 P2

Two bags A and B contain identical balls except for the colours. Bag A contains 4 red balls and 2 yellow balls. Bag B contains 2 red balls and 3 yellow balls.

(a) If a ball is drawn at random from each bag, find the probability that both balls are of the same colour. (4 marks)

(b) If two balls are drawn at random from each bag, one at a time without replacement, find the probability that:

(i) The two balls drawn from bag A or bag B are red (4 marks)

(ii) All the four balls drawn are red (2 marks)

27. 2008 Q 6 P2

A student at a certain college has a 60% chance of passing an examination at the first attempt. Each time a student fails and repeats the examination his chances of passing are increased by 15%

Calculate the probability that a student in the college passes an examination at the second or at the third attempt. (3 marks)

28. 2009 Q 12 P2

On a certain day, the probability that it rains is when it rains the probability that Omondi carried an umbrella is $^{2}/_{5}$. When it does not rain the probability that Omondi carries an umbrella is $^{1}/_{6}$. Find the probability that Omondi carried an umbrella that day (2 marks)

29. 2010 Q9 P2

A bag contains 2 white balls and 3 black balls. A second bag contains 3 white balls and 2 black balls. The balls are identical except for the colours.

Two balls are drawn at random, one after the other from the first bag and placed in the second bag.

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Calculate the probability that the 2 balls are both white. (2 marks)

30. 2011 Q 6 P2

The ages in years of five boys are 7, 8,9,10 and 11 while those of five girls are 4,5,6,7and 8. A boy and a girl are picked at random and the sum of their ages is recorded.

i. Draw a probability space to show all the possible outcomes. (1 mark)

ii. Find the probability that the sum of their ages is at least 17 years (1 mark)

31. 2012 Q23 P2

A box contains 3 brown,9 pink and 15 white clothes pegs. The pegs are identical except for the colour.

(a) Find the probability of picking:

(i) A brown peg; (1 mark)

(ii) A pink or a white peg. (2 marks)

(b) Two pegs are picked at random, one at a time, without replacement. Find the probability that:

(i) A white peg and a brown peg are picked; (3 marks)

(ii) Both pegs are of the same colour. (4 marks)

32. 2013 Q9 P2

Two machines, M and N produce 60% and 40% respectively of the total number of items manufactured in a factory. It is observed that 5% of the items produces by machine M are defective while 3% of the items produced by machine N are defective.

If an item is selected at random from the factory, find the probability that it is defective

(3 marks)

33. 2014 Q21 P2

Each morning Gataro does one of the following exercises: Cycling, jogging or weightlifting.

He chooses the exercise to do by rolling a fair die. The faces of the die are numbered

1, 1,2, 3, 4 and 5. ,

If the score is 2, 3 or 5, he goes for cycling. If the score is 1, he goes for jogging. If the score is 4, he goes for weightlifting.

(a) Find the probability that:

(i) on a given morning, he goes for cycling or weightlifting;

ii) on two consecutive mornings he goes for jogging

(b) In the afternoon, Gataro plays either football or hockey but never both games.

The probability that Gataro plays hockey in the afternoon is:

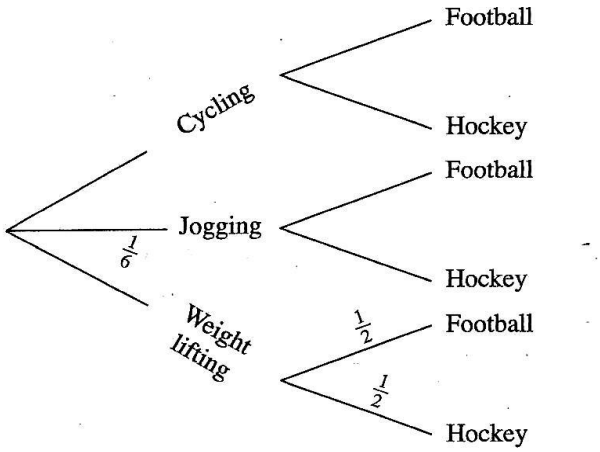
$\frac{1}{3}$ if he cycled;

$\frac{2}{5}$if he jogged and

½ if he did weightlifting in the morning.

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Complete the tree diagram below by writing the appropriate probability on each branch.



(c) Find the probability that on any given day:

(i) Gataro plays football; (2marks)

(ii) Gataro neither jogs nor plays football. (2marks)

34. 2015 Q11 P2

In a nomination for a committee, two people were to be selected at random from a group of 3 men and 5 women. Find the probability that a man and a woman were selected (2 marks)

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COMPOUND PROPORTIONS AND RATES OF WORK

(a) Rates of work

1. 1990 Q17 P1

A hot water tap can fill a bath in 5 minutes while a cold water tap can fill the same bath in three minutes. The drain pipe can empty the full bath in $3^3/_4$ minutes.

The two taps and the drain pipe are fully open for $1^1/_2$ minutes after which the drain pipe is closed. How much longer will it take to fill the bath? (8 marks)

(b) Mixtures

2. 1994 Q17 P2

Aden bought 3 brands of tea A, B and C. The cost price of the three brands were sh. 25, sh. 30 and sh. 45 per kilogram respectively. He mixed the three brands in ratio 5 : 2 : 1 respectively. After selling the mixture, he made a profit of 20%.

a) How much profit did he make per kilogram of the mixture? (4 marks)

b) After one year, the cost price of each brand was increased by 12%.
   i) For how much did he sell one kilogram of the mixture to maintain 20% profit? (Give your answer to the nearest 5ct.) (2 marks)
   ii) What would have been his percentage profit if he sold one kilogram of the mixture at sh. 40.25? (2 marks)

3. 1995 Q 11 P1

Akinyi bought and beans from a wholesaler. She then mixed the maize and beans the ratio 4:3 she brought the maize as Kshs. 12 per kg and the beans 4 per kg. If she was to make a profit of 30% what should be the selling price of 1kg of the mixture? (4 marks)

4. 1997 Q 14 P2

Mogaka and Onduso working together can do a piece of work in 6 days, Mogaka, working alone takes 5 days longer than Onduso. How many days does it take Onduso to do the work alone? (4 marks)

5. 1997 Q 17 P2

A company is to construct a parking bay whose area is $135m^2$. It is to be covered with concrete slab of uniform thickness of 0.15. To make the slab cement. Ballast and sand are to be mixed so that their masses are in the ratio 1: 4: 4. The mass of m^3 of dry slab is 2, 500kg.

Calculate

(a) (i) The volume of the slab
(ii) The mass of the dry slab
(iii) The mass of cement to be used

(b) If one bag of the cement is 50 kg, find the number of bags to be purchased If a lorry carries 7 tonnes of sand, calculate the number of lorries of sand to be purchased

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6. 1998 Q 17 P1

Wainaina has two dairy farms. A and B. Farm A produces milk with 3 ½ percent fat and farm B produces milk with 4 ¾ percent fat.

(a) Determine

(i) The total mass fat in 50 kg of milk from farm A and 30 kg of milk from farm B (2 marks)

(ii) The percentage of fat in a mixture of 50 kg of milk from A and 30 kg of milk from B (2 marks)

(b) Determine the range of values of mass of milk from farm B that must be used in a 50 kg mixture so that the mixture may have at least 4 percent fat. (4 marks)

7. 1999 Q 3 P2

The mass of a mixture A of beans and maize is 72kg. The ratio of beans to maize is 3:5 respectively

(a) Find the mass of maize in the mixture (1 mark)

(b) A second mixture of B of beans and maize of mass 98 kg in mixed with A. The final ratio of beans to maize is 8:9 respectively. Find the ratio of beans to maize in B (3 marks)

8. 1999 Q 15 P2

A construction firm has tractors T+1 and T_2. Both tractors working together can complete a piece of work in 6 days while T_1 alone can complete the working 15 days. After two tractors had worked together for four days, tractor T_1 broke down. Find the time it takes tractor T_2 to complete the remaining work (3 marks)

9. 1999 Q 17 P2

A retailer bought 49kg of grade 1 rice at Kshs. 65 per kilogram and 60 kg of grade II rice at Kshs 27.50 per kilogram. He mixed the two types of rice.

(a) Find the buying price of one kilogram of the mixture (2 marks)

(b) He packed the mixture into 2 kg packets

(i) If he intends to make a 20% profit find the selling price per packet (2 marks)

(ii) He sold 8 packets and then reduced the price by 10% in order to attract customers. Find the new selling price per packet. (1mark)

(iii) After selling of the remainder at reduced price, he raised the price so as to realize the original goal of 20% profit overall. Find the selling price per packet of the remaining rice. (3 marks)

10. 2002 Q 2 P2

Kipketer can cultivate a piece of land in 7 hours while Wanjiku can do the same work in 5 hours. Find the time they would take to cultivate the piece of land when working together.(3 marks)

11. 2002 Q 5 P2

A trader sells a bag of beans for shs. 2100 and that of maize at shs. 1200. He mixed beans and maize in the ratio 3:2. Find how much the trader should sell a bag of the mixture to realize the same profit (3 marks)

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12. 2003 Q 13 P2

Machine A can do a piece of work in 6 hours while machine B can do the same work in 9 hours. Machine A was set to do the piece of work but after $3^1/_2$ hours, it broke down and machine B did the rest of the work. Find how long machine B took to do the rest of the work (3 marks)

13. 2003 Q 18 P2

A dealer has three grades of coffee X,Y and Z. Grade X costs sh 140 per kg, grade y costs sh 160 per kg grade Z costs sh.256 per kg.

a) The dealer mixes grades X and Y in the ration 5:3 to make a brand of coffee which sells at sh 180 per kg.
b) The dealer makes a new brand by mixing the three grades of coffee. In the ratios X:Y =5:3 and Y:Z =2:5

Determine:

i) The ratio X: Y: Z in its simplest form (2 marks)
ii) The selling price of the new brand of he has to make a 30% profit. (3 marks)

14. 2004 Q 12 P2

An industrialist has 450 litres of a chemical which is 70% pure. He mixes it with a chemical of the same type but 90% pure so as to obtain a 75% pure. Find the amount of the 90% pure chemical used (3 marks)

15. 2004 Q 17 P2

Farmer has two tractors A and B. The tractors, working together can plough a farm in $2^1/_2$h. One day, the tractors started to plough the farm together. After 1 h 10 min tractor B broke down but A continued alone and completed the job after a further 4 h.

Find:

(a) The fraction of the job done by the tractors, working together for one hour (1 mark)
(b) The fraction of the job done by tractor A and B broke down (3 marks)
(c) The time each tractor working alone would have taken to plough the farm. (4 marks)

16. 2005 Q 6 P2

Pipe a can fill an empty water tank in 3 hours while, pipe B can fill the same tank in 6 hours, when the tank is full it can be emptied by pipe C in 8 hours.

Pipes A and B are opened at the same time when the tank is empty. If one hour later, pipe C is also opened, find the total time taken to fill the Tank (4 marks)

17. 2006 Q 21 P2

A solution whose volume is 80 litres is made 40% of water and 60% of alcohol. When litres of water are added, the percentage of alcohol drops to 40%

(a) Find the value of x (4 marks)
(b) Thirty litres of water is added to the new solution. Calculate the Percentage

(c) If 5 litres of the solution in (b) is added to 2 litres of the original solution, calculate in the simplest form, the ratio of water to that of alcohol in the resulting solution (4 marks)

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18. 2007 Q 9 P2

Water and milk are mixed such that the ratio of the volume of water to that of milk is 4: 1. Taking the density of water as 1 g/cm^3 and that of milk as 1.2g/cm^3, find the mass in grams of 2.5 litres of the mixture. (3 marks)

19. 2007 Q 17 P2

A tank has two inlet taps P and Q and an outlet tap R. when empty, the tank can be filled by tap P alone in 4 ½ hours or by tap Q alone in 3 hours. When full, the tank can be emptied in 2 hours by tap R.

a) The tank is initially empty. Find how long it would take to fill up the tank

(i) If tap R is closed and taps P and Q are opened at the same time

(2 marks)

(ii) If all the three taps are opened at the same time (2 marks)

b) The tank is initially empty and the three taps are opened as follows

P at 8.00 a.m
Q at 8.45 a.m
R at 9.00 a.m

(i) Find the fraction of the tank that would be filled by 9.00 a.m (3 marks)

(ii) Find the time the tank would be fully filled up (3 marks)

20. 2008 Q 17 P2

a) A trader deals in two types of rice; type A and with 50 bags of type B. If he sells the mixture at a profit of 20%, calculate the selling price of bag of the mixture. (4 marks)

b) The trader now mixes type A with type B in the ratio x: y respectively. If the cost of the mixture is Ksh 383.50 per bag, find the ratio x: y. (4 marks)

c) The trader mixes one bag of the mixture in part (a) with one bag of the mixture in part (b). Calculate the ratio of type A rice to type B rice in this mixture

(2 marks)

21. 2009 Q 3 P1

Given that the ratio x:y = 2:3, find the ratio (5x – 2y) : (x+y) (3 marks)

22. 2009 Q 17 P2

A water vendor has a tank of capacity 18 900 litres. The tank is being filled with water from two pipe A and B which are closed immediately when the tank is full. Water flows at the rate of 150 000cm^3/minute through pipe A and 120 000cm^3/minute through pipe B.

(a) If the tank is empty and the two pipes are opened at the same time, calculate the time it takes to fill the tank (3 marks)

(b) On a certain day the vendor opened the two pipes A and B to fill the empty tank.

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After 25 minutes be opened the outlet tap to supply water to his customers at an average rate of 20 litres per minute.

(i) Calculate the time it took to fill the tank on that day (4 marks)

(ii) The vendor supplied a total of 542 jerricans, each containing 25 litres of water, on that day. If the water that remained in the tank was 6300 litres, calculate, in litres, the amount of water that was wasted (3 marks)

23. 2010 Q 4 P2

A tea dealer mixes two brands of tea, x and y, to obtain 35 kg of the mixture worth Ksh.65 per kg. If brand x is valued at Ksh.68 per kg and brand y at Ksh. 53 per kg, calculate the ratio, in its simplest form, in which the brands x and y are mixed. (3 marks)

24. 2011 Q 2 P2

Three grades A,B and C of rice were mixed in the ratio 3:4:5. The cost per kg of each of the grades A,B and C were Ksh. 120,Ksh 90 and Ksh 60 respectively.

Calculate:

a) The cost of one kg of the mixture (2 marks)
b) The selling price of 5kg of the mixture given that the mixture was sold at 8% profit. (8 marks)

25. 2012 Q3 P2

An inlet tap can fill an empty tank in 6 hours. It takes 10 hours to fill the tank when the inlet tap and an outlet tap are both opened at the same time. Calculate the time the outlet tap takes to empty the full tank when the inlet tap is closed. (3 marks)

26. 2013 Q10 P2

Two taps A and B can each fill an empty tank in 3 hours and 2 hours respectively. A drainage tap R can empty the full tank in 6 hours; taps A and R are opened for 5 hours then closed.

(a) Determine the fraction of the tank is still empty (2 marks)
(b) Find how long it would take to fill the remaining fraction of the tank if all the three taps are opened (2 marks)

27. 2014 Q15 P1

Twenty five machines working at a rate of 9 hours per day can complete job in 16 days. A contractor intends to finish the job in 10days using similar machines working at a rate of 12 hours per day. Find the number of machines the contractor requires to complete the job.

(3marks)

28. 2014 Q17 P2

A paint dealer mixes three types of paint A, B and C, in the ratios A:B = 3:4 and B:C = 1:2.

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The mixture is to contain 168 litres of C.

(a) Find the ratio A:B:C. (2 marks)
(b) Find the required number of litres of B. (2 marks)

(c) The cost per litre of type A is Ksh 160, type B is Ksh 205 and type C is Ksh 100.
   i. Calculate the cost per litre of the mixture. (2 marks)
   ii. Find the percentage profit if the selling price of the mixture is Ksh182 per litre. (2 marks)
   iii. Find the selling price of a litre of the mixture if the dealer makes a 25% profit.(2 marks)

29. 2015 Q5 P2

Eleven people can complete | of a certain job in 24 hours. Determine the time in hours, correct to 2 decimal places, that 7 people working at the same rate can take to complete the remaining job. (3 marks)

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GRAPHICAL DETERMINATION OF LAWS

1. 1990 Q24 P1

The intensity I of a lamp was measured for various values of voltage V across it and the results tabulated as shown.

V (volts)	11.2	14.1	15.8	17.8	20.0	22.4
I(Lux)	281.8	501.2	562.3	707.9	891.2	1122.0

It is believed that V and I conform to a law of the form $I = kV^n$,where k and n are constants. Draw a suitable linear graph and determine the values of k and n (8 marks)

2. 1991 Q23 P1

In a experiment the volume *V* of a certain mass of a gas was measured at different pressures P, the temperature being constant. The results being obtained were as shown in the table below.

P (N/cm^2)	1.4	1.75	2.1	2.8	3.5
V (litres)	2.6	2.0	1.75	1.3	1.02

The relationship between P, and V is known to be of the form $P = \frac{K}{V}$ where k is a constant. By plotting P against I estimate the value of k. (6 marks)

3. 1992 Q23 P2

The relationship between the variables x and y is known to be of the form $y = kx^n$ where k and n are constants. For some fixed values of x, values of y were obtained experimentally. The corresponding values of *x* and log *y* are given in that the table below;

Log *x* = 0.301 0.699 1.00 1.301
Log *y* = 1.398 0.602 0.00 1.398

(b) Draw the graph of log *y* against log *x* (4 marks)

(c) Use your graph to estimate the values of k and n (4 marks)

4. 1994 Q24 P2

Two variables t and r are believed to obey a law of the form $t = \frac{a}{\sqrt{r}} + b\sqrt{r}$ .The table below shows the results obtained from an experiment involving t and r.

R	2	5	8	11	14
t	5.2	10.3	14.0	17.2	19.8

By plotting a suitable straight line graph on the grid provided, determine the values of a and b. (8 marks)

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5. 1995 Q20 P1

The table shows the height metres of an object thrown vertically upwards varies with the time t seconds

The relationship between s and t is represented by the equations $s = at^2 + bt + 10$ where b are constants.

t	0	1	2	3	4	5	6	7	8	9	10
s		45.1									

(a) (i) Using the information in the table, determine the values of a and b (2 marks)

(ii) Complete the table (1 mark)

(b) (i) Draw a graph to represent the relationship between s and t (3 marks)

(ii) Using the graph determine the velocity of the object when t = 5 Seconds (2 marks)

6. 1996 Q17 P1

The data given below represents the average monthly expenditure, E in K £, on food in a certain village. The expenditure varies with number of dependants, D in the family.

Dependants	3	7	12	25	32
Expenditure E (K£)	-210	250	305	440	500

(a) Using the grid provided, plot E against D and draw the line of the best fit (2 marks)

(b) Find the gradient and the E- intercept of the graph (3 marks)

(c) Write down an equation connecting E and D (1 mark)

(d) Estimate the cost of feeding a family with 9 dependants (2 marks)

7. 1996 Q24 P2

Data collected from an experiment involving two variables x and y was recorded as shown in the below.

X	1.1	1.2	1.3	1.4	1.5	1.6
Y	-0.3	0.5	1.4	2.5	3.8	5.2

The variables are known to satisfy a relation of the form $y = ax^3 + b$ where and b are constants.

a) For each value of in the table above, write down the value of x^3 . (2 marks)

b) (i) By drawing a suitable straight line graph, estimate the values of a and b (5 marks)

(ii) Write down the relationship connecting y and x

8. 1998 Q21 P2

Two variables R and V are known to satisfy a relation $R = kV^n$, where k and n are constants. The table below shows data collected from an experiment involving the two variables R and V.

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V	3	4	5	6	7	8
R	27	48	75	108	147	192

(a) Complete the table of log V and R given below, by giving the value to 2 decimal places. (2 marks)

Log V	0.48	0.60	0.70	0.78	0.85	0.90
Log R	1.43	1.88	2.03	1.80	2.28	

(b) On the grid provided draw a suitable straight line graph to represent the relation $R= kV^n$ (2 marks)

(c) (i) the gradient of the line (1 mark)

(ii) a relationship connecting R and V. (2 marks)

9. 2002 Q24 P1

Two quantities P and r are connected by the equation $p = kr^n$. The table of values of P and r is given below.

P	1.2	1.5	2.0	2.5	3.5	4.5
r	1.58	2.25	3.39	4.74	7.86	11.5

a) State a liner equation connecting P and r.

b) Using the scale 2cm to represent 0.1 units on both axes, draw a suitable line graph on the grid provided. Hence estimate the values of K and n. (8 marks)

10. 2002 Q16 P2

The equation of a circle is given by $x^2 + 4x + y^2 - 5 = 0$. Find the radius and the center of the circle.

11. 2006 Q10 P2

The points which coordinates (5,5) and (-3,-1) are the ends of a diameter of a circle centre A

Determine:

(a) the coordinates of A (1 mark)

(b) The equation of the circle, expressing it in form $x^2 + y^2 + ax + by + c = 0$ where a, b, and c are constants (3 marks)

12. 2007 Q16 2

Find the radius and the coordinate of the centre of the circle whose equation is $2x^2 + 2y^2 - 3x + 2y + ½ = 0$ (4 marks)

13. 2007 Q23 P2

The table below shows the values of the length X (in metres) of a pendulum and the corresponding values of the period T (in seconds) of its oscillations obtained in an experiment.

X (metres)	0.4	1.0	1.2	1.4	1.6
T (seconds)	1.25	2.01	2.19	2.37	2.53

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(a) Construct a table of values of log X and corresponding values of log T, correcting each value to 2 decimal places (2 marks)

(b) Given that the relation between the values of log X and log T approximate to a linear law of the form m log X + log a where a and b are constants

(i) Use the axes on the grid provided to draw the line of best fit for the graph of log T against log X. (2 marks)

(ii) Use the graph to estimate the values of a and b (3 marks)

(c) Find, to decimal places the length of the pendulum whose period is 1 second (3 marks)

14. 2008 Q11 P2

The equation of a circle is given by $4x^2 + 4y^2 - 8x + 20y - 7 = 0$.
Determine the coordinates of the centre of the circle. (3 marks)

15. 2009 Q11 P2

A circle whose equation is $(x - 1)2 + (y - k)2 = 10$ passes through the point (2, 5)
Find the coordinates of the two possible centres of the circle (3 marks)

16. 2009 Q5 P2

A solution was gently heated, its temperature readings taken at intervals of 1 minute and recorded as shown in the table below

Time (Min)	0	1	2	3	4	5
Temperature (˚C)	4	5.2	8.4	14.3	16.8	17.5

(a) Draw the time temperature graph on the grid provided

(b) Use the graph to find the average rate of change in temperature between t = 1.8 and t = 3.4 (2 marks)

17. 2009 Q24 P2

A solution was gently heated, its temperature readings taken at intervals of 1 minute and recorded as shown in the table below

Time (Min)	0	1	2	3	4	5
Temperature (˚C)	4	5.2	8.4	14.3	16.8	17.5

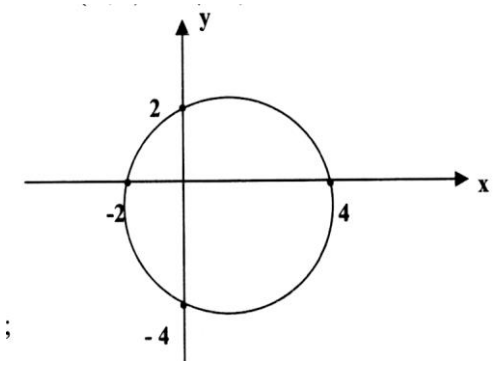
(c) Draw the time temperature graph on the grid provided

(d) Use the graph to find the average rate of change in temperature between t = 1.8 and t = 3.4 (2 marks)

18. 2010 Q16 P2

The circle shown below cuts the x-axis at (-2, 0) and (4,0). It also cuts y-axis at (0,2) and (0,-4).

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Determine the:

a) i) Coordinates of the centre; (1 mark)

ii) Radius of the circle. (1 mark)

b) Equation of the circle in the form $x^2 + y^2 + x + by = c$ where a, b and c are constants. (2 marks)

19. 2011 Q15 P2

The equation of a circle centre (ab) is $x^2 + y^2 – 6x – 10y + 30 =0$

Find the values of a and b (3 marks)

20. 2014 Q 24 P2

In an experiment involving two variables t and r, the following results were obtained

T	1.0	1.5	2.0	2.5	3.0	3.5
r	1.50	1.45	1.30	1.25	1.05	1.00

a) On the grid provided, draw the line of best fit for the data (4marks)

b) The variables r and t are connected by the equation r= at + k where a and k are constant Determine

i)The values of a and K: (3marks)

ii) The equation of the line of best fit. (1mark)

iii)The value of t when r = 0 (2marks)

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