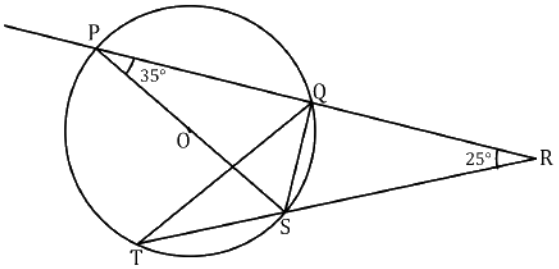
1. (a) Simplify, without using a calculator: $\dfrac{3\frac{4}{7} - 1\frac{1}{3} \div 2\frac{2}{5}}{\frac{13}{3} - 1\frac{6}{7}}$.

   (b) Simplify: $\dfrac{2}{3+2\sqrt{2}} + \dfrac{1}{3-2\sqrt{2}}$ leaving your answer in the form $a + b\sqrt{2}$.

2. (a) Simplify: $\dfrac{x + \frac{1}{x} + 2}{x^2 - 1}$.

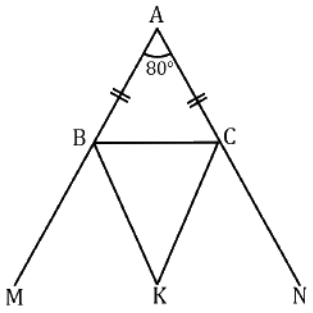
   (b) The sum of the ages of Akin and Dop is 35 years. The sum of twice Akin's age and three times Dop's age is 89 years. Find their present ages.

3. (a)



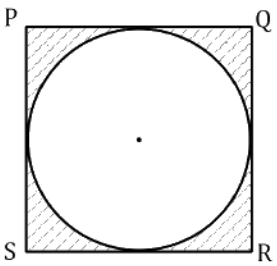
   In the diagram, PQR and TSR are straight lines, $\angle QRS = 25°$ and $\angle QPS = 35°$. Find $\angle SQT$.

   (b)



   In the diagram, $\overline{AM}$ and $\overline{AN}$ are straight lines. ABC is an isosceles triangle, $\angle BAC = 80°$, the bisectors of $\angle MBC$ and $\angle NCB$ meet at K. Calculate $\angle BKC$.

4. (a)



   In the diagram, a circle is drawn in square $PQRS$ as shown. If the total area of the shaded portion is 42 cm^2, calculate the radius of the circle.

   (b) A cube of length 4 cm has the same volume as a cone with base diameter 7 cm. Find correct to the nearest cm, the height of the cone. $\left[\text{Take } \pi = \dfrac{22}{7}\right]$

5. The table shows, in percentages, the monthly expenditure of an employee whose gross monthly salary is GHC 10,800.

Item	Percentage
Social security	5
Income tax	25
Food	40
Transport	10
Rent	12.5
Others	7.5

(a) Draw a pie chart to illustrate the data.

(b) If the social security contribution and income tax are deducted from the gross monthly salary before payment, calculate, correct to the nearest whole number, the expenditure on rent as a percentage of the employee's take home pay.

6. In a survey, 74 out of 88 tourists interviewed said they had visited at least one of Africa (A), Europe (E) and South America (S). Of these, 19 had visited Europe and Africa, 30 Europe and South America, 26 South America and Africa. No one had visited only Africa, 10 only Europe, 7 only South America and x had visited all the three countries.

(a) Draw a Venn diagram to represent this information.

(b) Write down a suitable equation in x and find the value of x.

(c) Find:

i. $n[(E \cap A) \cup S]$;

ii. $n\left[(E \cup A)' \cap S\right]$

iii. $n(A)$

7. (a) If $u = 1 - \dfrac{3v}{vt - w}$, make t the subject of the relation.

(b) The graph is that of the relation $y = ax^2 + bx + c$.

i. From the graph determine:
Please see Figure **??** on page **??** for the graph.

α. the minimum value of y;

β. the roots of the equation $ax^2 + bx + c = 0$.

ii. Using the roots, determine the value of a, b and c.

8. (a) From a point on a horizontal ground, the angle of elevation of the top of a tower 32 m high is .

i. Calculate the distance , correct to the nearest metre.

ii. If is due south of the tower and another point is 35 m due east of the tower, calculate correct to one decimal place the

α. distance ;

β. bearing of from .

(b) The table is a multiplication table in modulo 10 over the set $y = \{2, 4, 6, 8\}$. Find the identity element.

$\otimes$	2	4	6	8
2	4	8	2	6
4	8	6	4	2
6	2	4	6	8
8	6	2	8	4

9. An aircraft leaves airport P and flies on a bearing 060°. From a distance of 10 km due east of P, another aircraft leaves airport R and flies on a bearing of 330°. Both planes meet at Q. Using ruler and a pair of compasses only, with a scale of 1 cm to 1 km,
   (a) construct triangle PQR.
   (b) how far is Q from:
      i. P
      ii. R
   (c) measure $\angle PQR$.
   (d) Calculate how far north of R, Q is correct to one decimal place.

10. The table gives the frequency distribution of marks obtained by a number of students in a test. If the mean mark is 5, calculate the:

Marks	3	4	5	6	7	8
Freq.	5	m	$m+1$	9	4	1

   (a) value of m
   (b) median
   (c) standard deviation of the distribution

11. (a) Given that $sinx = 0.6$ and $0° \leq x \leq 90°$, find $1 - tanx$, leaving your answer in the form $\frac{a}{b}$, where a and b are integers.
   (b) Two equal chords PQ and QR are each 12 cm long. They meet at a point Q on the circle making angle . Calculate, correct to the nearest whole number the:
      i. radius of the circle;
      ii. perimeter of the major segment cut off by the chord PR.

12. (a) Find the image of $(-2, 4)$ under the mapping $\begin{pmatrix} 4 \\ -7 \end{pmatrix} \rightarrow \begin{pmatrix} 2y \\ y - 3x \end{pmatrix}$.
   (b) Two functions f and g are defined as: $f : x \rightarrow \frac{x^2}{4} - 9$ and $g : x \rightarrow \frac{1}{2x}\ (x \neq 0)$.
      i. Evaluate $f(4) + g(-\frac{1}{3})$
      ii. If $f \times g = 2$, solve for x.

13. (a) Using a scale if 2 cm to 2 units on both axis, draw on a graph sheet two perpendicular axes OX and OY for the intervals $-8 \leq x \leq 8$ and $-8 \leq y \leq 8$.
   (b) draw clearly and label the vertices as appropriate:
      i. triangle PQR with points $P(1, 2), Q(5, 3)$ and $\overrightarrow{RQ} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$;
      ii. The image $\triangle P'Q'R'$ of $\triangle PQR$ under a rotation of 180° about the origin where $P \rightarrow P', Q \rightarrow Q'$ and $R \rightarrow R'$;
      iii. The image $\triangle P''Q''R''$ of $\triangle PQR$ under a reflection in the line $x = 0$ where $P' \rightarrow P'', Q' \rightarrow Q''$ and $R' \rightarrow R''$.
   (c) Describe fully, a single transformation that maps $\triangle PQR$ onto $\triangle P''Q''R''$.