CHAPTER 10

TRIANGLES

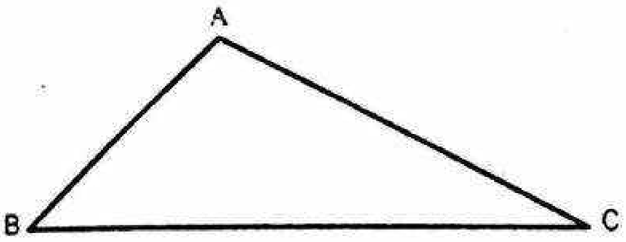
- A plane figure bounded by three lines in a plane is called a triangle.

Types of Triangles :-

1. On the basis of sides :-

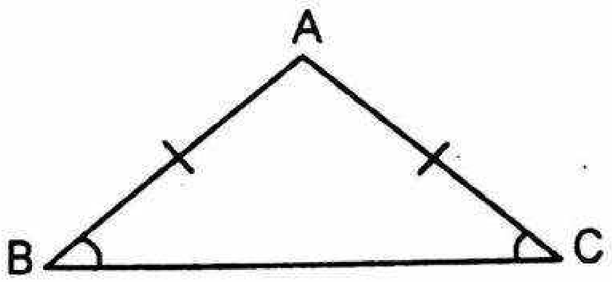
(i) Scalene Triangle - All three sides are of different lengths is called a Scalene Triangle.

$AB \neq BC \neq CA$



(ii) Isosceles Triangle :- Two sides are of equal length, is called a Isosceles Triangle.

$AB = AC$

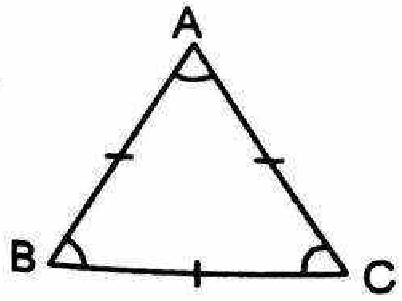


→ Angles opposite to equal sides are equal.

i.e. $\angle B = \angle C$

(iii) Equilateral Triangle - A triangle having all sides equal is called Equilateral triangle.

$AB = BC = CA$

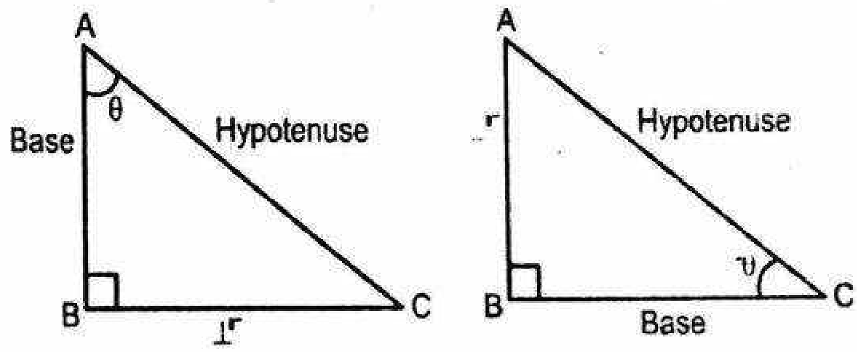


All angles are equal and is equal to 60°

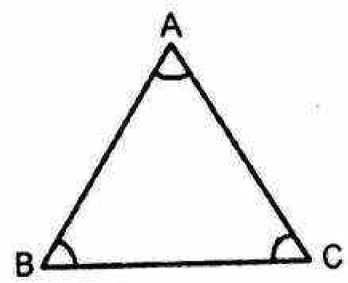
$\angle A = \angle B = \angle C = 60°$

2. On the basis of Angles :-

(i) Right-angled Triangle - In a triangle, in which one of the angles measures 90° is called a right-angled triangle.

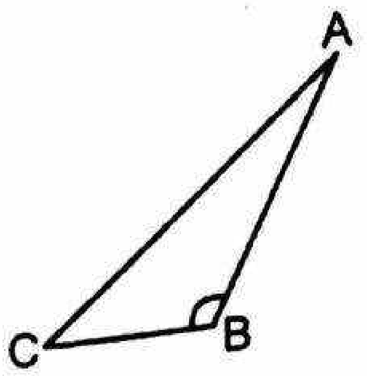


(ii) Acute-angled Triangle - A triangle in which every angle is more than 0° and less than 90° is called an acute-angle triangle.



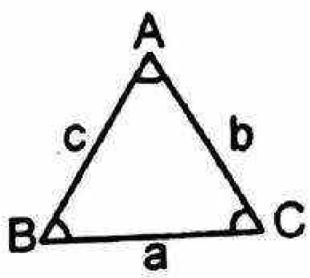
(iii) Obtuse-angled triangle - A triangle in which one of the angles is more than 90° is called an obtuse-angle triangle.

Note: An equilateral triangle is an isosceles triangle but the converse is not true.

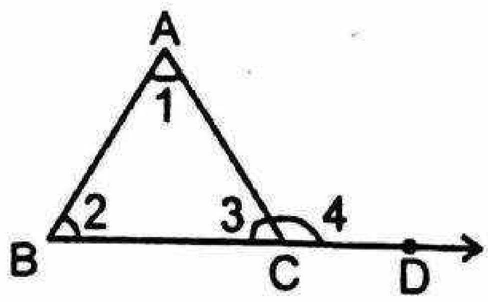


Perimeter of a triangle (2s) :-
The sum of lengths of three sides of a triangle is called its perimeter.

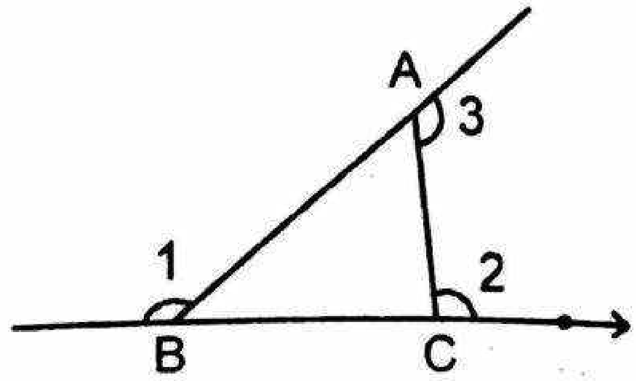
$2s = a + b + c$



Types of Triangles :-
Angle Sum property of a triangle :
Theorem 1. The sum of the angles of a Δ is 180°
Theorem 2. (Exterior angle Theorem) :- If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.
$\angle ACD = \angle ABC + \angle BAC$
$\Rightarrow \angle 4 = \angle 1 + \angle 2$

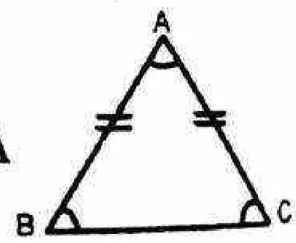


Note: An exterior angle of a triangle is greater than either of the interior opposite angles.
i.e. $4 > 1$, and $4 > 2$
If three sides of triangle be produced in order then sum of exterior angles so formed is 360°.
$\angle 1 + \angle 2 + \angle 3 = 360°$

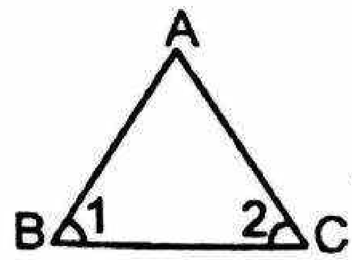


→ **Some properties of triangle** :
Theorem 3. Angles opposite to equal sides of an isosceles triangle are equal.
Here ΔABC is an isosceles Δ i.e. $AB = AC$

$\angle ABC = \angle BCA$



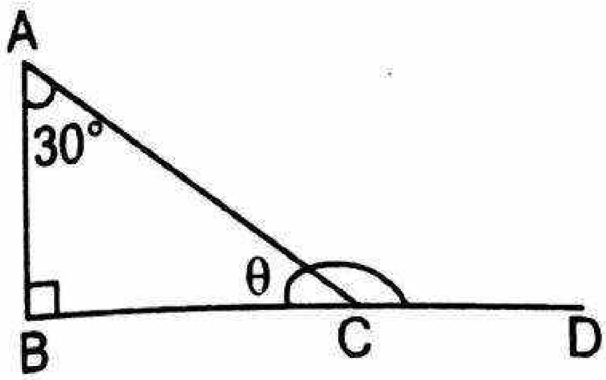
Theorem 4. The sides opposite to equal angles of a triangle are equal.
Here, $\angle B = \angle C \Rightarrow \angle 1 = \angle 2$



$\therefore AB = AC$

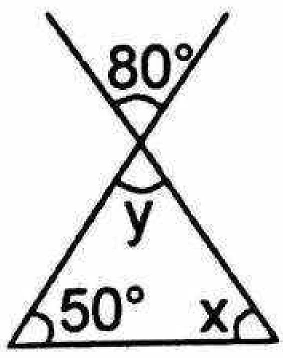
Exercise
LEVEL - 1

1. In the given figure, if $\angle ABC = 90°$, and $\angle A = 30°$, then $\angle ACD =$



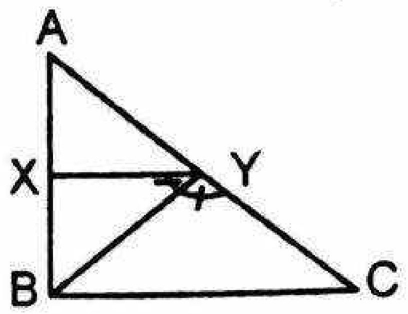
(a) 120° (b) 100°
(c) 110° (d) None of these

2. Value of x and y is :



(a) $x = 60°$, $y = 80°$
(b) $x = 80°$, $y = 50°$
(c) $x = 50°$, $y = 80°$
(d) None of these

3. In ΔABC. a line XY parallel to BC intersects AB at X and AC at Y :
If BY bisects $\angle XYC$, then $\angle CBY$: $\angle CYB$ is :



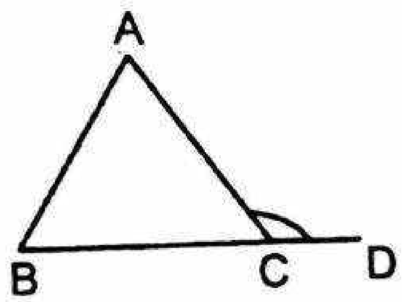
(a) 5 : 4 (b) 4 : 5
(c) 1 : 1 (d) 6 : 5

4. In a triangle ABC which of the statements is necessarily true ?
(a) AB + BC < AC
(b) AB + BC > AC
(c) AB + BC = AC
(d) $AB^2 + BC^2 = AC^2$

5. In $\Delta ABC, \angle A > 90°$, then $\angle B$ and $\angle C$ must be :
(a) acute
(b) obtuse
(c) one acute and one obtuse
(d) Can't be determined

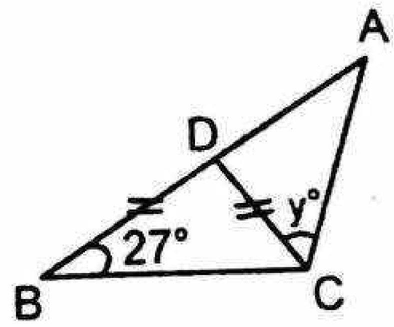
6. If the angles of triangle are in the ratio 1 : 4 : 7 then the value of the largest angle is :
(a) 135° (b) 84°
(c) 105°
(d) None of these

7. In the triangle ABC, side BC is produced to D, $\angle ACD = 100°$ if BC = AC, then find $\angle ABC$ is :



(a) 40° (b) 50°
(c) 80°
(d) can't be determined

8. In the following figure ADBC, BD = CD = AC, $\angle ABC = 27°$, $\angle ACD = Y$. Find the value of y :



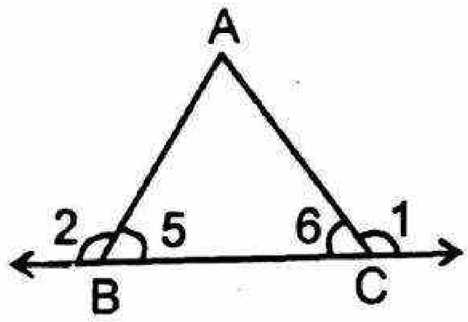
(a) 27° (b) 54°
(c) 72° (d) 58°

9. ABC is an isosceles triangle with AB = AC. Side BA is produced to D such that AB = AD. Find $\angle BCD$:
(a) 60° (b) 90°
(c) 120°
(d) can't be determined

10. A, B, C, are the three angles of a Δ. If $A - B = 15°$ and $B - C = 30°$, then $\angle A$ is equal to :
(a) 65° (b) 80°
(c) 75° (d) 85°

11. In a Δ ABC, IF $2\angle A = 3\angle B = 6\angle C$, then $\angle A$ is equal to :
(a) 60° (b) 30°
(c) 90° (d) 120°

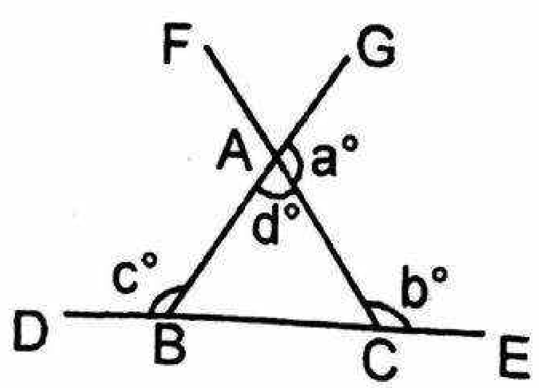
12. In the given figure, the side BC of a ΔABC is produced on both sides, then $\angle 1 + \angle 2$ is equal to :



(a) $\angle A + 180°$ (b) $180° - \angle A$
(c) $\frac{1}{2}(\angle A + 180°)$ (d) $\angle A + 90°$

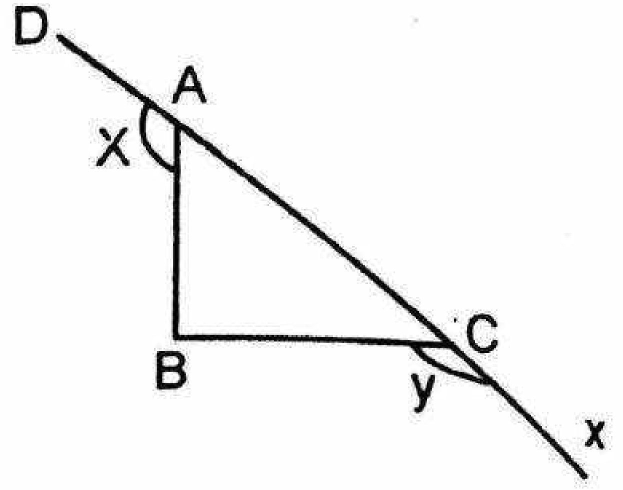
13. In a Δ ABC, $\angle A = x°$ $\angle B = y°$ and $\angle C = (y + 20)°$. If $4x - y = 10$, then the triangle is :
(a) Right-angled
(b) Obtuse-angled
(c) Equilateral-angled
(d) None of these

14. It is given that $d° = 70°$, $b° = 120°$, then :



(a) $c° = 130°$ (b) $a° = 110°$
(c) Both (a) and (b) are correct
(d) Both (a) and (b) are wrong

15. It is given that $AB \perp BC$. Which one of the following is true :



(a) $x + y = 180°$
(b) $x + y = 270°$
(c) $x + y = 300°$
(d) can not be said

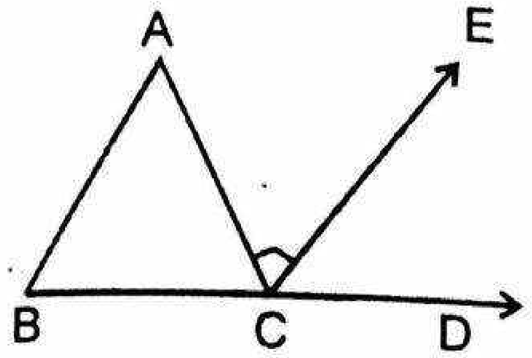
16. If the angles of a triangle are in the ratio 2 : 3 : 4, then the largest angle:
(a) 60° (b) 80°
(c) 100° (d) 75°

17. Of the three angles of a triangle, one is twice the smallest and another is three times the smallest. then find smallest angle :
(a) 60° (b) 90°
(c) 30° (d) 45°

18. The sum of two angles of a triangle is equal to its third angle. Determine the measure of third angle :
(a) 100° (b) 80°
(c) 120° (d) 90°

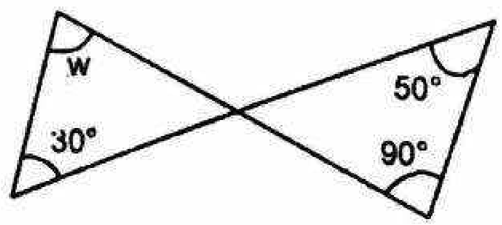
19. If one angle of a triangle is equal to the sum of the other two, then the triangle is :
(a) Right-angled
(b) Obtuse-angled
(c) acute-angled
(d) None of these

20. In the given figure, $AC \perp CE$ and $\angle A : \angle B : \angle C = 3 : 2 : 1$, find the value of $\angle ECD$:
(a) 50° (b) 45°
(c) 55° (d) 60°



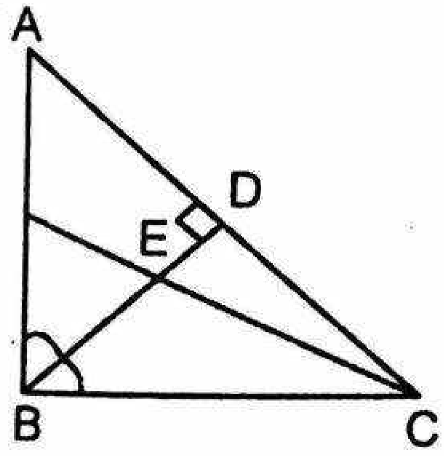
21. The degree measue of each of the three angles of a triangle is an integer. Which of dthe following could not be the ratio of their measures ?
(a) 2 : 3 : 4 (b) 3 : 4 : 5
(c) 5 : 6 : 7 (d) 6 : 7 : 8

22. In the given figure below, what is the value of w ?



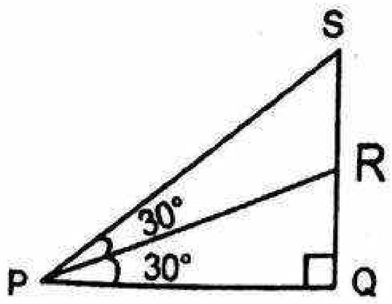
(a) 100° (b) 110°
(c) 120° (d) 130°

23. AB ⊥ BC, BD ⊥ AC and CE bisects ∠C, ∠A = 30°. then, what is ∠CED?



(a) 30° (b) 60°
(c) 45° (d) 65°

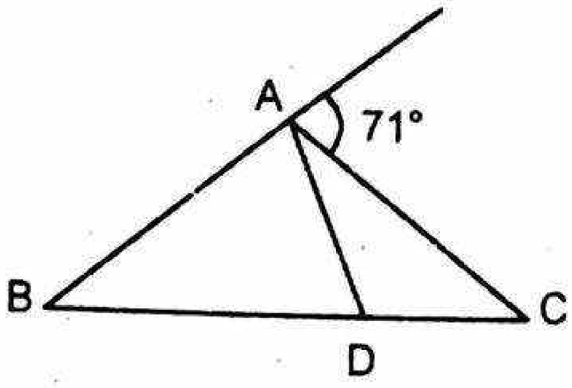
24. In the given figure which of the following statements is true ?



(a) PQ = QS (b) PR = RS
(c) QR = RS (d) PS > RS

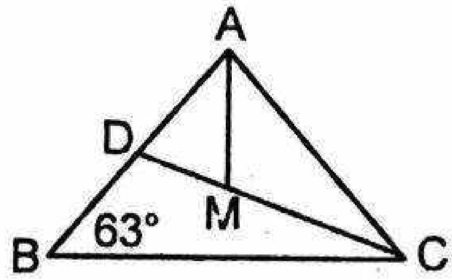
LEVEL - 2

1. In the given figure, if AD = BD = AC then the value of ∠C will be :



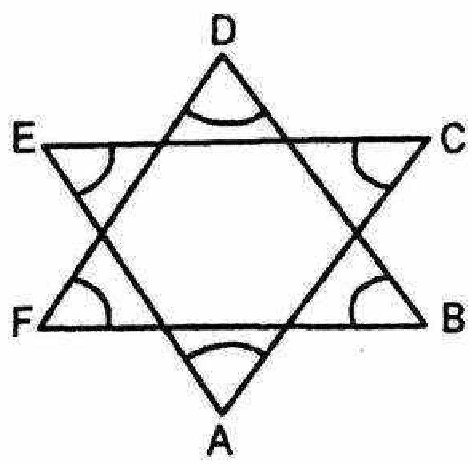
(a) $\frac{124}{3}$ (b) $\frac{142}{3}$
(c) 39°
(d) None of these

2. In the given figure, AM = AD, ∠B = 63° and CD is an angle bisector of ∠C, then ∠MAC = ?



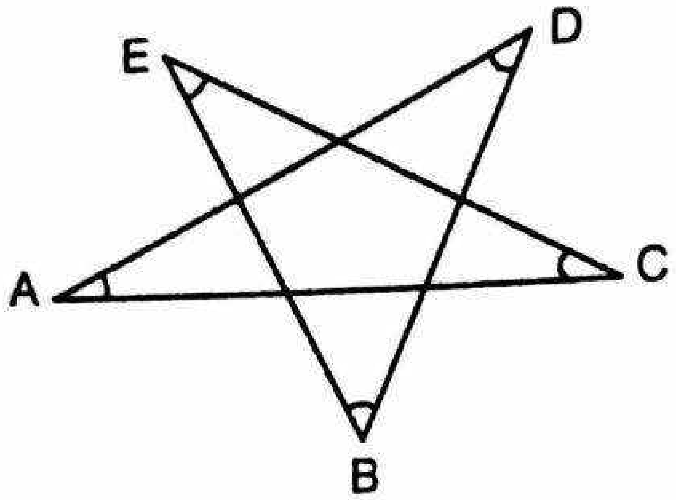
(a) 27° (b) 37°
(c) 63°
(d) None of these

3. In the given figure, ∠A + ∠B + ∠C + ∠D + ∠E + ∠F =



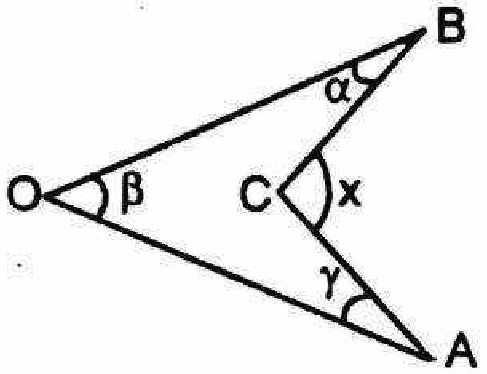
(a) 360° (b) 720°
(c) 180° (d) 300°

4. In the given figure, $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F =$



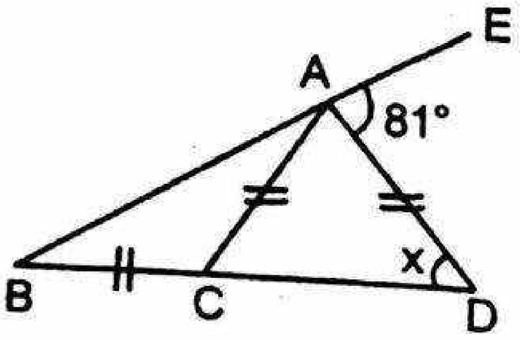
(a) 900° (b) 720°
(c) 180° (d) 540°

5. In the given figure, $x = ?$



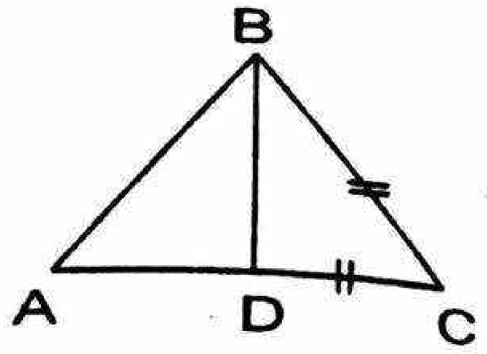
(a) $\alpha + \beta - \gamma$ (b) $\alpha - \beta + \gamma$
(c) $\alpha + \beta + \gamma$ (d) $\alpha + \gamma - \beta$

6. In the given figure, BC = AC = AD, $\angle EAD = 81°$. Find the value of x :

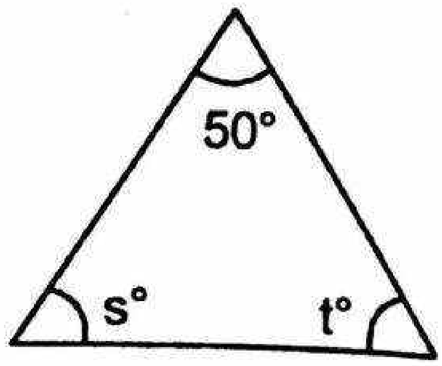


(a) 45° (b) 54°
(c) 63° (d) 36°

7. In the given triangle ABC, BC = CD and ($\angle ABC$ - $\angle BAC$) = 30°. The measure of $\angle ABD$ is :
(a) 30° (b) 45°
(c) 15°
(d) can't be determined

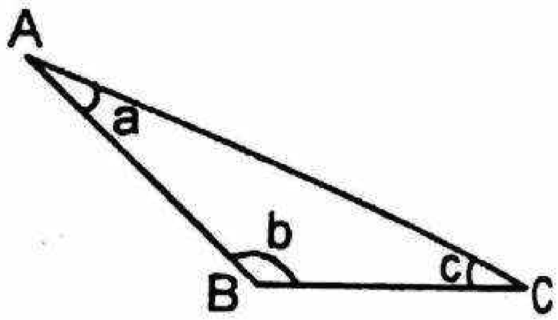


8. In the figure below, if $s < 50° < t$, then



(a) $t < 80$ (b) $s + t < 130$
(c) $50 < t < 80$ (d) $t > 80$

9. ABC is a triangle. It is given that $a + c > 90°$, then b is



(a) greater than 90°
(b) less than 90°
(c) equal to 90°
(d) can't be said

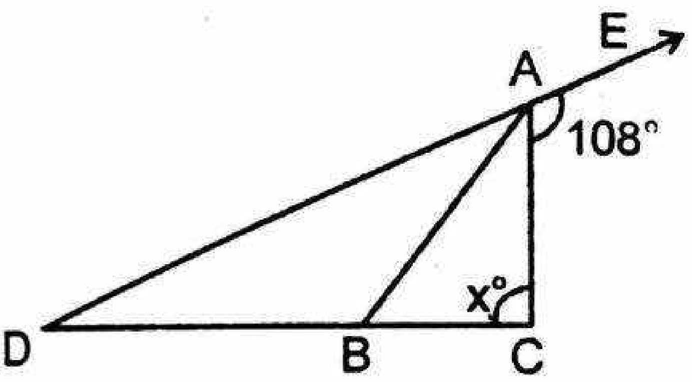
10. The sum of two angles of a triangle is 80° and their difference is 20°, then the smallest angle :
(a) 50° (b) 100°
(c) 30°
(d) None of these

11. If each angle of a triangle is less than the sum of the other two, then the triangle is :
(a) right-angled
(b) acute-angled
(c) obtuse-angled
(d) None of these

12. The angles of a triangle are arranged in ascending order of magnitude. If the difference between two consecutive angles is 10°, find largest angle :
(a) 60° (b) 100°
(c) 50° (d) 70°

13. If the side BC of a ΔABC is produced on both sides, then the sum of the exterior angles so formed is greater than $\angle$A by :
(a) one right angle
(b) three right angles
(c) two right angles
(d) None of these

14. In the given figure, AB divides $\angle$DAC in the ratio 1: 3 and AB = DB. The value of x :

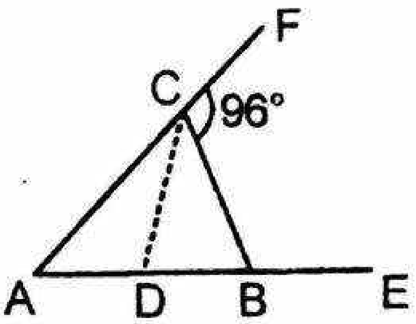


(a) 90° (b) 80°
(c) 100° (d) 100°

15. The side BC of Δ is produced to D. If $\angle ACD = 108°$ and $\angle B = \frac{1}{2} \angle A$ then $\angle$A is :
(a) 36° (b) 108°
(c) 59° (d) 72°

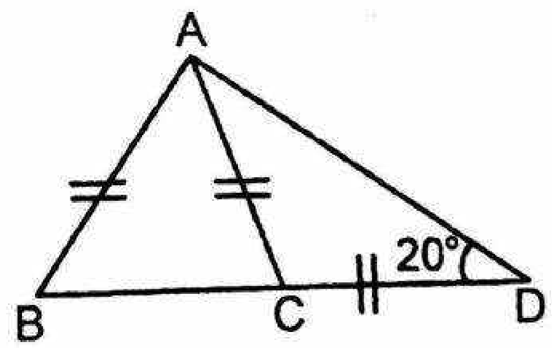
16. We have an angle of $2\frac{1°}{2}$. How big will it look through a glass that magnifies things three times ?
(a) $2\frac{1°}{2} \times 4$ (b) $2\frac{1°}{2} \times 3$
(c) $2\frac{1°}{2} \times 2$ (d) None of these

17. In the given figure below, if AD = CD = BC, and $\angle BCF = 96°$, How much is $\angle$DBC ?



(a) 32° (b) 84°
(c) 64°
(d) can't be determined

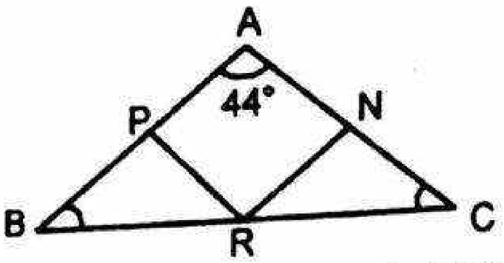
18. Consider ΔABD such that $\angle ADB = 20°$ and C is a point on BD such that AB = AC and CD = CA. Then the measure of $\angle$ABC is :



(a) 40° (b) 45°
(c) 60° (d) 30°

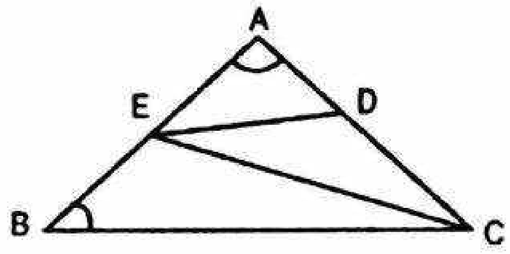
LEVEL - 3

1. If $\angle A = 44°$, $BP = BR$ and $CN = RC$ then $\angle PRN$ = ?



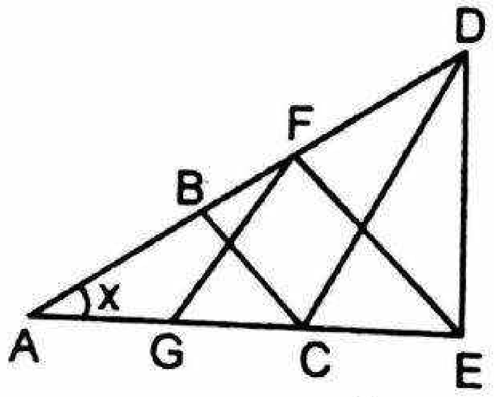
(a) 58° (b) 78°
(c) 68° (d) 66°

2. In the given figure, if $\angle B = \angle C = 78°$, $BC = EC$, $CD = BC$ and DE not parallel to BC, then $\angle EDB$ =



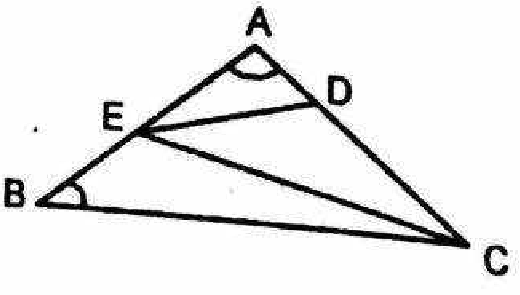
(a) 18° (b) 12°
(c) 22°
(d) None of these

3. In the given figure, if $AB = BC = CD = EF = DE = GA = FG$, then x =



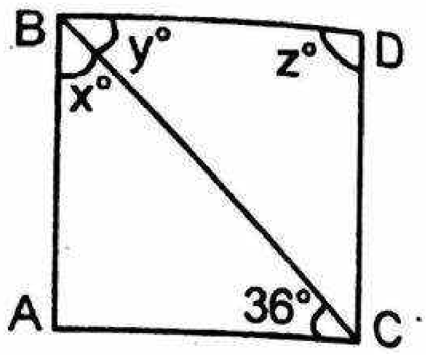
(a) $\frac{153}{7}$ (b) 28°
(c) $\frac{180}{7}$ (d) None of these

4. In the given figure, if $AD = DE = EC = BC$ then $\angle A : \angle B$ =



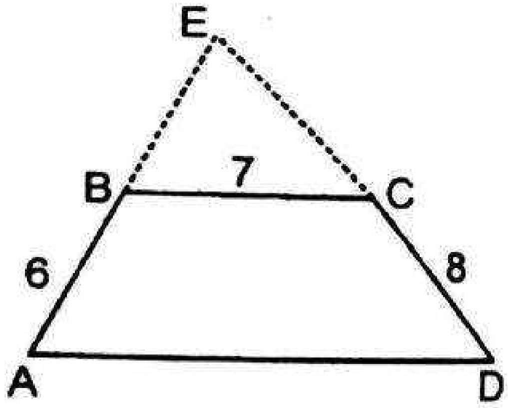
(a) 1 : 3 (b) 2 : 5
(c) 3 : 1 (d) 1 : 2

5. In the given figure, AB || DC. If $x = \frac{4}{3}y$ and $y = \frac{3}{8}z$, then $\angle BAD$:



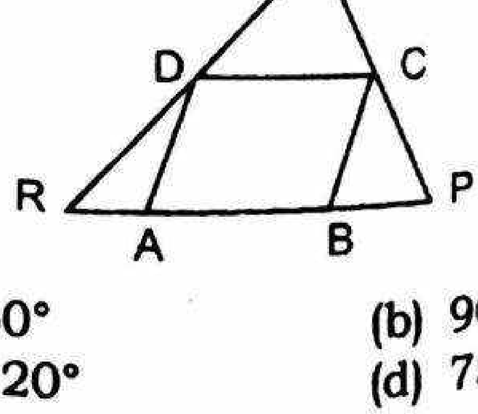
(a) 48° (b) 96°
(c) 108° (d) 84°

6. In the trapezium ABCD shown below, AD || BC and AB = 6, BC = 7, CD = 8, AD = 17, If sides AB and CD are extended to meet at E, find the measue of $\angle AED$:



(a) 120° (b) 100°
(c) 80° (d) 90°

7. In the given figure, ABCD is a rhombus and AR = AB = BP, then the value of $\angle RTP$ is :



(a) 60° (b) 90°
(c) 120° (d) 75°

Hints and Solutions:

LEVEL-1

1.(a) $\angle ACD = \angle B + \angle A$
$= 90^\circ + 30^\circ$
$= 120^\circ$(exterior agnle)

2.(c) $y = 80^\circ$ (vertically opposite angle)
$\therefore x = 180^\circ - 50^\circ - 80^\circ = 50^\circ$

3.(c) $\angle XYB = \angle YBC$ and $\angle XYB = \angle BYC$
$\Rightarrow \angle YBC = \angle BYC$

4.(b)

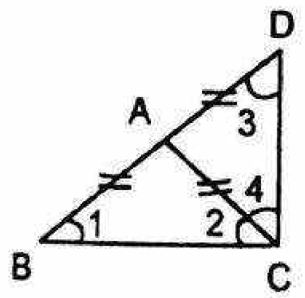
5.(a) $\angle B + \angle C < 90^\circ$
$\because \angle A + \angle B + \angle C = 180^\circ$

6.(c) $x + 4x + 7x = 180^\circ \Rightarrow x = 15^\circ$
$\therefore 7x = 105^\circ$

7.(b) $\angle ACD = \angle ABC + \angle BAC$ (exterior angle)
$\Rightarrow 100^\circ = \angle ABC + \angle ABC$
$(\because BC = AC)$
$\Rightarrow 2\angle ABC = 100^\circ \Rightarrow \angle ABC = 50^\circ$

8.(c) $\angle BCD = 27^\circ$
$\angle BDC = 180^\circ - (27^\circ + 27^\circ)$
$= 126$
$\therefore \angle ACD = 180^\circ - (54^\circ + 54^\circ)$
$= 72^\circ$

9.(b)



$\angle 1 = \angle 2 \quad \because AB = AC$
and $\angle 3 = \angle 4 \quad \because AB = AC = AD$
Now, $\angle B + \angle C + \angle D = 180^\circ$
$\Rightarrow \angle 1 + \angle 2 + \angle 4 + \angle 3 = 180^\circ$
$\Rightarrow \angle 2 + \angle 2 + \angle 4 + \angle 4 = 180^\circ$
$\Rightarrow 2(\angle 2 + \angle 4) = 180^\circ$
$\Rightarrow \angle 2 + \angle 4 = 90^\circ \Rightarrow \angle C = 90^\circ$

10.(b) Since A, B and C are the angles of a Δ.
$\therefore \angle A + B + C = 180^\circ$
Now, $A - B = 15^\circ, B - C = 30^\circ,$
$\therefore B = C + 30^\circ$
$\therefore \angle A = B + 15^\circ = C + 30^\circ + 15^\circ = C + 45^\circ$
$\therefore A + B + C = (C + 45^\circ) + (C + 30^\circ) + C = 180^\circ$
$3C = 180^\circ - 75^\circ = 105^\circ \Rightarrow c = 35^\circ$
$\therefore \angle A = 35^\circ + 45^\circ = 80^\circ$

11.(c) Let $2\angle A = 3\angle B = 6\angle C = K$

$$\therefore \angle A = \frac{K}{2}, \angle B = \frac{K}{3}, \angle C = \frac{K}{6}$$

But $\angle A + \angle B + \angle C = 180^\circ$

$$\frac{K}{2} + \frac{K}{3} + \frac{K}{6} = 180^\circ \Rightarrow K = 180^\circ$$

$$\therefore \angle A = \frac{180^\circ}{2} = 90^\circ$$

12.(a) $\angle 1 = \angle A + \angle 5$ and
$\angle 2 = \angle A + \angle 6$ (exterior angle)
$\angle 1 + \angle 2 = \angle A + (\angle A + \angle 5 + \angle 6)$
$= \angle A + 180^\circ$

13.(a) $x + y + (y + 20) = 180^\circ$
$\Rightarrow x + 2y = 160$
$4x - y = 10 \Rightarrow y = 70, x = 20$
$\therefore$ The angles of the triangle are $20^\circ, 70^\circ, 90^\circ$.

14.(c) $a^\circ = 180^\circ - d^\circ = 180^\circ - 70^\circ$
$= 110^\circ$
and $C^\circ = d^\circ + \angle ACB$
$= 70^\circ + (180^\circ - b^\circ)$
$= 70^\circ + 60^\circ$
$= 130^\circ$

15.(b) $\angle BCA = 180^\circ - Y$
$\therefore x = 90^\circ + (180^\circ - y)$
$\Rightarrow x + y = 270^\circ$

16.(b) Let the angles $= 2x^\circ, 3x^\circ$, and $4x^\circ$
$\therefore 2x + 3x + 4x = 180^\circ$
$\Rightarrow 9x = 180^\circ \Rightarrow x = 20^\circ$
$\therefore$ largest angle $= 4x^\circ = 80^\circ$

17.(c) Let the smallest angles $= x^\circ$
then other two angles $= 2x^\circ$ and $3x^\circ$
$\therefore x + 2x + 3x = 180^\circ \Rightarrow 6x = 180^\circ$
$\Rightarrow x = 30^\circ$

18.(d) Let ABC be a triangle s.t.
$\angle A + \angle B = \angle C$
we know that $(\angle A + \angle B) + \angle C = 180°$

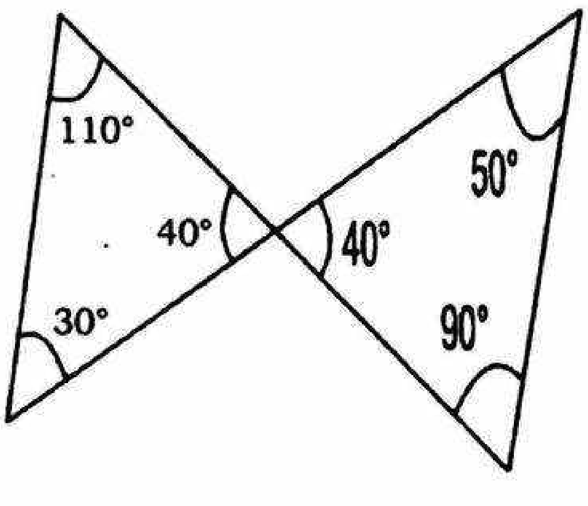
$\Rightarrow \angle C + \angle C = 180°$
$\Rightarrow 2\angle C = 180°$
$\Rightarrow \angle C = 90°$

19.(a) Let ABC be a triangle s.t. $\angle A = \angle B + \angle C$
then,
$\angle A + \angle B + \angle C = 180°$
$\Rightarrow \angle A + \angle A = 180°$
$\Rightarrow \angle A = 90°$

20.(d) $\because \angle A : \angle B : \angle C = 3 : 2 : 1$
$\Rightarrow 3x + x + x = 180°$
$\Rightarrow 6x = 180° \Rightarrow x = 30°$
$\therefore \angle C = x = 30°$
$\angle ECD = 180° - 90° - 30° = 60°$

21.(d) $\because (6 + 7 + 8)x = 180° \Rightarrow x = \dfrac{180°}{21} \neq$ integer

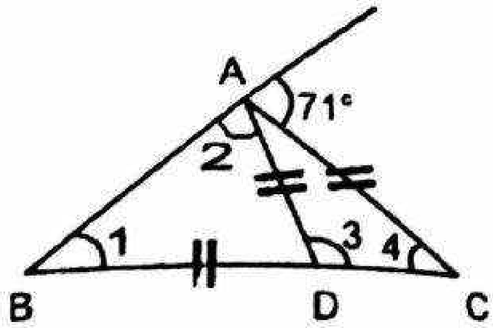
22.(b)



23.(b) $\because \angle A + \angle B + \angle C = 180°$
$\Rightarrow \angle C = 60°$
Now, CE bisects $\angle BCD$ (given)
$\therefore \angle ECD = 30°$
Now, $\angle CED + \angle EDC + \angle DCE = 180°$
$\therefore \angle CED = 60°$

24.(b) $\angle PSQ = 180° - (90° + 60°) = 30°$
in ΔPSR, PR = RS
$(\because \angle PSR = \angle RPS)$

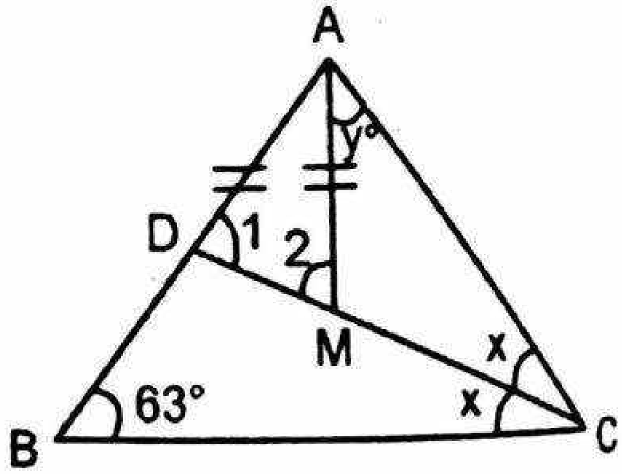
1.(b)



$\because AD = BD$
$\therefore \angle 1 = \angle 2 = X$ (let)
$\therefore \angle 3 = \angle 1 + \angle 2 = 2x$ (external angle)
$\therefore \angle 4 = \angle 3 = \angle 2x$ ($\because$ AD = AC)
Now, in ΔABC,
71° is an external angle.
$\therefore \angle 1 + \angle 4 = 71° \Rightarrow x + 2x = 71° \Rightarrow x = \dfrac{71°}{3}$

$\therefore \angle C = \angle 4 = 2x = \dfrac{142°}{3}$

2.(c)



In ΔBDC, $\angle 1$ is an external angle
$\therefore 1 = 63° + x$
and in Δ AMC, $\angle 2$ is an external angle
$\therefore \angle 2 = x + y°$
$\because$ AM = AD (given)
$\therefore \angle 1 = \angle 2$
$\Rightarrow 63° + x = x + y \Rightarrow y = \angle MAC = 63°$

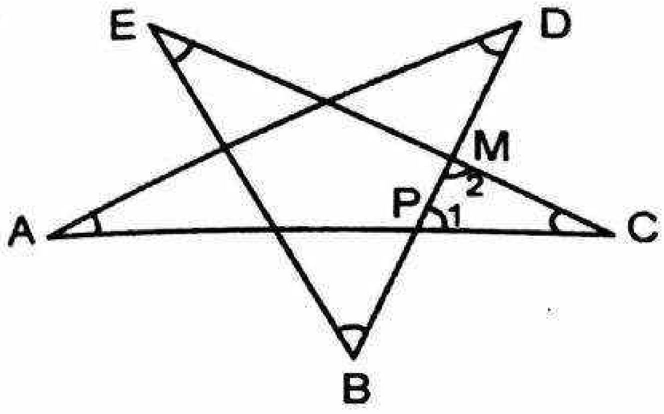
3.(a) Here in ΔAEC,
$\angle A + \angle E + \angle C = 180°$ ____ (i)
In ΔBFD,
$\angle B + \angle F + \angle D = 180°$ ____ (ii)
Adding (i) and (ii) we get,

$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360°$

4.(c) $\angle 2 = \angle E + \angle B$ (exterior angle of ΔMEB)

and $\angle 1 = \angle A + \angle D$ (exterior angle of ΔAPD)

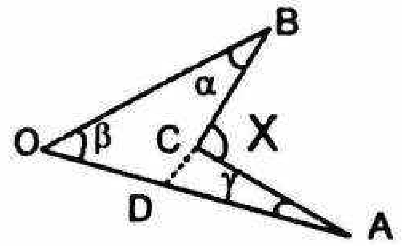
$\therefore$ from PMC



$\angle 1 + \angle 2 + \angle C = 180°$

$\therefore \angle A + \angle B + \angle C + \angle D + \angle E = 180°$

5.(c)



Produc BC to D

$\therefore \angle CDA = \alpha + \beta$ (exterior angle)

In ΔADC, x is an exterior angle.

$\therefore x = \angle CDA + \angle CAD$

$x = \alpha + \beta + \gamma$

6.(b) $\angle ACD = \angle ADC = x$

$\because \angle CAD = (180° - 2x)$

$\angle ABC = \angle BAC = \dfrac{X}{2}$

$(\therefore \angle ABC + \angle BAC = \angle ACD = x)$

$\therefore \angle BAC + \angle CAD + 81° = 180°$

$\therefore \dfrac{X}{2} + (180° - 2x) + 81° = 180°$

$\therefore \dfrac{3}{2}X = 81° \Rightarrow X = 54°$

7.(c) $\angle ABD = \angle ABC - \angle DBC$

$= \angle ABC - \angle BDC$

$= \angle ABC - (\angle ABD + \angle BAD)$

$\Rightarrow 2(\angle ABD) = \angle ABC - \angle BAD$

$= 30°$

$\Rightarrow \angle ABD = 15°$ ($\because \angle BAD = \angle BAC$)

8.(d) $\because s + t + 50° = 180°$

$\Rightarrow s + t = 130°$

$\Rightarrow t = 130° - s$

$\because s < 50°$

$\therefore t > 130° - 50°$

$\Rightarrow t > 80°$

9.(b) $\because a + b + c = 180°$

$\therefore b = 180° - (a + c)$

$\therefore b < 90°$ [$\because a + c > 90°$]

10.(c) Let ABCbe a triangle s.t.

$\angle A + \angle B = 80°$ ----------- (i)

$\angle A - \angle B = 20°$-------------(ii)

(i) + (ii) $2\angle A = 100° \Rightarrow \angle A = 50°$

$\therefore$ from (i) $\angle B = 80° - \angle A \Rightarrow \angle B = 30°$

$\therefore \angle C = 180° - (50° + 30°) = 100°$

$\therefore$ Smallest angle = $\angle B = 30°$

11.(b) Let $\angle A < \angle B + \angle C$ .Then

$2\angle A + \angle B + \angle C \Rightarrow 2\angle A < 180°$

$\angle \Rightarrow A < 90°$

Similarly, $\angle B < 90°$ and $\angle C < 90°$

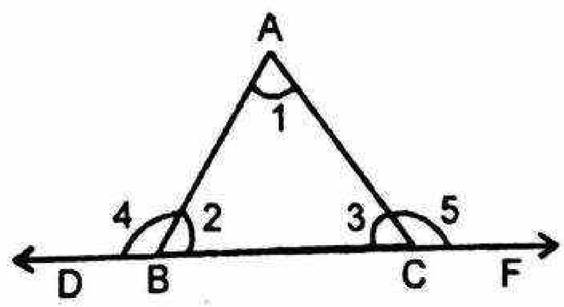
12.(d) Let the angles be $x°$, $(x + 10)°$ and $(x + 20°)$. Then,

$x + (x + 10) + (x + 20) = 180°$

$\Rightarrow 3x = 180° - 30° \Rightarrow x = 50°$

$\therefore$ largest angle = $x + 20° = 70°$

13.(c)



$\angle 4 = \angle 1 + \angle 3$

and $\angle 5 = \angle 1 + \angle 2$ (By exterior angle theorem)

$\therefore \angle 4 + \angle 5 = \angle 1 + (\angle 1 + \angle 2 + \angle 3)$

$= \angle 1 + 180°$

$= \angle 1 + 2 \times 90°$

$= \angle A + 2 \times 90°$

$\Rightarrow \angle 4 + \angle 5$, exceeds $\angle A$ by two right angles.

14.(a) $\angle DAC = 180° - 108° = 72°$

Let $\angle DAB = y°$ $\therefore \angle BAC = 3y°$

$\therefore y + 3y = 72° \Rightarrow y = 18°$

Now, DB = AB

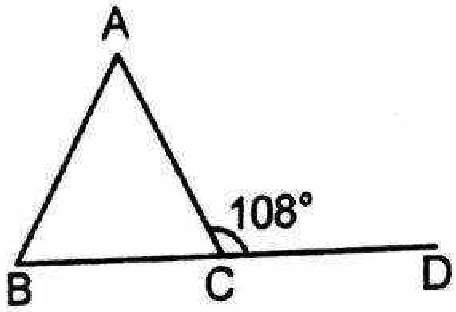
$\Rightarrow \angle ADB = \angle DAB = y° = 18°$

Now, in Δ ACD, $\angle CAE$ is exterior angle

$\therefore 108° = \angle ADC + x° = 18° + x$

$\Rightarrow x = 90°$

15.(d)



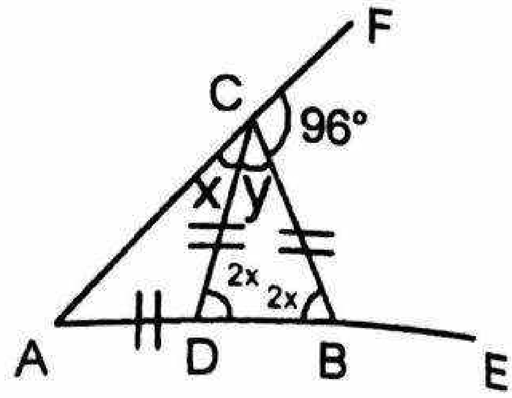
$\angle ACD = \angle ABC + \angle BAC$

$$\Rightarrow 108° = \frac{\angle A}{2} + \angle A$$

$$\Rightarrow \frac{3\angle A}{2} = 108° \Rightarrow \angle A = \frac{108 \times 2}{3} = 72°$$

16.(d) Measure of the angle will not change.

17.(c)



$x + y = 180° - 96 = 84$ ---------- (i)

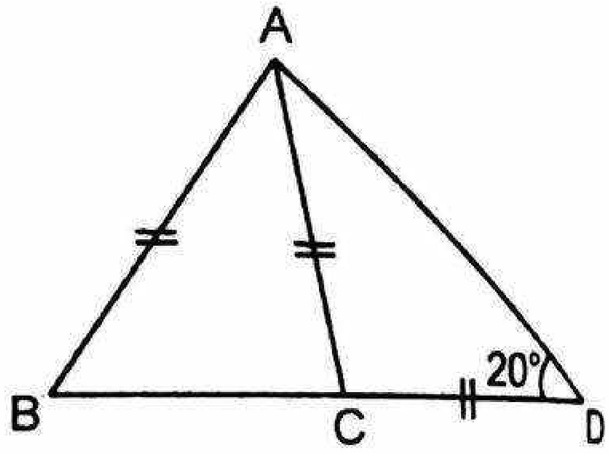
Also for Δ CDB,

$4x + y = 180°$ ---------- (ii)

(ii) - (i), $3x = 96$ or $x = 32°$

$\therefore \angle DBC = 2x = 64°$

18.(a)



$\angle ADB = 20°$

$\therefore \angle CAD = 20°$ (AC = CD)

$\therefore \angle ACB = 20° + 20° = 40°$ (exterior angle of Δ ACD)

$\therefore \angle ABC = \angle ACB = 40°$ ($\because$ AB = AC)

LEVEL-3

1.(c) ∵ BP = BR

∴ ∠BPR = ∠BRP = x° (let)

and CN = RC ∴ ∠CRN = ∠RNC = y° (let)

∴ ∠PBR = 180° - 2x and ∠NCR = 180°-2y

∴ in Δ ABC ∠A + ∠B + ∠C = 180°

⇒ 44°+180°-2x + 180°- 2y = 180°

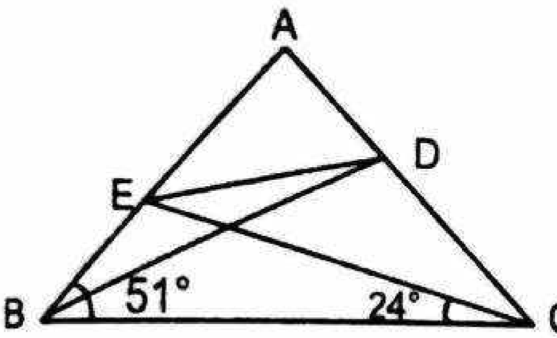
⇒ x + y = 112°

So, ∠PRN = 180° - (x + y)

= 180° - 112°

= 68°

2.(b)



∵ BC = EC

∴ ∠1 = ∠EBC = 78°

from Δ BCD ∵ CD = BC

∴ ∠4 = ∠5

∵ ∠4 + ∠5 + ∠C = 180°

∴ ∠4 + ∠4+ 78° = 180°

⇒ 2∠4 = 102°

⇒ ∠4 = 51°

in Δ BEC, ∠1+ 78°+ ∠7 = 180°

⇒ ∠7 = 102 - 78 = 24°

∴ ∠6 = 78°- 24 = 54°

BC = EC= CD (∵ BC = EC and CD = BC)

∴ in Δ ECD, ∠2 + (∠3 + ∠4) + ∠6 = 180°

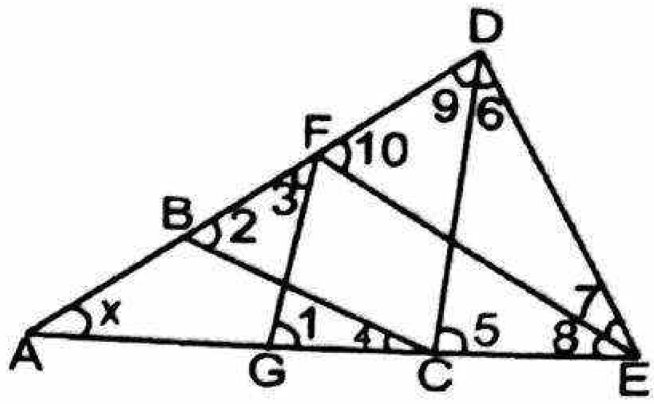
⇒ ∠2 + ∠2 + 54° = 180° [∵ (∠2 = ∠3 + ∠4),

∴ EC = CD]

∴ 2∠2 = 126 ⇒ ∠2 = 63° ⇒ ∠3 + ∠4 = 63°

⇒ ∠3 = 64°- ∠4 = 63° - 51° = 12°

3.(c)



∵ AB = BC

∴ ∠4 = X

∴ ∠2 = x + ∠4 = 2x (exterior angle) [and BC = CD]

∴ ∠9 = ∠2 = 2x

∴ ∠3 = x (∵ FG = GA)

∴ ∠1 = x + ∠3 = 2x (exterior angle)

∵ EF = FG ∠8 = ∠1 = 2x

∠5 = ∠A + ∠9 = x + 2x = 3x (exterior angle)

∵ CD = DE ∴ ∠7 + ∠8 = ∠5

⇒ ∠7 = 3x - 2x = x

∠10 = A + ∠8 = 3x (exterior angle)

∵ DE = EF ∴ ∠9 + ∠6 = ∠10

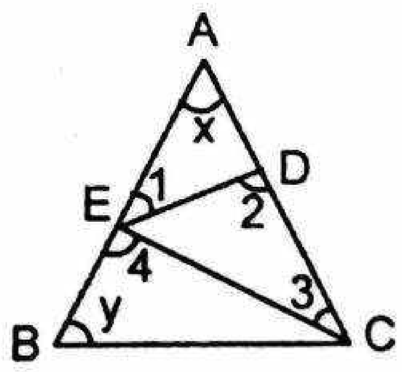
⇒ ∠6 = 3x - 2x = x

Now in D ADE,

⇒ ∠A + ∠D + ∠E = 180°

⇒ ∠x + 3x + 3x = 180° ⇒ $x = \frac{180°}{7}$

4.(a)



∵ AD = DE

∴ ∠1 = x

∴ ∠2 = ∠1 + x = 2x (exterior angle)

∵ DE = EC

∵ ∠3 = ∠2 = 2x

in Δ AEC, ∠4 is an exteri·· angle.

∴ ∠4 = x + ∠3 = 3x

∴ y = ∠4 = 3x (∵ EC = BC)

$\therefore \angle A : \angle B = x : y : = x : 3x = 1 : 3$

5.(b) $\angle ABD = BDC = x^\circ$ (Alternate angles)

in ΔBDC : $\angle BDC + \angle DCB + \angle CBD = 180^\circ$

$\Rightarrow x^\circ + z^\circ + y^\circ = 180^\circ$

$$\Rightarrow \frac{4}{3}y + \frac{8}{3}y + y^\circ = 180^\circ \left[x = \frac{4}{3}y, y = \frac{3}{8}z\right]$$

$\Rightarrow 5y = 180^\circ \Rightarrow y = 36^\circ$

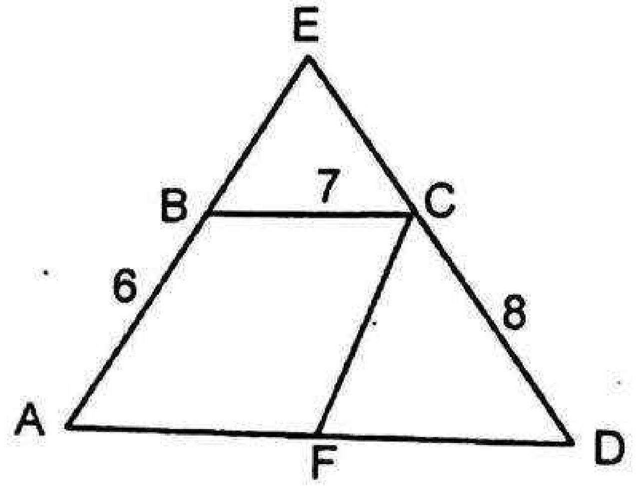
$$\Rightarrow \therefore x = \frac{4}{3}y = 48^\circ \text{ and } z = \frac{8}{3}y = 96^\circ$$

Now in Δ ABD,

$x^\circ + 36^\circ + \angle BAD = 180^\circ$

$\Rightarrow \angle BAD = 180^\circ - 36 - 48 = 96^\circ$

6.(d)



Draw CF || BA

$\therefore$ CF = BA = 6 and FD = AD - AF

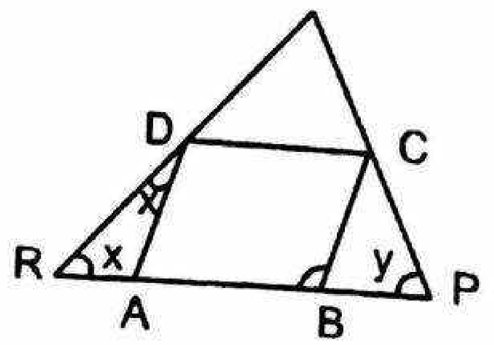
$\Rightarrow$ FD = AD - BC = 17 - 7 = 10

In Δ CFD, CF = 6, FD = 10 and CD = 8

thus, $\angle FCD = 90^\circ$

$\Rightarrow \angle AED = \angle FCD = 90$ (corresponding angles)

7.(b)



Let $\angle ARD = x$ and $\angle BPC = y$

$\angle ARD = \angle RDA$ ($\because$ AR = AB = AD)

$\therefore \angle DAB + \angle RDA = x + x = 2x$ (exterior angle)

similarly,

$\angle BPC = \angle BCP = y$

$\therefore \angle ABC = y + y = 2y$

$\therefore 2x + 2y = 180^\circ$ ($\because$ ABCD is a rhombus)

$\Rightarrow x + y = 90^\circ$

Now in Δ RTP,

$\angle RTP = 180^\circ - (x + y)$
$= 180^\circ - 90^\circ$
$= 90^\circ$

Answer -Key

LEVEL - 1

1. (a)	2. (c)	3. (c)
4. (b)	5. (a)	6. (c)
7. (b)	8. (c)	9. (b)
10. (b)	11. (c)	12. (a)
13. (a)	14. (c)	15. (b)
16. (b)	17. (c)	18. (d)
19. (a)	20. (d)	21. (d)
22. (b)	23. (b)	24. (b)

LEVEL - 2

1. (b)	2. (c)	3. (a)
4. (c)	5. (c)	6. (b)
7. (c)	8. (d)	9. (b)
10. (c)	11. (b)	12. (d)
13. (c)	14. (a)	15. (d)
16. (d)	17. (c)	18. (a)

LEVEL - 3

1. (c)	2. (b)	3. (c)
4. (a)	5. (b)	6. (d)
7. (b)		