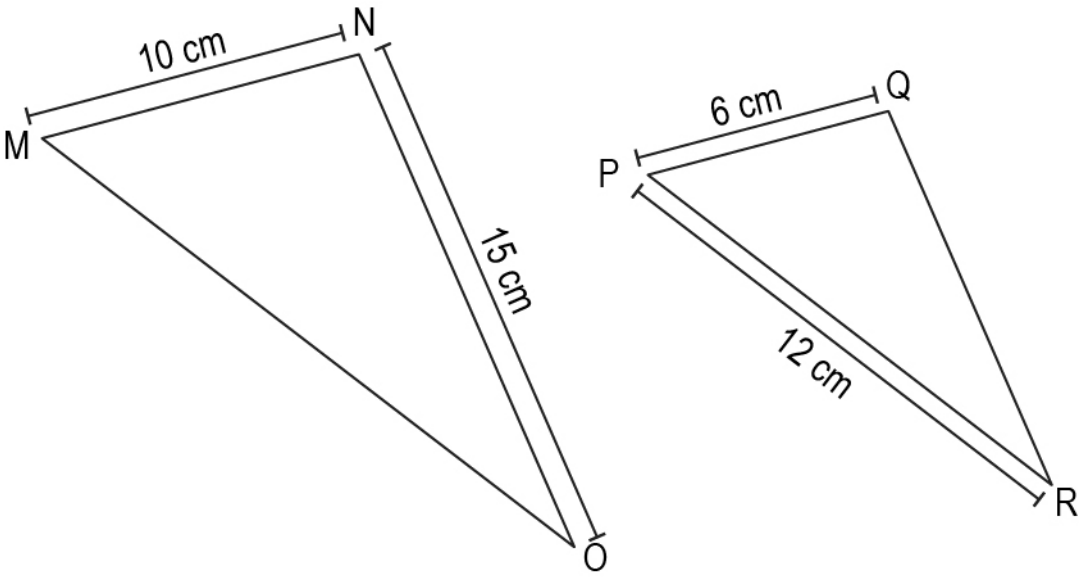
Multiple Choice Questions

Q: 1 **Which of the following may NOT be similar to each other?**

i) any two circles
ii) any two rhombuses
iii) any two regular hexagons

1 only ii)
2 only i) and ii)
3 only i) and iii)
4 all - i), ii) and iii)

Q: 2 **Shown below are two triangles ΔMNO and ΔPQR. Dimensions of their two sides are marked in the figure.**

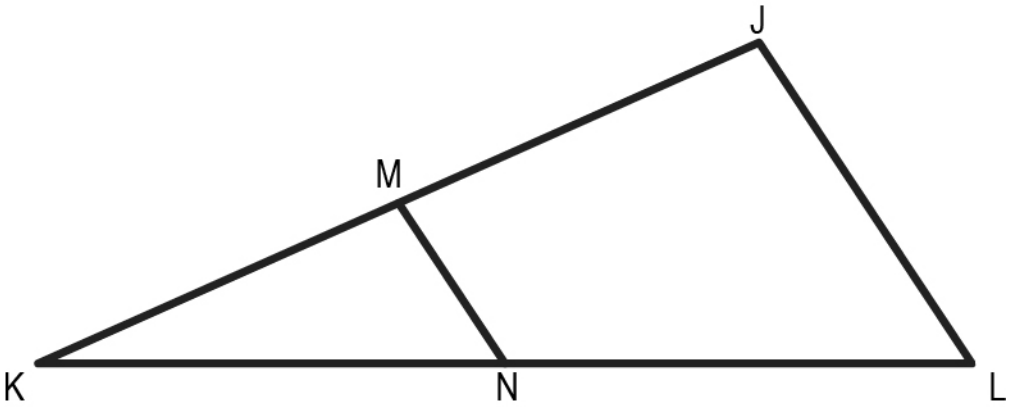


(Note: The figures are not to scale.)

What should be the value of QR if ΔMNO is similar to ΔPQR?

1 9 cm **2** 11 cm **3** 15 cm **4** 25 cm

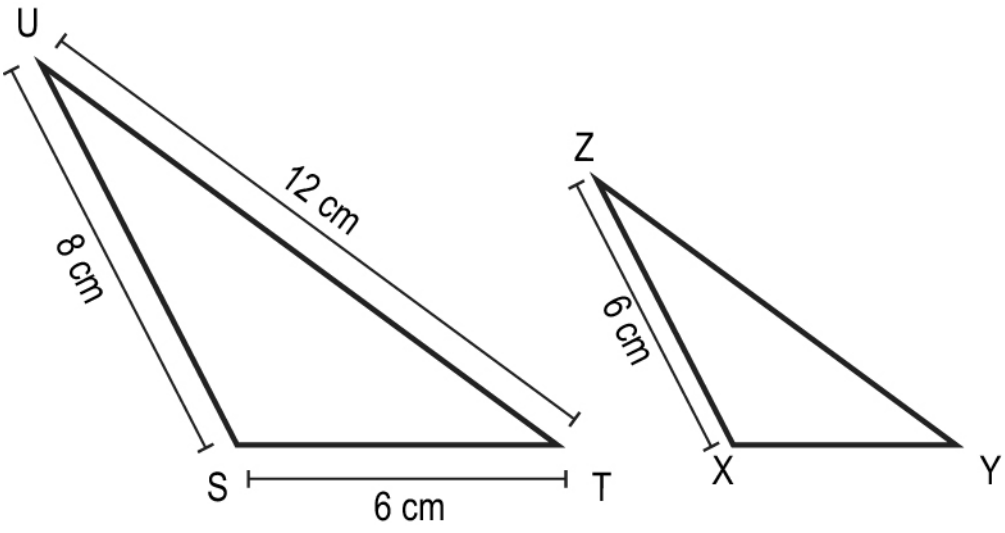
Q: 3 **In the following figure, MN is drawn such that M and N are mid-points on JK and KL, respectively.**



Which of these criteria CANNOT be used to prove that △JKL is similar to △MKN?

1 SSS similarity criterion
2 SAS similarity criterion
3 AAA similarity criterion
4 (All of the similarity criteria can be used.)

Q: 4 **In the figures given below, △STU and △XYZ are similar.**

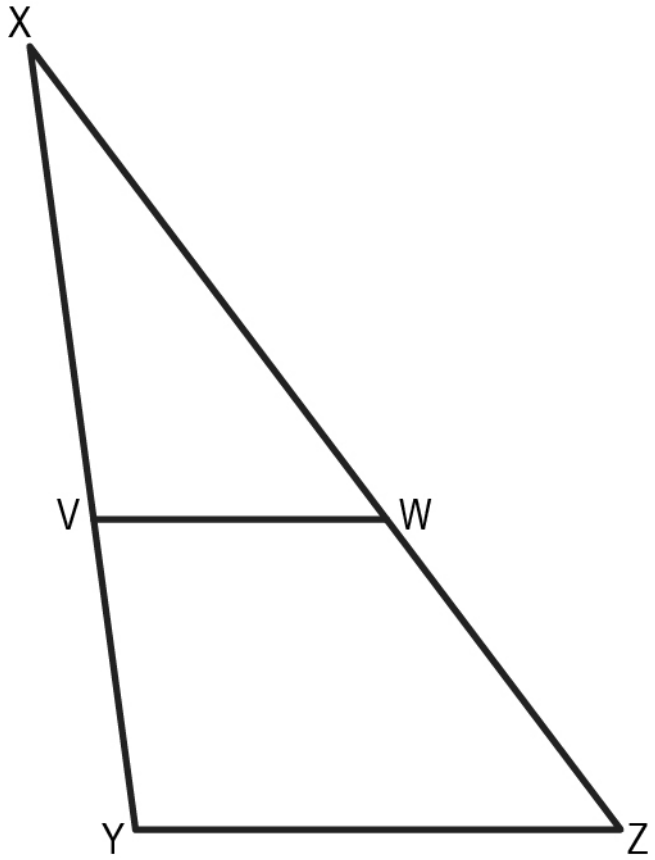


(*Note: The figures are not to scale.*)

What is the perimeter of △XYZ?

1 19.5 cm **2** 20 cm **3** 26 cm **4** 34.67 cm

Q: 5 **In the △XYZ given below, VW || YZ. VY = 6 cm, XY = 14 cm, XW = 12 cm.**



(Note: The figure is not to scale.)

What is the length of XZ?

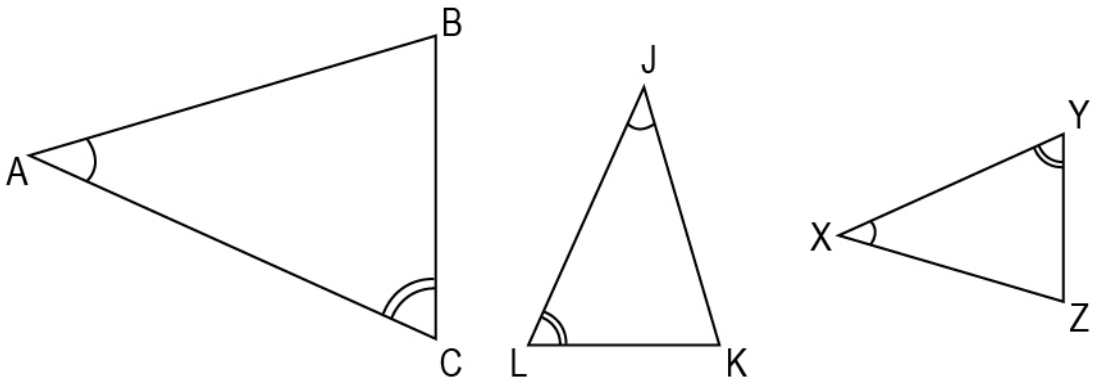
1 14 cm **2** 21 cm **3** 26 cm **4** 28 cm

Q: 6 **Danish created an equilateral triangle-shaped rangoli pattern in his room with an area of 10 square units. He replicated the same rangoli pattern in the lobby of his apartment building, where each side of the triangle was 2.5 times the length of the one in his room.**

What was the area of rangoli made in the lobby?

1 25 square units
2 62.5 square units
3 156.25 square units
4 (cannot be determined as exact dimensions of the design are required)

Q: 7 **Equal angles have been marked in the triangles below.**



(Note: The figures are not to scale.)

Which of these is NOT always true?

1 ΔABC ~ ΔJKL
2 ΔABC ~ ΔXYZ
3 ΔABC ~ ΔXZY
4 (All three triangles are similar.)

Q: 8 **The triangles ▲JKL and ▲MNO are similar such that their corresponding sides are in the ratio,**

$\frac{LJ}{OM} = \frac{5}{7}$

What is the ratio of the areas of ▲JKL and ▲MNO?

1 $\frac{49}{25}$ **2** $\frac{7}{5}$ **3** $\frac{5}{7}$ **4** $\frac{25}{49}$

Q: 9 **▲DEF and ▲XYZ are two triangles right angled at point E and Y, respectively. Also,** $\frac{DE}{XY} = \frac{EF}{YZ}$ **.**

Based on the above information, two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).

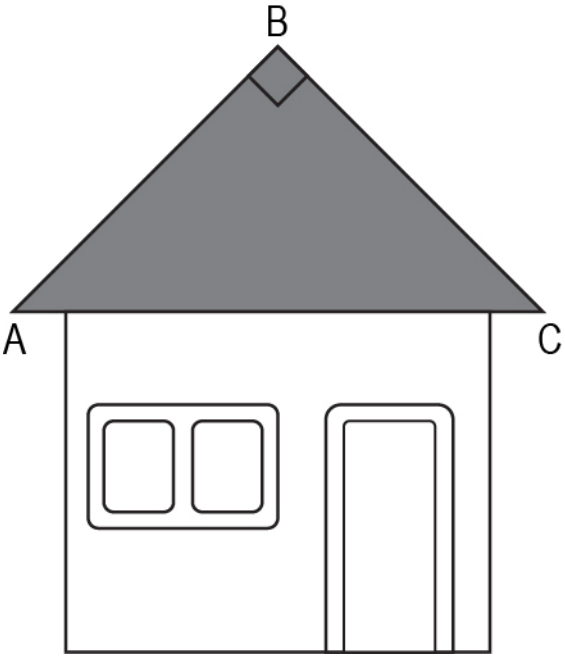
Assertion(A): ▲DEF is similar to ▲XYZ.

Reason(R): All right angled triangles are similar to each other.

1 Both (A) and (R) are true and (R) is the correct explanation for (A).
2 Both (A) and (R) are true and (R) is not the correct explanation for (A).
3 (A) is false but (R) is true.
4 (A) is true but (R) is false.

Free Response Questions

Q: 10 **Anuradha painted the front of the roof of her house, shown by the isosceles right-angled △ABC in the figure below. The area painted by her is 18 m^2.** **[1]**

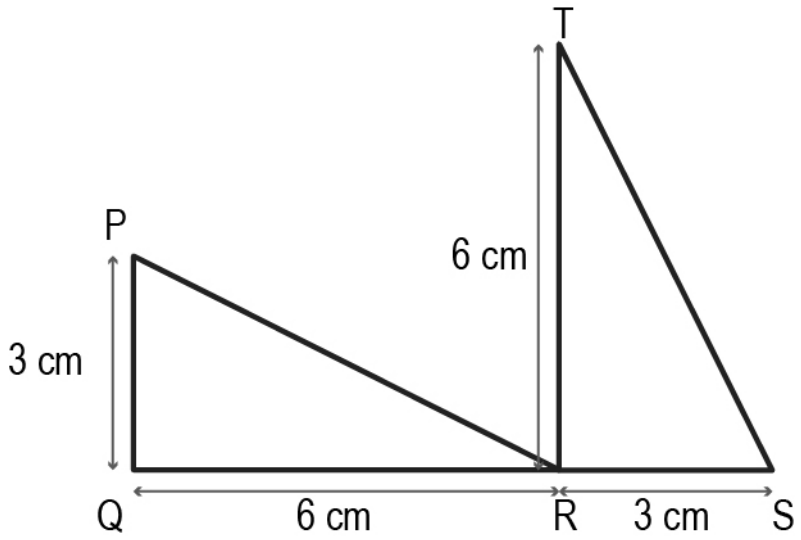


(Note: The figure is not to scale.)

She wants to hang string lights in a straight line along AC, for decoration.

Find the length of string lights Anuradha will need. Show your work.

Q: 11 **A graffiti artist wants to create a design on a wall using two triangles. He draws a miniature version of the artwork in his notebook, as shown below.** **[1]**



(Note: The figure is not to scale.)

△PQR is similar to △SRT. To find the dimensions of the larger image for the wall, he found the ratio of the corresponding sides of the two triangles as:

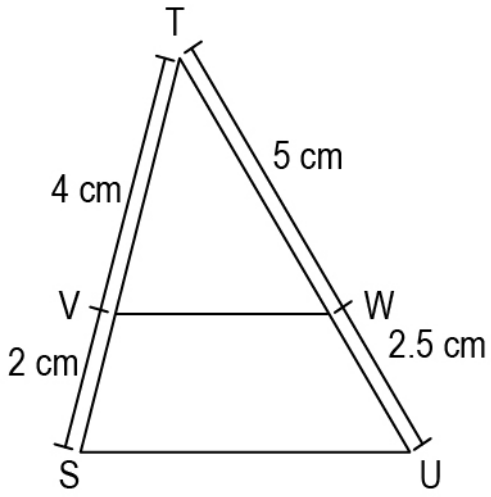
$$\frac{PQ}{RT} = \frac{SR}{QR} = \frac{1}{2}$$

Is the above ratio of sides correct? Give a valid reason.

Q: 12 **In a △KLM, N and O are points on KM and LM, respectively, such that NO || KL.** **[1]**

If KN:KM = 3:5 and OM = 12 cm, find the length of LM. Show your work.

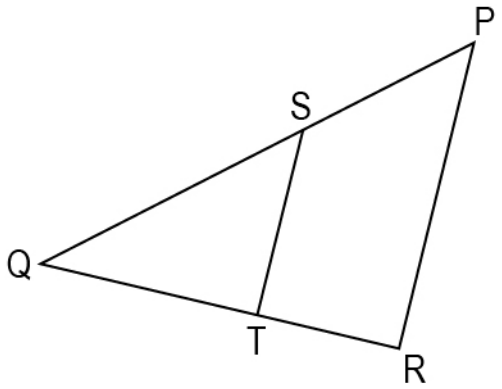
Q: 13 **Shown below is a figure.** **[1]**



(Note: The figure is not to scale.)

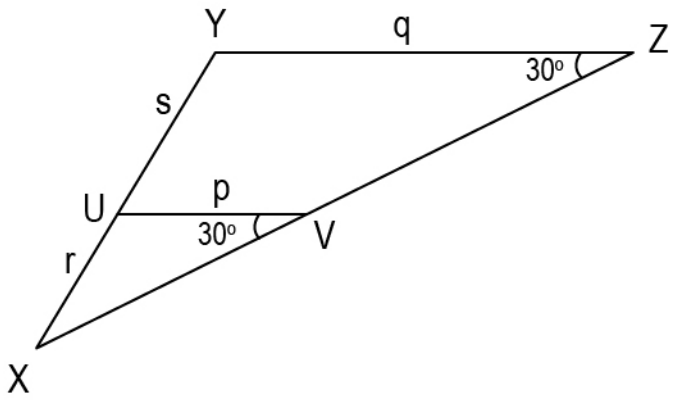
Show that ∠TUS = ∠TWV.

Q: 14 **In the following figure, S is a point on PQ and T is a point on QR such that ST || PR.** **[2]**



Prove that ΔPQR is similar to ΔSQT.

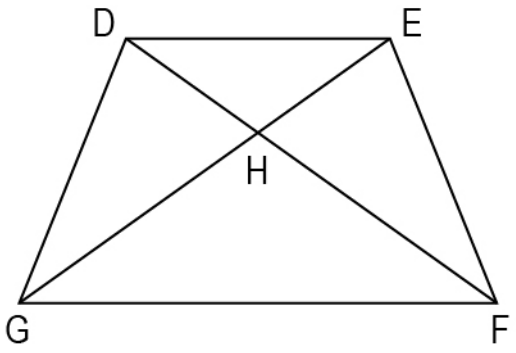
Q: 15 **Shown below are △XYZ and △XUV. All measurements are in cm.** **[2]**



(Note: The figure is not to scale.)

Show that $p = \frac{qr}{r+s}$.

Q: 16 **Shown below is a trapezium DEFG with DE || GF. The diagonals, DF and EG intersect at point H.** **[2]**



Prove that △DHE is similar to △FHG.

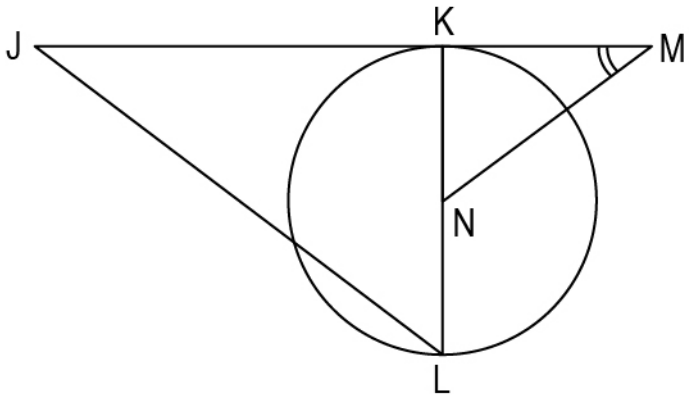
Q: 17 **Tanya cut a square piece of paper along its diagonal to get two right-angled triangles. He claimed that both these triangles are equilateral triangles.** **[2]**

Is his claim correct? Justify your answer.

Q: 18 **Sarthak notices that his 24 cm water bottle casts a shadow of 30 cm at a particular time of the day.** **[2]**

If Sarthak is 150 cm tall, what is the length of the shadow he casts at the same time? Show your work and give valid reasons.

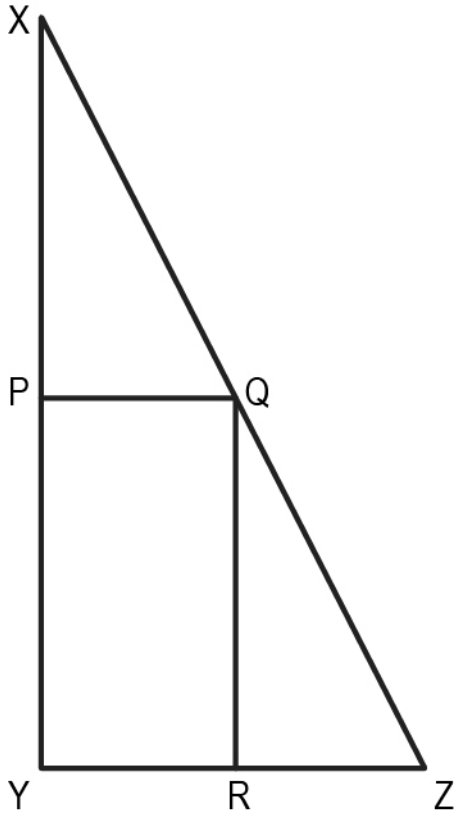
Q: 19 **In the figure below, JM is tangent to the circle which has its centre at point N and ∠LJK = ∠NMK.** **[2]**



(Note: The figure is not to scale.)

If JL = 15 cm, find the length of MN. Show your work.

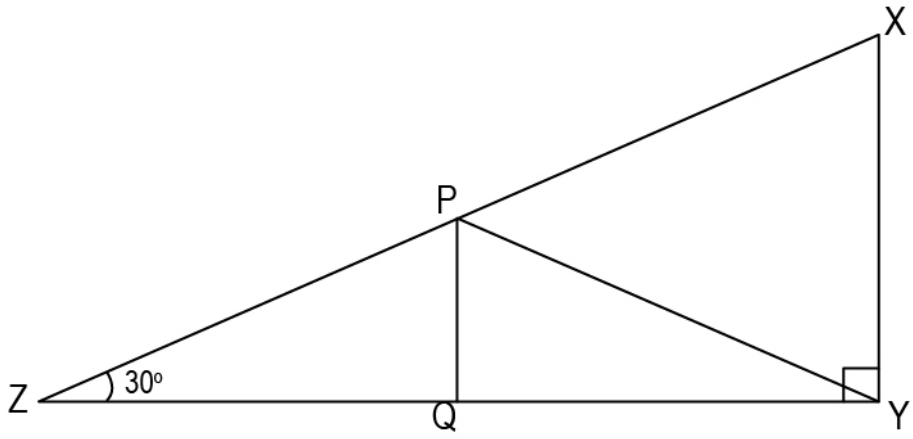
Q: 20 **In the figure below, QX = 10 cm, QZ = 8 cm, RZ = *b* cm, RY = (*b* + 1) cm and XY || QR.** **[3]**



(Note: The figure is not to scale.)

i) Find the length of YZ. Show your work.
ii) If PQ || YZ, show that $\frac{PX}{PY} = \frac{RY}{RZ}$.

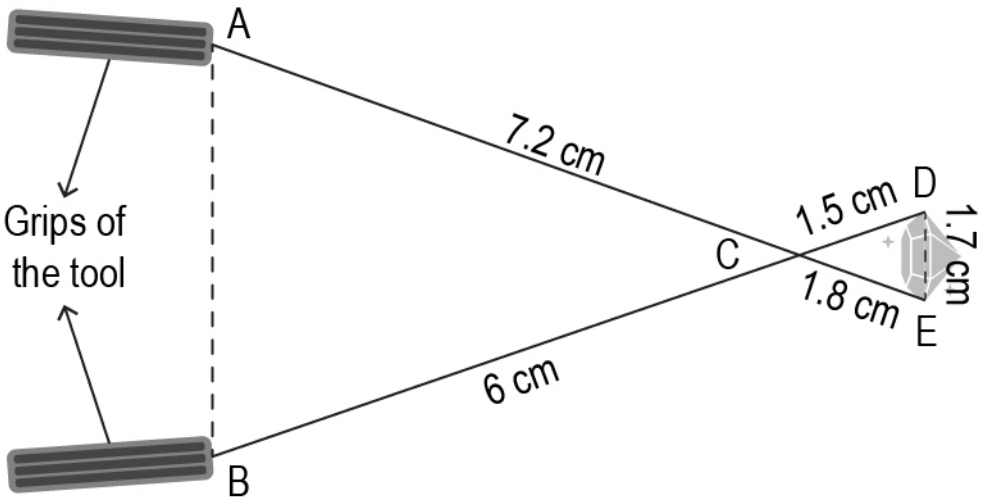
Q: 21 **In the figure below, PQ is drawn such that ZQ = QY and ZP = PX.** **[3]**



(Note: The figure is not to scale.)

i) Show that ▲PQZ ~ ▲XYZ.
ii) Find ∠PYQ. Show your work.

Q: 22 **Ritika's grandfather is a jeweller who needs to pick up a newly cut sapphire and place it in a necklace. To do so he uses a tool that is pictured in the figure below. The tool must be held in a specific manner as to not damage the sapphire.** **[3]**



(Note: The figure is not to scale.)

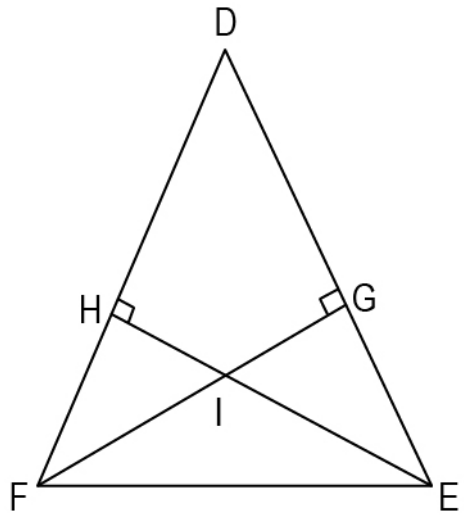
Ritika tells her grandfather tells her grandfather the width at which he needs to hold the tool.

i) How does Ritika know how wide apart the grips of the tool are to be held?
ii) Find the width at which Ritika's grandfather must hold the tool to safely place the sapphire in the necklace. Show your work.

Q: 23 **In a ▲UVW, X and Y are points on UV and UW, respectively such that the points divide the respective sides in the ratio of 2:1.** **[3]**

If XY = 7 units, find the length of VW. Show your work.

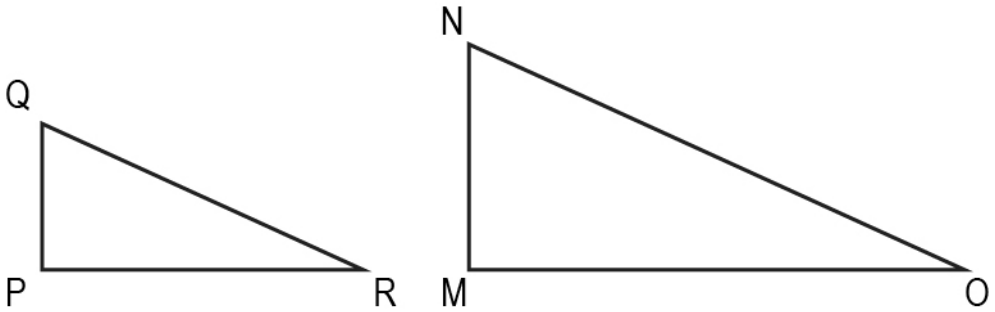
Q: 24 **In △DEF, altitudes EH and FG are altitudes intersecting at point I as shown below.** **[3]**



(Note: The figure is not to scale.)

i) Prove △DGF ~ △DHE.
ii) Prove △IHF ~ △IGE.

Q: 25 **All the corresponding sides of △PQR and △MNO shown below are in the ratio 5:7.** **[5]**



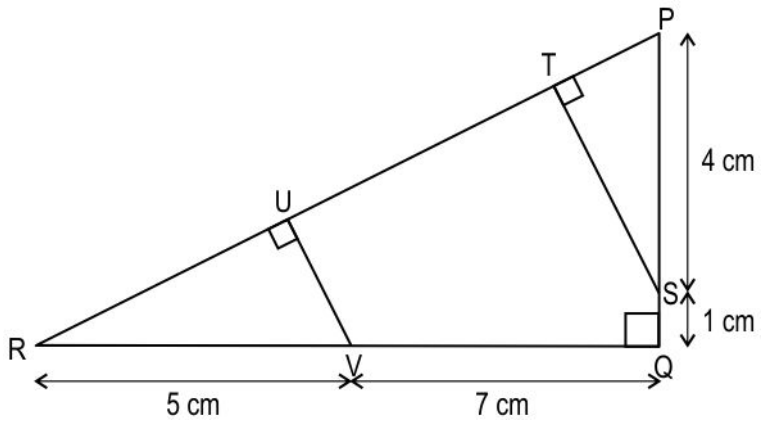
i) Shahnawaz claims, "△PQR is similar to △MNO as per the SSS similarity criterion." Dhruv claims, "△PQR is NOT similar to △MNO as per the AAA similarity criterion as ∠P ≠ ∠O."

Who is correct and incorrect?

ii) Abhiniti said that the ratio of the perimeter of △PQR and △MNO must be 5:7. Is she correct?

Explain your answers.

Q: 26 **Shown below is a figure.** **[5]**



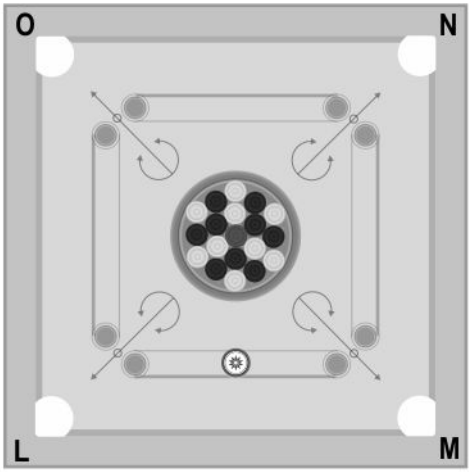
(Note: The figure is not to scale.)

Find the length of UT. Show your work.

Case Study

Answer the questions based on the given information.

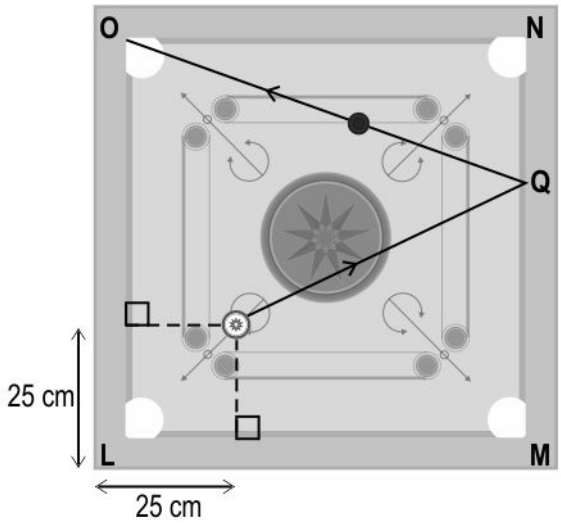
The carrom board has a 75 cm square playing top with four corner pockets. When coins hit the sides, they bounce off at the same angle. There are four types of coins: 9 white, 9 black, a red (the queen), and a larger and heavier striker. The striker is flicked to push these coins across the board to the pockets. See the carrom board below.



(Note: The figure is not to scale.)

Aryan and Sai got bored while playing the game and are now placing the striker and coins at random spots of the board and taking shots.

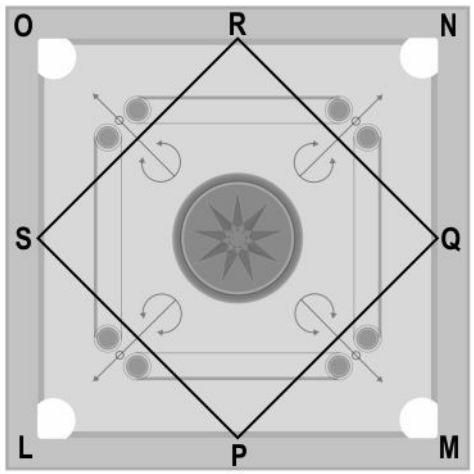
Q: 27 **Shown below is the path when Aryan strikes a white coin into pocket O.** **[3]**



(Note: The figure is not to scale.)

Find the distance QN. Draw a diagram, show your work and give valid reasons.

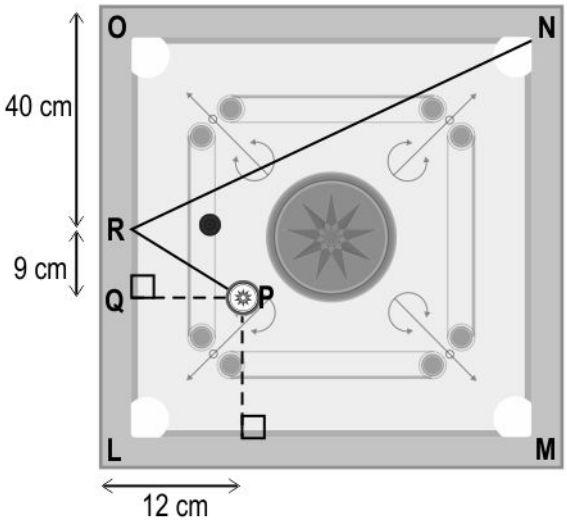
Q: 28 **Sai places the striker at the midpoint of LM. He flicks it in such a way that it hits the midpoints of all the sides and stops at the starting point. The rough sketch of the path of the striker is shown below.** **[1]**



(Note: The figure is not to scale.)

Are there any similar triangles formed? Give a valid reason for your answer.

Q: 29 **Sai flicks the striker in an attempt to hit a coin. He misses the coin and his striker ends up in pocket N. The rough sketch of the path of the striker is shown below.** **[1]**



(Note: The figure is not to scale.)

Find the distance travelled by the striker.

Q.No	Correct Answers
1	1
2	1
3	4
4	1
5	2
6	2
7	2
8	4
9	4

Q.No	What to look for	Marks
10	Assumes AB = BC as p and writes the equation for the area of the triangle as: $\frac{1}{2} \times p^2 = 18$ Using the above equation, finds p as 6 m.	0.5
	Uses the Pythagoras theorem to find the length of string lights required (length of AC) as: $\sqrt{(p^2 + p^2)}$ $= \sqrt{(6^2 + 6^2)}$ $= 6\sqrt{2}$ m	0.5
11	Writes that the the given ratio of sides is not correct.	0.5
	Gives a valid reason. For example, the corresponding sides of $\triangle PQR$ and $\triangle SRT$ are QR and RT respectively. Hence, the ratio of the corresponding sides is 1.	0.5
12	Uses the basic proportionality theorem to write: $\frac{2}{5} = \frac{12}{LM}$	0.5
	Solves the above equation to find the length of LM as 30 cm.	0.5
13	Writes $\frac{TU}{TW} = \frac{TS}{TV}$. Uses the converse of basic proportionality theorem to write VW || SU.	0.5
	Writes that $\angle TUS = \angle TWV$ as they are corresponding angles in parallel lines. (Award full marks if proved using similarity.)	0.5
14	Writes that for $\triangle PQR$ and $\triangle SQT$: i) $\angle PQR = \angle SQT$ (common) ii) $\frac{PQ}{SQ} = \frac{QR}{QT}$ (using basic proportionality theorem)	1
	Hence, concludes that $\triangle PQR \sim \triangle SQT$ by SAS similarity criterion.	1

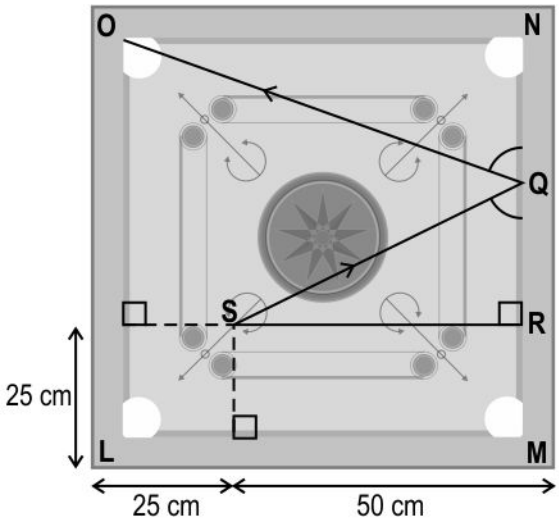
Q.No	What to look for	Marks
15	Writes that in △XYZ and △XUV, i) ∠YXZ = ∠UXV (common) ii) ∠YZX = ∠UVX = 30° (given) Hence, concludes that △XYZ ~ △XUV by AA similarity criterion.	1
	Uses similarity of triangles to write the relation of sides as: $\frac{XY}{XU} = \frac{YZ}{UV}$ Hence, concludes that $p = \frac{qr}{r+s}$.	1
16	Writes any two for △DHE and △FHG: i) ∠DHE = ∠FHG (Vertically opposite angles are equal.) ii) ∠HDE = ∠HFG (Alternate interior angles are equal.) iii) ∠HED = ∠HGF (Alternate interior angles are equal.)	1.5
	Writes that △DHE and △FHG are similar using AAA similarity criterion. (Award full marks if AA similarity criterion is correctly used.)	0.5
17	Assumes the length of each side of the square to be p units, where p is a real number. Uses Pythagoras's theorem to find the length of the hypotenuse as: $\sqrt{(p^2 + p^2)} = p\sqrt{2}$ units. Writes that the length of the hypotenuse does not equal to p.	1.5
	Concludes that the triangle is not an equilateral right-angled triangle and his claim is incorrect.	0.5
18	Mentions that the bottle and its shadow and Sarthak and his shadow form similar triangles.	0.5

Q.No	What to look for	Marks
	Identifies the corresponding sides of similar triangles and writes: $\frac{\text{Height of water bottle}}{\text{Length of the shadow of water bottle}} = \frac{\text{Height of Sarthak}}{\text{Length of the shadow of Sarthak}}$ $\Rightarrow \frac{24}{30} = \frac{150}{\text{Length of the shadow of Sarthak}}$	**1**
	Solves the equation in Step 2 to find the length of Sarthak's shadow as $\frac{375}{2}$ cm or 187.5 cm.	**0.5**
19	**Writes that in △JKL and △MKN,** **i) ∠LJK = ∠NMK (given)** **ii) ∠JKL = ∠MKN (tangents to a circle are perpendicular at the point of contact)** **Hence, concludes that △JKL ~ △MKN by AA similarity criterion.**	**1**
	Finds the ratio of the corresponding sides of △JKL and △MKN as $\frac{KL}{KN} = \frac{2}{1}$ as KN is the radius and KL is the diameter.	**0.5**
	Uses the ratio of corresponding sides of similar triangles writes $\frac{JL}{MN} = \frac{2}{1}$ to get MN as 7.5 cm.	**0.5**
20	**i) Uses basic proportionality theorem to write:** $\frac{QX}{QZ} = \frac{RY}{RZ}$ $\Rightarrow \frac{10}{8} = \frac{b+1}{b}$	**1**
	Solves the above equation to find the value of *b* as 4 cm.	**0.5**
	Uses the value of *b* and finds the length of YZ as 9 cm.	**0.5**
	ii) Uses basic proportionality theorem to write $\frac{PX}{PY} = \frac{QX}{QZ}$.	**0.5**
	Uses steps 1 and 4 to show that $\frac{PX}{PY} = \frac{RY}{RZ}$.	**0.5**

Q.No	What to look for	Marks
21	i) Mentions $\frac{ZQ}{QY} = \frac{ZP}{PX}$ and finds PQ || XY using converse of basic proportionality theorem. (Award full marks if another appropriate method is correctly used.)	0.5
	Writes that in △PQZ and △XYZ, ♦ ∠PQZ = ∠XYZ = 90° (corresponding angles as PQ || XY) ♦ ∠PZQ = ∠XZY (common) Hence, △PQZ ~ △XYZ using AA similarity criterion.	1
	ii) Gives proof for either similarity or congruency of △PQY and △PQZ. For Example, ♦ $\frac{PQ}{PQ} = \frac{QY}{QZ} = 1$ ♦ ∠PQY = ∠PQZ = 90° Hence, △PQY ~ △PQZ using SAS similarity criterion.	1
	Finds ∠PYQ = ∠PZQ = 30° as △PQY is similar to △PQZ.	0.5
22	i) Writes that she can know the width by using the properties of similar triangles.	0.5
	ii) Proves that △EDC and △ABC are similar. For example, i) ∠DCE = ∠ACB ii) $\frac{CE}{AC} = \frac{CD}{BD}$ Hence, using SAS similarity criterion, △EDC and △ABC are similar.	1.5
	Uses the above step to get the following equation, $\frac{CE}{AC} = \frac{CD}{BD} = \frac{DE}{AB} = \frac{1}{4}$ Solves it to find the width, AB = 6.8 cm.	1
23	Writes that in △UXY and △UVW: i) $\frac{UX}{UV} = \frac{UY}{UW} = \frac{2}{3}$ (given) ii) ∠XUY = ∠VUW (common angle) Hence, by SAS similarity criterion, △UXY and △UVW are similar.	1.5

Q.No	What to look for	Marks
	Uses the ratio of the corresponding sides of similar triangles to write: $\frac{UX}{UV} = \frac{XY}{VW}$ $\Rightarrow \frac{2}{3} = \frac{7}{VW}$	1
	Solves the above equation to find the length of VW as 10.5 units.	0.5
24	i) Writes that for $\triangle DGF$ and $\triangle DHE$, ♦ $\angle DGF = \angle DHE = 90°$ ♦ $\angle FDG = \angle EDH$ (Common)	1
	Uses AA similarity criterion to prove that $\triangle DGF \sim \triangle DHE$.	0.5
	ii) Writes that for $\triangle IHF$ and $\triangle IGE$, ♦ $\angle IHF = \angle IGE = 90°$ ♦ $\angle HFI = \angle GEI$ (Corresponding angles of similar triangles, $\triangle DGF$ and $\triangle DHE$)	1
	Uses AA similarity criterion to prove $\triangle IHF \sim \triangle IGE$.	0.5
25	i) Mentions that Shahnawaz is correct.	0.5
	Mentions that as per the SSS similarity criterion, the ratio of corresponding sides must be the same, which is true in this case.	0.5
	Mentions that Dhruv is incorrect.	0.5
	Mentions that as per the AAA similarity criterion, the corresponding angles must be equal. In PQR and $\triangle MNO$, $\angle P$ and $\angle O$ are not corresponding angles. Hence, AAA similarity criterion cannot be used.	1
	ii) Mentions that Abhiniti is correct.	0.5
	Uses the information from part i), $\triangle PQR$ is similar to $\triangle MNO$ to write: PQ = $\frac{5}{7}$ MN, QR = $\frac{5}{7}$ NO and RP = $\frac{5}{7}$ OM.	1

Q.No	What to look for	Marks
	Writes the following, $\frac{\text{Perimeter of } \Delta PQR}{\text{Perimeter of } \Delta MNO} = \frac{PQ + QR + RP}{MN + NO + OM}$ **Simplifies the expression to find the ratio of the perimeter of ▲PQR and ▲MNO as $\frac{5}{7}$.**	**1**
26	**Uses Pythagoras theorem in ▲PQR to find the length of PR as:** $PR^2 = 5^2 + 12^2$ $\Rightarrow PR = 13$	**1**
	Writes in ▲VUR and ▲PQR: ♦ ∠VUR = ∠PQR (Right angle) ♦ ∠VRU = ∠PRQ (Common angle) **Hence, by AA similarity criterion, ▲VUR ~ ▲PQR.**	**1**
	Writes that in ▲PTS and ▲PQR: ♦ ∠PTS = ∠PQR (Right angle) ♦ ∠TPS = ∠RPQ (Common angle) **Hence, by AA similarity criterion, ▲PTS ~ ▲PQR.**	**1**
	Uses properties of similar triangles to write: **i)** $\frac{UR}{QR} = \frac{VR}{PR}$ **ii)** $\frac{PT}{PQ} = \frac{PS}{PR}$ **Evaluates equation i) to find UR = $\frac{60}{13}$ cm and equation ii) to find PT = $\frac{20}{13}$ cm.**	**1.5**
	Finds the length of UT as 13 - $\frac{60}{13}$ - $\frac{20}{13}$ = $\frac{89}{13}$ cm or 6 $\frac{11}{13}$ cm.	**0.5**

Q.No	What to look for	Marks
27	**Draws a rough diagram. The figure may look as follows,**  	**0.5**
	Shows that ΔQRS and ΔQNO are similar. For example, **i) ∠OQN = ∠SQR (mentioned in the question)** **ii) ∠QRS = ∠ QNO = 90°**	**1**
	Uses the above step to conclude that ΔQRS and ΔQNO are similar by the AAA similarity criterion.	**0.5**
	Finds $\frac{QR}{NQ} = \frac{SR}{ON} = \frac{2}{3}$ as ΔQRS and ΔQNO are similar.	**0.5**
	Solves QR + NQ + 25 = 75 to get NQ = 30cm.	**0.5**
28	**Writes the following for ΔSLP, ΔPMQ, ΔQNR and ΔROS:** **∠SLP = ∠PMQ = ∠QNR = ∠ROS (Right angles)** **All the non-hypotenuse sides of the triangles are equal. (P, Q, R and S are midpoints of the sides of a square.)**	**0.5**

Q.No	What to look for	Marks
	Writes that $\triangle SLP \sim \triangle PMQ \sim \triangle QNR \sim \triangle ROS$ by SAS congruency criterion. Hence, concludes that all the triangles are similar triangles as they are congruent. (Award full marks if proved using suitable alternative method.)	0.5
29	Uses Pythagoras theorem to come up with the following equations, i) $PQ^2 + QR^2 = PR^2$ ii) $NO^2 + OR^2 = NR^2$ Solves the two equations to find PR = 15 cm and NR = 85 cm and distance travelled by the striker as 100 cm.	1