# WAEC

## MATHEMATICS theory

### Past questions

*(PT. 1–7)*

***For both:*** **SSCE & GCE**

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# WAEC MATHS THEORY QUESTIONS (PT.1)

## PART I

1. A = {2, 4, 6, 8} B = {2, 3, 7, 9} and C = {x: 3 < x < 9} are subsets of the universal set U = {2, 3, 4, 5, 6, 7, 8, 9}. Find;

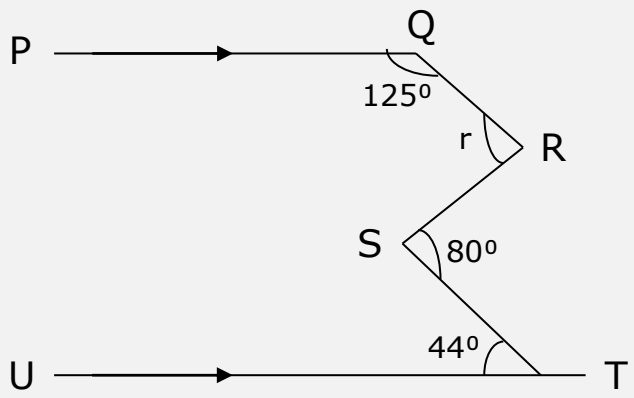
**(a)** A ∩ (B ∩ C)

**(b)** (A ∪ B) ∩ (B ∪ C)

2. **(a)** The angle of depression of a boat from the mid-point of a vertical cliff is 35⁰. If the boat is 120 m from the foot of the cliff, calculate the height of the cliff.

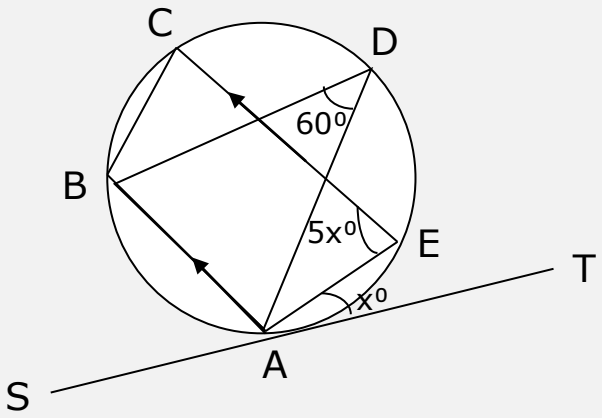
**(b)** Towns P and Q are x km apart. Two motorists set out at the same time from P to Q at steady speeds of 60 km/h and 80 km/h. The faster motorist got to Q 30 minutes earlier than the other. Find the value of x.

3. **(a)**



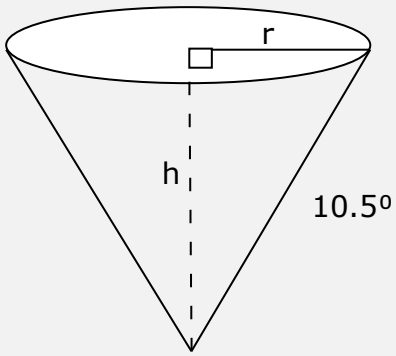

In the diagram, ∠PQR = 125⁰, ∠QRS = r, ∠RST = 80⁰ and ∠STU = 44⁰. Calculate the value of r.

**(b)**




In the diagram, TS is a tangent to the circle at A. AB//CE, ∠AEC = 5x°, ∠ADB = 60° and ∠TAE = x. Find the value of x.

4.




The diagram shows a cone with a slant height 10.5cm. If the curved surface area of the cone is 115.5cm$^2$, calculate, correct to 3 significant figures, the;

**(a)** base radius, r

**(b)** height, h

**(c)** volume of the cone

*[Take* $\pi = \frac{22}{7}$*]*

]

5. Two fair dice are thrown. M is the event described by "the sum of the scores is 10" and N is the event described by "the difference between the scores is 3".

**(a)** Write out the elements of M and N

**(b)** Find the probability of M or N

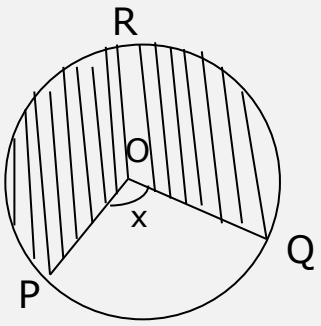
**(c)** Are M and N mutually exclusive? Give reasons.

## PART II

6. **(a)** The scale of a map is 1:20,000. Calculate the area, in square centimetres, on the map of a forest reserve which covers 85 $km^2$

**(b)** A rectangular playing field is 18m wide. It is surrounded by a path 6m wide such that its area is equal to the area of the path. Calculate the length of the field.

**(c)**




The diagram shows a circle centre O. If ∠POQ = $x^0$, the diameter of the circle is 7cm and the area of the shaded portion is 27.5 cm2. Find, correct to the nearest degree, the value of x.

*[Take* $\pi = \frac{22}{7}$*]*

7. **(a)** Madam Kwakyewaa imported a quantity of frozen fish costing GH¢400.00. The goods attracted an import duty of 15% of its cost. She also paid a sales tax of 10% of the total cost of the goods including the import duty and then sold the goods for GH¢660.00. Calculate her percentage profit.

**(b)** In a school, there are 1000 boys and a number of girls. The 48% of the total number of students that were successful

in an examination was made up of 50% of the boys and 40% of the girls. Find the number of girls in the school.

8. Using ruler and a pair of compasses only.

**(a)** Construct;

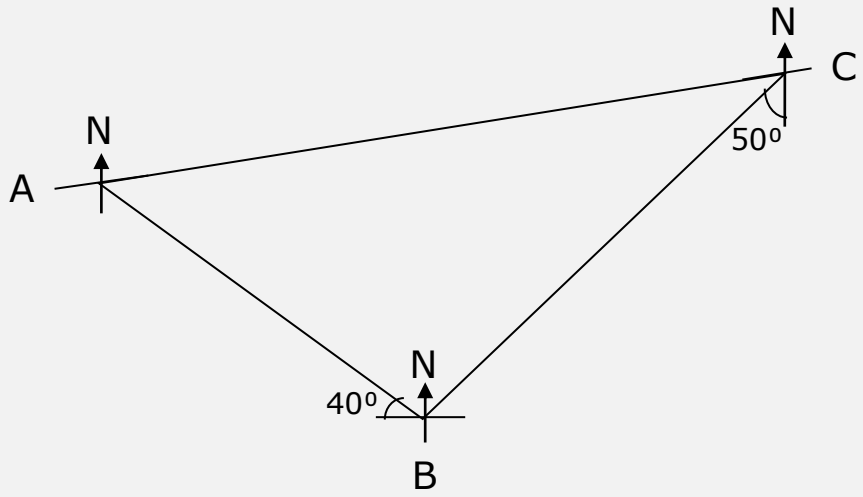
(**i**) a quadrilateral PQRS with /PS/ =6cm, ∠RSP =90º, /QR/ = 8.4cm and /PQ/ = 5.4cm

(**ii**) the bisectors of ∠RSP and ∠SPQ to meet at X

(**iii**) the perpendicular XT to meet PS at T

**(b)** Measure /XT/

9.




In the diagram, /AB/ = 8km, /BC/ = 13km, the bearing of A from B is 310º and the bearing of B from C is 230º. Calculate, correct to 3 significant figures,

**(a)** the distance AC

**(b)** the bearing of C from A

**(c)** how far east of B, C is

10. **(a)** Copy and complete the table of values for the relation $y = -x^2 + x + 2$ for $-3 \leq x \leq 3$.

| X | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| Y | | -4 | | 2 | | | -4 |

**(b)** Using scales of 2cm to 1 unit on the x-axis and 2cm to 2 units on the y-axis, draw a graph of the relation

$y=x^2 + x + 2$

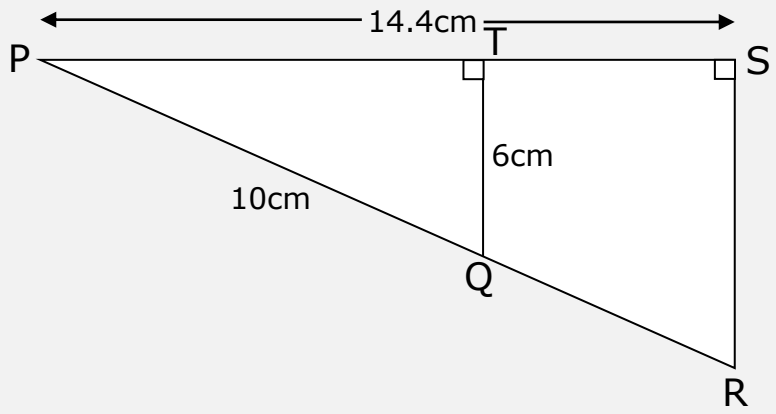
**(c)** From the graph, find the;

(**i**) minimum value of y

(**ii**) roots of the equation $x^2 - x - 2 = 0$

(**iii**) gradient of the curve at x = -0.5

11. **(a)**




In the diagram, ∠PTQ = ∠PSR = 90°, /PQ/ = 10cm, /PS/ = 14.4cm and /TQ/ = 6cm. Calculate the area of quadrilateral QRST.

**(b)** Two opposite sides of a square are each decreased by 10% while the other two are each increased by 15% to form a rectangle. Find the ratio of each area of the rectangle to that of the square.

12. The frequency distribution of the weight of 100 participants in a high jump competition is a shown below:

| Weight (kg) | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 |
|---|---|---|---|---|---|---|
| Number of participants | 10 | 18 | 22 | 25 | 16 | 9 |

**(a)** Construct the cumulative frequency table.

**(b)** Draw the cumulative frequency curve.

**(c)** From the curve, estimate the;

(**i**) median

(**ii**) semi-interquartile range

(**iii**) probability that a participant chosen at random weighs at least 60kg.

13. **(a)** The third term of a Geometric Progression (G.P) is 24 and its seventh term is $4\frac{20}{27}$. Find its first term.

**(b)** Given that y varies directly as x and inversely as the square of z. If y = 4, when x = 3 and z = 1, find y when x = 3 and z = 2

# WAEC MATHS THEORY QUESTIONS (PT.2)

## PART I

1. **(a)** Simplify: $\dfrac{\frac{1}{2} \text{ of } \frac{1}{4} \div \frac{1}{3}}{\frac{1}{6} - \frac{3}{4} + \frac{1}{2}}$

**(b)** Given that $\sqrt{x} = 10^{1.6741}$, without using calculators, find the value of x.

2. **(a)** Make q the subject of the relation: $t = \sqrt{\frac{pq}{r}} - r^2q$

**(b)** If $9^{(1-x)} = 27^y$ and x – y = -1½, find the value of x +y.

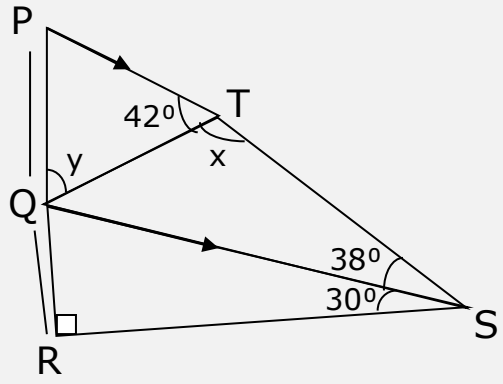
3. A sector of a circle with radius 21cm has an area 280 $cm^2$.

**(a)** Calculate, correct to 1 decimal place, the perimeter of the sector.

**(b)** If the sector is bent such that its straight edges coincide to form a cone, calculate, correct to the nearest degree, the vertical angle of the cone.

*[Take* $\pi = \frac{22}{7}$*]*

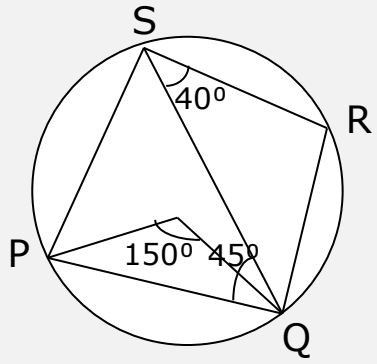
4. **(a)**




In the diagram, PQRST is a quadrilateral. PT//QS, ∠PTQ =42⁰, ∠TSQ = 38⁰ and ∠QSR = 30⁰. If ∠QTS = x and ∠PQT = y, find;

(**i**) x (**ii**) y

**(b)**




In the diagram, PQRS is a circle centre O. POQ = 150⁰, ∠QSR = 40⁰ and ∠SQP = 45⁰, calculate ∠RQS.

5. A library received $1,300 grant. It spends 10% of the grant on magazine subscriptions, 35% on new books, 15% to repair damaged books, 30% to buy new furniture and 10% to train library staff.

**(a)** Represent this information on a pie chart

**(b)** Calculate, correct to the nearest whole number, the percentage increase of the amount of buying new books over that of furniture.

## PART II

6. In a class of 40 students, 18 passed Mathematics, 19 passed Accounts, 16 passed Economics, 5 Mathematics and Accounts only, 9 Accounts only, 2 Accounts and Economics only. If each student offered **at least** one of the subjects,

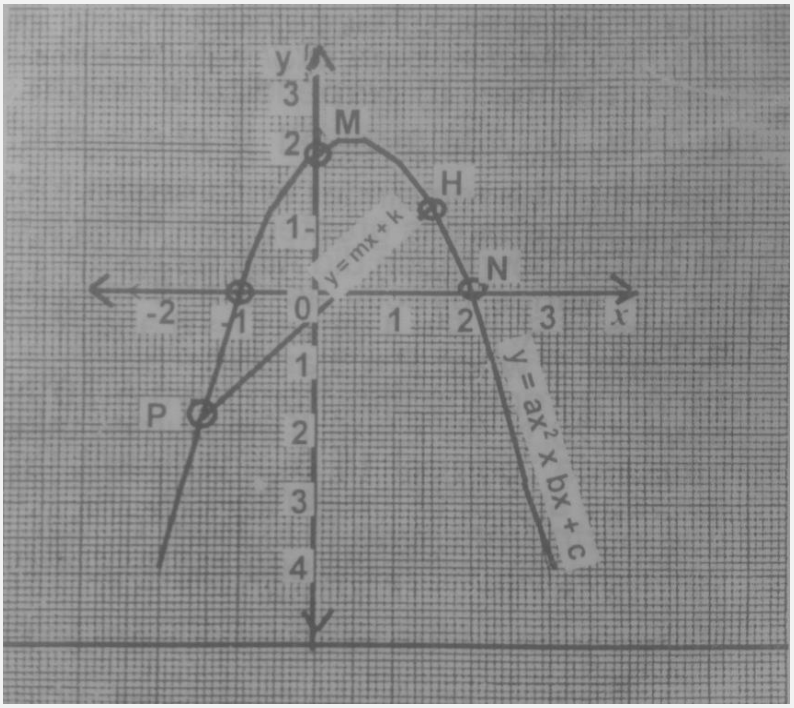
**(a)** how many students failed in all subjects

**(b)** find the percentage number who failed in atleast one of Economics and Mathematics

**(c)** calculate the probability that a student at random failed in Accounts

7. **(a)** Divide $\frac{x^2 - 4}{x^2 + x}$ by $\frac{x^2 - 4x + 4}{x + 1}$

**(b)**




The diagram shows the graphs of $y = ax^2 + bx + c$ and $y = mx + k$ where a, b, c, m and k are constants. Use the graph(s) to:

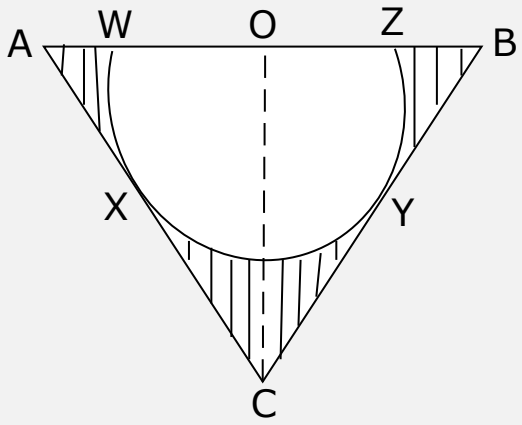
(**i**) find the roots of the equation $ax^2 + bx + c = mx + k$

(**ii**) determine the values of a, b and c using the coordinates of points L, M and N and hence write down the equation of the curve

(**iii**) determine the line of symmetry of the curve $y = ax^2 + bx + c$

8. **(a)** Given that sin x = 0.6 and $0^0 \leq x \leq 90^0$, evaluate 2cos x + 3sin x, leaving your answer in the form $\frac{m}{n}$ where m and n are integers.

**(b)**




In the diagram, a semi-circle WXYZ with centre O is inscribed in an isosceles triangle ABC. If /AC/ = /BC/, /OC/ = 30cm and ACB = $130^0$, calculate, correct to one decimal place;

(**i**) radius of the circle

(**ii**) area of the shaded portion

*[Take* $\pi = \frac{22}{7}$*]*

9. Using ruler and a pair of compasses only,

**(a)** construct a rhombus PQRS of side 7cm and ∠PQR = $60^0$

**(b)** locate point X such that X lies on the locus of points equidistant from PQ and QR and also equidistant from Q and R

**(c)** measure /XR/

10. **(a)** The total surface area of two spheres are in the ratio 9:49. If the radius of the smaller sphere is 12cm, find, correct to the nearest cm3, the volume of the bigger sphere.

**(b)** A cyclist starts from a point X and rides 3km due West to a point Y. At Y, he changes direction and rides 5km North-West to a point Z.

(**i**) how far is he from the starting point, correct to the nearest km?

(**ii**) find the bearing of Z from X, to the nearest degree

11. The table shows the scores obtained when a fair die was thrown a number of times.

| Score | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Frequency | 2 | 5 | x | 11 | 9 | 10 |

If the probability of obtaining a 3 is 0.26, find the;

**(a)** median

**(b)** standard deviation of the distribution

12. **(a)** The area of trapezium PQRS is 60 $cm^2$. PQ//RS, /PQ/ = 15cm, /RS/ 25cm and ∠PSR = $30^0$. Calculate the;

(**i**) perpendicular height of PQRS

(**ii**) perpendicular height of /PS/

**(b)** Ade received $\frac{3}{5}$ of a sum of money, Nelly $\frac{1}{3}$ of the remainder while Austin took the rest. If Austin's share is greater than Nelly's share by ₦3,000, how much did Ade receive?

13. **(a)** P varies directly as Q and inversely as the square of R. If P = 1 when Q = 8 and R = 2, find the value of Q when P = 3 and R = 5.

**(b)** An aeroplane flies from town A (20ºN, 60ºE) to town B (20ºN, 20ºE).

(**i**) if the journey takes 6 hours, calculate, correct to 3 significant figures, the average speed of the aeroplane.

(**ii**) if it then flies due North from town B to town C, 420 km away, calculate, correct to the nearest degree, the latitude of town C.

*[Take radius of the earth = 6400km and $\pi$ = 3.142]*

# WAEC MATHS THEORY QUESTIONS (PT.3)

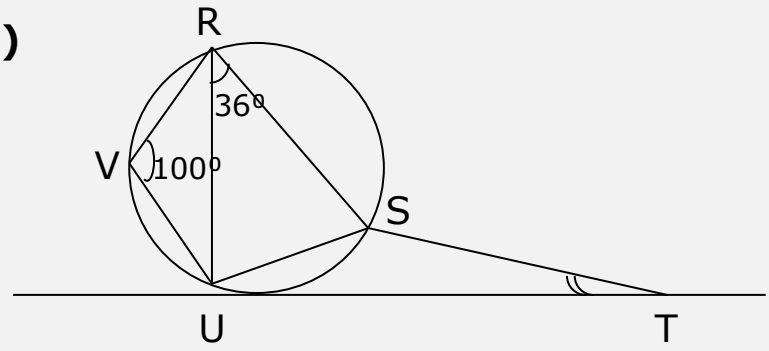
## PART I

1. **(a)** Simplify: $\dfrac{1\frac{1}{4} + \frac{7}{9}}{1\frac{4}{9} - 2\frac{2}{3} \times \frac{9}{64}}$

**(b)** Given that $\sin x = \frac{2}{3}$, evaluate, leaving your answer in surd form and without using tables or calculator, tan x – cos x.

2. Sonny is twice as old as Wale. Four years ago, he was four times as old as Wale. When will the sum of their ages be 66?

3. **(a)**




In the diagram, TU is a tangent to the circle. RVU = 100⁰ and ∠URS = 36⁰. Calculate the value of STU.

**(b)** In triangle XYZ, /XY/ = 5cm, /YZ/ = 8cm and /XZ/ = 6cm. P is a point on the side XY such that /XP/ = 2cm and the line through P, parallel to YZ meets XZ at Q. Calculate /QZ/.

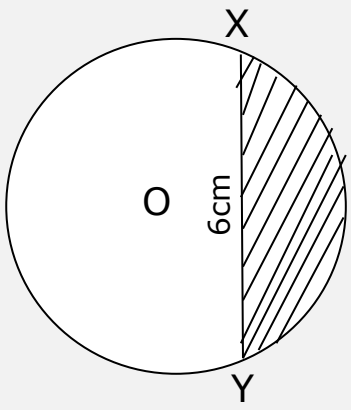
4. **(a)** A box contains 40 identical discs which are either red or white. If the probability of picking a red disc is $\frac{1}{4}$, calculate the number of:

(**i**) white discs

(**ii**) red discs that should be added such that the probability of picking a red disc will be $\frac{1}{3}$

**(b)** A salesman bought some plates at ₦50.00 each. If he sold all of them for ₦600.00 and made a profit of 20% on the transaction, how many plates did he buy?

5.




In the diagram, O is the centre of the circle and XY is a chord. If the radius is 5cm and /XY/ = 6cm, calculate, correct to 2 decimal places, the;

**(a)** angle at which XY subtends at the centre O

**(b)** area of the shaded portion

## PART II

6. **(a)** A boy had M Dalasis (D). He spent D15 and shared the remainder equally with his sister. If the sister's share was equal to $\frac{1}{3}$ of M, find the value of M.

**(b)** A number of tourists were interviewed on their choice of means of travel. Two-third said that they travelled by road, $\frac{13}{30}$ by air and $\frac{4}{15}$ by both air and road. If 20 tourists did not travel by either air or road,

(**i**) represent the information on a Venn diagram

(**ii**) how many tourists;

(A) were interviewed

(B) travelled by air only

7. **(a)** (**i**) Using a scale of 2cm to 1 unit on both axes on the same graph sheet, draw the graph of $y - \frac{3x}{4} = 3$ and $y + 2x = 6$.

(**ii**) From your graph, find the coordinates of the point of intersection of the two graphs.

(**iii**) Show, on the grap sheet, the region satisfied by the inequality $y - \frac{3}{4^x} \geq 3$.

**(b)** Given that $x^2 + bx + 18$ is factorized as $(x+2)(x+c)$. Find the values of c and b.

8. A point H is 20m away from the foot of a tower on the same horizontal ground. From the point H, the angle of elevation of the point (P) on the tower and the top (T) of the tower are 30º and 50º respectively. Calculate, correct to 3 significant figures;

**(a)** /PT/

**(b)** the distance between H and the top of the tower

**(c)** the position of H if the angle of depression of H from the top of the tower is to be 40º

9. Three towns X, Y and Z are such that Y is 20 km from X and 22 km from Z. Town X is 18 km from Z. A Health Centre is to be built by the government to serve the three towns. The Centre is to be located such that patients from X and Y will always travel equal distance to access the Health Centre while patients from Z will travel exactly 10 km to reach the Health Centre.

**(a)** Using a scale of 1cm to 2 km, find by construction, using a pair of compasses and ruler only, the possible positions the Health Centre can be located.

**(b)** In how many possible locations can the Health Centre be built?

**(c)** Measure and record the distances of the locations from town X.

**(d)** Which of these locations would be convenient for all the three towns?

10.

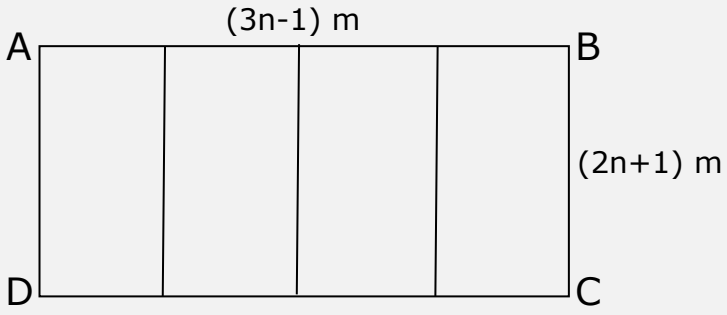
| Class interval | Frequency |
|---|---|
| 60 – 64 | 2 |
| 65 – 69 | 3 |
| 70 – 74 | 6 |
| 75 – 79 | 11 |
| 80 – 84 | 8 |
| 85 – 89 | 7 |
| 90 – 94 | 2 |
| 95 – 99 | 1 |

The table shows the distribution of marks scored by students in an examination. Calculate, correct to 2 decimal places, the;

**(a)** mean

**(b)** standard deviation of the distribution

11. **(a)**



In the diagram, ABCD is a rectangular garden (3n-1)m long and (2n+1)m wide. A wire-mesh 135 m long is used to mark its boundary and to divide it into 8 equal plots. Find the value of n.

**(b)** A cylinder with base radius 14 cm has the same volume as a cube of side 22 cm. Calculate the ratio of the total surface area of the cylinder to that of the cube.

*[Take* $\pi = \frac{22}{7}$*]*

12. **(a)** Copy and complete the table of values for $y = 1 - 4\cos x$.

| x | $0^0$ | $30^0$ | $60^0$ | $90^0$ | $120^0$ | $150^0$ | $180^0$ | $210^0$ | $240^0$ | $270^0$ | $300^0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| y | -3.0 | | | 1.0 | | | | 4.5 | | | -1.0 |

**(b)** Using a scale of 2cm to $30^0$ on the x-axis and 2cm to 1 unit on the y- axis, draw the graph of $y = 1 - 4\cos x$ for $0^0 \leq x \leq 300^0$.

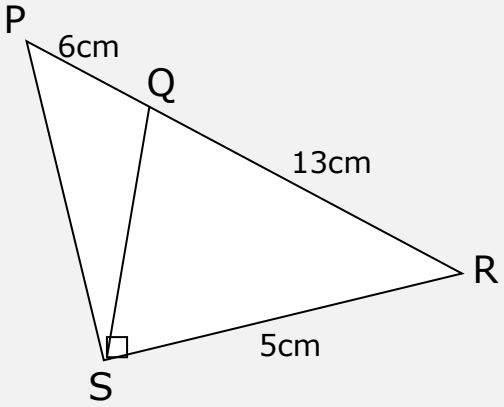
**(c)** Use the graph to;

(**i**) solve the equation $1 - 4\cos x = 0$

(**ii**) find the value of y when $x = 105^0$

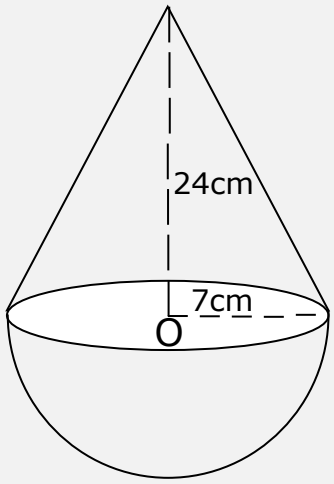
(**iii**) find x when y = 1.5

13. **(a)**



In the diagram, /PQ/ = 6 cm, /QR/ = 13 cm, /RS/ = 5 cm and ∠RSQ is a right angle. Calculate, correct to one decimal place, /PS/.

**(b)**




The diagram shows a wooden structure in the form of a cone mounted on a hemispherical base. The vertical height of the cone is 24 cm and the base radius 7 cm. Calculate, correct to 3 significant figures, the surface area of the structure.

*[Take* $\pi = \frac{22}{7}$*]*

# WAEC MATHS THEORY QUESTIONS (PT.4)

## PART I

1. **(a)** Simplify without using tables or calculator:

$$\frac{\frac{3}{4}\left(3\frac{3}{8} + 1\frac{5}{8}\right)}{2\frac{1}{8} - 1\frac{1}{2}}$$

**(b)** Given that $\log_{10}2 = 0.3010$ and $\log_{10}3 = 0.4771$, evaluate, correct to 2 significant figures and without using tables or calculator, $\log_{10}1.125$

2. **(a)** Solve: $7x + 4 < \frac{1}{2}(4x + 3)$

**(b)** Salem, Sunday and Shaka shared a sum of ₦1,100.00. For every ₦2.00 that Salem gets, Sunday gets 50 kobo and for every ₦4.00 Sunday gets, Shaka gets ₦2.00. Find Shaka's share.

3. **(a)** The present ages of a father and his son are in the ratio 10:3. If the son is 15 years old now, in how many years will the ratio of their ages be 2:1

**(b)** The arithmetic mean of x, y and z is 6 while that of x, y, z, t, u, v and w is 9. Calculate the arithmetic mean of t, u, v and w.

4. The area of a circle is 154 $cm^2$. It is divided into three sectors such that two of the sectors are equal in size while the third sector is three times the size of the other two put together. Calculate the perimeter of the third sector.

*[Take* $\pi = \frac{22}{7}$*]*

5. A boy 1.2 m tall, stands 6 m away from the foot of a vertical lamp pole 4.2 m long. If the lamp is at the tip of the pole,

**(a)** represent this information in a diagram

**(b)** calculate the;

(**i**) length of the shadow of the boy cast by the lamp

(**ii**) angle of elevation of the lamp from the boy, correct to the nearest degree

## PART II

6. **(a)** Two positive numbers P and q are such that P is greater than q and their sum is equal to three times their difference.

(**i**) Express P in terms of q

(**ii**) Hence, evaluate $\frac{P^2 + q^2}{Pq}$

**(b)** A man sold 100 articles at 25 for ₦66.00 and made a gain of 32%. Calculate his gain or loss percent if he sold them at 20 for ₦50.00

7. **(a)** Copy and complete the table of values for the relation $y = 3x^2 - 5x - 7$

| X | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| Y | 35 | | | -7 | -9 | | 5 | |

**(b)** Using scales of 2cm to 1 unit on the x-axis and 2cm to 5 units on the y-axis, draw the graph of $y = 3x^2 - 5x - 7$ for $-3 \leq x \leq 4$.

**(c)** From your graph;

(**i**) find the roots of the equation $3x^2 - 5x - 7 = 0$

(**ii**) estimate the minimum value of y

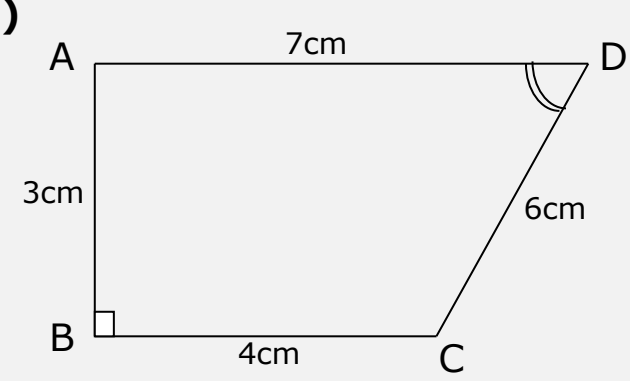
(**iii**) calculate the gradient of the curve at the point x= 2

8. **(a)** If (3-x), 6, (7-5x) are consecutive terms of a geometric progression (G.P) with constant ratio r > 0. Find the;

(**i**) values of x

(**ii**) constant ratio

**(b)**




In the diagram, /AB/ = 3 cm, /BC/ = 4 cm, /CD/ = 6 cm and /DA/ = 7 cm. Calculate ∠ADC, correct to the nearest degree.

9. **(a)** Using ruler and a pair of compasses only, construct;

(**i**) a trapezium WXYZ such that /WX/ = 10.2 cm, /XY/ = 5.6 cm, /YZ/ = 5.8 cm, ∠WXY = $60^{0}$ and WX is parallel to YZ

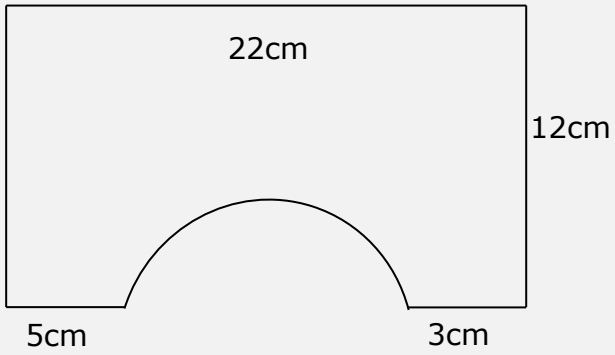
(**ii**) a perpendicular from Z to meet WX at N

**(b)** Measure;

(**i**) /WZ/

(**ii**) /ZN/

10. **(a)**




A segment of a circle is cut off from a rectangular board as shown in the diagram. If the radius of the circle is $1\frac{1}{2}$ times the length of the chord, calculate, correct to two decimal places, the perimeter of the remaining portion.

*[Take* $\pi = \frac{22}{7}$*]*

**(b)** Evaluate without using calculators or tables,

$$\frac{3}{\sqrt{3}}\left(\frac{2}{\sqrt{3}} - \frac{\sqrt{12}}{3}\right)$$

11. The frequency distribution table shows the marks obtained by 100 students in a Mathematics test.

| **Mark (%)** | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 | 81-90 | 91-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency** | 2 | 3 | 5 | 13 | 19 | 31 | 13 | 9 | 4 | 1 |

**(a)** Draw a cumulative frequency curve for the distribution

**(b)** Use the graph to find the;

(**i**) $60^{th}$ percentile

(**ii**) probability that a student passed the test if the pass mark was fixed at 35%

12. An aeroplane flies due North from a town T on the equator at a speed of 950 km per hour for 4 hours to another town P. It then flies eastward to town Q on longitude 65ºE. If the longitude T is 15ºE,

**(a)** represent the information in a diagram

**(b)** calculate the;

(**i**) latitude of P, correct to the nearest degree

(**ii**) distance between P and Q, correct to 4 significant figures

*[Take* $\pi = \frac{22}{7}$*, Radius of the Earth = 6400km]*

13. When one end of a ladder, LM, is placed against a vertical wall at a point 5 metres above the ground, the ladder makes an angle of 37º with the horizontal ground.

**(a)** represent this information in a diagram

**(b)** calculate, correct to 3 significant figures, the length of the ladder

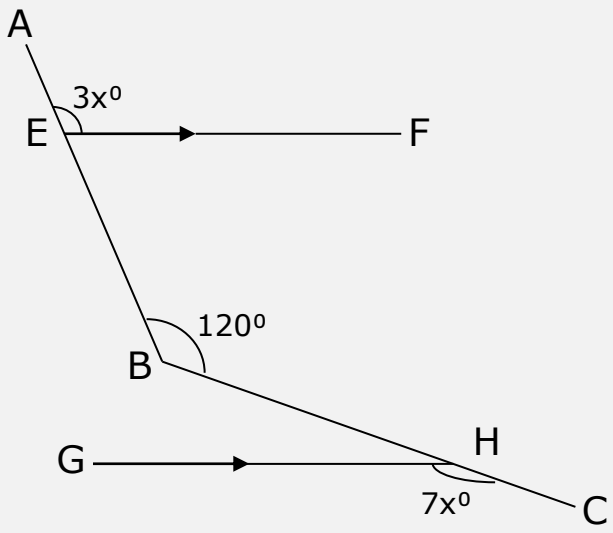
**(c)** If the foot of the ladder is pushed towards the wall by 2 metres, calculate, correct to the nearest degree, the angle which the ladder now makes with the ground.

# WAEC MATHS THEORY QUESTIONS (PT.5)

## PART I

1. **(a)** Without using tables or calculator, simplify; $\frac{0.6 \times 32 \times 0.004}{1.2 \times 0.008 \times 0.16}$ leaving your answer in standard form (scientific notation).

**(b)**




In the diagram, /EF/ is parallel to /GH/. If ∠AEF = 3x⁰, ∠ABC = 120⁰ and ∠CHG = 7x⁰, find the value of ∠GHB.

2. **(a)** Simplify $3\sqrt{75} - \sqrt{12} + \sqrt{108}$, leaving your answer in surd form (radicals).

**(b)** If $124_n = 232_{five}$, find $_n$.

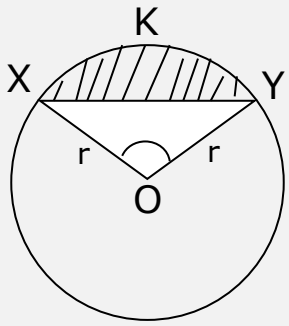
3. **(a)** Solve the simultaneous equations:

$$\frac{1}{x} + \frac{1}{y} = 5$$

$$\frac{1}{y} - \frac{1}{x} = 1$$

**(b)** A man drives from Ibadan to Oyo, a distance of 48km in 45 minutes. If he drives at 72km/h where the surface is good and 48km/hr where the surface is bad, find the number of kilometres of good surface.

4. **(a)**




In the diagram, O is the centre of the circle radius r cm and ∠XOY = 90⁰. If the area of the shaded part is 504 cm², calculate the value of r.

*[Take* $\pi = \frac{22}{7}$*]*

**(b)** Two isosceles triangles PQR and PQS are drawn on opposite sides of a common base PQ. If ∠PQR = 66⁰ and ∠PSQ = 109⁰, calculate the value of ∠RQS.

5. A building contractor tendered for two independent contracts, X and Y. The probability that he will win contract X is 0.5 and not win contract Y is 0.3. what is the probability that he will win:

**(a)** both contracts

**(b)** exactly one of the contracts

**(c)** neither of the contracts

## PART II

6. **(a)** If $\frac{3}{2p - \frac{1}{2}} = \frac{\frac{1}{3}}{\frac{1}{4}p + 1}$ find p.

**(b)** A television set was marked for sale at GH¢760.00 in order to make a profit of 20%. The television set was actually sold at a discount of 5%. Calculate, correct to 2 significant figures, the actual percentage profit.

7. **(a)** Copy and complete the table of values for the relation $y = 2 \sin x + 1$

| x | $0^0$ | $30^0$ | $60^0$ | $90^0$ | $120^0$ | $150^0$ | $180^0$ | $210^0$ | $240^0$ | $270^0$ |
|---|---|---|---|---|---|---|---|---|---|---|
| y | 1.0 | | | | 2.7 | | | 0.0 | -0.7 | |

**(b)** Using scales of 2cm to $30^0$ on the x-axis and 2cm to 1 unit on the y-axis, draw the graph of $y = 2 \sin x + 1$ for $0^0 \leq x \leq 270^0$

**(c)** Use the graph to find the value of x for which sin x =¼

8. **(a)** Copy and complete the following table for multiplication module 11

| $\otimes$ | **1** | **5** | **9** | **10** |
|---|---|---|---|---|
| **1** | 1 | 5 | 9 | 10 |
| **5** | 5 | | | |
| **9** | 9 | | | |
| **10** | 10 | | | |

Use the table to;

(**i**) evaluate $(9 \otimes 5) \otimes (10 \otimes 10)$

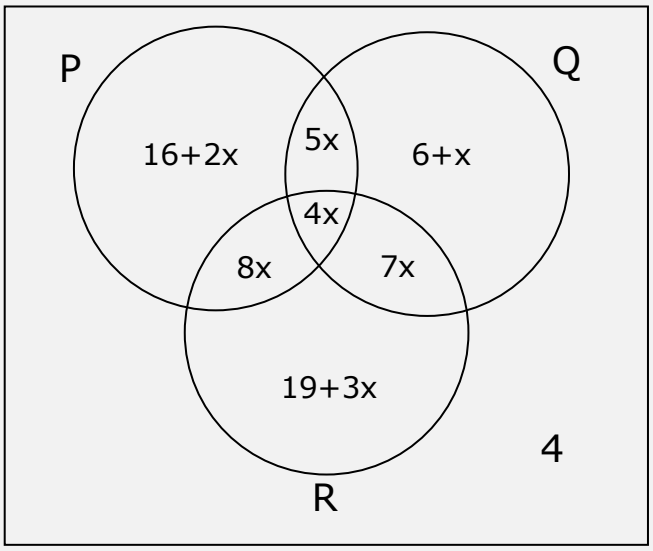
(**ii**) find the truth set of

I. $10 \otimes m = 2$

II. $n \otimes n = 4$

**(b)** When a fraction is reduced to its lowest term, it is equal to $\frac{3}{4}$. The numerator of the fraction when doubled would be 34 greater than the denominator. Find the fraction.

9. **(a)**

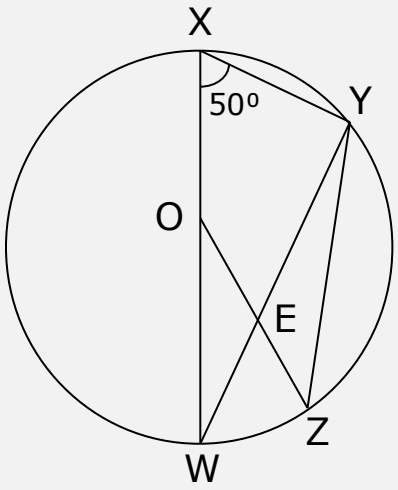



In the Venn diagram, P, Q and R are subsets of the universal set U. If n(U) = 125, find;

(**i**) the value of x

(**ii**) n(P ∪ Q ∩ R')

**(b)**



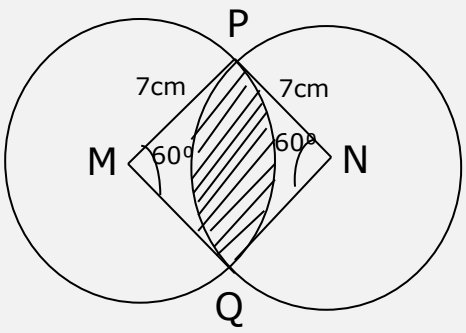

In the diagram, O is the centre of the circle. If WX is parallel to YZ and ∠WXY = 50°, find the value of;

(**i**) ∠WYZ

(**ii**) ∠WEZ

10. **(a)** Solve: (x-2) (x-3) = 12

**(b)**




In the diagram, M and N are the centres of two circles of equal radii 7cm. The circles intercept at P and Q . If ∠PMQ = ∠PNQ = 60°, calculate, correct to the nearest whole number, the area of the shaded portion.

*[Take* $\pi = \frac{22}{7}$*]*

11.

| ***Scores*** | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| ***Frequency*** | 2 | 5 | 13 | 11 | 9 | 10 |

The table shows the distribution of outcomes when a die is thrown 50 times. Calculate the;

**(a)** mean deviation of the distribution

**(b)** probability that a score selected at random is **at least** a 4

12. **(a)** Given that 5 cos (x+8.5)° - 1 = 0, 0° ≤ x ≤ 90°, calculate, correct to the nearest degree, the value of x.

**(b)** The bearing of Q from P is 150° and the bearing of P from R is 015°. If Q and R are 24km and 32km respectively from P;

(**i**) represent this information in a diagram

(**ii**) calculate the distance between Q and R, correct to 2 decimal places

(**iii**) find the bearing of R from Q, correct to the nearest degree

13. **(a)** Two functions, f and g, are defined by $f:x \rightarrow 2x^2 - 1$ and $g:x \rightarrow 3x + 2$ where x is a real number.

(**i**) If f(x – 1) – 7 = 0, find the value of x

(**ii**) Evaluate $\frac{f\left(-\frac{1}{2}\right).\ g(3)}{f(4) - g(5)}$

**(b)** An operation (*) is defined on a set R, of real numbers, by m(*)n = $\frac{-n}{m^2 + 1}$ , where m, n ∈ R. If -3, -10 ∈ R, show whether or not (*) is cumulative.

# WAEC MATHS THEORY QUESTIONS (PT.6)

## PART I

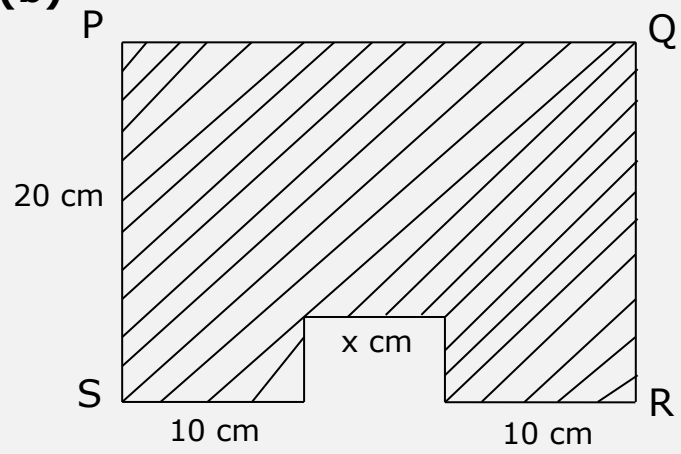
1. **(a)** Without using mathematical tables or calculators, simplify;

$3\frac{4}{9} \div \left(5\frac{1}{3} - 2\frac{3}{4}\right) + 5\frac{9}{10}$

**(b)** A number is selected at random from each of the sets {2,3 4} and {1, 3, 5}. Find the probability that the sum of the two numbers is **greater than** 3 and **less than** 7.

2. **(a)** Solve the inequality: $4 + \frac{3}{4}(x+2) \leq \frac{3}{8}x + 1$

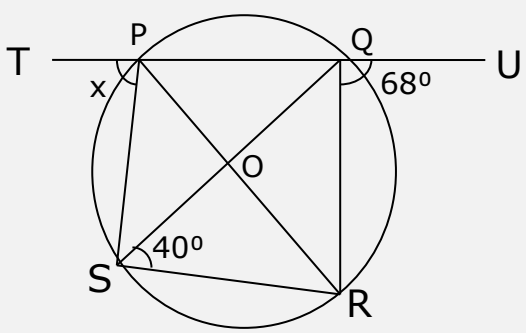
**(b)**




The diagram shows a rectangle PQRS from which a square of side x cm has been cut. If the area of the shaded portion is 484 $cm^2$, find the value of x.

3. **(a)** The ratio of the interior angle to the exterior angle of a regular polygon is 5:2. Find the number of sides of the polygon.

**(b)**




The diagram shows a circle PQRS with centre O, ∠UQR =68°, ∠TPS = 74° and ∠QSR = 40°. Calculate the value of ∠PRS.

4. **(a)** By how much is the sum of $3\frac{2}{3}$ and $2\frac{1}{5}$ **less than** 7

**(b)** The height, h m, of a dock above sea level is given by h = 6 + 4cos (15p)°, 0 < p < 6. Find;

(**i**) the value of h when p = 4

(**ii**) correct to 2 significant figures, the value of p when h = 9m

5. A trapezium PQRS is such that PQ//RS and the perpendicular from P to Rs is 40cm. If /PQ/ = 20cm, /SP/ = 50cm and /SR/ = 60cm, calculate, correct to 2 significant figures, the;

**(a)** area of the trapezium

**(b)** ∠QRS

## PART II

6. **(a)** (**i**) Illustrate the following statement in a Venn diagram: All good Literature students in school are in the General Arts class.

(**ii**) Use the diagram to determine whether or not the following are valid conclusions from the given statement:

I. Vivian is in the General Arts class therefore she is a good Literature student.

II. Audu is not a good Literature student therefore he is not in the General Arts class.

III. Kweku is not in the General Arts class therefore he is not a good Literature student

**(b)** The cost (c) of producing n bricks is the sum of a fixed amount h, and a variable amount y, where y varies directly as n. If it costs GH¢950.00 to produce 600 bricks and GH¢1,030.00 to produce 1000 bricks,

(**i**) find the relationship between c, h and n

(**ii**) calculate the cost of producing 500 bricks

7. The table is for the relation $y = px^2 - 5x + q$

| **x** | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|
| **y** | 21 | 6 | | -12 | | | | 0 | 13 |

**(a)** (**i**) Use the table to find the value of p and q.

(**ii**) Copy and complete the table.

**(b)** Using scales of 2cm to 1 unit on the x-axis and 2cm to 5 units on the y-axis, draw the graph of the relation for $-3 \leq x \leq 5$.

**(c)** Use the graph to find:

(**i**) y when x = 1.8

(**ii**) x when y = -8

8. **(a)** Using ruler and a pair of compasses only, construct a;

(**i**) trapezium WXYZ such that /WX/ = 8cm, /XY/ = 5.5 cm, /XZ/ = 8.3 cm, ∠WXY = 60º and WX//ZY

(**ii**) rectangle PQYZ where P and Q are on /WX/

**(b)** Measure;

(**i**) QX

(**ii**) ∠XWZ

9. **(a)** The first term of an Arithmetic Progression (A.P) is 8. If the ratio of the $7^{th}$ term and $9^{th}$ term is 5:8, find the common difference of the AP.

**(b)** A trader bought 30 baskets of pawpaw and 100 baskets of mangoes for ₦2,450.00. She sold the pawpaw at a profit of 40% and the mangoes at a profit of 30%. If her profit on the entire transaction was ₦855.00, find the;

(**i**) cost price of a basket of pawpaw

(**ii**) selling price of the 100 baskets of mangoes

10. **(a)** Without using mathematical tables or calculators, simplify: $\frac{2\tan 60^{\circ} + \cos 30^{\circ}}{\sin 60^{\circ}}$

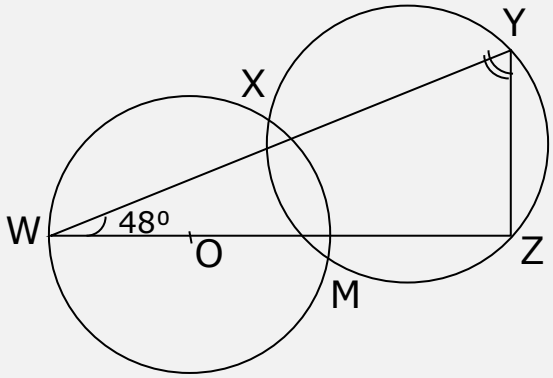
**(b)** From an aeroplane in the air and at a horizontal distance of 1050 m, the angle of depression of the top and base of a control tower at an instance are $36^0$ and $41^0$ respectively. Calculate, correct to the nearest metre, the:

(**i**) height of the control tower

(**ii**) shortest distance between the aeroplane and the base of the control tower

11. **(a)** Make m the subject of the relation $h = \frac{mt}{d(m+p)}$

**(b)**




In the diagram, WY and WZ are straight lines. O is the centre of the circle WXM and ∠XWM = 48⁰. Calculate the value of ∠WYZ

**(c)** An operation ⊗ is defined on the set X = {1, 3, 5, 6} by m ⊗ n = m + n + 2(mod 7), where m, n ∈ X.

(**i**) draw a table for the operation

(**ii**) using the table, find the truth set of;

I. 3 ⊗ n = 3

II. n ⊗ n = 3

12. A water reservoir in the form of a cone mounted on a hemisphere is built such that the plane face of the hemisphere fits exactly to the base of the cone and the height of the cone is 6 times the radius of its base.

**(a)** Illustrate the information in a diagram

**(b)** If the volume of the reservoir is $333\frac{1}{3}$ πm$^3$, calculate, correct to the nearest whole number, the;

(**i**) volume of the hemisphere

(**ii**) total surface area of the reservoir

*[Take* $\pi = \frac{22}{7}$*]*

13.

| **Mark %** | 0-9 | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80-89 | 90-99 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Freq...** | 7 | 11 | 17 | 20 | 29 | 34 | 30 | 25 | 21 | 6 |

**(a)** Construct a cumulative frequency table for the distribution and draw a cumulative frequency curve.

**(b)** Use the curve to estimate, correct to one decimal place, the;

(**i**) lowest mark for distinction if 5% of the candidates passed with distinction

(**ii**) probability of selecting a candidate who scored **at most** 45%

# WAEC MATHS THEORY QUESTIONS (PT.7)

## PART I

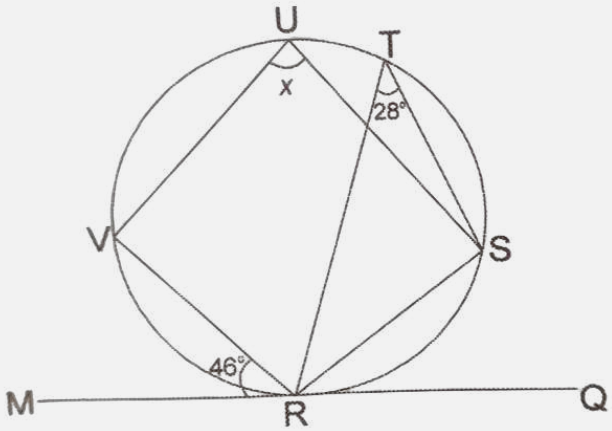
1. **(a)** Without using mathematical tables or calculators, evaluate $\frac{0.09 \times 1.21}{3.3 \times 0.00025}$, leaving the answer in standard form *(Scientific Notation)*.

   **(b)** A principal of *GH¢*5,600 was deposited for 3 years at compound interest. If the interest earned was *GH¢*1,200, find, correct to 3 significant figures, the interest rate per annum.

2. **(a)** Solve : $7(x+4)-\frac{2}{3}(x-6) \leq 2[x-3(x+5)]$

   **(b)** A transport company has a total of 20 vehicles made up of tricycle and taxicabs. Each tricycle carries 2 passengers while each taxicab carries four passengers. If the 20 vehicles carry a total of 66 passengers at a time, how many tricycles does the company have?

3. **(a)**




   In the diagram, < RTS = 28°, < VRM = 46°, MQ is a tangent to the circle VRSTU at the point R. Find < VUS.

   **(b)** A cylinder tin, 7cm high, is closed at one end. If its total surface area is 462cm$^2$, calculate its radius. *[Take* $\pi=\frac{22}{7}$*]*.

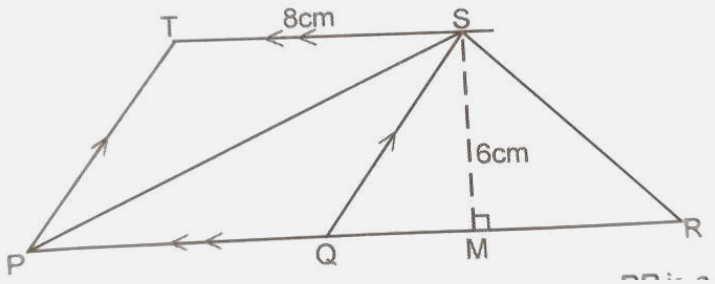
| ***Scores*** | *1* | *2* | *3* | *4* | *5* | *6* |
|---|---|---|---|---|---|---|
| ***Frequency*** | *25* | *30* | ***x*** | *28* | *40* | *32* |

The table shows the outcome when a die is thrown a number of times. If the probability of obtaining a 3 is 0.225;

4. **(a)** How many times was the die thrown?

   **(b)** Calculate the probability that a trial chosen at random gives a score of an even number or a prime number.

5. **(a)**




In the diagram, PQST is a parallelogram, PR is a straight line, |TS| = 8cm, |SM| = 6cm and area of triangle PSR = 36cm$^2$. Find the value of |QR|.

**(b)** A tree and a flagpole are on the same horizontal ground. A bird on top of the tree observes the top and bottom of the flagpole below it at angle of 45° and 60° respectively. If the tree is 10.65m high, calculate, correct to 3 significant figures, the height of the flagpole.

## PART II

6. **(a)** Find the sum of the Arithmetic Progression (AP) *1, 3, 5,..., 101*.

**(b)** Out of the 95 travelers interviewed, 7 travelled by bus and train only, 3 by train and car only and 8 travelled by all 3 means of transport. The number, *x*, of travelers who travelled by bus only was equal to the number who travelled by bus and car only. If 47 people travelled by bus and 30 by train:

**(i)** represent this information in a Venn diagram;

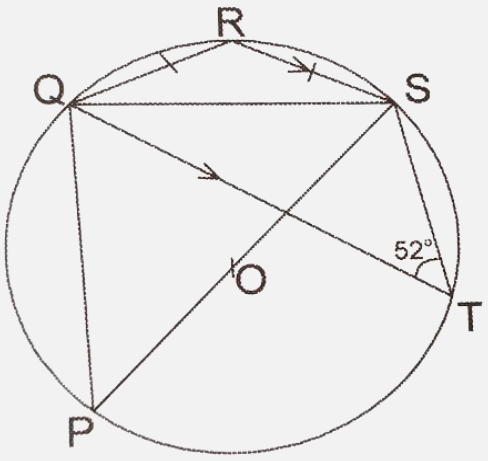
**(ii)** calculate the

**(a)** value of *x*;

**(b)** number who travelled by at least two means.

7. **(a)** Using the method of completing the square, solve, correct to 2 decimal places, $\frac{x-4}{4} = \frac{x+2}{2x}$.

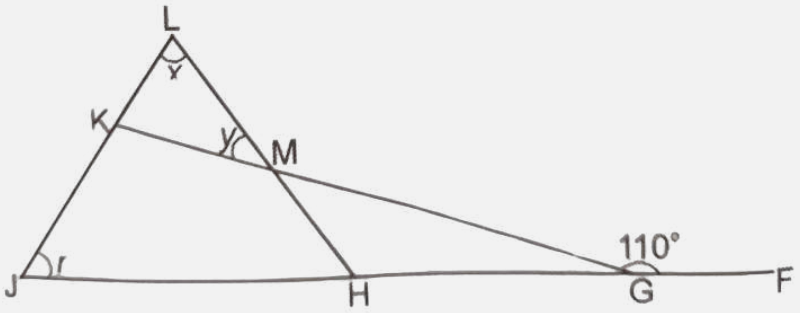
**(b)**




In the diagram, PQRST is a circle with Centre O. If PS is a diameter, RS//QT, and < QTS = 52°, find:

**(i)** < SQT; **(ii)** < PQT.

8. **(a)**




In the diagram, <KLM = x, <LMK = y, <KJH = r and <KGF = 110°. If 2x = r = y, find the value of x.

**(b)** Ten boys and twelve girls collected donations for a project. The total amount collected by the boys was ₦600.00 greater than that collected by the girls. If the average collection of the boys was ₦100.00 greater than the average collection of the girls, how much was collected by the two groups?

9. The weight *(in kg)* of 50 contestants at a competition is as follows:

*65 66 67 66 64 66 65 63 65 68*
*64 62 66 64 67 65 64 66 65 67*
*65 67 66 64 65 64 66 65 64 65*
*66 65 64 65 63 63 67 65 63 64*
*66 64 68 65 63 65 64 67 66 64*

**(a)** Construct a frequency table for the discrete data.

**(b)** Calculate, correct to 2 decimal places, the;

**(i)** mean;

**(ii)** standard deviation of the data.

10. Using ruler and a pair of compasses only,

**(a)** construct:

**(i)** ΔXYZ such that |XY|=10cm, <XYZ =30° and <YXZ = 45°.

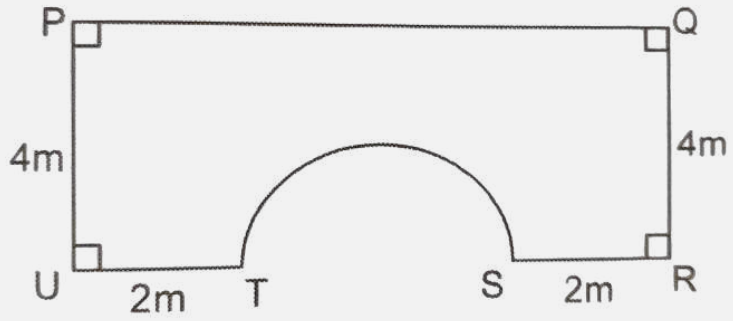
**(ii)** locus, l1, of points equidistant from Y and Z.

**(iii)** locus, l2, of points parallel to XY through Z.

**(b)** Locate M, the point of intersection of l1 and l2.

**(c)** Measure <ZMY.

11. **(a)** If $\frac{3p+4q}{3p-4q} = 2, Find\ p:q.$




The diagram shows the cross section of a bridge with a semi-circular hollow in the middle. If the perimeter of the cross section is 34 cm, calculate the:

**(i)** length PQ;

**(ii)** area of the cross section.

*[Take* $\pi=\frac{22}{7}$*]*.

12. **(a)** Copy and complete the table of values, correct to one decimal place, for the relation y = 3sinx + 2cosxy = 3sinx + 2cosx for 0° ≤ x ≤ 360° 0° ≤ x ≤ 360°.

| ***x*** | *0°* | *30°* | *60°* | *90°* | *120°* | *150°* | *180°* | *210°* | *240°* | *270°* | *300°* | *330°* | *360°* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***y*** | | | | *3.0* | *1.6* | | *-2.0* | | *-3.6* | *-3.0* | | | *2.0* |

**(b)** Using scales of 2cm to 30°m on the x- axis and 2cm to 1 unit on the y-axis, draw the graph of the relation $y=3\sin x + 2\cos x$ for $0° \leq x \leq 360°$.

**(c)** Use the graph to solve:

**(i)** $3\sin x+2\cos x = 0$

**(ii)** $2+2\cos x+3\sin x=0$.

13. **(a)** Find the equation of a straight line which passes through the point (2, -3) and is parallel to the line $2x + y = 6$.

**(b)** The operation $\Delta$ is defined on the set $T = \{2,3,5,7\}$ by $x\Delta y=(x + y + xy) \bmod 8$.

**(i)** Construct modulo 8 table for the operation $\Delta$ on the set T.

**(ii)** Use the table to find:

**(a)** $2\Delta(5\Delta7)$;

**(b)** $2\Delta n=5\Delta7$.

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