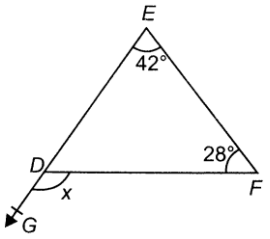
The Triangle and Its Properties

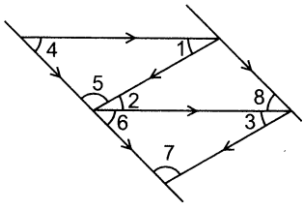
MATHEMATICAL REASONING

1. Find the measure of the angle x in the given figure.



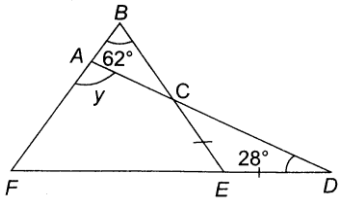
(a) 50^o (b) 70^o
(c) 60^o (d) 30^o

2. Which of the following options is INCORRECT? I



(a) $\angle 1 = \angle 3$
(b) $\angle 1 + \angle 4 + \angle 5 = 180^o$
(c) $\angle 8 = \angle 6$
(d) $\angle 1 + \angle 3 = 180^o$

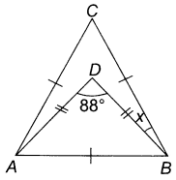
3. In the figure (not drawn to scale), ADF and BEF are triangles and EC = ED, find y.



(a) 90^o (b) 91^o
(c) 92^o (d) 93^o

4. In a ΔABC, which of the given condition holds?
(a) $AB - BC > CA$
(b) $AB + BC < CA$
(c) $AB - BC < CA$
(d) $AB + CA < BC$

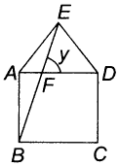
5. In the figure (not drawn to scale), ABC is an equilateral triangle and ABD is an isosceles triangle with DA = DB, find x.



(a) 14^o (b) 16^o
(c) 12^o (d) 32^o

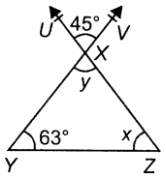
6. ABC is an isosceles triangle with AB = AC and AD is altitude, then ____.
(a) $\angle B > \angle C$ (b) $\angle B < \angle C$
(c) $\angle B = \angle C$ (d) None of these

7. In the figure (not drawn to scale), ABCD is a square, ADE is an equilateral triangle and BFE is a straight line, find y.



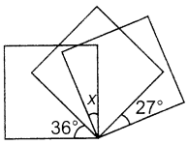
(a) 90^o (b) 45^o
(c) 75^o (d) 15^o

8. Find the measure of the angle x in the given figure.



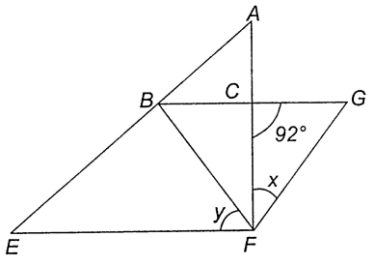
(a) 72^o (b) 82^o
(c) 90^o (d) 40^o

9. The given figure shows three identical squares. Find x.



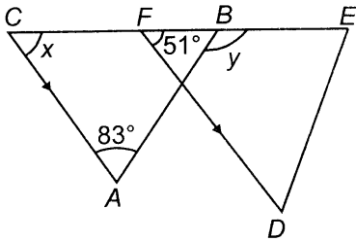
(a) 30^o (b) 27^o
(c) 36^o (d) 16^o

10. In the figure (not drawn to scale), EFA is a right-angled triangle with $\angle EFA = 90^o$ and FGB is an equilateral triangle, find $y - 2x$.



(a) 2^o (b) 8^o
(c) 17^o (d) 20^o

11. In the figure (not drawn to scale), ABC and DEF are two triangles, CA is parallel to FD and CFBE is a straight line. Find the value of $x + y$.

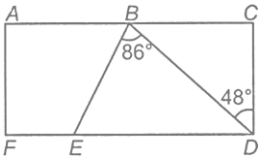


(a) 185^o (b) 134^o
(c) 148^o (d) 176^o

12. In a ΔABC, if $AB + BC = 10\ cm$, $BC + CA = 12\ cm$, $CA + AB = 16\ cm$, then the perimeter of the triangle is ____.

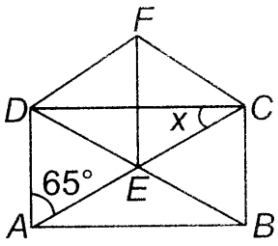
(a) $19\,cm$ (b) $17\,cm$
(c) $28\,cm$ (d) $22\,cm$

13. In the figure, not drawn to scale, ACDF is a rectangle and BDE is a triangle. Find $\angle BED$



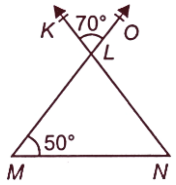
(a) 42^o (b) 52^o
(c) 128^o (d) 134^o

14. In the figure, ABCD is a rectangle, ΔCEF is an equilateral triangle. Find x.



(a) 25^o (b) 30^o
(c) 20^o (d) 50^o

15. Find the measure of $\angle LNM$ in the given figure.



(a) 30^o (b) 80^o
(c) 70^o (d) 60^o

EVERYDAY MATHEMATICS

16. A 26 m long ladder reached a window 24 m from the ground on placing it against a wall. Find the distance of the foot of the ladder from the wall.

(a) $10\,m$ (b) $20\,m$
(c) $5\,m$ (d) $25\,m$

17. A tree is broken at a height of 5 m from the ground and its top touches the ground at a distance of 12 m from the base of the tree. Find the original height of the tree.

(a) $20\,m$ (b) $36\,m$
(c) $18\,m$ (d) $25\,m$

18. Aryan wants to plant a flower on the ground in the form of a rhombus. The diagonals of the rhombus measures 42 cm and 56 cm. Find the perimeter of the field.

(a) $150\ cm$ (b) $140\ cm$
(c) $130\,cm$ (d) $120\,cm$

19. A 34 m long ladder reached a window 16 m from the ground on placing it against a wall. Find the distance of the foot of the ladder from the wall.

(a) $40\ m$ (b) $30\ m$

(c) $50\ m$ (d) $10\ m$

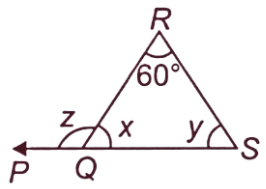
20. Mrs. Kaushik gives a problem to her students. Find the perimeter of a rectangle whose length is 28 cm and diagonal is 35 cm. What will be the correct answer?

(a) 90 cm (b) 45 cm

(c) 89 cm (d) 98 cm

ACHIEVERS SECTION (HOTS)

21. If y is five times of x, find the values of x, y and z.



	x	y	z
(a)	20^o	80	140^o
(b)	30^o	80^o	140^o
(c)	20^o	100^o	160^o
(d)	30^o	100^o	160^o

22. State T for true and T' for false.

(i) In the given right-angled triangle;

$ABC,\ \angle B = 65^o,\ \angle C = 25^o$, then

$AB^2 = BC^2 + CA^2$.

(ii) The length of the third side of a triangle cannot be smaller than the difference of the lengths of any two sides.

(iii) A triangle can have only one median.;

	(i)	(ii)	(iii)
(a)	F	F	T
(b)	F	T	F
(c)	F	T	T
(d)	F	F	F

23. Fill in the blanks.

(i) The line segment joining a vertex of a triangle to the midpoint of its opposite side is called a P of the triangle.

(ii) The perpendicular line segment from a vertex of a triangle to its opposite side is called an Q of the triangle.

(iii) A triangle has R altitudes and S medians.

	P	Q	R	S
(a)	Altitude	Median	1	1
(b)	Altitude	Median	3	3
(c)	Median	Altitude	3	3
(d)	Median	Altitude	2	3

24. Which of the following statements is TRUE?

Statement 1: The sum of the lengths of any two sides of a triangle is greater than the length of the third side.

Statement-2: If P is a point on the side BC of ΔABC. Then $(AB + BC + AC) > 2AP$

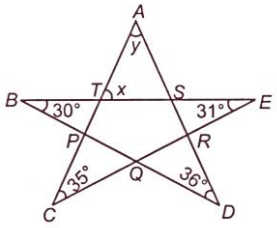
(a) Only Statement-1

(b) Only Statement-2

(c) Both Statement-1 and Statement-2

(d) Neither Statement-1 nor Statement-2

25. Find the values of x and y respectively.



(a) $47^o, 66^o$

(b) $66^o, 48^o$

(c) $68^o, 47^o$

(d) $47^o, 68^o$

ANSWER KEY

1.	B	**2.**	D	**3.**	A	**4.**	C	**5.**	A
6.	C	**7.**	C	**8.**	A	**9.**	B	**10.**	A
11.	A	**12.**	A	**13.**	B	**14.**	A	**15.**	D
16.	A	**17.**	C	**18.**	B	**19.**	B	**20.**	D
21.	C	**22.**	D	**23.**	C	**24.**	C	**25.**	B

SOLUTION

1. (b): $\angle EFD + \angle FED = x$
(Exterior angle property of a triangle)
$\Rightarrow \quad 28^o + 42^o = \angle x$
or $\quad \angle x = 70^o$

2. (d): $\angle 1 = \angle 2$ and $\angle 2 = \angle 3$
[Alternate angles]
So, $\angle 1 = \angle 3$
and $\angle 1 + \angle 4 + \angle 5 = 180^o$
[Angle sum property]
Also, $\angle 8 = \angle 6$ [Alternate angles]

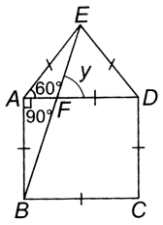
3. (a): In ΔCED,
$CE = ED$
$\therefore \quad \angle EDC = \angle ECD$
[Angles opposite to equal sides are equal]
$\Rightarrow \angle ECD = 28^o$
Also, $\angle ECD = \angle BCA$ (Vertically opposite angles)
$\Rightarrow \angle BCA = 28^o$
In ΔBCA,
$y = 62^o + 28^o$ [Exterior angle property]
$\Rightarrow y = 90^o$

4. (c)

5. (a): Since ABC is an equilateral triangle.
$\therefore \angle CAB = \angle ABC = \angle BCA = 60^o$
And
$\angle DBA = \angle DAB = (60^o - x)$ [$\because DA = DB$]
In ΔDAB,
$\angle DAB \angle DAB + \angle ADB = 180^o$
$\Rightarrow 2(60^o - x) + 88^o = 180^o$
$\Rightarrow$
$2(60^o - x) = 92^o \Rightarrow 60^o - x = 46^o \Rightarrow x = 14^o$

6. (c):

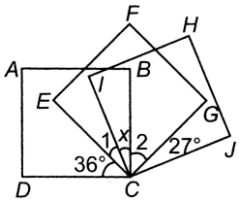
7. (c): In ΔAEB,



$\angle A = \angle DAE + \angle BAD$
$\Rightarrow \angle A = 60^o + 90^o = 150^o$
And, $AE = AB$
$\Rightarrow \angle ABE = \angle AEB$
[Angles opposite to equal sides are equal]
Now, $\angle A + \angle ABE + \angle AEB = 180^o$
(Angle sum property)
$\Rightarrow 2\angle AEB = 180^o - 150^o = 30^o \Rightarrow \angle AEB = 15^o$
Now, $\angle E = 60^o$
$\Rightarrow \angle DEF = 60^o - 15^o = 45^o$
$\therefore$ In ΔEFD,
$\angle DEF + \angle EDF + \angle EFD = 180^o$
$\Rightarrow 45^o + 60^o + y = 180^o$
$\Rightarrow y = 180^o - (45^o + 60^o) = 75^o$

8. (a): $\angle UXV = y$ (Vertically opposite angles)
$\therefore \quad y = 45^o$
In ΔXYZ
$y + x + 63^o = 180^o$ (Angle sum property)
$\Rightarrow 45^o + x + 63^o = 180^o \Rightarrow x = 180^o - (45^o + 63^o)$
$\Rightarrow \quad x = 180^o - 108^o = 72^o$

9. (b): We have, ABCD, CEFG and CIHJ are all squares.



So, $\angle 1 + \angle 2 + x = 90^o$ .....(i)
$36^o + \angle 1 + x = 90^o$ q .....(ii)
$x + \angle 2 + 27^o = 90^o$ .....(iii)
Adding (ii) and (iii), we get
$36^o + x + 27^o + (\angle A + \angle 2 + x) = 180^o$
$\Rightarrow 63^o + x + 90^o = 180^o$ (From (i))
$\Rightarrow x = 180^o - 153^o = 27^o$

10. (a): In ΔFGC, $\angle CBF = 60^o$

(Angle of equilateral triangle)

$\therefore \quad x + 60^o + 92^o = 180^o$

$\Rightarrow \quad x = 180^o - 152^o = 28^o$

Now, In ΔBCF, $\angle CBF = 60^o$

$\angle FCB = 180^o - 92^o$ (Linear pair)

$\Rightarrow \quad \angle FCB = 88^o$

$\therefore \quad \angle BFC + 88^o + 60^o = 180^o$

(Angle sum property)

$\Rightarrow \quad \angle BFC = 180^o - 148^o = 32^o$

And $\angle AFE = 90^o$

$\Rightarrow \quad y + 32^o = 90^o \quad \Rightarrow \quad y = 90^o - 32^o = 58^o$

$\therefore \quad y - 2x = 58^o - 2 \times 28^o = 58^o - 56^o = 2^o$

11. (a): $\angle FCA = \angle BFD$ (Corresponding angles)

$\Rightarrow \quad x = 51^o$

Now, in ΔABC

$y = 51^o + 83^o$ (Exterior angle property)

$\Rightarrow \quad y = 134^o$

So, $x + y = 51^o + 134^o = 185^o$

12. (a): It is given that,

$AB + BC = 10\,cm$ .....(i)

$BC + CA = 12\,cm$ .....(ii)

$CA + AB = 16\,cm$ .....(iii)

Adding (i), (ii) and (iii); we get

$2(AB + BC + CA) = 10 + 12 + 16$

$\Rightarrow \quad AB + BC + CA = 19\,cm$

13. (b): $\angle CDB + \angle BDE = 90^o$ (Angle of a rectangle)

$\Rightarrow \quad 48^o + \angle BDE = 90^o$

$\Rightarrow \quad \angle BDE = 90^o - 48^o = 42^o$

In ΔBED

$\angle EBD + \angle BDE + \angle BED = 180^o$

(Angle sum property)

$\Rightarrow \quad 86^o + 42^o + \angle BED = 180^o$

$\Rightarrow \quad \angle BED = 180^o - (86^o + 42^o) = 52^o$

14. (a): It is given that, ABCD is a rectangle

$\therefore \quad \angle ADC = 90^o$

In ΔADC,

$\angle DAC + \angle ADC + \angle DCA = 180^o$

(Angle sum property)

$\Rightarrow \quad 65^o + 90^o + x = 180^o \Rightarrow x = 25^o$

15. (d): $\angle KLO = \angle MLN$

$\therefore \quad \angle MLN = 70^o$

in $\angle LMN$,

$\angle MLN + \angle LNM + \angle LMN = 180^o$

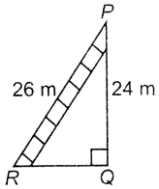
(Angle sum property)

$\Rightarrow 70^o + \angle LNM + 50^o = 180^o$

$\Rightarrow \quad \angle LNM = 180^o - (70^o + 50^o) = 60^o$

16. (a): In ΔPRQ,

$PR^2 = PQ^2 + QR^2$



(By Pythagoras theorem)

$(26)^2 = (24)^2 + QR^2$

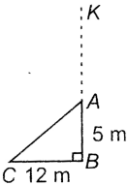
or $QR^2 = 676 - 576 = 100$

$\Rightarrow \quad QR = \sqrt{100} \Rightarrow QR = 10$

$\therefore$ The distance of the foot of the ladder from the wall is 10 m.

17. (c): Let KB is original height of the tree.

In ΔABC,



$AC^2 = AB^2 + BC^2 = 52 + 122$

$= 25 + 144 = 169$

$\therefore \quad AC = \sqrt{169} = 13m$

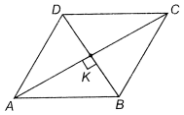
$KB = KA + AB$

$= (13 + 5)\,m = 18m$

$\therefore$ Original height of the tree is 18m.

18. (b): Since diagonals of a rhombus bisect each other at 90^o.

Given: $BD = 42\ cm$ and $AC = 56\ cm$



$\therefore \quad BK = \frac{1}{2}BD = \frac{42}{2} = 21cm$

$AK = \frac{1}{2}AC = \frac{56}{2} = 28cm$

In ΔKAB, $AB^2 = AK^2 + BK^2$

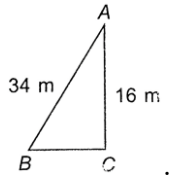
$= (28)^2 + (21)^2 = 784 + 441 = 1225$

$\therefore \quad AB = \sqrt{1225} = 35cm$

$\therefore$ Perimeter of the field

$ABCD = 4 \times 35 = 140\ cm;$

19. (b): Let AB = length of ladder, AC = height of window



In ΔABC,

$(AB)^2 = (AC)^2 + (BC)^2$

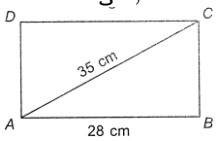
$\Rightarrow \quad (34)^2 = (16)^2 + BC^2$

or $\quad BC^2 = (34)^2 - (16)^2$

$\Rightarrow \quad BC^2 = 1156 - 256 = 900$

$\therefore \quad BC = \sqrt{900} = 30m$

20. (d): ABCD is a rectangle,



In ΔACB,

$AC^2 = AB^2 + BC^2$ (By Pythagoras theorem)

$(35)^2 = (28)^2 + BC^2$ or $BC^2 = (35)^2 - (28)^2$

$\Rightarrow \quad BC^2 = 1225 - 784 \Rightarrow BC^2 = 441$

$\therefore \quad BC = \sqrt{441} = 21cm$

$\therefore$ Perimeter of rectangle $= 2 \times (28 + 21)\ cm$

$= 2 \times (49)\ cm = 98\ cm$

21. (c): As, $y = 5x$

In ΔRQS,

$x + y + 60^o = 180^o$ (Angle sum property)

$\Rightarrow \quad x + 5x + 60^o = 180^o$

$\Rightarrow \quad 6x = 180^o - 60^o = 120^o \Rightarrow x = \frac{120^o}{6} = 20^o$

$\therefore \quad y = 5 \times 20^o = 100^o$

Also $\quad \angle QRS + \angle QSR = z$

(Exterior angle property)

$\Rightarrow \quad z = 60^o + 100^o = 160^o$

22. (d): (i) In the given right angled triangle,

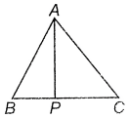
$BC^2 = AB^2 + AC^2$

(ii) The length of the third side of a triangle is always greater than the difference of lengths of any two sides.

(iii) A triangle can have three medians.

23. (c)

24. (c): Statement - 2



In ΔABP,

$AB + BP > AP$ .....(i)

In ΔAPC

$PC + AC > AP$ .....(ii)

Adding (i) & (ii), we get

$AB + BP + PC + AC > AP + AP$

$\Rightarrow \quad AB + BC + AC > 2AP$

$\therefore$ Both Statement -1 and Statement-2 are true.

25. (b): In ΔTCE,

$x = \angle TCE + \angle TEC$ (Exterior angle property)

$\Rightarrow \quad x = 35^o + 31^o$

$\Rightarrow \quad x = 66^o$

In ΔSBD,

$\angle AST = \angle SBD + \angle SDB$

(Exterior angle property)

$\angle AST = 30^o + 36^o = 66^o$

In ΔATS,

$y + x + \angle AST = 180^o$ (Angle sum property)

$\Rightarrow \quad y + 66^o + 66^o = 180^o$

$\Rightarrow \quad y = 180^o - (66^o + 66^o) \Rightarrow y = 48^o$