

FORM THREE HOLIDAYS SMART PASS MATHEMATICS PP2 10 QUESTION PAPERS



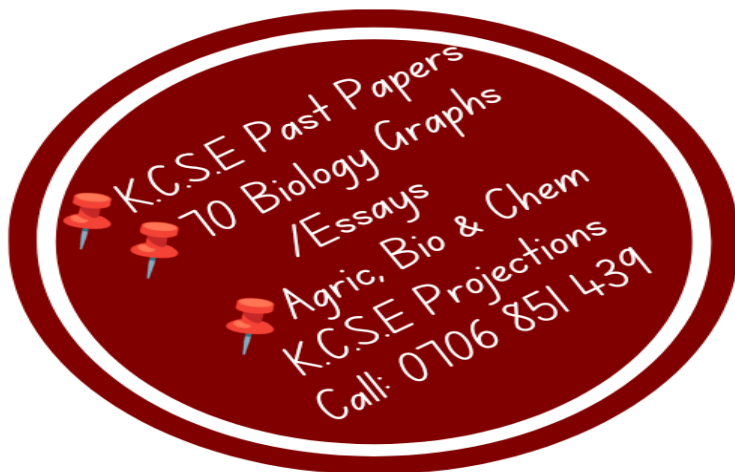
FORM 3 HOLIDAYS SMART PASS MATHEMATICS PP2 TEN QUESTION PAPERS

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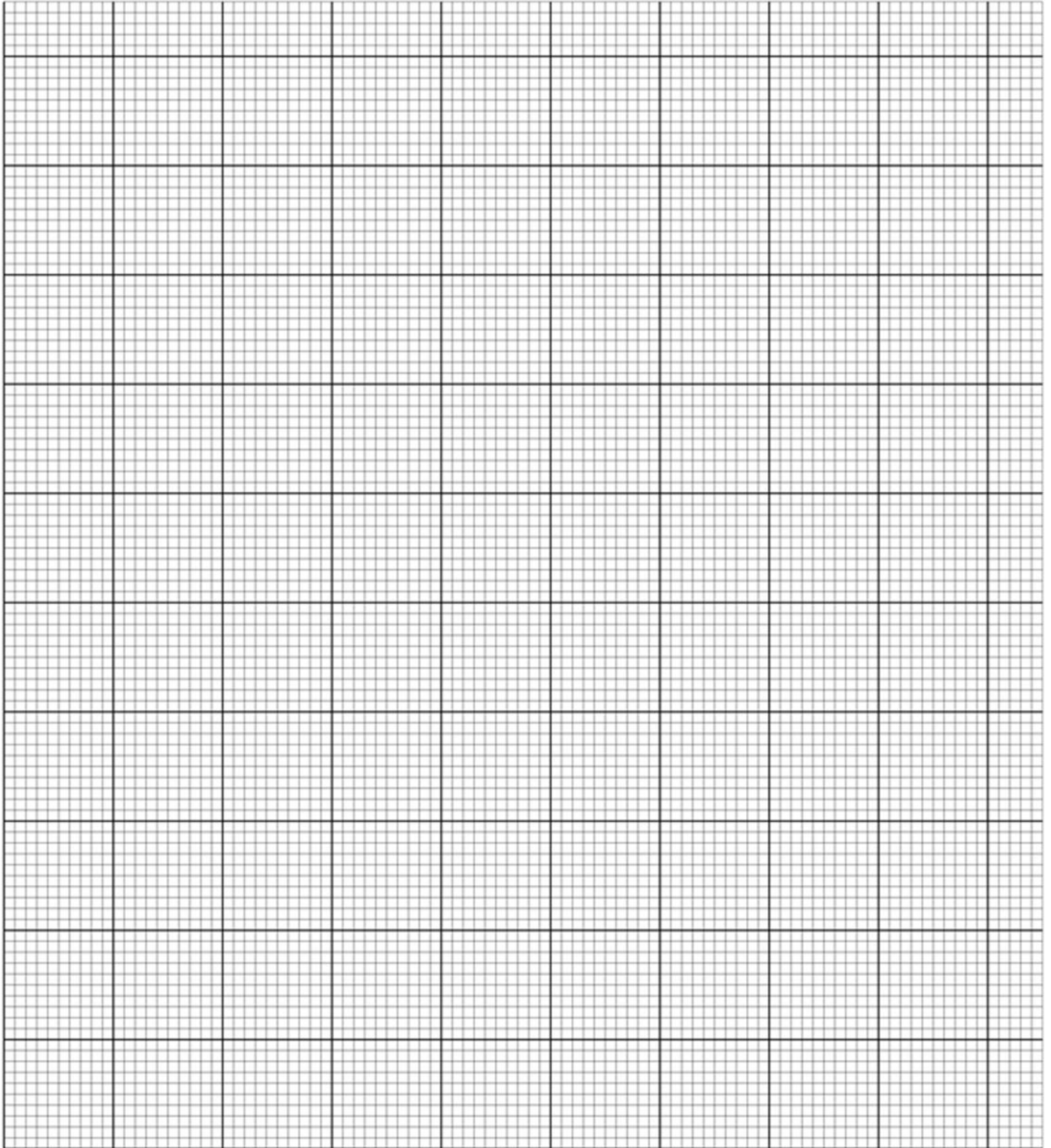
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MATHEMATICAL GRAPH PAPER



FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 01

SECTION 1

1. Evaluate $\frac{36 - 8 \times -4 - 15 \div -3}{-3 \times -3 - 8(-6 + -2)}$ (3mk)
2. Simplify $\frac{a+b}{2} - \frac{2a-b}{3}$ (3mk)
3. Find the greatest number which divides 181 and 236 and leaves a remainder of 5 in each case (2mk)
4. A rectangle measures 20cm by 15cm. If each dimension is increased by 2.5cm, by what percentage is
 - a) the perimeter of the rectangle increased (2mk)
 - b) the area of the rectangle is increased (2mk)
5. The angle of elevation of the top of a tree from a point P on horizontal ground is 30° . From another point Q 8 metres from the base of the tree, the angle of elevation of the top of the tree is 48° .
 - a) Calculate to one decimal place the height of the tree. (1mk)
 - b) Calculate the distance between P and Q (2mk)
6. Given that $\cos \theta = -0.8070$, find θ for $0 \leq \theta \leq 720$ (3mk)
7. A piece of wire 40cm is bent to form a right-angled triangle whose hypotenuse is 17cm long. Find the lengths of the other two sides of the triangle (4mk)
8. Solve for x in $\log 5 - 2 + \log(2x+10) = \log(x-4)$ (3mk)
9. Solve the quadratic equation by completing of squares giving your answer to 3sf
 $11x^2 - 13x + 3 = 0$ (4mk)

10. Rationalize the denominator and simplify

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

(4mk)

11. Use a calculator to work out

12. A tourist from Kenya left for Ethiopia. He exchanged sh 9898 into Ethiopian Birr at the rate of 1 Eth.Birr=ksh7.95. He spent $\frac{3}{4}$ of the money he got and converted the balance back to Kenyan money at the rate of 1Eth.Birr=ksh7.98 Calculate what he finally got to 2dp (3mk)

13. Simplify the expression

$$\frac{9t^2-25a^2}{6t^2+19at+15a^2}$$

(3mk)

14. Three types of tea costing sh203, sh146 and sh197 per kg are blended in the ratio of 2:5:k. Find the value of k, if the blend when sold at sh221 per kg gives 30% profit (3mk)

15. A two digit number is such that 4 times the units digit exceeds the tens digit by 1. If the digits are reversed, the number formed is decreased by 45. Find the number. (3mk)

16. A triangular field has dimensions 21m by 52m by 47m.

a) calculate the area of the field to the nearest m^2 . (2mk)

b) calculate the length of a straight ditch dug from the largest angle meeting the opposite side at right angles. (1mk)

SECTION 2

17. A bookseller bought a number of cartons of books at a cost of ksh 57600 from Kagumo bookstore. Had he bought the same books from Kerugoya bookstore, it would have cost him ksh 480 less per carton. This would have enabled him to buy 4 extra cartons of books for the same amount of money. By taking x to be the number of cartons of books he actually bought;

a) write an expression in x

i) for the cost of each carton he bought at Kagumo bookstore (1mk)

ii) for the cost of each carton had he bought from Kerugoya bookstore (1mk)

- b)** find the value of x (6mk)
- c)** the bookseller later sold all the books he had bought each carton at ksh 720 more than he had paid for it. Determine the percentage profit he made (2mk)
- 18.** A cylindrical metal bar of diameter 14cm and length 2m is melted and moulded into spherical balls. In the process, 5% by volume of metal is lost and what remains makes balls of radius 3.5cm.
- a)** calculate the volume of metal used to make the balls. (3mk)
- b)** find to the nearest whole number the number of balls made (3mk)
- c)** find the total surface area of the metal bar (2mk)
- d)** find the total surface area of the balls made (2mk)
- 19.a)** Draw the graph of $y=(2x-3)(x-1)$ for the interval $-2 \leq x \leq 4$ (6mk)
- b)** use your graph to solve
- i) $2x^2-5x+3=0$ (1mk)
- ii) $2x^2=3x+2$ (3mk)
- 20.a)** Plot triangle ABC with coordinates A(1, 1), B(3, 1) and C(1,3) (1mk)
- b)**Plot A'B'C' the image of ABC under an enlargement scale factor 2 centre A and write down it's coordinates (2mk)
- c)** Plot A''B''C'' the image of A'B'C' under a reflection in the line $x+y=0$ and write down it's coordinates (3mk)
- d)** A''B''C'' is then reflected in the line $y=0$ to give A'''B'''C'''. Give the coordinates of A'''B'''C''' (2mk)
- e)** Describe fully a rotation that maps A'''B'''C''' onto A'B'C' (2mk)

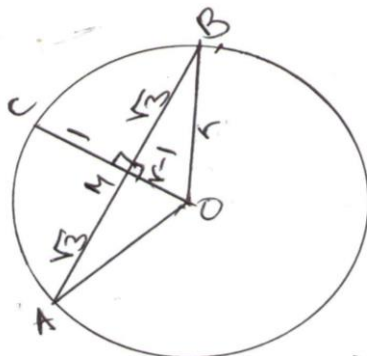
21 Three business ladies Wanjiku, Muthoni and Njoki decided to buy a lorry. The marked price of the lorry was 2.8 million shillings. The dealer agreed that the ladies could pay a deposit of 60% of the marked price and the rest to be paid within a year. The ladies raised the deposit in the ratio of 3:2:5 respectively. At the end of the year the lorry had realized 2.08 million shillings which the three shared in the ratio of their contribution. However, they were required to contribute for the balance of the lorry from these earnings again in the ratio of their original contributions.

- a) calculate amount to be paid as deposit (1mk)
- b) how much did each contribute to pay for the deposit? (3mk)
- c) how much did Njoki receive at the end of the year? (1mk)
- d) calculate the total amount Muthoni and Njoki contributed to pay for the balance. (3mk)
- e) how much money did Wanjiku remain with after paying her share of the balance? (2mk)

22.a) Make a table and draw the graph of $y = \sin x - \cos x$ for x in the range 0 , with y values to 2dp and x intervals of 30 (6mk)

- b) use the graph to find the value of y when
 - i) $x = 75$ (1mk)
 - ii) $x = 255$ (1mk)
- c) find the values of x for which $y = -0.9$ (2mk)

23. The figure below is a segment of a circle centre O radius r units. CM is the perpendicular bisector of AB .



Given that $CM = 1\text{cm}$ and $AB = 2\text{cm}$,

- a) calculate the radius of the circle centre O from which the segment was cut (3mk)
- b) calculate the angle that chord AB subtends at the centre of the circle (2mk)
- c) hence calculate
- i) the length of arc ACB (2mk)
- ii) the area of the segment AMBC (3mk)

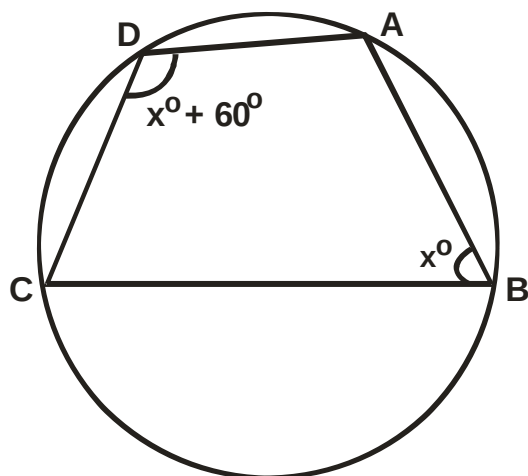
24. A rectangular sheet of metal which measures 120cm by 0.8m is 1.5mm thick and is made of material whose density is 2.2 g/cm^3 . From each of the four corners of the rectangle, a square of side 10cm is cut off and the remaining part folded to form an open cuboid.

- a) calculate
- i) the capacity of the cuboid in cm^3 to the nearest whole number (3mk)
- ii) the mass of the empty cuboid in kg to the nearest whole number (3mk)
- b) the cuboid is filled with a liquid whose density is 0.75 g/cm^3 . Calculate the mass in kg of the cuboid when full of the liquid (2mk)
- c) calculate the mass of metal lost in kg (2mk)

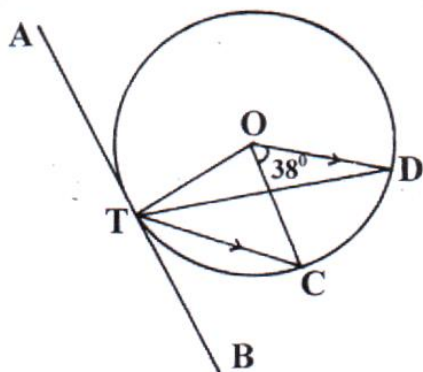
FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 02

1. Find all the integral values of X Which satisfy the following inequalities. $2x-7 < x + 2 \leq 2(x-2)$
(4mks)
2. Using method of completing the square, find the values of x that satisfies the quadratic equation below. $x^2 + x - 6 = 0$
(3mks)
3. A triangle PQR is such that $\angle PQR = 60^\circ$ length QR = 600cm and length QP=540cm. Find the area of triangle PQR and leave your answer in M^2
(3mks)
4. Use logarithms tables to evaluate $\sqrt[3]{\frac{239.5 \times 0.004832}{\sin 30^\circ}}$
(4mks)
5. Juma, Ali and Choge are three masons together to complete building a stone wall together in 12 hours. Juma and Ali working together complete the work in 18 hours while Juma and Choge working together complete the work in 24 hours. For how long each would take to complete building of the stone wall while alone.
(3mks)
6. Find the value of X that satisfy the equation
 $\log(x + 5) + \log(x + 2) = \log 4$
(3mks)
7. Simplify $\frac{x}{x+2} + \frac{3x-2}{x^2-4}$
(2mks)
- 8 Without using a calculator or mathematical tables, express $\frac{\cos 30^\circ}{\tan 45^\circ + \sqrt{3}}$ in surd form and simplify leaving your answer in the form $a+b\sqrt{c}$ where a, b and c are rational numbers.
(3mks)

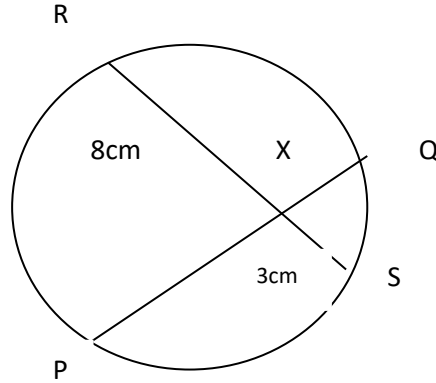
9 The figure below shows a quadrilateral ABCD which is cyclic. Solve for x. (3MKS)



- 10 Two cyclists moving towards each other take two hours to meet. If one cycles at a speed of 25km/h and the other at Y km/hr, find the value of Y if their distance apart is 92km. (3mks)
- 11 Using a ruler and a pair of compass only construct a triangle in which AB is 7cm and BC=9cm and angle BAC = 75°. Measure AC. Construct an inscribed circle in triangle ABC and measure its radius. **4mks**
- 12 Given that $\cos (x - 20)^\circ = \sin (2x + 32)^\circ$ and x is an acute angle. Find $\tan (x - 4)$. **(3mks)**
13. Given that $\frac{3}{3+\sqrt{5}} + \frac{3\sqrt{5}}{3-\sqrt{5}} = a + b\sqrt{5}$. Find the values of **a** and **b**. **(4mks)**
- 14 In the figure below, O is the centre of the circle which passes through the points T, C and D. Line TC is parallel to OD and line ATB is a tangent to the circle at T. Angle DOC = 38°. Calculate the size of angle CTB. **(3mks)**



15. In the circle below chords **PQ** and **RS** intersect at **X**. Given that **RX** = 8cm, **XS** = 3cm and **PQ** = 10cm. Calculate **PX** (2mks)



- 16 The length and width of a rectangular window pane measured to the nearest millimeter are 8.6cm and 5.3 respectively.
Find to four significant figures. The percentage error in the area of the windowpane. 3mk

SECTION B

- 17 Using a ruler and a pair of compasses only, draw a parallelogram ABCD, such that angle $DAB = 75^\circ$. Length $AB = 6.0\text{cm}$ and $BC = 4.0\text{cm}$. From point D, drop a perpendicular to meet line AB at N. (7Mks)

(i) Measure length DN (1Mk)

(ii) Find the area of the parallelogram. (2Mks)

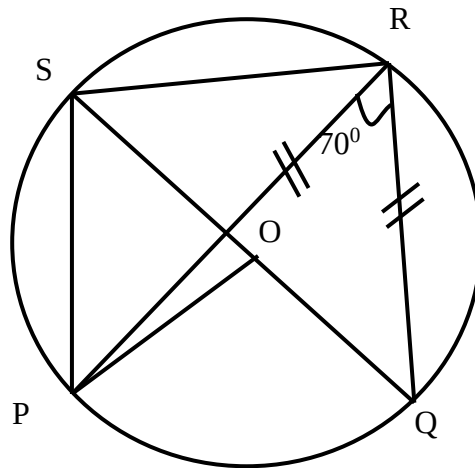
- 18 The table below shows income tax rates in the year 2013.
A constable earned a monthly salary of ksh. 42500, house allowance of 10,000.
Travelling allowance of 5000.

Monthly Income in Ksh	Tax rate in each shilling
Up to 9680	10%
9681-18800	15%
18801 – 27920	20%
27921 – 37040	25%
Over 37040	30%

In that year, a monthly personal tax relief of ksh 1056 was allowed. Calculate the monthly

- | | |
|-----------------------------|--------|
| a) taxable income | (2mks) |
| b) Tax due | (3mks) |
| c) Payable tax | (1mk) |
| d) Net pay of the constable | 4mks |

19 The figure below shows a circle centre O, PQRS is a cyclic quadrilateral and QOS is a straight line.



Giving reasons for your answers, find the size of

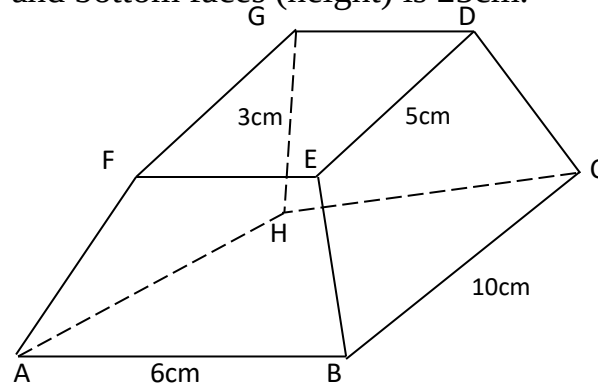
- | | |
|----------------------|--------|
| (a) Angle PRS | (2Mks) |
| (b) Angle POQ | (2Mks) |
| (c) Angle QSR | (3Mks) |
| (d) Reflex angle POS | (3Mks) |

20 A group of people planned to contribute equally towards a water project which was to cost Ksh 2000,000 to complete. 40 members of the group withdrew before the project started. Hence the remaining members had to contribute Ksh. Using x as the original no. of members,

- | | |
|--|-------|
| a) Form expressions to show the original and the new contribution for each member. | 2 mks |
|--|-------|

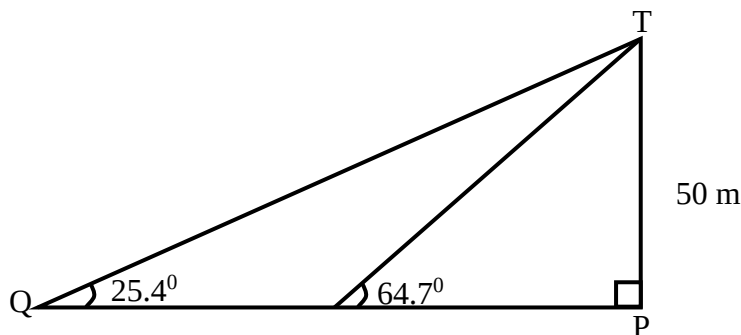
- b)** Form a quadratic expression to represent the information above (no. 24) **(2mks)**
- c)** find the original number of members **3mks**
- d)** luckily, 45% of the value of the project was funded by CDF. Calculate amount contributed by each member **(3mks)**

21 The figure below shows a frustum of a right pyramid whose top face is a rectangle of side 3 cm by 5 cm and the bottom face is also a rectangle of side 6cm by 10cm. The perpendicular distance between the top and bottom faces (height) is 25cm.



Find;

- (a)** the height of the chopped off pyramid **(2mks)**
- (b)** the volume of the frustum **(4mks)**
- (c)** The surface area of the frustum. **(4mks)**
- 22** The figure below shows the position of a boat Q which is observed sailing directly towards the pier P at the base of a vertical cliff PT. The angle of elevation of the top of the cliff from Q is 25.4° . After 14 seconds the boat is at point R, and the angle for elevation of T is now 64.7° .



If the cliff is 50m high, calculate

(a) The distance PQ (2mks)

(b) The distance QR (4mks)

(c) The speed of the boat in km/h (4mks)

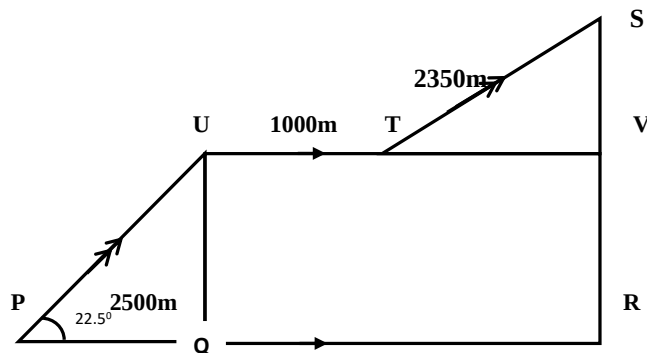
23 A surveyor recorded the measurements of a field book using XY=400m as the base line as shown below.

	Y	
To E 200	320	
150	210	To D
To F 250	170	150 To C
	50	225 To B
	X	100 To A

a) Use a scale of 1cm to represent 50m to draw the map of the field. (5mks)

b) Find the area of the field in hectares (5mks)

24 In the figure below PQ = 2500m, U T= 1000m and TS =2350m. PQR is a straight line. Parallel to UT and angle UPQ =22.5°.



Calculate to the nearest meter

(a) (i) U Q (2mks)

(ii) T V (2mks)

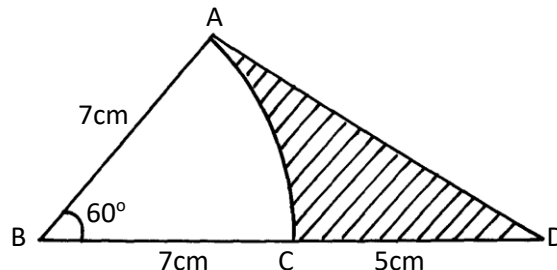
(iii) V S (2mks)

(iv) P U (2mks)

(b) Find the perimeter of the figure. (2mks)

FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 03

1. Evaluate without using tables or calculators. (3mks)
$$\frac{\sqrt{0.8064 \times 6.048}}{1.008 \times 0.1344}$$
2. Evaluate $\frac{-4 \text{ of } [(-4 + -5 \div 15) + -3 - 4 \div 6]}{84 \div -7 + 3 - -5}$ (2mks)
3. Solve for θ without using table given that $0 \leq \theta \leq 90^\circ$ and that $\sin (2\theta - 30^\circ) - \cos 4\theta = 0$ (3mks)
4. Solve for x given that $5^{2x+2} - 20 \times 5^{2x} = 625$ (3mks)
5. The angle of a quadrilateral ABCD in order are $2(x - 10)$, $4(x + 5)$, $5(x + 4)$ and $(x - 20)$ in degrees. Find the exterior angles of the quadrilateral. (4mks)
6. A radio costing kshs. 1240 is marked to sell at a price calculated to give a profit of 40 %. What will be its selling price in sale when 25% is taken off the marked price? (3mks)
7. Show that if $\vec{OA} = -\vec{i} + 7\vec{j}$, $\vec{OB} = 3\vec{i} - 5\vec{j}$ and $\vec{OC} = 4\vec{j}$, then points AB and C are collinear. (4mks)
8. Four men can dig 2 acres of land in 3 days working 4 hour a day. How many men are required to dig 5 acres of land in 4 days working 3 hours a day at the same rate. (3mks)
9. The surface area of two similar bottles are 12 cm^2 and 108 cm^2 respectively. If the larger one has a volume of 810 cm^3 . Find the volume of the smaller one. (3mks)
10. In the figure given below, AC is an arc of a circle centre B $\angle ABD = 60^\circ$, $AB = BC = 7 \text{ cm}$ and $CD = 5 \text{ cm}$.



Calculate

- a) The area of triangle ADB (2mks)
- b) The area of the shaded region. (2mks)
11. Solve the inequalities and represent the information on the number line. (3mks)
 $-3+2x < 3x+2 < 4(x-5)$
12. Make x the subject of the formula in $3s=2p\sqrt{\frac{x}{3x-5}}$ (3mks)
13. Given $x = 13.4\text{cm}$ and $y = 4.3\text{ cm}$. calculate the percentage error in $\sqrt{\frac{x}{y}}$ correct to 4 d.p (3mks)
14. A straight line through the point A (2, 1) and B (4,m) is perpendicular to the line whose equation is $3y = 5 - 2x$, Determine the value of m. (3mks)
15. Okoth deposited some money at 10% compound interest compounded annually. How long will it take to double the amount to the nearest year? (3mks)
16. Chebet has 5 brown chicken and 3 black ones. She picks two of them for slaughter at random, one after the other. What is the probability that the two are of different colours. (3mks)

SECTION II

17. A bus left Nairobi at 8.00am and traveled towards Busia at an average speed of 80km/hr. At 8.30 am a car left Busia for Nairobi at an average speed of 120km/hr. Given that the distance between Nairobi and Busia is 400km.

Calculate:

- a) The time the car arrived in Nairobi. (2mks)
- b) The time the two vehicles met. (4mks)
- c) The distance from Nairobi to the meeting point. (2mks)
- d) The distance of the bus from Busia when the car arrived in Nairobi. (2mks)

18. A triangle whose vertices are A (1,4) B (2,1) and C (5,2) is given the following transformation:

- i)** Reflection in the line $y = -x$ to $A^1B^1C^1$
- ii)** $A^1B^1C^1$ is then given rotation of $+ 90^\circ$ about the origin to $A^{11}B^{11}C^{11}$
- iii)** $A^{11}B^{11}C^{11}$ is then given a translation vector $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$ to $A^{111}B^{111}C^{111}$
- iv)** $A^{111}B^{111}C^{111}$ is then given an enlargement scale factor $- 2$ centre (0, 0) to $A^{IV}B^{IV}C^{IV}$.

On the given grid plot a triangle ABC and it's images $A^1B^1C^1$, $A^{11}B^{11}C^{11}$, $A^{111}B^{111}C^{111}$ and $A^{IV}B^{IV}C^{IV}$. And give coordinates of $A^{IV}B^{IV}C^{IV}$. **(10mks)**

19. A Post OT stand vertically on level ground John moves from O, the foot of the flag post to point R, on the level ground. The points T, O and R form a right angled isosceles triangle whose perimeter is 56m. S is another point on the level ground 35m from O calculate:

- a)** The angle of elevation of T from S. **(6mks)**
- b)** The distance ST. **(2mks)**
- c)** Find the maximum possible distance between R and S. **(2mks)**

20. A salesman received a basic salary of sh. 50,000 a year together with a commission of 6 % on the value of goods sold and a car allowance of sh. 2.50 per km.

- a)** Find the total amount he received in a year in which he sells goods worth sh. 625,000 and travels 10,000km. **(4mks)**
- b)** The next year he travels 12,000km and receives a total of shs. 134,000
 - i)** Calculate the value of goods sold. **(4mks)**
 - ii)** Calculate the percentage increase in the value of the goods sold. **(2mks)**

21. Two airports A and B are such that B is 500km due east of A. two plane P and Q take off from A and B respectively and at the same time.

Plane P flies at 360km/hr on a bearing of 030°

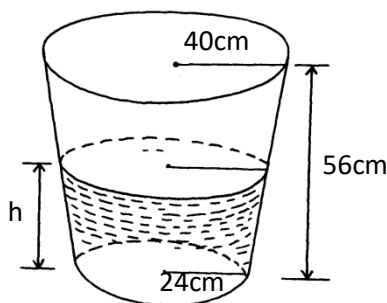
Plane Q flies at 240km/hr on a bearing of 315°

The two planes land after 90 minutes.

Using a scale of 1: 10,000,000

- a) Show the positions of the planes after 90 min. (6mks)
- b) Find the distance between the planes after 90 min. (2mks)
- c) Find the bearing of plane Q from plane P after 90 minutes (2mks)

22. The figure below shows a container in form a frustrum of an open top radius 40cm and base radius 24 cm. the depth is 56 cm.



- a) Calculate the volume of the container in litres. (4mks)
- b) Of the container is $\frac{3}{4}$ full of water by volume, Calculate the radius of the meniscus. (6mks)

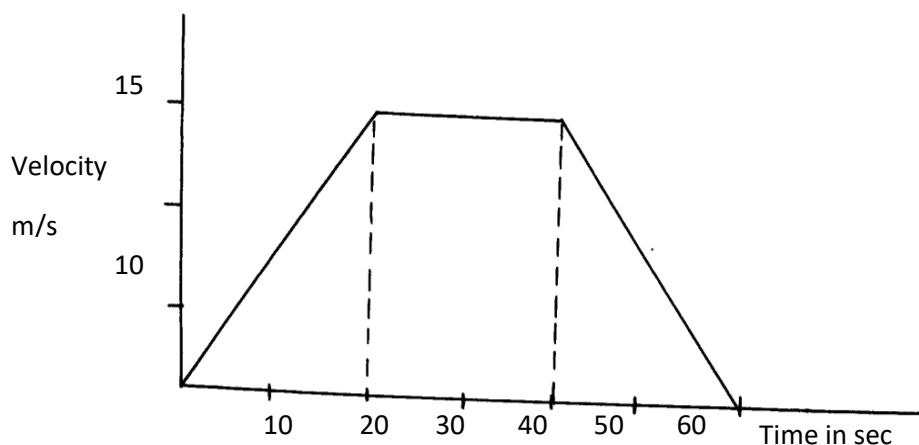
23. The table below shows values of x and some values of y for the curve $y = x^3 + 2x^2 - 3x - 4$ For $-3 \leq x \leq 2$

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

Complete the table by filling in the missing values of y , correct to 1 decimal place. (2mks)

- b) On the grid provided, draw the graph of $y = x^3 + 2x^2 - 3x - 4$.
Use the scale: 1 cm represents 0.5 units on x axis. 1 cm represents 1 unit on y axis. (3 mks)
- (c) Use the graph to:
- (i) Solve the equation $x^3 + 2x^2 - 3x - 4 = 0$; (3mks)
- (ii) Estimate the coordinates of the turning points of the curve. (2mks)

24. The diagram below shows the graph of a moving matatu from one bus stop to another.



- a) Find the acceleration of the matatu. (2mks)
- b) Find the deceleration of the matatu (2mks)
- c) Calculate the distance the matatu while accelerating. (2mks)
- d) Calculate the distance the matatu covered while traveling at an acceleration of 0m/s^2 (2mks)
- e) Find the distance between the two bus stops. (2mks)

FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 04

SECTION A : 50MKS.

1. Use mathematical tables to evaluate: (4mks)

$$\frac{3\sqrt{0.8423 \times 72.5}}{930.5}$$

2. After how many years would kshs. 15000 amount to ksh 24015.50 at a rate of 16% p.a. (3mks)

3. Three years ago, Juma was three time as old as Ali. In two years time, the sum of their ages will be 62. Determine their present ages. (3mks)

4. Evaluate:

$$\frac{1}{3} \text{ of } (2\frac{3}{4} - 5\frac{1}{2}) \times 3\frac{6}{7} \div \frac{9}{4} \quad (3\text{mks})$$

5. Find the height of an isosceles triangle if the equal sides are each 26cm and the base is 48cm long. (2mks)

6. A straight line L1 has a gradient of $-\frac{1}{2}$ and passes through the point P(-1, -3). Another straight line L2 passes through the points Q(1,-3) and R (4,5), find:

a. The equation of L1. (2mks)

b. The equation of L2. (2mks)

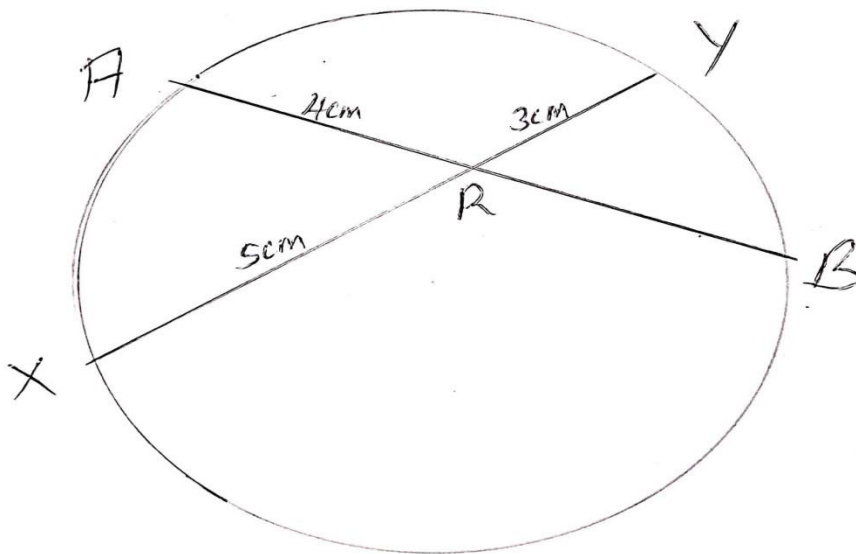
7. Solve the following quadratic equation by completing the square. (3mks)

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

8. Make A the subject of the formula. (3mks)

$$T = \frac{2m\sqrt{L - A}}{n \quad 3K}$$

9. In the figure below, chords AB and XY intersect in a circle at R. Given that AR = 4cm, XR = 5cm and RY = 3cm. find AB. (2mks)



10. Given the matrix $M = \begin{pmatrix} 3 & -5 \\ 5 & 2 \end{pmatrix}$ Find the inverse of M and hence or otherwise, solve the simultaneous equations. (3mks)

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

$$5x - 2y = 16$$

11. Solve the equation $\frac{2}{x-1} - \frac{1}{x+2} = \frac{1}{x}$ (3mks)

12. Solve for x in the equation: (3mks)

$$\log(x-1) = \log 12 - \log(x-2)$$

- 13.a Using binomial expression, expand and simplify $(1 - 2x)^3$ up to the term x^3 . (1mk)

- b. Use the simplified expansion in (a) above to calculate to 4 decimal places the approximate value of $(0.98)^3$ (3mks)

- 14.** A trader bought two brands of sugar labeled Grade A and Grade B. Grade A sugar costs sh 60 per kg and grade B sugar costs sh 50 per kg. he mixed them in a ratio such that after selling the mixture at sh 81 per kg, he made a profit of 50%. Determine the ratio in which he mixed grade A sugar to grade B. **(3mks)**
- 15.** A quantity P is partly constant and partly varies as the square of Q when Q=2, P= 40 and when Q=3 P=65. Determine the value of P when Q=4. **(3mks)**
- 16.** A cold water tap can fill a bath in 6 minutes while a hot water tap can fill it in 12 minutes. The drainage pipe can empty the bath in 8 minutes. All the three are opened fully for 3 minutes and then the hot water tap is closed. How many more minutes will it take to fill the bath? **(4mks)**

SECTION B (50 MKS)

- 17.** Personal tax relief p.a is sh 12672 p.a

Income (K£per annum)	Rate (Sh per pound)
1-5808	2
5809-11280	3
11281-16752	4
16753-22224	5
Excess over 22224	6

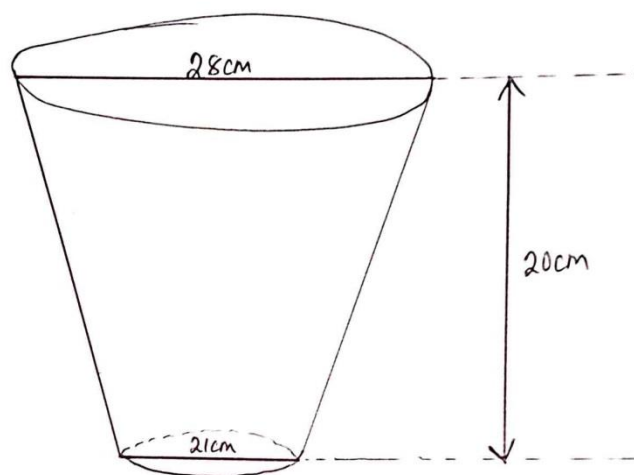
- a.** Mr. Omondi earns a basic salary of sh 15000 per month. In addition, he gets a medical allowance of sh 2400 and a house allowance of sh 12000. Use the tax brackets above to calculate the tax he pays in a year. **(10mks)**
- 18.** A student at Anestar school tossed a coin three times and recorded the results on every successive toss.
- a)** By use of a tree diagram, show all the possible outcomes. **(3mks)**
- b)** Find the probability of getting:
- i.** One head **(1mk)**
- ii.** Two heads and a tail, in the order. **(1mk)**
- iii.** Two heads and a tail, in any order. **(1mk)**

iv. Three heads. (1mk)

v. At least one head. (1mk)

vi. No head. (2mks)

19. The diagram below shows a frustum made by cutting off a small cone on a plane parallel to the base of the original cone. The frustum represents a bucket with the open – end diameter of 28cm and the bottom diameter of 21cm. The bucket is 20cm deep as shown. Calculate to one decimal place, the capacity of the bucket in litres. (10mks)



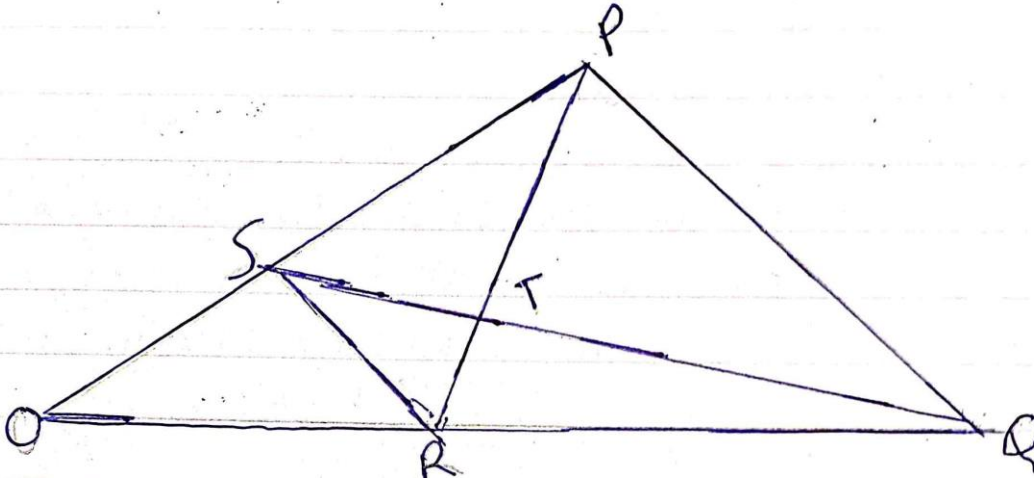
20. Town B is 180km on a bearing of 050° from town A. another town C is on a bearing of 110° from town A and on a bearing of 150° from town B. A fourth town D is 240km on a bearing of 320° from town A. using a scale drawing 1cm to represent 30km, calculate to the nearest kilometer:

a) The distance AC (2mks)

b) The distance CD (2mks)

c) The distance BC. (2mks)

21. In the figure below OPQ is a triangle in which $OS = \frac{1}{3}OP$ and $OR = \frac{1}{3}OQ$. T is a point on QS such that $QT = \frac{3}{4}QS$.



- a) Given that $OP = p$ and $OQ = q$, express the following vectors in terms of p and q .
- i. SR (2mks)
 - ii. QS (2mks)
 - iii. PT (2mks)
 - iv. TR (2mks)
- b) Hence or otherwise show that the points P, T and R are collinear. (2mks)

22. The first term of an arithmetic progression is 2, the sum of the first 8 terms of the AP is 240.

- i. Find the common difference of the AP. (2mks)
 - ii. Given that the sum of the first n terms of the AP is 1560, find n . (2mks)
- b. The 3rd, 5th and 8th term of another AP form the first three terms of a G.P if the common difference of the AP is 3. Find
- i. The first term of G.P (4mks)
 - ii. The sum of the first 9 terms of the GP to 4 s.f (2mks)

23. James is a sales executive earning a salary of ksh. 20,000 and commission of 8% for the sales in excess of kshs. 100,000. If in January 2010 she earned a total of ksh. 48,000 in salaries and commissions.

a. Determine the amount of sales he made in the month. **(4mks)**

b. If the total sales in the month of February and March increased by 18% and they dropped by 25% respectively. Calculate:

i. James's commission in the month of February. **(3mks)**

ii. His total earning in the month of March. **(3mks)**

24. At the beginning of the year 2000, Gachago bought two houses, one in Thika and another one in Nakuru each at sh. 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. **(2mks)**

b. After n years, the value of the house in Thika was 2,741,245 while the value of the house in Nakuru was 2917231.

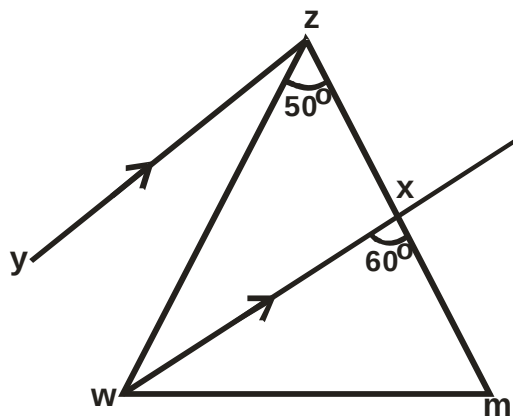
i. Find n **(4mks)**

ii. Find the annual rate of appreciation of the house in Nakuru. **(4mks)**

FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 05

SECTION I (50 MARKS)

1. Evaluate using mathematical tables only. (3mks)
$$\frac{6.373 \log 4.948}{\sqrt{0.004636}}$$
2. Determine the inverse of the matrix $\begin{pmatrix} 4 & 3 \\ 5 & -2 \end{pmatrix}$. Hence find the coordinates of the point at which the two lines $4x - 18 = -3y$ and $5x - 2y = 11$ intersect. (4mks)
3. Solve the equation. (4mks)
 $5^{2x+1} - 3(5^{x+1}) + 10 = 0$
4. Solve for x in the equation $\cos x = \sin (3x - 30)$. Hence determine the value of $\tan x$ leaving your answer in surd form. (3mks)
5. In the figure below, YZ is parallel to WX. Angle WZX = 50° and angle WXM = 60° . Determine the size of angle YZW. (2mks)



6. Kaula has two types of coffee, costing Ksh.120 and Ksh.200 respectively. He mixed them in the ratio 6: 5 by weight. (2mks)
- a) Determine to the nearest shilling the cost of one kilogramme of the mixture. (2mks)
- b) Find the percentage profit on the cost price if the mixture was sold at Ksh. 250. (Give your answer in 2 d.p). (2mks)

7. Rationalise the denominator and simplify leaving your answer in the form $\sqrt{a} + b$.

(3mks)

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

8. Use squares, square roots and reciprocals tables only to evaluate;

$$\frac{3}{\sqrt{42.15}} + \frac{4}{(3.152)^2}$$

(4mks)

9. Make h the subject of the formula in

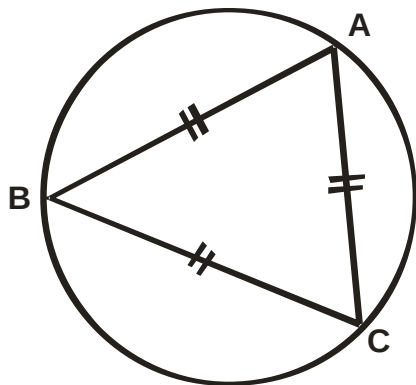
$$m = \frac{p}{\sqrt{h} + k^2}$$

(3mks)

10. The diagram below shows an equilateral triangle ABC inscribed in a circle of radius 9cm.

Calculate the length of the sides of the triangle (2 d.p)

(2mks)



11. Agotho has a rectangular plot that was measured to the nearest meter and found to be 80m in length and 60m in width. Determine the percentage error in its perimeter.

(3mks)

12. A circle of radius 3cm has its centre at (3, -2). Express the equation of the circle in the form $x^2 + y^2 + mx + ny + c = 0$. Where m, n and c are constants.

(3mks)

13. Wambua invested Sh. 6400 at 15% per annum compound interest for 3 years. Muinde invested twice that amount at $12\frac{1}{2}\%$ per annum simple interest for the same period of time.

Find whose investment earned more interest and by how much.

(4mks)

14.a) Expand $\left(1 - \frac{1}{2}x\right)^5$

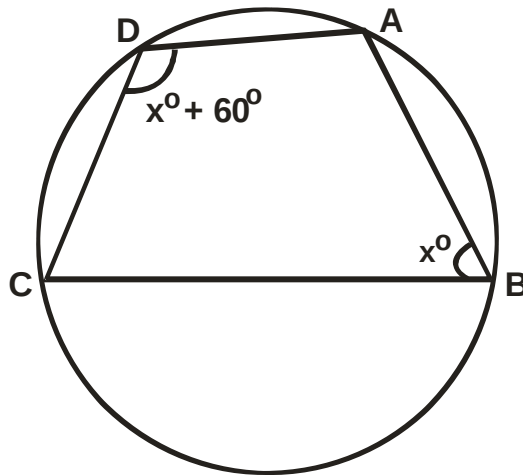
(1mk)

b) Use the expansion upto x^3 in (a) above to evaluate $(0.98)^5$ correct to 4 d.p

(2mks)

15. The figure below shows a quadrilateral ABCD which is cyclic. Solve for x.

(2mks)



16. Solve for x in the equation $\log(x - 1) = \log 12 - \log(x - 2)$

(3Mks)

SECTION II (50 MARKS)

17. Mr. Kobe is a civil servant who earns a monthly salary of Ksh.21200. He has a house allowance of Ksh.12000 per month, other taxable allowances are commuter Ksh.1100, medical allowance Ksh.2000. He is entitled to a personal relief of Ksh.1240 per month. Using the income rates below, solve the questions that follow.

Income in Ksh. per month	Rates in Ksh per sh 20
1 – 8,400	2
8401 – 18,000	3
18001 – 30,000	4
30001 – 36,000	5
36001 – 48,000	6
Above 48,000	7

Determine;

a) i) His monthly taxable income.

(2mks)

ii) Net tax (PAYEE)

(5mks)

b) In addition to the PAYEE, the following deductions were made. Ksh.250 for NHIF, Ksh.120 service charges, he repays a loan at sh.4500 and contributes towards savings at sh.1800 every month. Calculate his net salary per month.

(3mks)

18.a) From whole numbers 1 to 10, a number is selected at random, find the probability that, the number selected is a prime or a multiple of 3. **(2mks)**

b) A tetrahedron is thrown and a coin is tossed.

i) List down all the possible events in the probability space. **(1mk)**

ii) Find the probability of getting at least 2 and a head. **(2mks)**

c)i) A bag contains 6 white marbles and some brown ones. If the probability of picking a brown marble is 0.6, find the number of marbles in the bag. **(3mks)**

ii) Two marbles are then picked, one at a time from the bag in c(i) above, with replacement. Find the probability that the marbles picked are of different colours. **(2mks)**

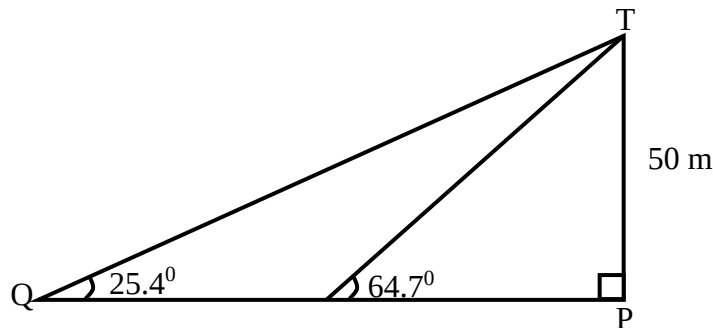
19. Kennedy bought three cows and twenty-five goats spending a total of Sh. 75000. If he had bought two cows and thirty three goats, he would have saved Sh. 5400. Kennedy later sold all his animals at a profit of 40% per cow and 50% per goat.

Determine;

(a) the cost at which he bought each animal. **(5Mks)**

(b) the total amount of money Kennedy received after selling all the animals. **(5Mks)**

20. The figure below shows the position of a boat Q which is observed sailing directly towards the pier P at the base of a vertical cliff PT. The angle of elevation of the top of the cliff from Q is 25.4° . After 14 seconds the boat is at point R, and the angle for elevation of T is now 64.7° .



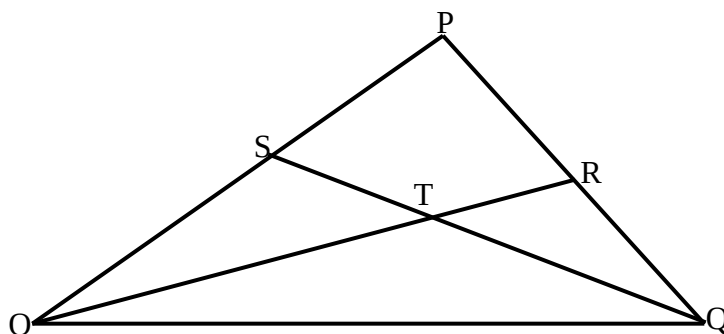
If the cliff is 50m high, calculate

(a) The distance PQ **(2Mks)**

(b) The distance QR **(4Mks)**

(c) The speed of the boat in km/h **(4Mks)**

21.



In the figure above, OPQ is a triangle in which $OS = \frac{3}{4}OP$ and $PR: RQ = 2:1$

Line OR and SQ meet at T .

(a) Given that $OP = p$ and $OQ = q$, express the following vectors in terms of p and q .

(i) PQ (1Mk)

(ii) OR (2Mks)

(iii) SQ (1Mk)

(b) You are further given that $ST = mSQ$ and $OT = nOR$. Determine the values of m and n . (6Mks)

22. Two variables A and B are connected by the equation. $A = kB^n$ Where k and n are constants.

The table below gives values of A and B .

A. 1.5 1.95 2.51 3.20 4.50

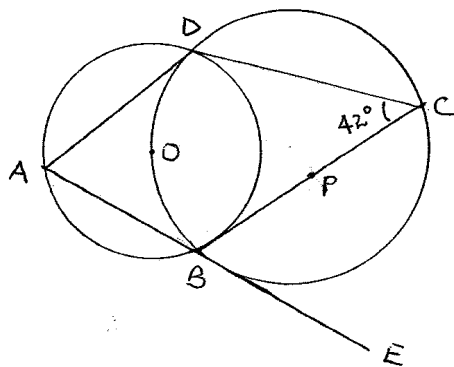
B. 1.59 2.51 3.98 6.31 11.5

(a) Find a linear equation connecting A and B (2Mks)

(b) On the graph paper provided draw a suitable straight line graph to represent the relation in (a) above (5Mks)

(c) Use your graph to estimate the values of k and n in to one decimal place. (3Mks)

23.(a)



Giving reasons, determine the size of:

- a) Angle CBD (2mks)
- b) Angle ODB (2mks)
- c) Angle BAD (2mks)
- d) Angle ABC (2mks)
- e) Angle ODA (2mks)

24.(a) Draw the graph of the function below on the grid provided

$y = 2x^2 - 7x - 2$ for the values of $-1 \leq x \leq 6$ (5mks)

(b) From your graph determine the roots of the function. $2x^2 - 7x - 2 = 0$. (1mks)

(c) By drawing a suitable graph of function $y = 2x - 7$ on the same axis, solve the simultaneous equations $y = 2x^2 - 7x - 2$ and $y = 2x - 7$. (4mks)

FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 06

SECTION I (50 MARKS)

1. Use logarithms in all steps to evaluate. (4mks)

$$\frac{2.53^2 \times 83.45}{\sqrt{0.4562}}$$

2. By using completing square method, solve for x in $4x^2 - 3x - 6 = 0$ (3mks)

3. Make p the subject in $T = \sqrt[3]{\frac{p^2 + n}{m^2}} + R$ (3mks)

4. If $\frac{\sqrt{14}}{\sqrt{7} - \sqrt{2}} - \frac{\sqrt{14}}{\sqrt{7} + \sqrt{2}} = a\sqrt{7} + b\sqrt{2}$

Find the value of a and b where a and b are rational numbers. (3mks)

5. (a) Find the first three terms in ascending powers of x of $(2 - x)^5$ (1mk)

(b) Hence find the value of the constant k , for which the coefficient of x in the expansion of $(k + x)(2 - x)^5$ is -8 (2mks)

6. $\vec{OA} = 3\vec{i} + 4\vec{j} - 6\vec{k}$ and $\vec{OP} = \vec{i} + 15\vec{k}$. P divides AB in the ratio $3: -2$. Write down the coordinates of B . (3mks)

7. Simplify (3mks)

$$\frac{p^2 - 2pq + q^2}{p^3 - pq^2 + p^2q - q^3}$$

8. Find the relative error in the area of a parallelogram whose base is 8cm and height 5cm. (3mks)

9. (a) Find the inverse of the matrix $\begin{pmatrix} 4 & 3 \\ 3 & 5 \end{pmatrix}$ (1mk)

(b) Hence solve the simultaneous equation using the matrix method **(2mks)**

$$4x + 3y = 6$$

$$3x + 5y = 5$$

10. A straight line L_1 has its X intercept $a = -3$ and its y-intercept $b = 5$.

a) Write the equation of L_1 in the form $\frac{x}{a} + \frac{y}{b} = 1$ **(1mks)**

b) Find the equation of another line L_2 which passes through $(1, -2)$ and is perpendicular to L_1 **(3mks)**

11. Use reciprocals, squares and square root tables only to evaluate **(3mks)**

$$\frac{2}{(0.5245)^2} - \frac{5}{\sqrt{363.4}}$$

12. Using a ruler and a pair of compasses only construct triangle ABC such that

BC=6cm, $\angle ABC = 75^\circ$ and $\angle BCA = 45^\circ$. Drop a perpendicular to BC from A to meet BC at O hence find the area of triangle ABC **(3mks)**

13. A two digit number is such that the difference between the ones digit and the tens digit is 2. If the two digits are interchanged, the sum of the new and the original number is 132. Find the original number **(3mks)**

14. A quantity P varies partly as the cube of Q and partly varies inversely as the square of Q. when $Q = 2$, $P = 108$ and when $Q = 3$, $P = 259$. Find the value of P when $Q = 6$. **(3mks)**

15. Solve for y in the following equation below: **(4mks)**

$$\log_4 y + \log_y 4 = 2$$

16. Obtain the values of x for which the matrix is singular **(3mks)**

$$\begin{pmatrix} x^3 & x \\ 1 & 1 \end{pmatrix}$$

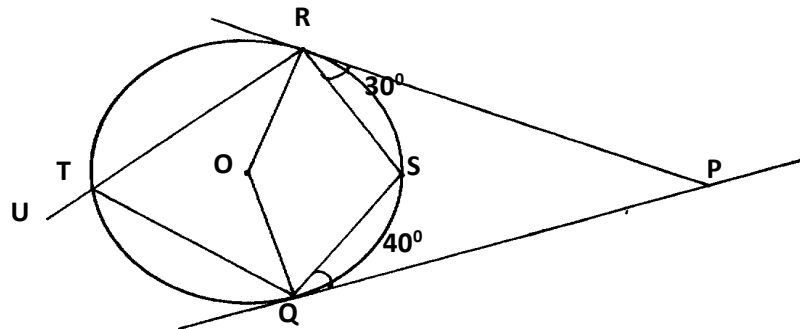
SECTION II (50 MARKS)

17. The table below shows income tax rates.

Monthly taxable income	Rate of tax(Ksh/£)
1 – 435	2
436 – 870	3
871 - 1305	4
1306 – 1740	5
Excess over 1740	6

An employee earns a monthly basic salary of sh. 30,000 and is also entitled to taxable allowances amounting to Ksh. 10,480.

- (a) Calculate the gross income tax (4mks)
- (b) The employee is entitled to a personal tax relief of Ksh. 800 per month. Determine the net tax. (2mks)
- (c) If the employee received a 50% increase in his total income, calculate the percentage increase on the income tax. (4mks)
18. In the figure below, **O** is the centre of the circle. **PQ** and **PR** are tangents to the circle at **Q** and **R** respectively. $\angle PQS = 40^\circ$ and $\angle PRS = 30^\circ$. **RTU** is a straight line.



Calculate by giving reasons

- (a) $\angle QRS$ (2mks)
- (b) $\angle RTQ$ (2mks)
- (c) $\angle RPQ$ (2mks)
- (d) Reflex $\angle QOR$ (2mks)
- (e) $\angle TRO$ given that $TR = TQ$ (2mks)

19. Three darts players Jane, Kelly and Brony are playing in a competition the probability that Jane, Kelly and Brony hit the bull's eye is $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{3}{10}$ respectively.
- (a) Draw a probability tree diagram to show all the possible outcomes for the players. (4mks)
- (b) Calculate the probability that :
- (i) Jane or Brony hit the bull's eye. (2mks)
- (ii) All the three fail to hit the bull's eye. (2mks)
- (iii) Only two fail to hit the bull's eye. (2mks)
20. Three towns X, Y and Z are such that X is on a bearing of 120° and 20km from Y. Town Z is on a bearing of 220° and 12km from X
- (a) Using a scale of 1cm to represent 2km, show the relative position of the places (3mks)
- (b) Find;
- (i) The distance between Y and Z (2mks)
- (ii) The bearing of X from Z (1mk)
- (iii) The bearing of Z from Y (1mk)
- (iv) The area of the figure bounded by XYZ (3mks)
21. The fourth, seventh and sixteenth term of an arithmetic progression are in geometric progression. The sum of the first six terms of the arithmetic progression is 12.
- Determine the
- (a) First term and the common difference of the arithmetic progression. (6mks)
- (b) Common ratio of the geometric progression. (2mks)
- (c) Sum of the first six terms of the geometric progression. (2mks)
22. Draw the graph of $y = 2x^2 - 3x - 5$ taking the values of x in the interval $-2 \leq x \leq 4$. (5mks)
- (b) Use the graph in to solve the equation $2x^2 - 3x - 5 = 0$ (2mks)
- (c) Using a suitable straight line, solve the equation $2x^2 - 5x - 3 = 0$ (3mks)

23. Draw the quadrilateral with vertices at **A** (-6,-1) **B** (-6,-4) **C**(3,-7) and **D** (3,2).

a) On the same grid draw the image of **ABCD** under enlargement centre (0,-1) scale factor $\frac{1}{3}$ label the image **A¹ B¹ C¹ D¹** (3mks)

b) Draw **A¹¹B¹¹C¹¹D¹¹** the image of **A¹ B¹ C¹ D¹** under rotation of +ve 90° about (1,0) (2mks)

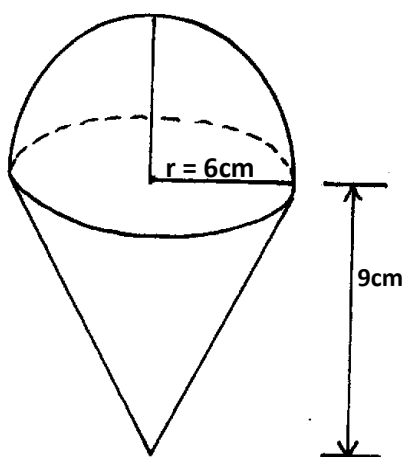
c) Draw **A¹¹¹B¹¹¹C¹¹¹D¹¹¹** the image of **A¹¹ B¹¹ C¹¹ D¹¹** under a reflection in the line $y-x = 0$ (2mks)

d) Draw **A^{1V}B^{1V}C^{1V}D^{1V}** the image of **A¹¹¹ B¹¹¹ C¹¹¹ D¹¹¹** under translation $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and write the co-ordinate of the final image. (3mks)

24. The volume of two similar solid cylinders are 4096cm^3 and 1728cm^3 .

(a) If the curved surface area of the smaller one is 112cm^2 . Find the height of the larger cylinder if the radius is 7cm. (4mks)

b) The diagram below represents a solid made up of a hemisphere mounted on a cone. The radius of the hemisphere and cone are each 6cm, and the height of the cone is 9cm.



Calculate the volume of the solid. Take $\pi = \frac{22}{7}$ (6mks)

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MATHEMATICS PP2 QUESTION PAPER NO: 07

1. Make x the subject of the formula.

(3mks)

$$P = \sqrt{\frac{x+2w}{4x+3R}}$$

2. Simplify the following by rationalizing the denominator.

(3mks)

$$\frac{8}{4 - 2\sqrt{3}}$$

3. A quantity P is partly constant and partly varies inversely as square of t. $p = 6$ when $t = 6$ and $p = 18$ when $t = 3$. Find t when $p = 11$.

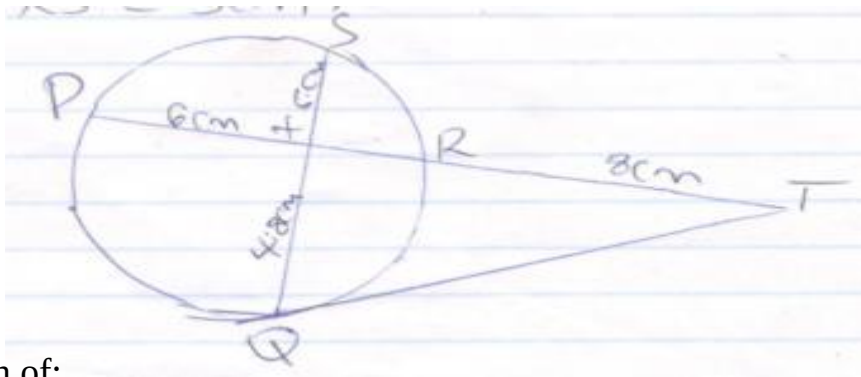
(3mks)

4. Solve for x in the equation;

(3mks)

$$\log_8(x+6) - \log_8(x-3) = \frac{2}{3}$$

5. In the figure below QT is a tangent to a circle at Q. PXRT and QXS are straight lines. $PX = 6\text{cm}$, $RT = 8\text{cm}$, $QX = 4.8\text{cm}$ and $XS = 5\text{cm}$.



Find the length of;

a. XR

(2mks)

b. QT

(2mks)

6. Solve for x and y in the simultaneous equation below.

(3mks)

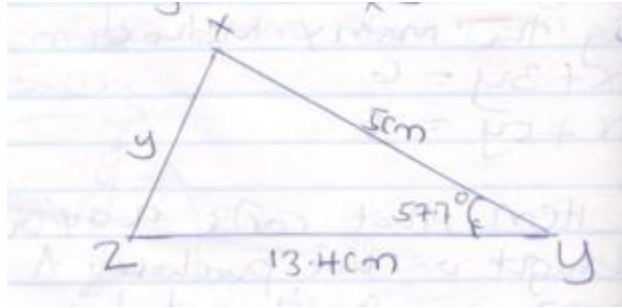
$$xy + 6 = 0$$

$$x - 2y = 7$$

7. Solve for x. (3mks)
 $2x^2 + x - 36 = 0$
8. Expand $(1+2x)^7$ up to the term in x^3 , hence use the expansion to estimate the value of $(1.02)^7$ correct to four decimal places. (3mks)
9. Find the value of y for which $\begin{bmatrix} 3 & 4 \\ y & 6 \end{bmatrix}$ is a singular matrix. (3mks)
- 10.a) Find the inverse of the matrix $\begin{bmatrix} 4 & 3 \\ 3 & 5 \end{bmatrix}$. (1mk)
 b) Hence solve the simultaneous equation using the matrix method. (3mks)
 $4x + 3y = 6$
 $3x + 5y = 5$
11. An item that costs sh. 24, 000 cash can be bought on hire purchase. A customer pays sh.6, 000 as deposit and then makes 6 monthly installments of sh.3, 500 each. Calculate the monthly rate of compound interest, giving your answer to 1 d.p. (3mks)
12. Barasa shared sh.360, 000 among his children Simiyu, Wasike and Nekesa in the ratio 1:3:5 respectively. How much did each receive? (3mks)
13. In the arithmetic series $1+4+7+10+\dots$ find the sum of the first 100 terms. (3mks)
14. If $a = \frac{1}{2}$, $b = \begin{bmatrix} 4 \\ -4 \\ 5 \end{bmatrix}$ and $c = \begin{bmatrix} 1 \\ 0 \\ -5 \end{bmatrix}$, find $3a - 2b + c$. (3mks)
15. Make x the subject (3mks)

$$P = \sqrt[3]{\frac{bx^2 - ax}{x}}$$

16. The figure below shows a triangle xyz in which $x=13.4\text{cm}$, $z=5\text{cm}$ and $\angle xyz = 57.7^\circ$. Find length y . (3mks)



SECTION B:

- 17.a) Complete the table below for the function $y=2x^2+3x-5$

x	-4	-3	-2	-1	0	1	2
$2x^2$					0		
$3x$	-12	18					
-5	-5			-3			6
y							

- b) On the grid provided draw the graph of $y=2x^2+3x-5$ for $-4 \leq x \leq 2$. (4mks)
- c) Use your graph to state the roots of

i. $2x^2+3x-5=0$ (1mk)

ii. $2x^2+6x-2=0$ (3mks)

18. A trader bought 8 cows and 12 goats for a total of ksh.294, 000. If he had bought 1 more cow and 3 more goats he would have spend ksh.337, 500.

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

- b. Use matrix method to determine the cost of a cow and that of a goat. (3mks)

- c. The trader sold the animals he had bought making a profit of 40% per cow and 45% per goat.

- i. Calculate the total amount of money he received. (3mks)

- ii. Determine his profit in Kenyan shillings. (2mks)

20. The bearing of towns P and Q on a horizontal ground from a tower are 050 and 142 respectively. The angle of elevation of the top of the tower from town P is 34°. Given that P is 200m from the top of the tower and Q is 120m from the base of the tower Determine
- The height of the tower (3mks)
 - The angle of elevation of the top of the tower from Q (3mks)
 - The distance between the two towns P and Q (4mks)
21. A group of young men decided to raise ksh.480, 000 to start a business. Before actual payment was made four members pulled out and each of the remaining had to pay an additional ksh.20,000 write an expression in terms of p for;
- Original contribution of each member. (1mk)
 - Contribution after withdrawal of four members. (1mk)
 - Form an equation in p and hence determine the number of initial members. (5mks)
 - Three men Kamau, James and Hassan shared shs.480, 000 such that Kamau: James is 3:2 and James:Hassan is 4:2. Find how much each got. (3mks)
19. The relationship between two variables S and T is given by the equation $S=KT^n$ where K and n are constant
- | | | | | | | |
|---|------|------|------|------|-------|-------|
| T | 2 | 3 | 4 | 5 | 6 | 7 |
| S | 12.8 | 28.8 | 51.2 | 80.8 | 115.2 | 156.8 |
- Write down the linear equation relating to S and T (1mk)
 - Complete the table above for the linear equation relating to S and T (to one decimal place) (2mks)
 - Draw a suitable straight line graph to represent the data (3mks)
 - Use your graph to determine the value of K and n (2mks)
 - Find the value of S when T =3.5 (2mks)

- 17. a)** The current price of a vehicle is shs 500,000. If the vehicle depreciates at a rate of 15% p.a . Find the number of years it will take for its value to fall to shs 180,000. (4mks)
- b)** The cash price of a cooker is shs 9,000. A customer bought the cooker by paying 15 monthly installments of shs 950 each. Calculate:
- a)** the carrying charge (3mks)
- b)** the rate of interest (3mks)

20. The table below shows the income tax rates in a certain year.

Total income in k£ per annum	Rate in shs per pound
1 – 3,900	2
3,901 – 7,800	3
7,801 – 11,700	4
11,701 – 15,600	5
15,601 – 19,500	7
Over 19,500	7.5

Mrs Musau earned a basic salary of ksh 18,600 per month and allowances amounting to ksh.7,800 per month. She claimed a personal relief of ksh 1,080 per month. Calculate;

- a.** Total taxable income in k£ p.a. (2mks)
- b. i.** The tax payable in ksh per month without relief. (4mks)
- ii. The tax payable in ksh per month after relief. (2mks)
- c.** Mrs Musau's net monthly income. (2mks)

FORM THREE HOLIDAYS SMART PASS

MATHEMATICS PP2 QUESTION PAPER NO: 08

SECTION I (50 Marks)

1. Use tables of squares, square roots and reciprocals only to evaluate: (4mks)

$$\frac{4}{\sqrt{12.83 \times 10^{-3}}} + \frac{3}{0.459^2}$$

2. Three computer key boards and 2 charger cost Kshs. 5,100 while 4 similar keyboards and 3 similar chargers cost Kshs. 7,050. Use matrices to find the cost of each item. (4mks)

3. Given that the $\log 2 = 0.30103$ and $\log 3 = 0.47712$, without using a calculator or mathematical table, find the value of $\log 1080$. (3mks)

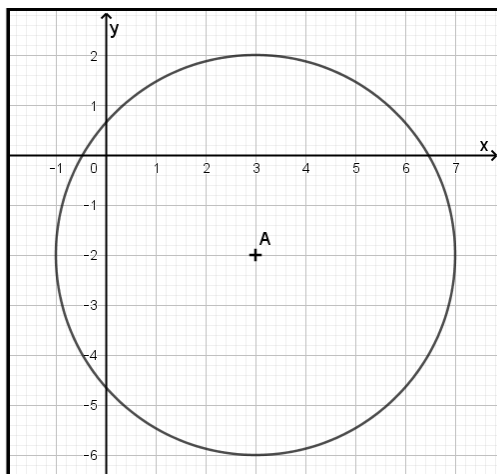
4. Simplify by rationalizing the denominator, (3mks)

$$\frac{7}{3 - \sqrt{5}} - \frac{4}{3 + \sqrt{5}}$$

5. Calculate the percentage error in the calculation of volume of a sphere of radius 7.0 cm (3mks)

6. Nadia a branding machine on hire purchase. The cash price of the branding machine is Kshs. 56,000. She pays a deposit of Kshs. 14,000 and followed by 24monthly installments of Kshs. 3,500 each. Calculate the monthly rate at which compound interest was charged. (3mks)

7. The figure below shows a circle centre A.



- Find the equation of the circle in below in the form $x^2 + y^2 + ax + by + c = 0$, where a , b and c are integers. (3mks)

8. Make x the subject of the formula

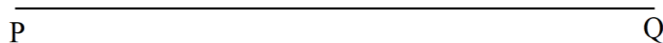
(3mks)

$$P = \sqrt{\frac{kx + 1}{1 - kx}}$$

9. A quantity Z varies directly as the square of X and inversely as the square root of Y . If X increases by 20% and Y decreases by 36%, find the percentage change in Z . (3mks)

10. On the line PQ below,

(a) Use a ruler and a pair of compasses only to construct $\angle PQR = 37\frac{1}{2}^\circ$ such that R is on the upper side of PQ. (1mk)



(b) By construction and using line QR, locate a point T on PQ such that PT: TQ = 4: 3 (2mks)

11.(a) Expand the expression below in increasing powers of x , leaving coefficients as fractions in their simplest forms

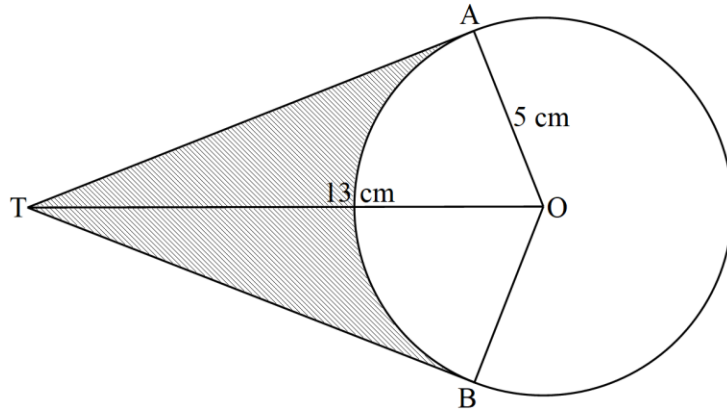
$$\left(1 - \frac{3}{10}x\right)^5$$

(b) Use the first three terms of the expansion in part (a) above to estimate the value of $(0.97)^5$ (4mks)

12. John bought 3 brands of tea **A**, **B** and **C**. The cost price of the three brands were Kshs. 250, Kshs. 300 and Kshs. 450 per kilogram respectively. He mixed the three brands in the ratio 5:2:1 respectively. After selling the mixture he made a profit of 20%. How much profit did he make per kilogram of the mixture? (4mks)

13. A farmer has two tractors P and Q. Tractor P, working alone, can plough a piece of land in 5 hours while tractor Q would take $1\frac{2}{3}$ hours less than tractor P. Determine the time the two tractors ploughing together, would take to complete the work. (3mks)

14. In the figure below, O is the centre of a circle of radius 5 cm. TA and TB are tangents to the circle at A and B respectively. OT = 13 cm



Using $\pi = 3.142$, calculate the shaded area, correct to 3 decimal places. (4mks)

15. During an inter-schools games competition, hockey and basketball teams from Zeraki School took part. The probability that rugby team would win the first match was $\frac{5}{8}$ while that of the hockey team losing was $\frac{1}{7}$. Determine the probability that at least one team won the first match. (3mks)
16. Given that $\cos \theta = \frac{9}{41}$ and $0^\circ \leq \theta \leq 90^\circ$, find $\tan(90^\circ - \theta) + \sin \theta$ without using a mathematical table or a calculator. (3 mks)

SECTION II (50 Marks)

Answer any *five* questions in this

- 17.(a) By taking integral values of x from $x = -2$ to $x = 6$, make a table of values for the function $y = 3x(4 - x)$ (2mks)
- (b) On the same pair of axes and using the scales: 1 cm for 1 unit on the x -axis and 1 cm for 5 units on the y -axis, draw the graphs of $y = 3x(4 - x)$ and $y = 5(x - 2)$ (4mks)
- (c) From the graphs;
- (i) Find the roots of the equation $3x(4 - x) = 0$ (1mk)
- (ii) Write the maximum value of $y = 3x(4 - x)$ (1mk)
- (iii) Deduce the roots to the equation $3x(4 - x) = 5(x - 2)$ (2mks)

- 18.** Three ships **P**, **Q** and **R** are approaching a harbour **T**. **P** is 16 km due east of **T**. **Q** is 14 km from **T** on a bearing of 130^0 and **R** is 26.31 km to the west of **Q** and on a bearing of 240^0 from **T**.
- (a)** Make a sketch drawing showing the relative positions of the ships and the harbour **(1mk)**
- (b)** By calculation, find
- (i)** The distance between P and Q
 - (ii)** The distance from R to T
 - (iii)** The bearing of
 - (iv)** The bearing of

19. The table below shows how income tax was charged in a certain year.

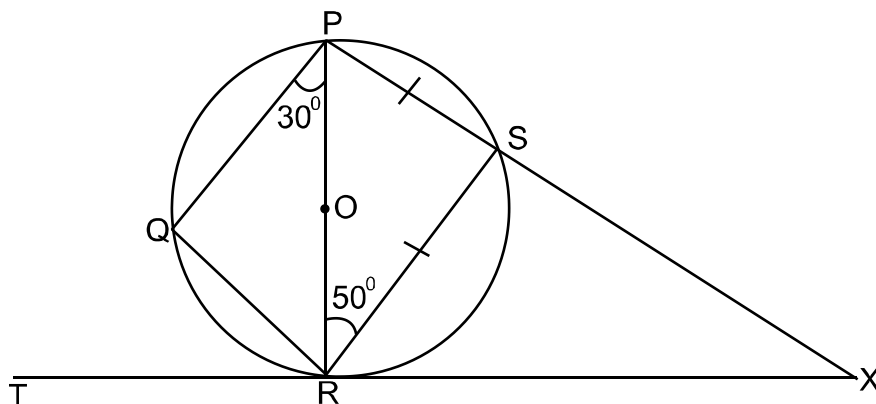
Taxable Income (Kenya pounds p.a.)	Tax Rate (Kshs. per Kenya pound)
1 – 3,630	2
3,631 – 7,260	3
7,261 – 10,890	4
10,891 – 14,520	5
14,521 – 18,150	6
18,151 – 21,780	7
21,781 and above	7.5

During the year, Agnetta earned a basic salary of Kshs. 25,200 and a house allowance of Kshs. 12,600 per month. She was entitled to a personal tax relief of Kshs. 1,162 per month.

Calculate:

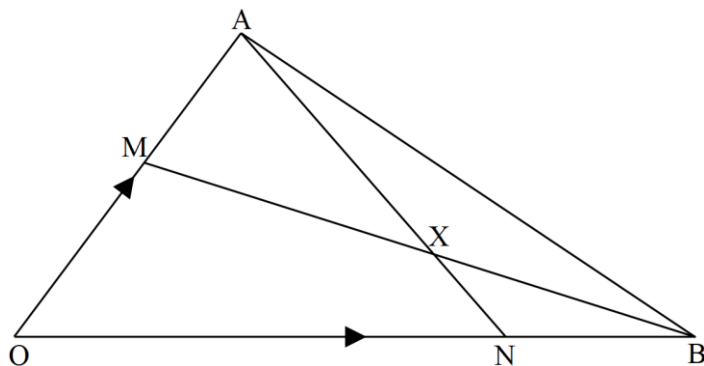
- (a)** Agnetta's taxable income in Kenya pounds per annum **(2mks)**
- (b)** The net tax she pays per month **(6mks)**
- (c)** Apart from income tax, she also contributes monthly NHIF Kshs. 1,600, WCPS Kshs. 1,000. Calculate her net monthly pay **(2mks)**

- 20. (a)** The first term of an arithmetic progression is 3 and the sum of its first 8 terms is 164.
- (i)** Find the common difference of the arithmetic progression. **(2mks)**
- (ii)** Given that the sum of the first n terms of this arithmetic progression is 570, find n . **(3mks)**
- (b)** The first, fifth and seventh terms of another arithmetic sequence forms a decreasing geometric progression. If the first term of the geometric progression is 64, find
- (i)** The values of the common difference of the arithmetic sequence **(3mks)**
- (ii)** The sum of the first 12 terms of the geometric progression. **(2mks)**
- 21.** The figure below is a cyclic quadrilateral PQRS. Given that TRX is a tangent at R and O is the centre of the circle and that PSX is a straight line, angle PRS = 50° and angle QPR = 30° and cord RS = PS.



- (a)** Giving reason in each case, find the sizes of the following angles,
- (i)** $\angle XRS$ **(2mks)**
- (ii)** $\angle SXR$ **(2mks)**
- (iii)** $\angle PQR$ **(2mks)**
- (iv)** Reflex $\angle QOR$ **(2mks)**
- (b)** Given that $RX = 12\text{cm}$, $SX = 8\text{cm}$, Find the length of chord PS. **(2mks)**

22. In triangle OAB below $OA = a$ and $OB = b$. point M lies on ON such that $OM : MA = 2:3$ and point N lies on OB such that $ON : NB = 5:1$. Lines AN and MB intersect at X.



(a) Express in terms of a and b ;

(i) $\mathbf{AN}$

(1mk)

(ii) $\mathbf{BM}$

(1mk)

(b) Given that $\mathbf{AX} = h\mathbf{AN}$ and $\mathbf{BX} = k\mathbf{BM}$, where h and k are constants

(i) Express $\mathbf{OX}$ in two different ways in terms of a , b , h and k

(2mks)

(ii) Find the values of h and k

(4mks)

(iii) Determine the ratio $\mathbf{MX} : \mathbf{MB}$

(2mks)

23. The table below shows the wages of workers in a construction firm in Kenya Shillings deposited by selected students in a Zeraki School.

Wages (Kshs.)	Number of Workers
510 – 519	2
520 – 529	4
530 – 539	9
540 – 549	11
550 – 559	10
560 – 569	6
570 – 579	5
580 – 589	3
590 – 599	1

(a) Calculate the mean wage (4mks)

(b) Calculate the median wage (3mks)

(c) On the grid provided, draw a frequency polygon to represent the information above. (3mks)

24.(a) On the grid provided, draw triangle ABC with coordinates $A(-2,6)$, $B(2,3)$ and $C(-2,3)$ (1mk)

(b) ΔABC is reflected along the line $x + 3 = 0$ to obtain $\Delta A'B'C'$. On the same pair of axes, draw $\Delta A'B'C'$. (2mks)

(c) Translate $\Delta A'B'C'$ through $\begin{pmatrix} 10 \\ 2 \end{pmatrix}$ and label the image as $\Delta A''B''C''$. Write down the coordinates of $\Delta A''B''C''$ (3mks)

(d) $A'''(6, -6)$, $B'''(2, -3)$ and $C(6, -3)$ is the image of $\Delta A''B''C''$ after a transformation P. Plot $\Delta A'''B'''C'''$ and describe P fully. (2mks)

(e) What single transformation would have mapped ΔABC onto $\Delta A'''B'''C'''$? (2mks)

FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 09

1. Use logarithm table to evaluate

(4mks)

$$\sqrt[5]{\frac{75.4 \times 4.83^2}{0.00521}}$$

2. Make b the subject of the formula given that $a = \frac{bd}{Nb^2 - d}$

(3mks)

3. Line PQ is the diameter of a circle such that the coordinates of P and Q are $(-2, 2)$ and $(-2, -6)$ respectively. Find the equation of the circle in the form $ax^2 + ay^2 + bx + cy + d = 0$.

(4mks)

4. Use completing the square method to solve the equation

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

(3mks)

5. Given that $P = 4 + \sqrt{2}$ and $Q = 2 + \sqrt{2}$ and that $\frac{P}{Q} = a + b\sqrt{c}$, where a , b and c are constants, find the values of a , b and c .

(3mks)

6. The table below shows the temperature readings of four different solutions recorded by students to nearest 0.1°C during a laboratory lesson. Calculate the percentage error in $\frac{P + Q}{S - R}$ to 3 d.p.

(3mks)

Quantity	Temperature in $^\circ\text{C}$
P	22.5
Q	19.4
R	17.3
S	26.2

7. Use matrix method to solve the simultaneous equations

$$2x + y = 10$$

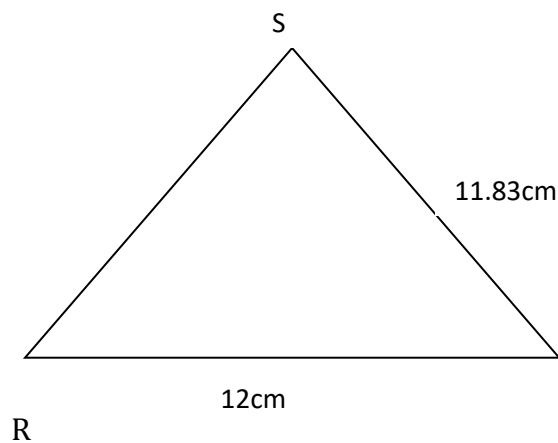
$$2x + 2y = 14$$

(3mks)

- 8.(a) Expand $(1+2x)^5$ to the fourth term. (1mk)
- (b) Hence evaluate $(1.02)^5$ correct to 3 decimal places. (3mks)
9. It is known that the value of land appreciate at 7% p.a in a town. John bought a plot in the town at Ksh 500,000. Given that he plans to sell the plot after 6 years, find out how much profit he expects to get. (Give your answer correct to the nearest thousand). (3mks)
10. The mass of a wire varies jointly with its length and with the square of its diameter. A section of the wire 500m long, with diameter 3mm has a mass of 31.5kg. what is the mass of 1000m of wire of diameter 2mm? (3mks)
11. Mr. Gatua has a salary of sh.80000 per annum. He lives rent free in company house and is entitled to a monthly personal relief of sh.1056. Based on the tax rates given below, calculate his PAYE. (3mks)

<u>Taxable income</u> (KE p.a.)	<u>Rate</u>
1 - 1500	10%
1501 - 3000	15%
3000 - 4500	25%
Above 4500	35%

12. The third term and sixth term of a geometric series are $3\frac{1}{3}$ and $11\frac{1}{4}$ respectively. Calculate the common ratio and hence find its first term. (3mks)
13. Use the figure below to answer the question that follows



Given that angle $RSQ = 50^\circ$, $SQ = 11.83$ cm and $QR = 12$ cm. A circumcircle is drawn on the triangle. Find the radius of the circle (2mks)

- 14.** A Business man bought commodity A and commodity B at shs.60 and sh.72 respectively. In what ratio must he mix so that when he sells at shs.78, he makes a profit of 200%. (3 marks)
- 15.** Points A($x^{\circ}N, 30^{\circ}E$) and B($x^{\circ}N, 50^{\circ}E$) are 1935 kilometres apart. Taking $R = 6370$ km and $\pi = \frac{22}{7}$, find the value of x . (3mks)
- 16.** Find the gradient function of the curve $y = \frac{1}{3}x^3 - 4x^2 + 9x + 4$ hence, find the gradient of the curve at point (1, -4) (3mks)
- 17.** Use a scale of 1:1 in both axes to draw the graphs of $y = x^2 - 6x + 7$ and $y = x - 2$ for the domain $0 \leq x \leq 6$. The point of intersection of the two functions satisfy a certain quadratic equation in x . Obtain the equation in x hence calculate its solutions. Give answer correct to 2d.p. (10mks)
- 18.** Points A and B are centres of two equal circles of a radius 2 cm and 10 cm apart.
- Construct the two circles in the space given below. (1mk)
 - Construct the transverse common tangents to both circles. (4mks)
 - Calculate the length of the transverse common tangents (Take $\pi = \frac{22}{7}$) (5mks)
- 19.** Albert, Bonny and Charles competed in a game of chess. Their probabilities of winning the game are $\frac{2}{5}$, $\frac{3}{5}$ and $\frac{1}{10}$ respectively.
- (a)** Draw a probability tree diagram to show all the possible outcomes. (2mks)
- (b)** Calculate the probability that;
- No one loses the game. (2mks)
 - Only one of them wins the game. (2mks)
 - At least one of them wins the game. (2mks)
 - At most two of them lost the game. (2mks)

20. Construct rhombus ABCD such that $AB=BC= 6\text{cm}$ and $\angle ABC=60^\circ$.

- (a) Measure BD. (1mrk)
 (b) On the same diagram, construct the inscribed circle of triangle ACD. (3mks)
 (c) Construct the locus of points equidistant from A and C. (3mks)
 (d) If x is a point on the circle in b above such that $AX=XD$ and $\angle AXD$ is acute, find the locus of X and make it on the diagram. (3mks)

21.(a) Complete the table below. (2mks)

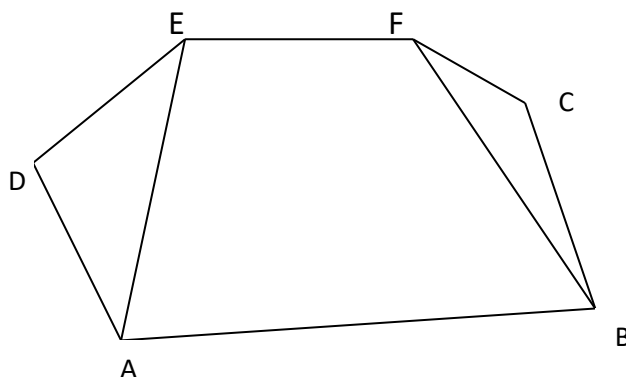
X	-180°	-150°	-120°	-90°	-60°	-30°	0°	30°	60°	90°	120°	150°	180°
$Y=2\cos x$		-1.73			1		2		1	0			
$Y=\cos(x-60^\circ)$	-0.5			-0.9		0			1				-0.5

- (b) On the same axes plot the graphs of $y= \cos(x-60^\circ)$ and $y= 2 \cos x$ (use a scale of 1 unit for 30° on the x axis and 1 unit for 0.5 units on the y axis) (4mks)
 (c) Describe the transformation which maps $y= \cos(x-60^\circ)$ to $y= 2\cos x$. (2mks)
 (d) State the period and amplitude of each of the waves above. (1mk)

	Amplitude	Period
$Y=2\cos x$		
$Y=\cos(x-60^\circ)$		

- (e) Using the graph above determine the values of x for which $\cos(x-60^\circ) - 2\cos x = 0$ (1mk)

22.



The roof of a building is as shown in the figure above with a rectangular base ABCD. $AB = 20\text{m}$ and $AD = 8\text{m}$. The ridge $EF = 10\text{m}$ and is centrally placed. The faces ADE and BFC are equilateral triangles. Calculate

- (i) The height of E above the base ABCD (2mks)
- (ii) The angle between the planes ABCD and ADFE (3mks)
- (iii) The angle between the planes AED and ABCD (2mks)
- (iv) The acute angle between lines DB and EF (3mks)

23. Kiprop has at least 50 acres of land on which he plans to plant potatoes and cabbages. Each acre of potatoes requires 6 men and each acre of cabbages requires 2 men. The farmer has 240 men available and he must plant at least 10 acres of potatoes. The profit on potatoes is KShs. 1200 per acre. If he plants x acres of potatoes and y acres of cabbages;

- (a) Write down 3 inequalities in x and y to describe the information. (2mks)
- (b) Represent these inequalities graphically. (use a scale of 1:10 for both axes) (4mks)
- (c) Use your graph to determine the number of acres for each vegetable which will give maximum profit. (4mks)

24. (a) Complete the table below for $y = x^2 - 3x + 5$ in the range $2 \leq x \leq 8$ (2mks)

x	2	3	4	5	6	7	8
y	3		9		23	33	

- (b) Use the trapezium rule with six strips to estimate the area enclosed by the curve, x-axis and the lines $x=2$ and $x=8$. (2mks)
- (c) Find the exact area of the region given in (b). (4mks)
- (d) Calculate the percentage error in the area. (2mks)

FORM THREE HOLIDAYS SMART PASS
MATHEMATICS PP2 QUESTION PAPER NO: 10

SECTION I (50 MARKS)

1. Use logarithms to evaluate:

$$\sqrt[3]{\frac{45.3 \times 0.00697}{0.534}} \quad (4\text{mks})$$

2. a) Expand $\left(1 - \frac{1}{2}x\right)^6$ to fourth term. (2mks)

b) Use the expansion above to evaluate $(0.98)^6$ (2mks)

3. The price of a new car is shs. 800,000. If it depreciates at a constant rate to shs. 550,000 within 4 years, find the annual rate of depreciation. (3mks)

4. Find the inverse of $\begin{pmatrix} 1 & 2 \\ 2 & 5 \end{pmatrix}$ and hence solve the simultaneous equations below (3mks)

$$x + 2y = 21$$

$$2x = 34 - 5y$$

5. Without using a calculator or mathematical tables, express $\frac{\sqrt{3}}{1 - \cos 30^\circ}$ in surd form and simplify. (3mks)

6. The position vector of A and B are $a = 4\mathbf{i} + 4\mathbf{j} - 6\mathbf{k}$ and $b = 10\mathbf{i} + 4\mathbf{j} + 12\mathbf{k}$. D is a point on AB such that AD:DB is 2:1. Find the co-ordinates of D. (3mks)

7. A variable Z varies directly as the square of X and inversely as the square root of Y. Find percentage change in Z if X is increased by 20% and Y decreased by 19%. (3mks)

8. Pipe A can fill a tank in 2 hours, Pipe B and C can empty the tank in 5 hours and 6 hours respectively. How long would it take:

a) To fill the tank if A and B are left open and C is closed. (2mks)

b) To fill the tank with all pipes open. (2mks)

9. Given that $\sin\left(\frac{2}{3}x + 20^\circ\right) - \cos\left(\frac{5}{6}x + 10^\circ\right) = 0$. Without using a mathematical table or a calculator, determine $\tan(x + 20^\circ)$. **(3mks)**
10. Make P the subject of the formula $XY^P = Q^{PX}$ **(3mks)**
11. The coordinates of the end points of diameter are A(2,4) B(-2,6). Find the equation of a circle in the form $ax^2 + by^2 + cx + dy + e = 0$ **(3mks)**
12. A bag contains 10 balls of which 3 are red, 5 are white and 2 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 a ball picked at random. Find the probability the ball so chosen is red. **(3mks)**
13. The first, the second and sixth terms of an increasing arithmetic progression are the three consecutive terms of a geometric progression. If the first term of the arithmetic progression is 2, find:
- a) Common difference of the arithmetic progression **(2mks)**
 - b) Common ratio of the geometric progression. **(1mk)**
14. The distance S metres moved by a particle along a straight line is given by $S = 7 + 8t^2 - 2t^3$. Find the velocity at $t = 2$ seconds. **(2mks)**
15. The length and breadth of a rectangular floor garden were measured and found to be 4.1m and 2.2m respectively. Find the percentage error in its area. **(3mks)**
16. A train moving at an average speed of 72km/h takes 15 seconds to completely cross a bridge that is 80 metres long
- (a) Express 72km/h in metres per second **(1mk)**
 - (b) Find the length of the train in metres **(2mks)**

SECTION II (50 MARKS)

17. A steel manufacturing factory had a sample of 53 iron rods of various lengths. The lengths of the rods were measured and recorded in the table below:

Length (cm)	8-10	11-13	14-16	17-19	20-22	23-25	26-28
No. of rods	4	7	11	15	8	5	3

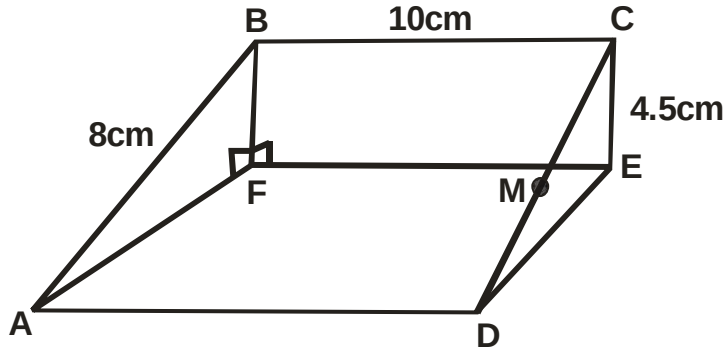
a) State the frequency of the modal class. (1mk)

b) Using 18 as an assumed mean, calculate:

i) Actual mean (5mks)

ii) Variance (3mks)

iii) Standard deviation (1mk)



18. The above diagram represents a wooden prism. ABCD is a rectangle. Points E and F are directly below C and B respectively. M is the midpoint of CD. $AB = 8\text{cm}$, $BC = 10\text{cm}$ and $CE = 4.5\text{cm}$.

a) The size of angle CDE. (2mks)

b) Calculate:

i) Length of AC. (2mks)

ii) The angle CAE makes with the plane ADEF. (2mks)

c) Find the:

i) Length of MB. (2mks)

ii) Angle CBM. (2mks)

19. An aeroplane flies from a point P(60°N , 45°W) to a point Q(60°N , 135°E). Given that the radius of the earth is 6370km,

a) Calculate the shortest distance between P and Q:

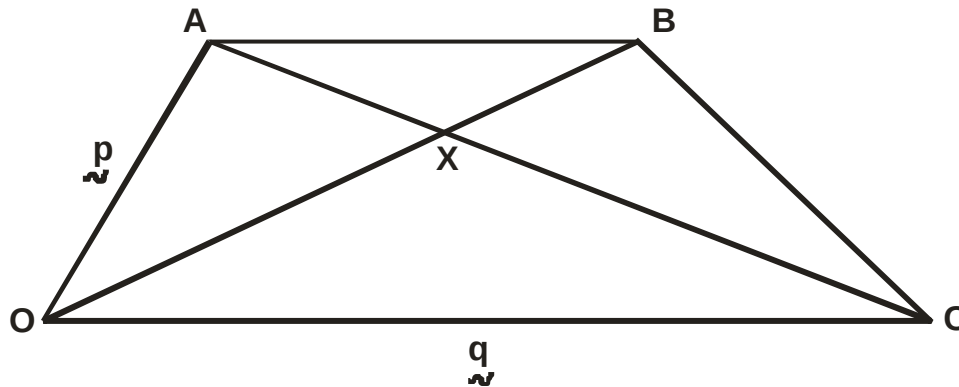
i) in kilometres (km) (3mks)

ii) in nautical miles (nm) (1mk)

b) If the plane flew at a speed of 600 knots, how long did it take to move from P to Q.? (2mks)

c) The plane left P at 10.00a.m on Monday. At what time did it arrive at Q if it travelled along a parallel latitude at the same speed. (4mks)

20. In the figure below $\vec{OA} = \mathbf{p}$ and $\vec{OC} = \mathbf{q}$. Vector $\vec{AB} = \frac{3}{4}\vec{OC}$. Express in terms of unit vectors $\mathbf{p}$ and $\mathbf{q}$ the vectors.



a)

i) $\vec{AC}$ (1mk)

ii) $\vec{OB}$ (1mk)

iii) $\vec{BC}$ (1mk)

b) Vector AC intersects with vector OB at X such that $\vec{AX} = t\vec{AC}$ and $\vec{OX} = h\vec{OB}$. By expressing $\vec{OX}$ in two ways in terms of t and h,

Find:

i) Scalars t and h (5mks)

ii) the ratio OB: BX (2mks)

- 21.** Two fair dice one a regular tetrahedron (4 faces) and the other a cube are thrown. The scores are added together. Complete the table below to show all possible outcomes. **(2mks)**

	1	2	3	4	5	6
TETRAHEDRON						

a) Find the probability that:

- i)** The sum is 6. **(1mk)**
- ii)** The sum is an odd number. **(1mk)**
- iii)** The sum is 6 or 9. **(2mks)**

b) If a player wins a game by throwing a sum of 6 or 9, draw a tree diagram and use it to find probability that he wins at least once when the dice are thrown twice. **(4mks)**

- 22.i)** Find the y- intercept of the curve $y = x^3 - 3x + 2$ **(1mk)**
- ii)** Find the coordinates of the stationary points of the curve $y = x^3 - 3x + 2$ **(3mks)**
- iii)** For each stationary point in a (ii) above, determine whether it is a maximum or a minimum turning point. **(4mks)**
- iv)** Sketch the graph of $y = x^3 - 3x + 2$ **(2mks)**

23. A number of people working at a factory decided to raise 72000 to buy a plot of land. Each person was to contribute the same amount. Before contributions five people retired from working at the factory and thus did not contribute. The same target of 72000 was still to be met by the remaining.

- a) If n stands for the number of people working in the factory originally, show that the increase in the contribution per person was shs. $\frac{360000}{n(n-5)}$ (3mks)
- b) If the increase in contribution per person was sh.1200, find the number of people originally working at the factory. (4mks)
- c) Calculate the percentage increase in the contributions per person caused by retirement, giving your answer to one decimal place. (3mks)

24.a) Complete the table below for the functions $y = 3\sin x$ and $y = 4\cos(2x - 10)$ (2 mks)

x	0	15	30	45	60	75	90	105	120	135	150	165
$3\sin x$	0	0.78						2.90			1.50	
$4\cos(2x-10)$	3.94		2.57			3.06				-0.69		3.06

- b) Using a scale of 1cm to rep 1 unit on the vertical axis and 1cm to rep 150 on the horizontal axis, draw both curves on the same axes. (5mks)
- c) Use your curves to solve $3 \sin x - 4 \cos(2x - 10) = 0$ (2mks)
- d) State the phase angle of the curve $y = 4 \cos(2x - 10)$ (1mk)

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