MATHEMATICAL REASONING

**1.** Which of the following statements is INCORRECT?

(a) The sum of any two sides of a triangle is greater than the third side.

(b) In a right angled triangle, hypotenuse is the longest side.

(c) A, B, C are collinear if $AB + BC = AC$.

(d) The sum of any two sides of a triangle is smaller than the third side.

2. In the given diagram (not drawn to scale), PO and RS are straight lines. Which of the following statements is true?
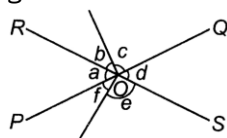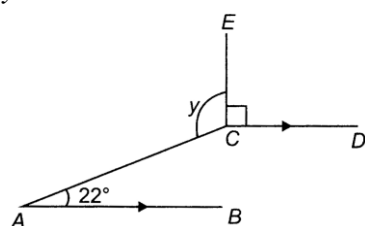

(a) $\angle f = \angle d$

(b) $\angle c = \angle e$

(c) $\angle a + \angle b = \angle f + \angle e$

(d) $\angle b + \angle c = \angle e + \angle f$
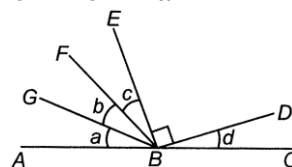
3. Which line is parallel to AB?
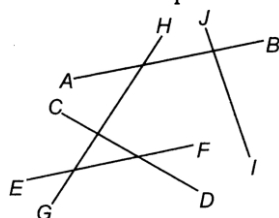
(a) CD   (b) EF

(c) GH   (d) IJ

4. In the figure (not drawn to scale), AB is parallel to CD and $\angle ECD$ is a right angle. Find $\angle y$.
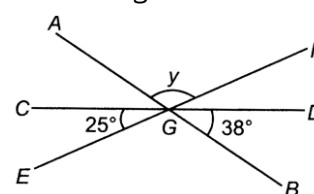

(a) 111° (b) 112°

(c) 113° (d) 114°

5. In the figure (not drawn to scale), ABC is a straight line, $\angle DBE$ is a right angle and $\angle a = \angle b = \angle c = \angle d$. Find $\angle a$.
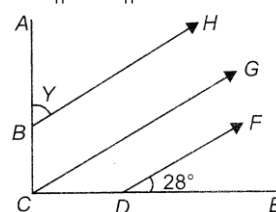

(a) 22.5^o (b) 30°

(c) 45° (d) 60°

6. In the figure (not drawn to scale), AGB, CGD and EGF are straight lines. Find $\angle y$.
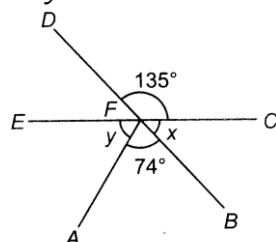

(a) 97° (b) 127°

(c) 100° (d) 117°

7. In the figure (not drawn to scale), ABC and CDE are straight lines, $\angle ACE$ is a right angle, $DF \parallel CG \parallel BH$. Find $\angle Y$.

(a) 65° (b) 73°
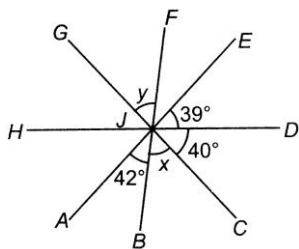
(c) 62° (d) 60°

8. In the figure (not drawn to scale), EEC and DFB are straight lines. Find $\angle x$ and $\angle y$ respectively.
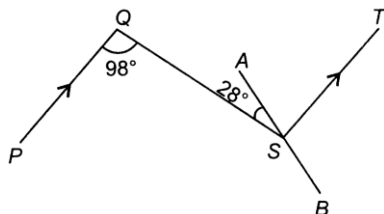

(a) $40^o, 62^o$ (b) $45^o, 61^o$

(c) $47^o, 54^o$ (d) $30^o, 60^o$

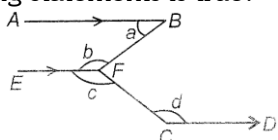**9.** In the figure (not drawn to scale), AJE, BJF, CJG and DJH are straight lines.
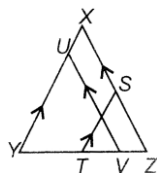

Find $\angle x$ and $\angle y$ respectively.

(a) $50^o, 49^o$ (b) $59^o, 40^o$

(c) $59^o, 59^o$ (d) $49^o, 48^o$

10. In the figure, PQ is parallel to ST. AB is a straight line. Find $\angle BST$.

(a) 110° (b) 125°

(c) 152° (d) 98°

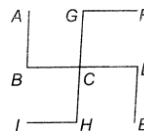**11.** In the figure, $AB \parallel CD \parallel EF$. Which of the following statements is true?

(a) $a+b=180^o$ (b) $b+c=180^o$

(c) $c+d=180^o$ (d) $a+b+c=360^o$

12. In the given figure (not drawn to scale), $\angle UVT = 72^o$ and $\angle TSZ = 53^o$, then find. $\angle XZY + \angle SXY$.

(a) 60° (b) 125°

(c) 180° (d) None of these

13. In the given figure, $AB \parallel GH \parallel DE$ and $GF \parallel BD \parallel HI$ $\angle FGC = 80^o$. Find the value of $\angle CHI$.

(a) 80° (b) 120°

(c) 100° (d) 160°

14. In the given figure, find the value of $\angle BOC$.

(a) 101° (b) 149°

(c) 71° (d) 140°
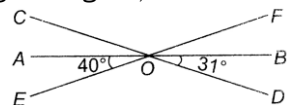
15. In the given figure, PQ, RS and UT are parallel lines. If $c = 75^o$ and $a = (2/5)c$, find $b+d/2$.

(a) 92° (b) 115°

(c) 112.5^o (d) 135.5^o
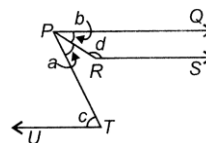
16. In the given figure, AB and CD are straight lines. Find $\angle y$..

(a) 97° (b) 27°

(c) 77° (d) 55°
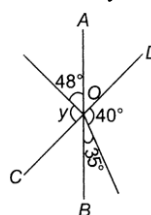
17. In the given figure, $AB \parallel DE$. Find a.

(a) 67° (b) 113°

(c) 40° (d) 140°
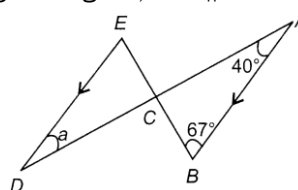
18. If $p \parallel q$, then find the value of $\angle 1, \angle 2$ and $\angle 1 + \angle 2$ respectively.

(a) $41^o, 90^o, 131^o$ (b) $42^o, 89^o, 131^o$

(c) $90^o, 41^o, 131^o$ (d) $49^o, 41^o, 90^o$

19. Which of the following options hold?
Statement-1: If two lines intersect then the vertically opposite angles are equal.
Statement -2: Sum of all the angles around a point is 180°.
(a) Both Statement-1 and Statement-2 are true.
(b) Statement-1 is true but Statement-2 is false.
(c) Statement-1 is false but Statement-2 is true.
(d) Both Statement-1 and Statement-2 are false.

20. In the figure (not drawn to scale),
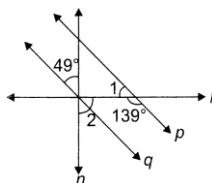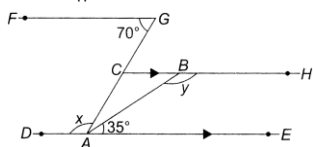DAE, CBH and ACG are straight lines $DAE \parallel CBH \parallel FG$. Find x and/respectively.

(a) $70^o, 35^o$ (b) $110^o, 145^o$

(c) $110^o, 35^o$ (d) $140^o, 20^o$

ACHIEVERS SECTION (HOTS)

21. Fill in the blanks.
(i) A <u>P</u> has two end points.
(ii) A line has <u>Q</u> end points on either side.
(iii) A <u>R</u> is a line that intersects two or more lines at distinct points.
(iv) An <u>S</u> is formed when two rays meets.

P	Q	R	S
(a) Line	Two	Ray	Angle
(b) Line segment	No	Transversal	Angle
(c) Ray segment	No	Transversal	Line
(d) Line segment	Two	Transversal	Angle

22. If $RS \parallel PQ$ and $RT \parallel UQ$, then find the value of $8x - 2y$.

(a) 60° (b) 30°

(c) 150° (d) 100°
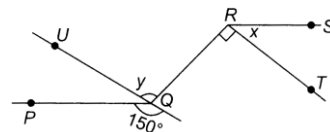
23. Which of the following options hold?
Statement-1: $\angle e$ and $\angle h$ are supplementary angles.
Statement- 2: $\angle c + \angle d + \angle h + \angle b = 360^o$
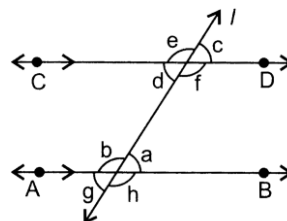
(a) Both Statement-1 and Statement-2 are true.
(b) Statement-1 is true but Statement-2 is false.
(c) Statement-1 is false but Statement-2 is true.
(d) Both Statement-1 and Statement-2 are false.

24. In the given figure (not drawn to scale), AD is parallel to BC. JDK, GHCI, EABF are straight and parallel lines.

Find:
(i) $\angle GHD - \angle HDC$
(ii) $\angle BCl + \angle HAB$.

	(i)	(ii)
(a)	58°	150°
(b)	48°	150°
(c)	58°	180°
(d)	48°	180°
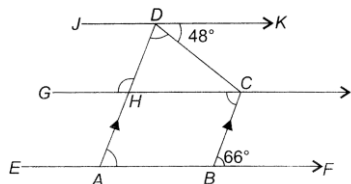
25. Mohit got an assignment where he had to explain the types of angles formed by a pair of parallel lines.

He completed the assignment but when his teacher checked he saw mistakes. Identify the correct option pointing out the mistake in the parts (i to iv).

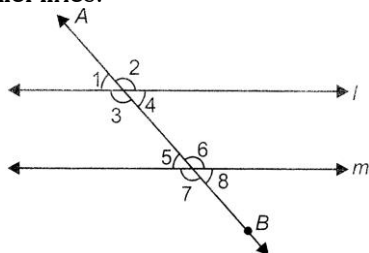| Types of Angle	Observations
(i) Corresponding	$\angle 1 = \angle 5, \angle 3 = \angle 7,$ $\angle 2 = \angle 6, \angle 4 = \angle 8$
(ii) Alternate interior	$\angle 3 = \angle 6, \angle 4 = \angle 5$
(iii) Vertically opposite	$\angle 1 = \angle 4, \angle 5 = \angle 6$
(iv) Alternate exterior	$\angle 1 = \angle 8, \angle 2 = \angle 5$

(a) Only (i)
(b) Only (ii)
(c) Both (I) and (iii)
(d) Both (Iii) and (iv)

ANSWER KEY

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

SOLUTION

1. (d):

2. (d): $\angle ROQ = \angle POS \Rightarrow \angle b + \angle c = \angle f + \angle e$
(Vertically opposite angles)

3. (b): EF is parallel to AB.

4. (b): Since, $AB \parallel CD$
$\therefore \ \angle CAB + \angle DCA = 180^o$
(Co-interior angles)
$\therefore \ 22^o + \angle DCA = 180^o$

$\Rightarrow \angle DCA = 180^o - 22^o = 158^o$
Also, $\angle ECD + \angle DCA + \angle y = 360^o$
(Angles about a point)
$\Rightarrow \ 90^o + 158^o + \angle y = 360^o$
$\Rightarrow \angle y = 360^o - (90^o + 158^o)$
$\Rightarrow \ \angle y = 360^o - 248^o = 112^o$

5. (a): We have, $\angle a = \angle b = \angle c = \angle d = x \,(\text{say})$
Now, $\angle a + \angle b + \angle c + 90^o + \angle d = 180^o$
(Angles on a straight line)
$\therefore \ x + x + x + 90^o + x = 180^o \Rightarrow 4x = 90^o$
$\Rightarrow \ x = \dfrac{90^o}{4} = 22.5^o \ \therefore \ \angle a = 22.5^o$

6. (d): $\angle CGE + \angle EGB + \angle BGD = 180^o$
(Angles on a straight line)
$\therefore \ 25^o + \angle EGB + 38^o = 180^o$
$\angle EGB = 180^o - (25^o + 38^o) = 180^o - 63^o = 117^o$
And $\quad \angle y = \angle EGB$ (vertically opposite angles)
$\therefore \quad \angle y = 117^o$

7. (c): Since, CG$\parallel$DF and CE is transversal.
$\therefore \ \angle GCE = \angle FDE$ (Corresponding angles)
$\Rightarrow \ \angle GCE = 28^o$
Now, $\angle ACE = 90^o$ (given)
$\Rightarrow \ \angle ACG + \angle GCE = 90^o$
$\angle ACG + 28^o = 90^o$
$\therefore \ \angle ACG = 90^o - 28^o = 62^o$
Also, $BH \parallel CG$ and CA is transversal.
$\therefore \ \angle Y = ACG$ (Corresponding angles)
$\Rightarrow \ \angle Y = 62^o$

8. (b): (a) As. $\angle DFC + \angle x = 180^o$ (Linear pair)
$\therefore \ 135^o + \angle x = 180^o$
$\Rightarrow \ \angle x = 180^o - 135^o = 45^o$
(b) As, $\angle y + \angle AFB + \angle x = 180^o$
(Angles on a straight line)
$\therefore \ \angle y + 74^o + 45^o = 180^o$
$\Rightarrow \angle y = 180^o - (74^o + 45^o)$
$\Rightarrow \angle y = 180^o - 119^o = 61^o$

9. (c): (a) As,

$\angle AJB + \angle BJC + \angle CJD + \angle DJE = 180^o$
       (Angles on a straight line AE)

$\therefore\ 42^o + \angle x + 40^o + 39^o = 180^o$

$\angle x = 180^o - (42^o + 40^o + 39^o)$

$\angle x = 180^o - 121^o = 59^o$

(b) $\angle y = \angle x$ (Vertically opposite angles)

$\therefore\ \angle y = 59^o$

10. (a): Since, $PQ \parallel ST$

$\therefore \angle PQS = \angle QST$ (Alternate angles)

$\Rightarrow\ \angle QST = 98^o$

$\Rightarrow\ \angle QSA + \angle AST = 98^o$

$\Rightarrow\ \angle AST = 98^o - 28^o = 70^o$

Now, AB is a straight line.

$\therefore\ \angle AST + \angle TSB = 180^o$ (linear pair)

$\Rightarrow \angle TSB = 180^o - 70^o = 110^o$

11. (a): Since, $AB \parallel EF$

$\therefore a + b = 180^o$ (Consecutive interior angles)

12. (b): We have given that,
$XZ \parallel UV$ and $ST \parallel XY$.

Now, $\angle UVY = \angle XZY$ (Corresponding angles)

$\Rightarrow \angle XZY = 72^o$

Also, $\angle TSZ = \angle YXS$ (Corresponding angles)

$\Rightarrow\ \angle YXS = 53^o$

Hence, $\angle XZV + \angle YXS = 72^o + 53^o = 125^o$

13. (a): $GF \parallel HI$ and GH is the transversal line.
So, $\angle FGC = \angle CHI$ (Alternate interior angles)

$\therefore\ \angle CHI = 80^o$

14. (b): Since, COD is a straight line.

$\therefore\ \angle BOC + \angle BOD = 180^o$ (linear pair)

$\Rightarrow \angle BOC + 31^o = 180^o$

$\Rightarrow \angle BOC = 180^o - 31^o = 149^o.$

15. (c): We have, $c = 75^o$

$\therefore\ a = \dfrac{2}{5}c = \dfrac{2}{5} \times 75^o = 30^o$

Now, $UT \parallel PQ$

$\Rightarrow c = a + b$ (Alternate angles)

$\Rightarrow\ 75^o = 30^o + b \Rightarrow b = 75^o - 30^o = 45^o$

Also, $PQ \parallel RS$

$\therefore\ b + d = 180^o$ (Co-interior angles)

$\Rightarrow\ d = 180^o - 45^o = 135^o$

So,

$b + \dfrac{d}{2} = 45^o + \dfrac{135^o}{2} = 45^o + 67.5^o = 112.5^o$

16. (b): Since, CD is a straight line.

$\therefore\ 40^o + 35^o + \angle BOC = 180^o$

$\Rightarrow\ \angle BOC = 180^o - 75^o = 105^o$

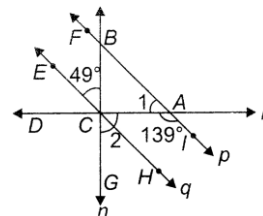Now, AB is a straight line.

$\therefore\ \angle BOC + \angle y + 48^o = 180^o$

$\therefore\ \angle y = 180^o - (105^o + 48^o) = 27^o$

17. (c): Since, $AB \parallel DE$ and AD is a transversal.

$\therefore\ \angle EDC = \angle BAC$ (Alternate angles)

$\Rightarrow\ a = 40^o$

18. (a):

Since $p \parallel q$ and l is transversal

$\angle PAC = \angle ECA$ (Alternate angles)

$\Rightarrow \angle ECA = 139^o$

$\Rightarrow \angle ECB + \angle BCA = 139^o$

$\Rightarrow\ 49^o + \angle BCA = 139^o$

$\Rightarrow\ \angle BCA = 139^o - 49^o$

$\Rightarrow\ \angle BCA = 90^o$

Now, $\angle BCA + \angle ACG = 180^o$ (linear pair)

$\Rightarrow\ 90^o + \angle 2 = 180^o$

$\Rightarrow\ \angle 2 = 180^o - 90^o \Rightarrow \angle 2 = 90^o$

Also, $\angle DCE + \angle ECB + \angle BCA = 180^o$
           (Angles on a straight line)

$\Rightarrow\ \angle DCE + 49^o + 90^o = 180^o$

$\Rightarrow\ \angle DCE = 180^o - 139^o = 41^o$

Now, $p \parallel q$ and l is transversal

∴ $\angle BAC = \angle ECD$ (Corresponding angles)

$\angle 1 = 41^o$

Hence, $\angle 1 + \angle 2 = 41^o + 90^o = 131^o$

19. (b): The sum of all the angles around a point is 360°.

20. (b): Since, $FG \parallel DE$ and AG is transversal.

∴ $\angle FGA + \angle DAG = 180^o$ (Co-interior angles)

$\Rightarrow 70^o + \angle x = 180^o \Rightarrow \angle x = 110^o$

Also, $CBH \parallel DAE$ and BA is transversal.

$\angle y + 35^o = 180^o$ (Co-interior angles)

$\Rightarrow \angle y = 180^o - 35^o \Rightarrow \angle y = 145^o$

21. (b):

22. (a): Since, $RT \parallel UQ$ and QR is a transversal.

$\angle UQR = \angle QRT$ (Alternate angles)

$\Rightarrow y = 90^o$

Also, $\angle PQU + 150^o = 180^o$ (Linear pair)

$\Rightarrow \angle PQU = 180^o - 150^o = 30^o$

And $PQ \parallel RS$ and RQ is transversal.

$\angle PQR = \angle QRS$ (Alternate angles)

$\Rightarrow \angle PQU + \angle UQR = \angle SRT + \angle TRQ$

$\Rightarrow 30^o + 90^o = x + 90^o \Rightarrow x = 30^o$

Now, $8x - 2y = 8 \times 30^o - 2 \times 90^o$

$= 240^o - 180^o = 60^o$

23. (c): Statement - 1: Since, $\angle e = \angle f$ ...(i)

(Vertically opposite angles)

and $\angle f = \angle h$ ...(ii) (Corresponding angles)

From (i) and (ii), $\angle e = \angle h$

So, $\angle e$ and $\angle h$ are not supplementary angles.

Statement - 2: $\angle c = \angle d$

(Vertically opposite angles)

$\angle h = \angle b$ (Vertically opposite angles)

and $\angle d = \angle b = 180^o$ (Co-interior angles)

Now, $\angle c + \angle d + \angle h + \angle b$

$= 2\angle d + 2\angle b = 2(\angle d + \angle b) = 2 \times 180^o = 360^o$

24. (d): (i) $JK \parallel Gl$ and DH is transversal.

∴ $\angle GHD = \angle HDK$ (Alternate angles)

$\Rightarrow \angle GHD = \angle HDC + 48^o$

$\Rightarrow$ ZGHD - ZHDC = 48°

(ii) $Gl \parallel EF$ and BC is transversal.

$\angle BCl + \angle CBF = 180^o$ (Co-interior angles)

$\angle BCl + 66^o = 180^o$

$\angle BCl = 180^o - 66^o = 114^o$

As, $HA \parallel CB$, and AB is transversal

$\angle CBF = \angle HAB$ (Corresponding angles)

$\angle HAB = 66^o$

Now. $\angle BCl + \angle HAB = 114^o + 66^o = 180^o$

25. (d): (iii) $\angle 1 = \angle 4, \angle 5 = \angle 8$ are vertically opposite angles.

Also, (iv) $\angle 1 = \angle 8, \angle 2 = \angle 7$ are alternate exterior angles.