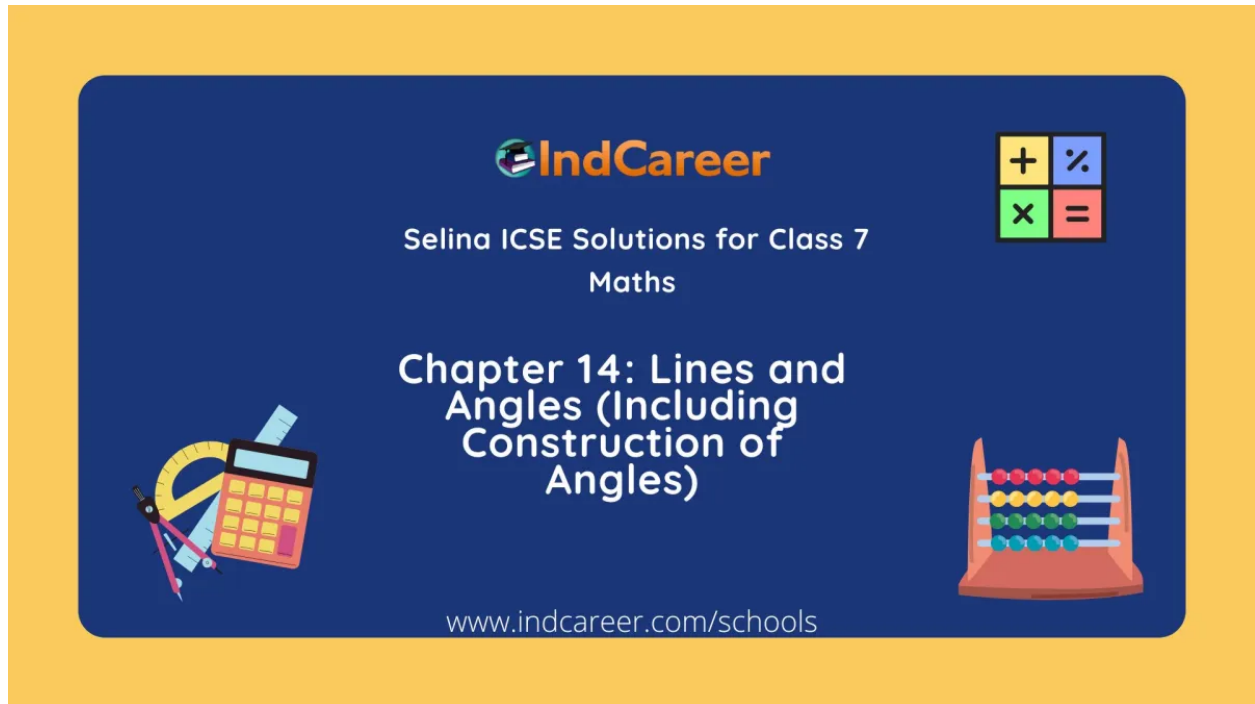


Selina Class 7 ICSE Solutions Mathematics : Chapter 14- Lines and Angles (Including Construction of Angles)



For any clarifications or questions you can write to **info@indcareer.com**

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Selina Class 7 ICSE Solutions Mathematics :

Chapter 14- Lines and Angles (Including Construction of Angles)

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Selina Class 7 ICSE Solutions Mathematics : Chapter 14- Lines and Angles (Including Construction of Angles)

Selina 7th Maths Chapter 14, Class 7 Maths Chapter 14 solutions

Exercise 14A page: 162

1. State, true or false:

- (i) A line segment 4 cm long can have only 2000 points in it.
- (ii) A ray has one end point and a line segment has two end-points.
- (iii) A line segment is the shortest distance between any two given points.
- (iv) An infinite number of straight lines can be drawn through a given point.
- (v) Write the number of end points in
 - (a) a line segment AB (b) a ray AB (c) a line AB
- (vi) Out of which one has a fixed length?
- (vii) How many rays can be drawn through a fixed point O?
- (viii) How many lines can be drawn through three
 - (a) collinear points?

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(b) non-collinear points?

(ix) Is 40° the complement of 60° ?

(x) Is 45° the supplement of 45° ?

Solution:

(i) False.

It contains infinite number of points.

(ii) True.

(iii) True.

(iv) True.

(v) (a) 2 (b) 1 (c) 0

(vi) $\overline{AB}$ has fixed length.

(vii) Infinite rays can be drawn through a fixed point O.

(viii) (a) 1 line can be drawn through three collinear points.

(b) 3 lines can be drawn through three non-collinear points.

(ix) False.

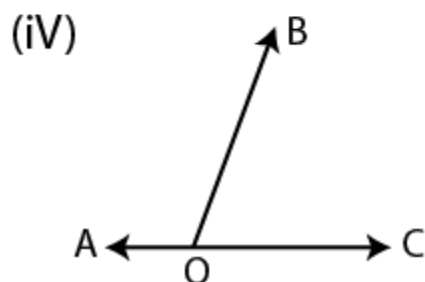
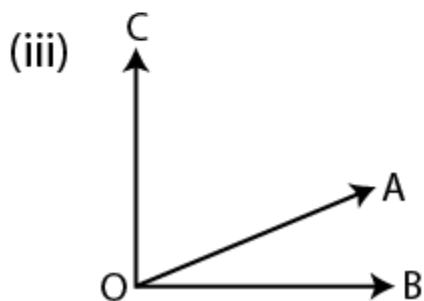
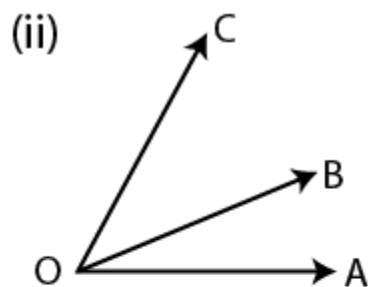
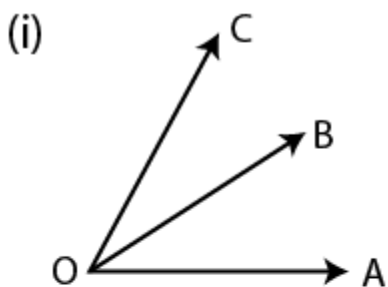
40° is the complement of 50° as $40^\circ + 50^\circ = 90^\circ$

(x) False.

45° is the supplement of 135° not 45° .

2. In which of the following figures, are $\angle AOB$ and $\angle AOC$ adjacent angles? Give, in each case, reason for your answer.

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**Solution:**

If $\angle AOB$ and $\angle AOC$ are adjacent angle, they have OA as their common arm.

(i) From the figure

OB is the common arm

$\angle AOB$ and $\angle AOC$ are not adjacent angles.

(ii) From the figure

OC is the common arm

$\angle AOB$ and $\angle AOC$ are not adjacent angles.

(iii) From the figure

OA is the common arm

$\angle AOB$ and $\angle AOC$ are adjacent angles.

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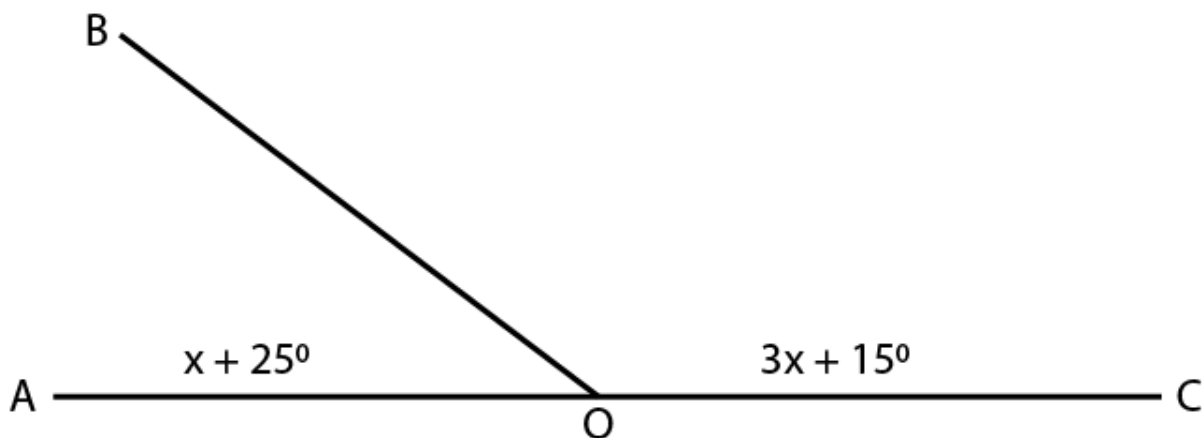
(iv) From the figure

OB is the common arm

$\angle AOB$ and $\angle AOC$ are not adjacent angles.

3. In the given figure, AOC is a straight line.

Find: (i) x (ii) $\angle AOB$ (iii) $\angle BOC$



Solution:

We know that

$\angle AOB$ and $\angle COB$ are linear pairs

It can be written as

$$\angle AOB + \angle COB = 180^\circ$$

Substituting the values

$$x + 25^\circ + 3x + 15^\circ = 180^\circ$$

By further calculation

$$4x + 40^\circ = 180^\circ$$

So we get

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$$4x = 180 - 40 = 140^\circ$$

$$(i) x = 140/4 = 35^\circ$$

$$(ii) \angle AOB = x + 25$$

Substituting the value of x

$$\angle AOB = 25 + 35 = 60^\circ$$

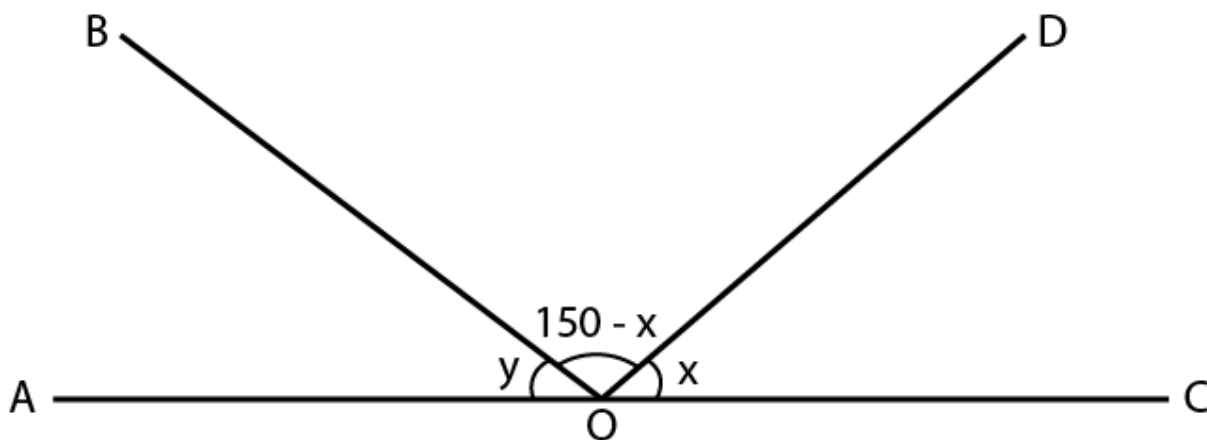
$$(iii) \angle BOC = 3x + 15^\circ$$

Substituting the value of x

$$\angle BOC = (3 \times 35) + 15$$

$$\angle BOC = 120^\circ$$

4. Find y in the given figure.



Solution:

Here AOC is a straight line

We can write it as

$$\angle AOB + \angle BOD + \angle DOC = 180^\circ$$

Substituting the values

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$$y + 150 - x + x = 180$$

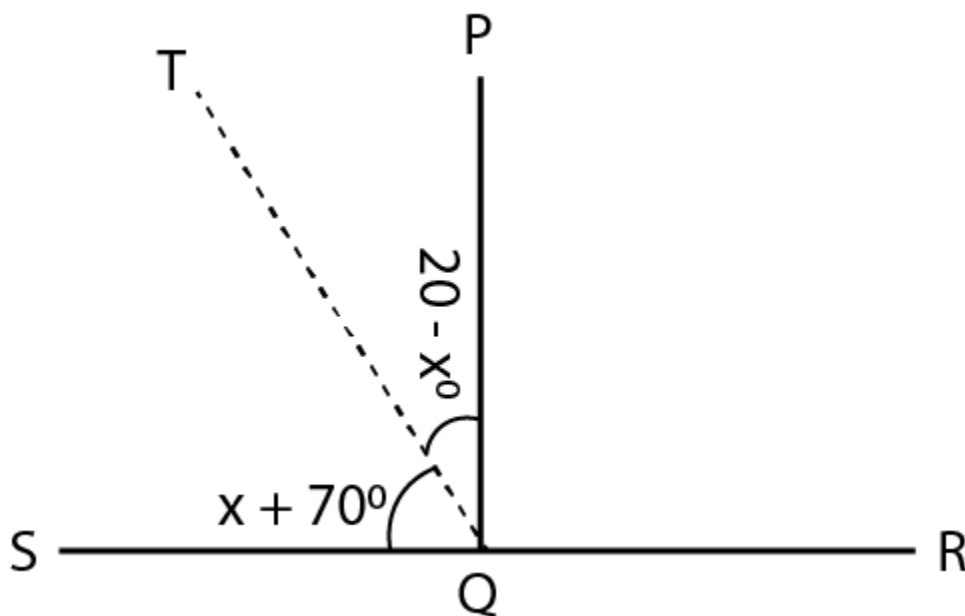
By further calculation

$$y + 150 = 180$$

So we get

$$y = 180 - 150 = 30^\circ$$

5. In the given figure, find $\angle PQR$.



Solution:

Here SQR is a straight line

We can write it as

$$\angle SQT + \angle TQP + \angle PQR = 180^\circ$$

Substituting the values

$$x + 70 + 20 - x + \angle PQR = 180^\circ$$

By further calculation

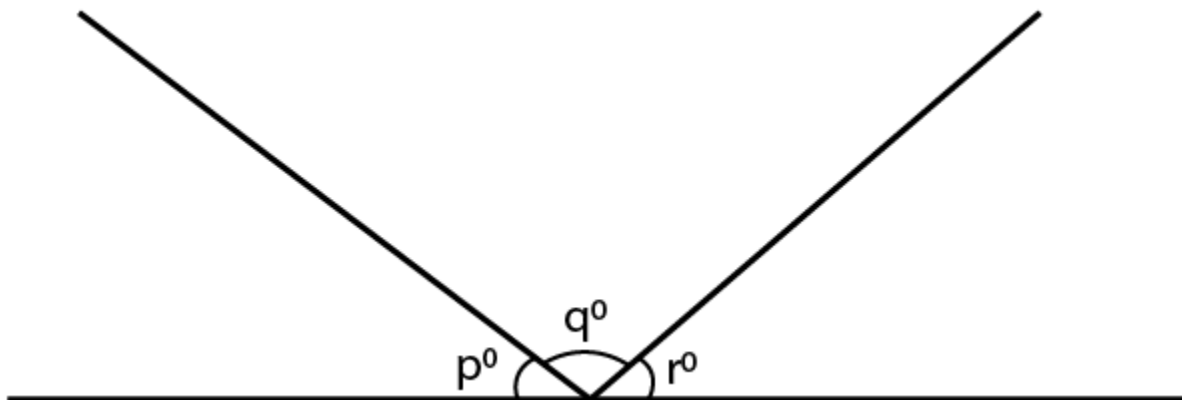
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$$90^\circ + \angle PQR = 180^\circ$$

So we get

$$\angle PQR = 180^\circ - 90^\circ = 90^\circ$$

6. In the given figure, $p^\circ = q^\circ = r^\circ$, find each.



Solution:

We know that

$$p^\circ + q^\circ + r^\circ = 180^\circ \text{ is a straight angle}$$

It is given that

$$p^\circ = q^\circ = r^\circ$$

We can write it as

$$p^\circ + p^\circ + p^\circ = 180^\circ$$

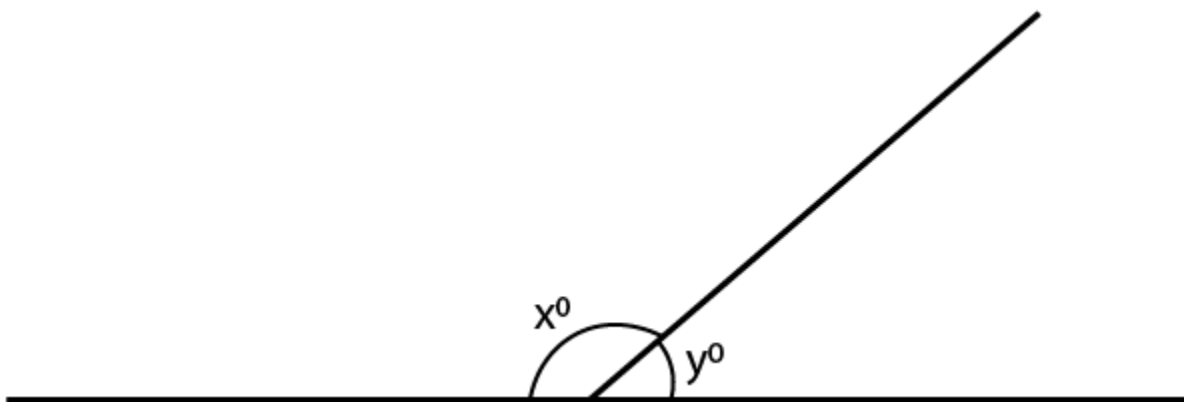
$$3p = 180$$

$$p = 180/3 = 60^\circ$$

$$\text{Therefore, } p^\circ = q^\circ = r^\circ = 60^\circ$$

7. In the given figure, if $x = 2y$, find x and y .

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Solution:

It is given that

$$x = 2y$$

For a straight angle

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

Substituting the values

$$2y + y = 180$$

By further calculation

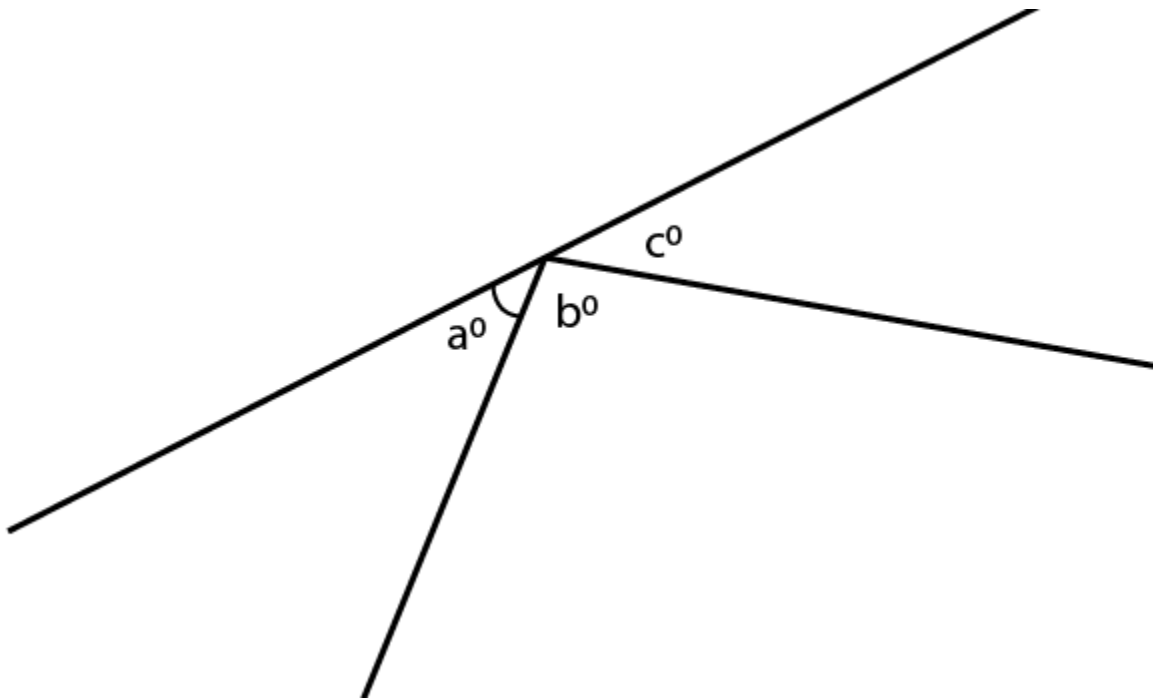
$$3y = 180$$

$$y = 180/3 = 60^\circ$$

$$x = 2y = 2 \times 60^\circ = 120^\circ$$

8. In the adjoining figure, if $b^\circ = a^\circ + c^\circ$, find b .

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Solution:

It is given that

$$b^\circ = a^\circ + c^\circ$$

For a straight angle

$$a^\circ + b^\circ + c^\circ = 180^\circ$$

Substituting the values

$$b^\circ + b^\circ = 180^\circ$$

$$2b^\circ = 180^\circ$$

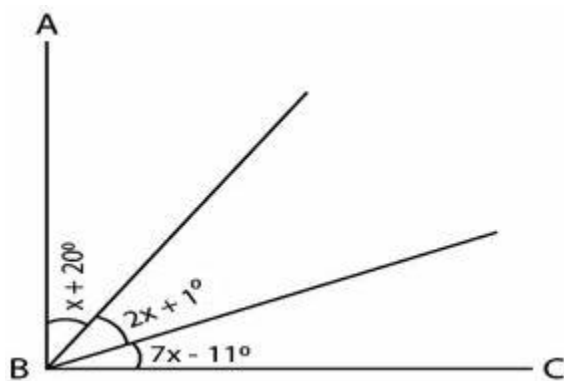
$$b^\circ = 180/2 = 90^\circ$$

9. In the given figure, AB is perpendicular to BC at B.

Find : (i) the value of x.

(ii) the complement of angle x.

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Solution:

(i) From the figure

$AB \perp BC$ at B

Here $\angle ABC = 90^\circ$

Substituting the values

$$x + 20 + 2x + 1 + 7x - 11 = 90$$

By further calculation

$$10x + 10 = 90$$

$$10x = 90 - 10 = 80$$

$$x = 80/10 = 8^\circ$$

(ii) The complement of angle $x = 90 - x$

So we get

$$= 90 - 8 = 82^\circ$$

10. Write the complement of:

(i) 25°

(ii) 90°

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(iii) a°

(iv) $(x + 5)^\circ$

(v) $(30 - a)^\circ$

(vi) $\frac{1}{2}$ of a right angle

(vii) $\frac{1}{3}$ of 180°

(viii) $21^\circ 17'$

Solution:

(i) The complement of $25^\circ = 90^\circ - 25^\circ = 65^\circ$

(ii) The complement of $90^\circ = 90^\circ - 90^\circ = 0$

(iii) The complement of $a^\circ = 90^\circ - a^\circ$

(iv) The complement of $(x + 5)^\circ = 90^\circ - (x + 5)^\circ$

By further calculation

$$= 90^\circ - x - 5^\circ$$

$$= 85^\circ - x$$

(v) The complement of $(30 - a)^\circ = 90^\circ - (30 - a)^\circ$

By further calculation

$$= 90^\circ - 30^\circ + a^\circ$$

$$= 60^\circ + a^\circ$$

(vi) The complement of $\frac{1}{2}$ of a right angle $= 90^\circ - \frac{1}{2}$ of a right angle

So we get

$$= 90^\circ - \frac{1}{2} \times 90^\circ$$

$$= 90^\circ - 45^\circ$$

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$$= 45^\circ$$

(vii) The complement of $\frac{1}{3}$ of $180^\circ = 90^\circ - \frac{1}{3}$ of 180°

By further calculation

$$= 90^\circ - 60^\circ$$

$$= 30^\circ$$

(viii) The complement of $21^\circ 17' = 90^\circ - 21^\circ 17'$

So we get

$$= 68^\circ 43'$$

11. Write the supplement of:

(i) 100°

(ii) 0°

(iii) x°

(iv) $(x + 35)^\circ$

(v) $(90 + a + b)^\circ$

(vi) $(110 - x - 2y)^\circ$

(vii) $\frac{1}{5}$ of a right angle

(viii) $80^\circ 49' 25''$

Solution:

(i) The supplement of $100^\circ = 180 - 100 = 80^\circ$

(ii) The supplement of $0^\circ = 180 - 0 = 180^\circ$

(iii) The supplement of $x^\circ = 180^\circ - x^\circ$

(iv) The supplement of $(x + 35)^\circ = 180^\circ - (x + 35)^\circ$

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We can write it as

$$= 180 - x - 35$$

$$= 145^\circ - x^\circ$$

$$(v) \text{ The supplement of } (90 + a + b)^\circ = 180^\circ - (90 + a + b)^\circ$$

We can write it as

$$= 180 - 90 - a - b$$

So we get

$$= 90^\circ - a^\circ - b^\circ$$

$$= (90 - a - b)^\circ$$

$$(vi) \text{ The supplement of } (110 - x - 2y)^\circ = 180^\circ - (110 - x - 2y)^\circ$$

We can write it as

$$= 180 - 110 + x + 2y$$

$$= 70^\circ + x^\circ + 2y^\circ$$

$$(vii) \text{ The supplement of } 1/5 \text{ of a right angle} = 180^\circ - 1/5 \text{ of a right angle}$$

We can write it as

$$= 180^\circ - 1/5 \times 90^\circ$$

So we get

$$= 180^\circ - 18^\circ$$

$$= 162^\circ$$

$$(viii) \text{ The supplement of } 80^\circ 49' 25'' = 180^\circ - 80^\circ 49' 25''$$

We know that $1^\circ = 60'$ and $1' = 60''$

So we get

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$$= 99^{\circ} 10' 35''$$

12. Are the following pairs of angles complementary?

(i) 10° and 80°

(ii) $37^{\circ} 28'$ and $52^{\circ} 33'$

(iii) $(x + 16)^{\circ}$ and $(74 - x)^{\circ}$

(iv) 54° and $\frac{2}{5}$ of a right angle.

Solution:

(i) 10° and 80°

Yes, they are complementary angles as their sum $= 10^{\circ} + 80^{\circ} = 90^{\circ}$

(ii) $37^{\circ} 28'$ and $52^{\circ} 33'$

No, they are not complementary angles as their sum is not equal to 90°

$$37^{\circ} 28' + 52^{\circ} 33' = 90^{\circ} 1'$$

(iii) $(x + 16)^{\circ}$ and $(74 - x)^{\circ}$

Yes, they are complementary angles as their sum $= x + 16 + 74 - x = 90^{\circ}$

(iv) 54° and $\frac{2}{5}$ of a right angle

We can write it as

$$= 54^{\circ} \text{ and } \frac{2}{5} \times 90^{\circ}$$

$$= 54^{\circ} \text{ and } 36^{\circ}$$

Yes, they are complementary angles as their sum $= 54 + 36 = 90^{\circ}$

13. Are the following pairs of angles supplementary?

(i) 139° and 39°

(ii) $26^{\circ} 59'$ and $153^{\circ} 1'$

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(iii) $\frac{3}{10}$ of a right angle and $\frac{4}{15}$ of two right angles

(iv) $2x^\circ + 65^\circ$ and $115^\circ - 2x^\circ$

Solution:

(i) 139° and 39°

No, they are not supplementary angles as their sum is not equal to 180°

$$139^\circ + 39^\circ = 178^\circ$$

(ii) $26^\circ 59'$ and $153^\circ 1'$

Yes, they are supplementary angles as their sum = $26^\circ 59' + 153^\circ 1' = 180^\circ$

(iii) $\frac{3}{10}$ of a right angle and $\frac{4}{15}$ of two right angles

We can write it as

$$= \frac{3}{10} \text{ of } 90^\circ \text{ and } \frac{4}{15} \text{ of } 180^\circ$$

$$= 27^\circ \text{ and } 48^\circ$$

No, they are not supplementary angles as their sum is not equal to 180°

$$27^\circ + 48^\circ = 75^\circ$$

(iv) $2x^\circ + 65^\circ$ and $115^\circ - 2x^\circ$

Yes they are supplementary angles as their sum = $2x + 65 + 115 - 2x = 180^\circ$

14. If $3x + 18^\circ$ and $2x + 25^\circ$ are supplementary, find the value of x .

Solution:

It is given that $3x + 18^\circ$ and $2x + 25^\circ$ are supplementary

We can write it as

$$3x + 18^\circ + 2x + 25^\circ = 180^\circ$$

By further calculation

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$$5x + 43^\circ = 180^\circ$$

So we get

$$5x = 180 - 43 = 137^\circ$$

$$x = 137/5 = 27.4^\circ \text{ or } 27^\circ 24'$$

15. If two complementary angles are in the ratio 1:5, find them.

Solution:

It is given that two complementary angles are in the ratio 1:5

Consider x and $5x$ as the angles

We can write it as

$$x + 5x = 90^\circ$$

$$6x = 90^\circ$$

So we get

$$x = 90/6 = 15^\circ$$

Here the angles will be 15° and $15 \times 5 = 75^\circ$

Exercise 14B page: 166

1. In questions 1 and 2, given below, identify the given pairs of angles as corresponding angles, interior alternate angles, exterior alternate angles, adjacent angles, vertically opposite angles or allied angles:

(i) $\angle 3$ and $\angle 6$

(ii) $\angle 2$ and $\angle 4$

(iii) $\angle 3$ and $\angle 7$

(iv) $\angle 2$ and $\angle 7$

(v) $\angle 4$ and $\angle 6$

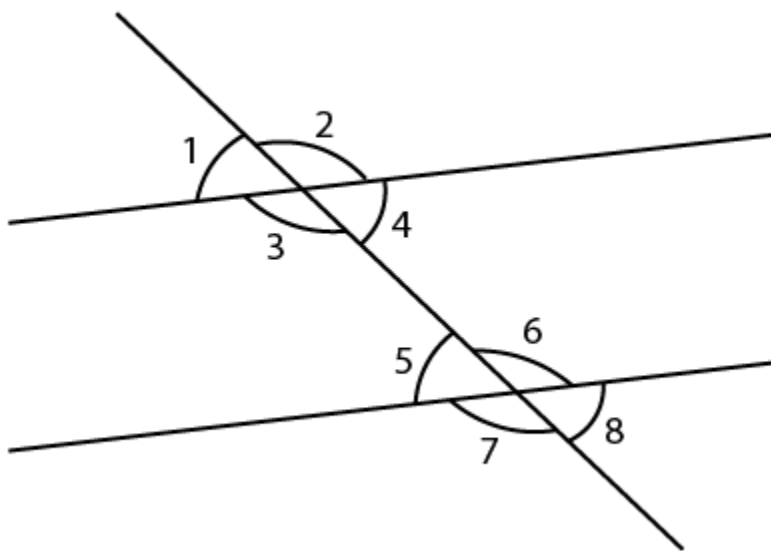
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(vi) $\angle 1$ and $\angle 8$

(vii) $\angle 1$ and $\angle 5$

(viii) $\angle 1$ and $\angle 4$

(ix) $\angle 5$ and $\angle 7$



Solution:

(i) $\angle 3$ and $\angle 6$ are interior alternate angles.

(ii) $\angle 2$ and $\angle 4$ are adjacent angles.

(iii) $\angle 3$ and $\angle 7$ are corresponding angles.

(iv) $\angle 2$ and $\angle 7$ are exterior alternate angles.

(v) $\angle 4$ and $\angle 6$ are allied or co-interior angles.

(vi) $\angle 1$ and $\angle 8$ are exterior alternate angles.

(vii) $\angle 1$ and $\angle 5$ are corresponding angles.

(viii) $\angle 1$ and $\angle 4$ are vertically opposite angles.

(ix) $\angle 5$ and $\angle 7$ are adjacent angles.

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2. (i) $\angle 1$ and $\angle 4$

(ii) $\angle 4$ and $\angle 7$

(iii) $\angle 10$ and $\angle 12$

(iv) $\angle 7$ and $\angle 13$

(v) $\angle 6$ and $\angle 8$

(vi) $\angle 11$ and $\angle 8$

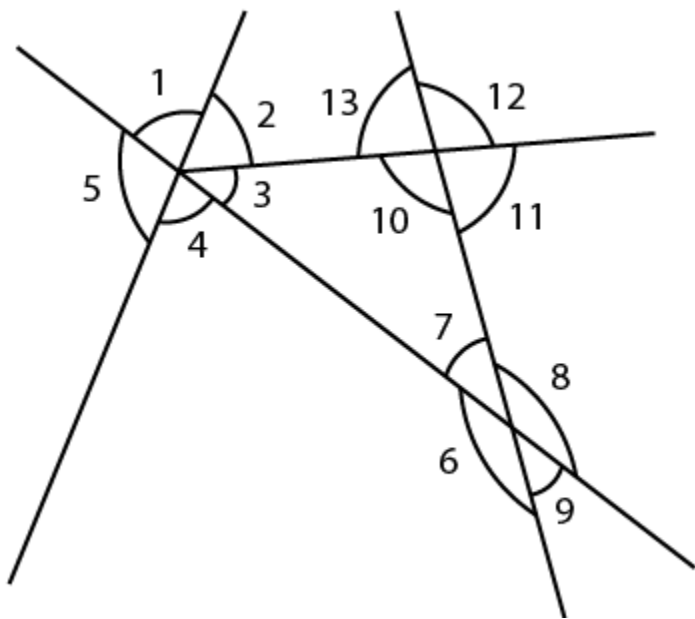
(vii) $\angle 7$ and $\angle 9$

(viii) $\angle 4$ and $\angle 5$

(ix) $\angle 4$ and $\angle 6$

(x) $\angle 6$ and $\angle 7$

(xi) $\angle 2$ and $\angle 13$



Solution:

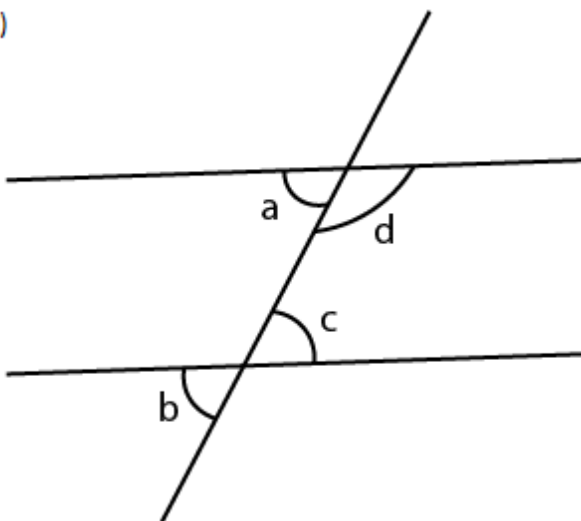
(i) $\angle 1$ and $\angle 4$ are vertically opposite angles.

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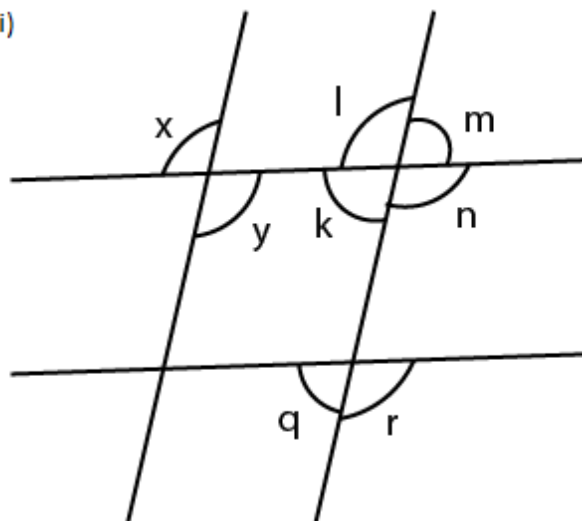
- (ii) $\angle 4$ and $\angle 7$ are interior alternate angles.
- (iii) $\angle 10$ and $\angle 12$ are vertically opposite angles.
- (iv) $\angle 7$ and $\angle 13$ are corresponding angles.
- (v) $\angle 6$ and $\angle 8$ are vertically opposite angles.
- (vi) $\angle 11$ and $\angle 8$ are allied or co-interior angles.
- (vii) $\angle 7$ and $\angle 9$ are vertically opposite angles.
- (viii) $\angle 4$ and $\angle 5$ are adjacent angles.
- (ix) $\angle 4$ and $\angle 6$ are allied or co-interior angles.
- (x) $\angle 6$ and $\angle 7$ are adjacent angles.
- (xi) $\angle 2$ and $\angle 13$ are allied or co-interior angles.

3. In the following figures, the arrows indicate parallel lines. State which angles are equal. Give reasons.

(i)



(ii)



Solution:

(i) From the figure (i)

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$a = b$ are corresponding angles

$b = c$ are vertically opposite angles

$a = c$ are alternate angles

So we get

$a = b = c$

(ii) From the figure (ii)

$x = y$ are vertically opposite angles

$y = l$ are alternate angles

$x = l$ are corresponding angles

$1 = n$ are vertically opposite angles

$n = r$ are corresponding angles

So we get

$x = y = l = n = r$

Similarly

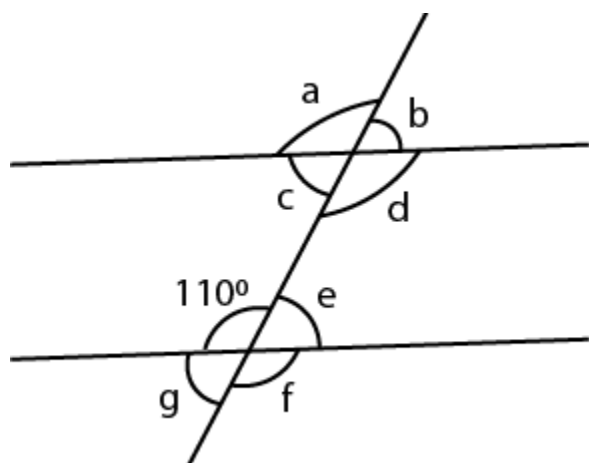
$m = k$ are vertically opposite angles

$k = q$ are corresponding angles

Hence, $m = k = q$.

4. In the given figure, find the measure of the unknown angles:

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**Solution:**

From the figure

$a = d$ are vertically opposite angles

$d = f$ are corresponding angles

$f = 110^\circ$ are vertically opposite angles

So we get

$$a = d = f = 110^\circ$$

We know that

$e + 110^\circ = 180^\circ$ are linear pair of angles

$$e = 180 - 110 = 70^\circ$$

$b = c$ are vertically opposite angles

$b = e$ are corresponding angles

$e = g$ are vertically opposite angles

So we get

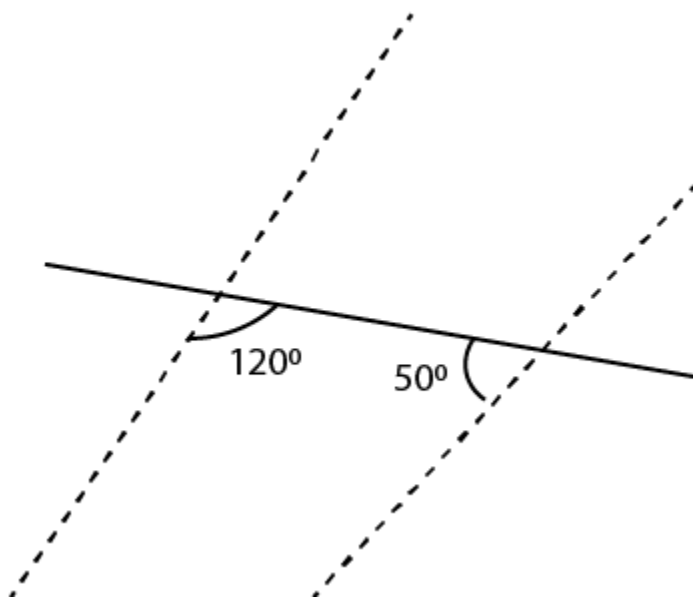
$$b = c = e = g = 70^\circ$$

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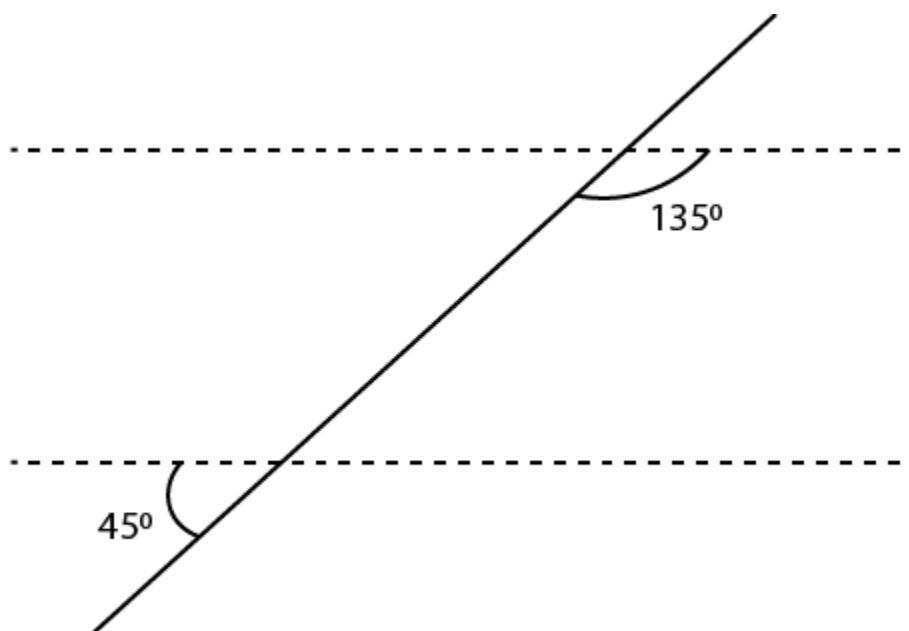
Therefore, $a = 110^\circ$, $b = 70^\circ$, $c = 70^\circ$, $d = 110^\circ$, $e = 70^\circ$, $f = 110^\circ$ and $g = 70^\circ$.

5. Which pair of the dotted line, segments, in the following figures, are parallel. Give reason:

i)

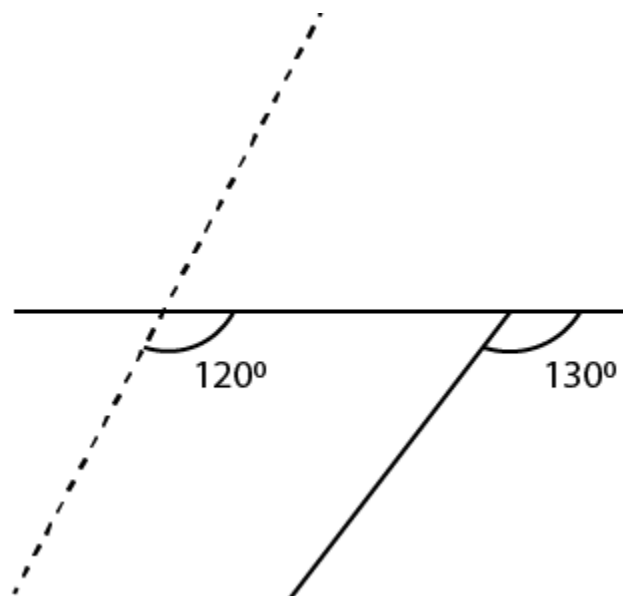


ii)

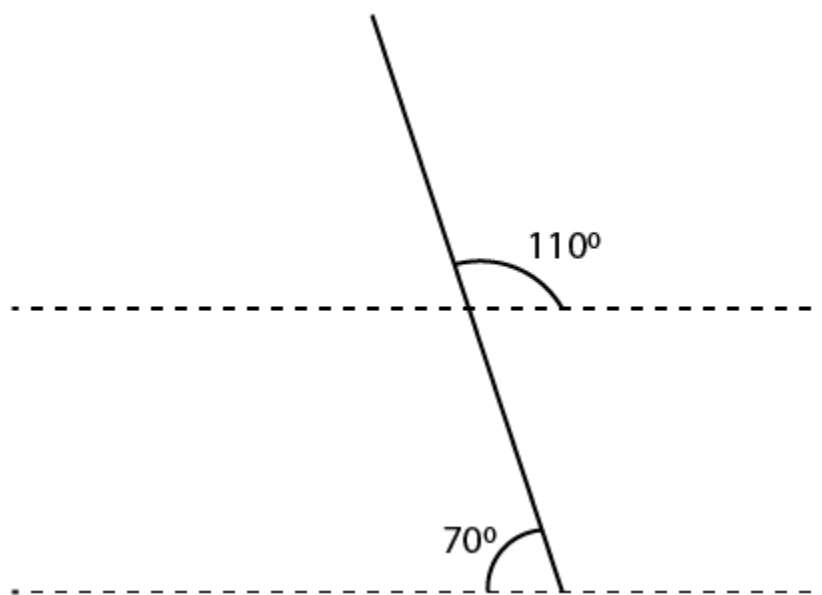


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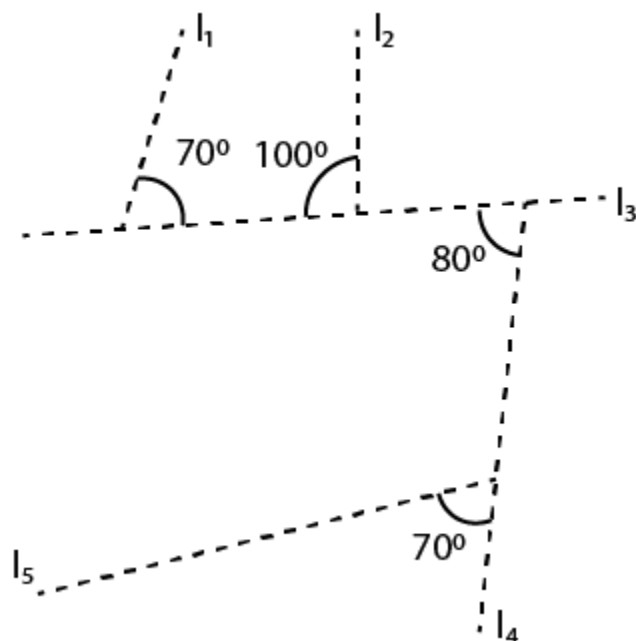
iii)



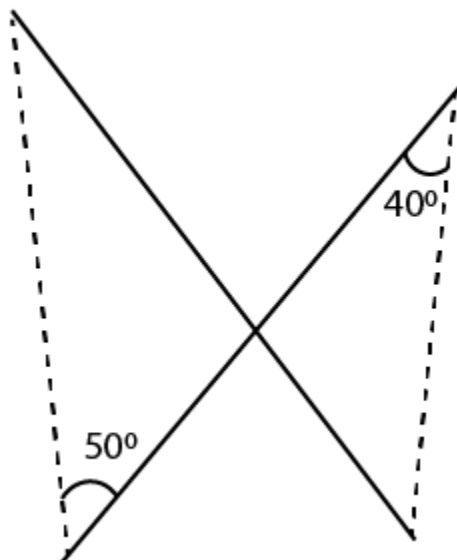
iv)



v)



vi)



Solution:

(i) From the figure (i)

If the lines are parallel we get $120^\circ + 50^\circ = 180^\circ$

There are co-interior angles where $170^\circ \neq 180^\circ$

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Therefore, they are not parallel lines.

(ii) From the figure (ii)

$\angle 1 = 45^\circ$ are vertically opposite angles

We know that the lines are parallel if

$\angle 1 + 135^\circ = 180^\circ$ are co-interior angles

Substituting the values

$$45^\circ + 135^\circ = 180^\circ$$

$$180^\circ = 180^\circ \text{ which is true}$$

Therefore, the lines are parallel.

(iii) From the figure (iii)

The lines are parallel if corresponding angles are equal

$$\text{Here } 120^\circ \neq 130^\circ$$

Hence, lines are not parallel.

(iv) $\angle 1 = 110^\circ$ are vertically opposite angles

We know that if lines are parallel

$\angle 1 + 70^\circ = 180^\circ$ are co-interior angles

Substituting the values

$$110^\circ + 70^\circ = 180^\circ$$

$$180^\circ = 180^\circ \text{ which is correct}$$

Therefore, the lines are parallel.

(v) $\angle 1 + 100^\circ = 180^\circ$

So we get

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$\angle 1 = 180^\circ - 100^\circ = 80^\circ$ which is a linear pair

Here the lines l_1 and l_2 are parallel if $\angle 1 = 70^\circ$

But here $\angle 1 = 80^\circ$ which is not equal to 70°

So the lines l_1 and l_2 are not parallel

Now, l_3 and l_5 will be parallel if corresponding angles are equal

But here, the corresponding angles $80^\circ \neq 70^\circ$

Hence, l_3 and l_5 are not parallel.

We know that, in l_2 and l_4

$\angle 1 = 80^\circ$ are alternate angles

$80^\circ = 80^\circ$ which is true

Hence, l_2 and l_4 are parallel.

(vi) Two lines are parallel if alternate angles are equal

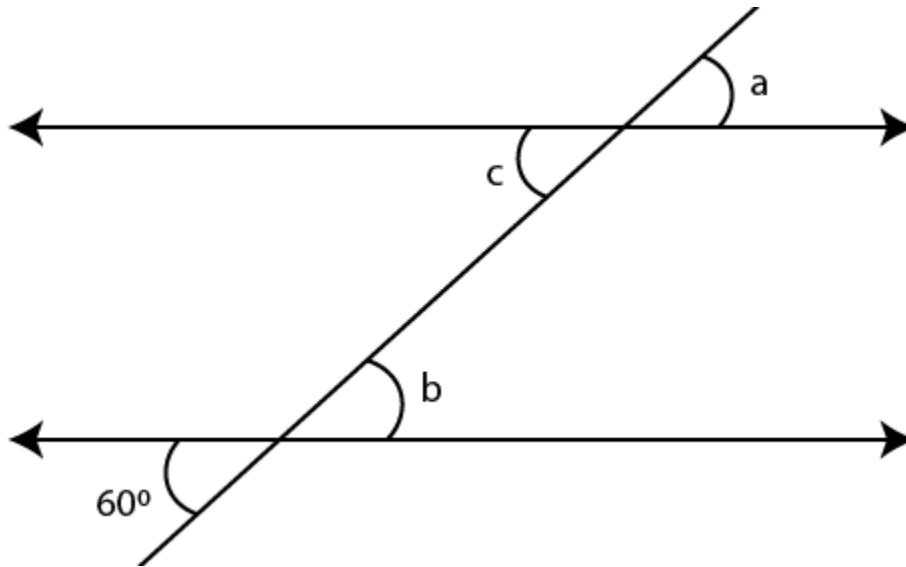
Here, $50^\circ \neq 40^\circ$ which is not true

Hence, the lines are not parallel.

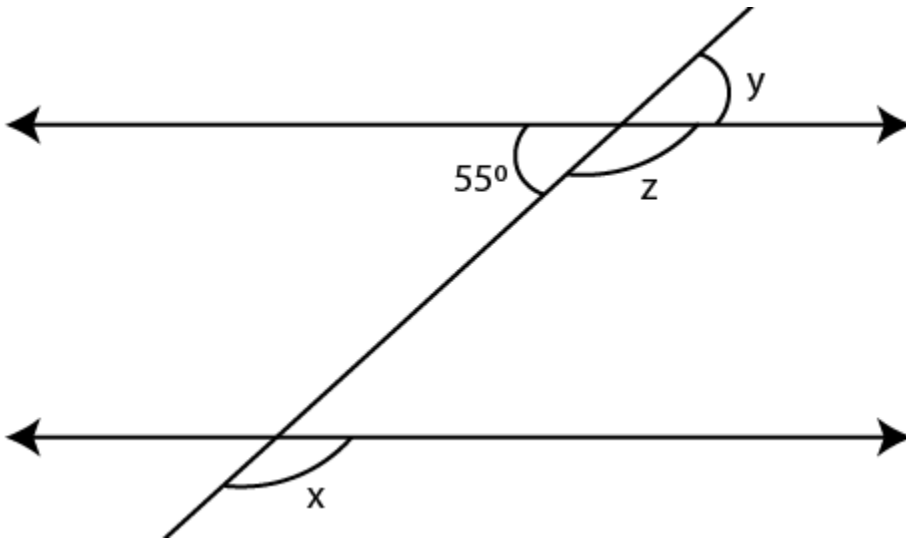
6. In the given figures, the directed lines are parallel to each other. Find the unknown angles.

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i)

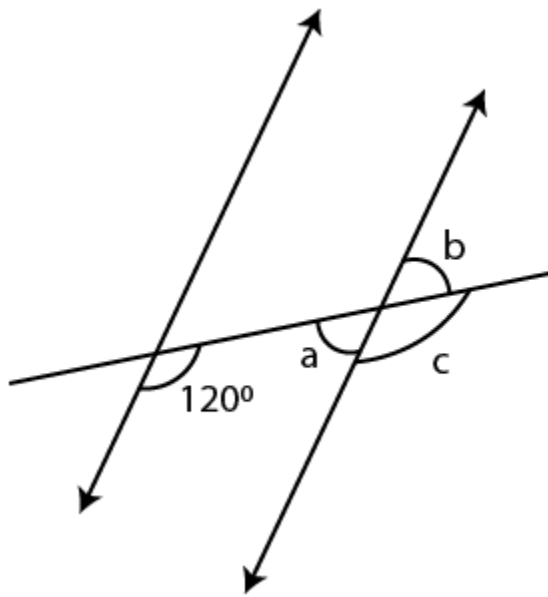


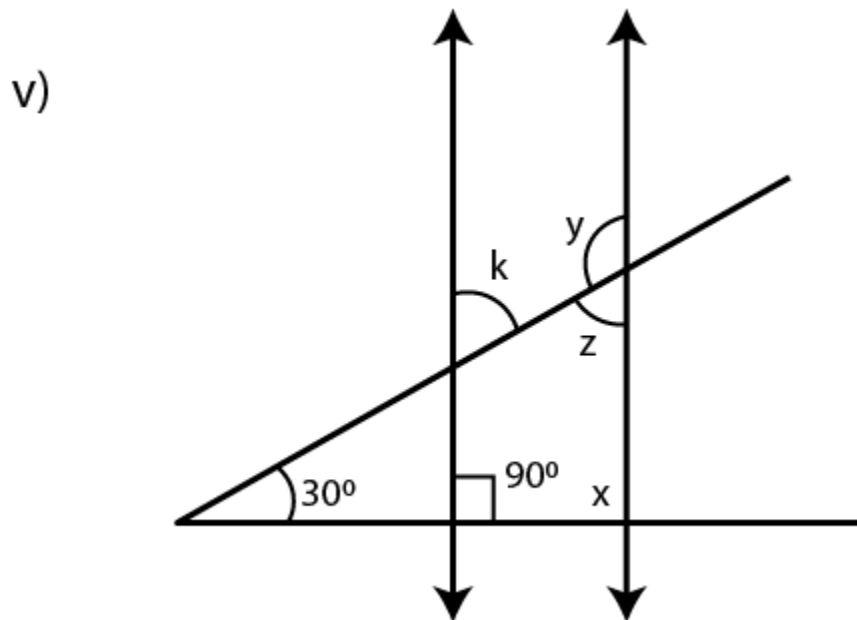
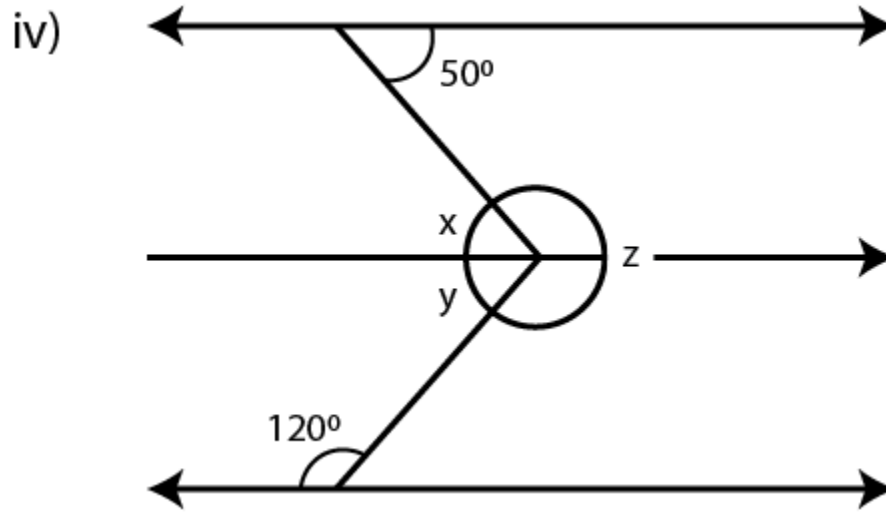
ii)



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iii)





Solution:

(i) If the lines are parallel

$a = b$ are corresponding angles

$a = c$ are vertically opposite angles

$a = b = c$

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Here $b = 60^\circ$ are vertically opposite angles

Therefore, $a = b = c = 60^\circ$

(ii) If the lines are parallel

$x = z$ are corresponding angles

$z + y = 180^\circ$ is a linear pair

$y = 55^\circ$ are vertically opposite angles

Substituting the values

$$z + 55^\circ = 180^\circ$$

$$z = 180 - 55 = 125^\circ$$

If $x = z$ we get $x = 125^\circ$

Therefore, $x = 125^\circ$, $y = 55^\circ$ and $z = 125^\circ$.

(iii) If the lines are parallel

$c = 120^\circ$ (corresponding angles)

$a + 120^\circ = 180^\circ$ are co-interior angles

$$a = 180 - 120 = 60^\circ$$

We know that $a = b$ are vertically opposite angles

So $b = 60^\circ$

Therefore, $a = b = 60^\circ$ and $c = 120^\circ$.

(iv) If the lines are parallel

$x = 50^\circ$ are alternate angles

$y + 120^\circ = 180^\circ$ are co-interior angles

$$y = 180 - 120 = 60^\circ$$

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We know that

$x + y + z = 360^\circ$ are angles at a point

Substituting the values

$$50 + 60 + z = 360$$

By further calculation

$$110 + z = 360$$

$$z = 360 - 110 = 250^\circ$$

Therefore, $x = 50^\circ$, $y = 60^\circ$ and $z = 250^\circ$.

(v) If the lines are parallel

$x + 90^\circ = 180^\circ$ are co-interior angles

$$x = 180^\circ - 90^\circ = 90^\circ$$

$$\angle 2 = x$$

$$\angle 2 = 90^\circ$$

We know that the sum of angles of a triangle

$$\angle 1 + \angle 2 + 30^\circ = 180^\circ$$

Substituting the values

$$\angle 1 + 90^\circ + 30^\circ = 180^\circ$$

By further calculation

$$\angle 1 + 120^\circ = 180^\circ$$

$$\angle 1 = 180 - 120 = 60^\circ$$

Here $\angle 1 = k$ are vertically opposite angles

$$k = 60^\circ$$

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Here $\angle 1 = z$ are corresponding angles

$$z = 60^\circ$$

Here $k + y = 180^\circ$ are co-interior angles

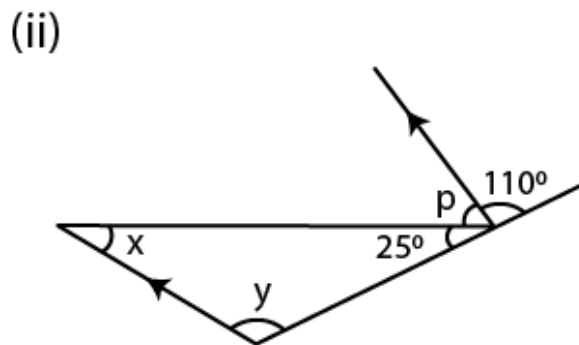
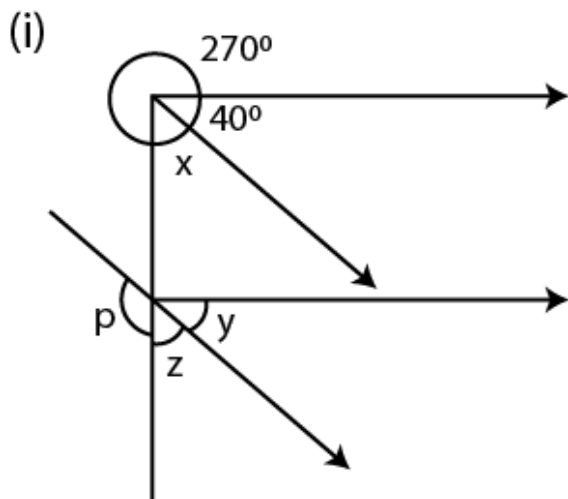
Substituting the values

$$60^\circ + y = 180^\circ$$

$$y = 180 - 60 = 120^\circ$$

Therefore, $x = 90^\circ$, $y = 120^\circ$, $z = 60^\circ$, $k = 60^\circ$.

7. Find x , y and p in the given figures:



Solution:

(i) From the figure (i)

The lines are parallel

$x = z$ are corresponding angles

$y = 40^\circ$ are corresponding angles

We know that

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$x + 40^\circ + 270^\circ = 360^\circ$ are the angles at a point

So we get

$$x + 310^\circ = 360^\circ$$

$$x = 360 - 310 = 50^\circ$$

$$\text{So } z = x = 50^\circ$$

Here $p + z = 180^\circ$ is a linear pair

By substituting the values

$$p + 50^\circ = 180^\circ$$

$$p = 180 - 50 = 130^\circ$$

Therefore, $x = 50^\circ$, $y = 40^\circ$, $z = 50^\circ$ and $p = 130^\circ$.

(ii) From the figure (ii)

The lines are parallel

$y = 110^\circ$ are corresponding angles

We know that

$25^\circ + p + 110^\circ = 180^\circ$ are angles on a line

$$p + 135^\circ = 180^\circ$$

$$p = 180 - 135 = 45^\circ$$

We know that the sum of angles of a triangle

$$x + y + 25^\circ = 180^\circ$$

$$x + 110^\circ + 25^\circ = 180^\circ$$

By further calculation

$$x + 135^\circ = 180^\circ$$

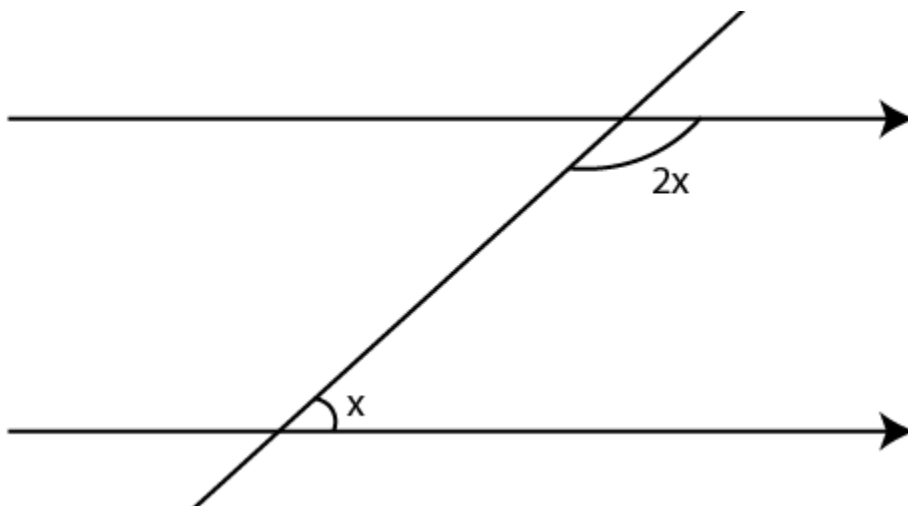
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$$x = 180 - 135 = 45^\circ$$

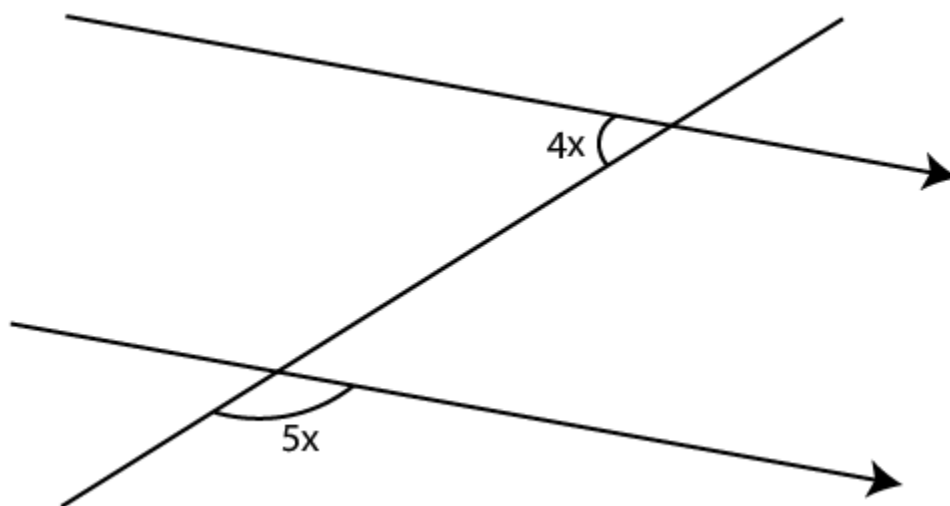
Therefore, $x = 45^\circ$, $y = 110^\circ$ and $p = 45^\circ$.

8. Find x in the following cases:

(i)

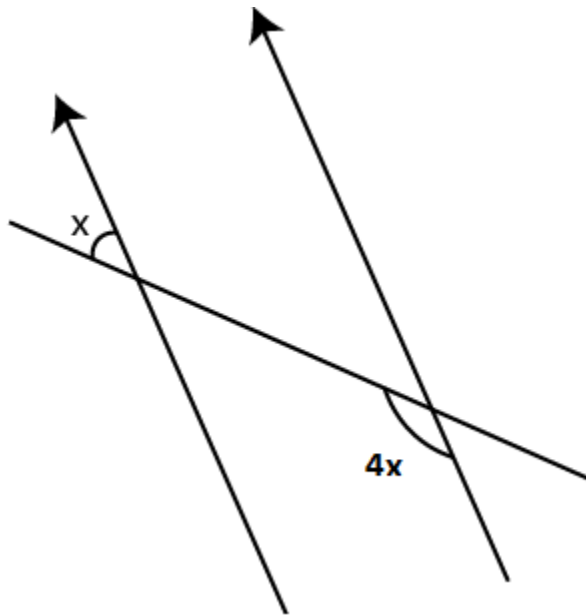


(ii)



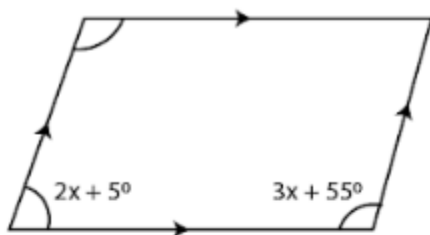
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(iii)

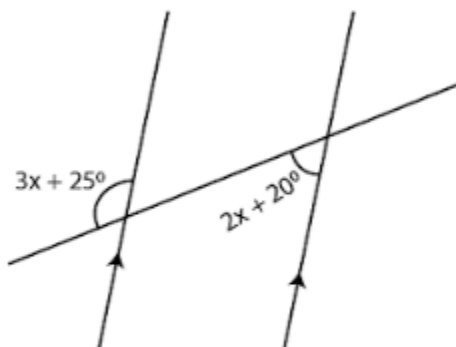


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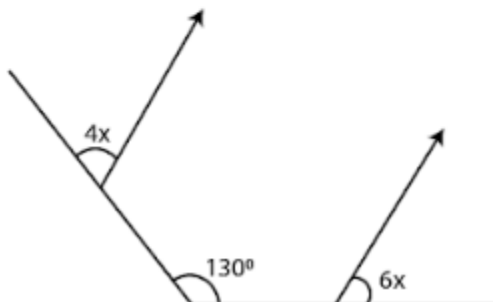
(iv)



(v)



(vi)

**Solution:**

(i) From the figure (i)

The lines are parallel

 $2x + x = 180^\circ$ are co-interior angles

$$3x = 180^\circ$$

$$x = 180/3 = 60^\circ$$

(ii) From the figure (ii)

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The lines are parallel

$4x + \angle 1 = 180^\circ$ are co-interior angles

$\angle 1 = 5x$ are vertically opposite angles

Substituting the values

$$4x + 5x = 180^\circ$$

So we get

$$9x = 180^\circ$$

$$x = 180/9 = 20^\circ$$

(iii) From the figure (iii)

The lines are parallel

$\angle 1 + 4x = 180^\circ$ are co-interior angles

$\angle 1 = x$ are vertically opposite angles

Substituting the values

$$x + 4x = 180^\circ$$

$$5x = 180^\circ$$

So we get

$$x = 180/5 = 36^\circ$$

(iv) From the figure (iv)

The lines are parallel

$2x + 5 + 3x + 55 = 180^\circ$ are co-interior angles

$$5x + 60^\circ = 180^\circ$$

By further calculation

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$$5x = 180 - 60 = 120^\circ$$

So we get

$$x = 120/5 = 24^\circ$$

(v) From the figure (v)

The lines are parallel

$\angle 1 = 2x + 20^\circ$ are alternate angles

$\angle 1 + 3x + 25^\circ = 180^\circ$ is a linear pair

Substituting the values

$$2x + 20^\circ + 3x + 25^\circ = 180^\circ$$

$$5x + 45^\circ = 180^\circ$$

So we get

$$5x = 180 - 45 = 135^\circ$$

$$x = 135/5 = 27^\circ$$

(vi) From the figure (vi)

Construct a line parallel to the given parallel lines

$\angle 1 = 4x$ and $\angle 2 = 6x$ are corresponding angles

$$\angle 1 + \angle 2 = 130^\circ$$

Substituting the values

$$4x + 6x = 130^\circ$$

$$10x = 130^\circ$$

So we get

$$x = 13$$

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$e + 110^\circ = 180^\circ$ are linear pair of angles

$$e = 180 - 110 = 70^\circ$$

$b = c$ are vertically opposite angles

$b = e$ are corresponding angles

$e = g$ are vertically opposite angles

So we get

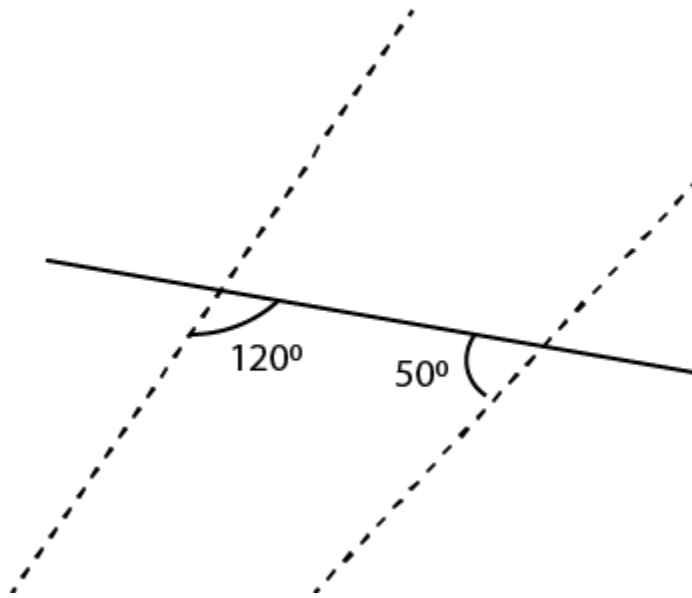
$$b = c = e = g = 70^\circ$$

Therefore, $a = 110^\circ$, $b = 70^\circ$, $c = 70^\circ$, $d = 110^\circ$, $e = 70^\circ$, $f = 110^\circ$ and $g = 70^\circ$.

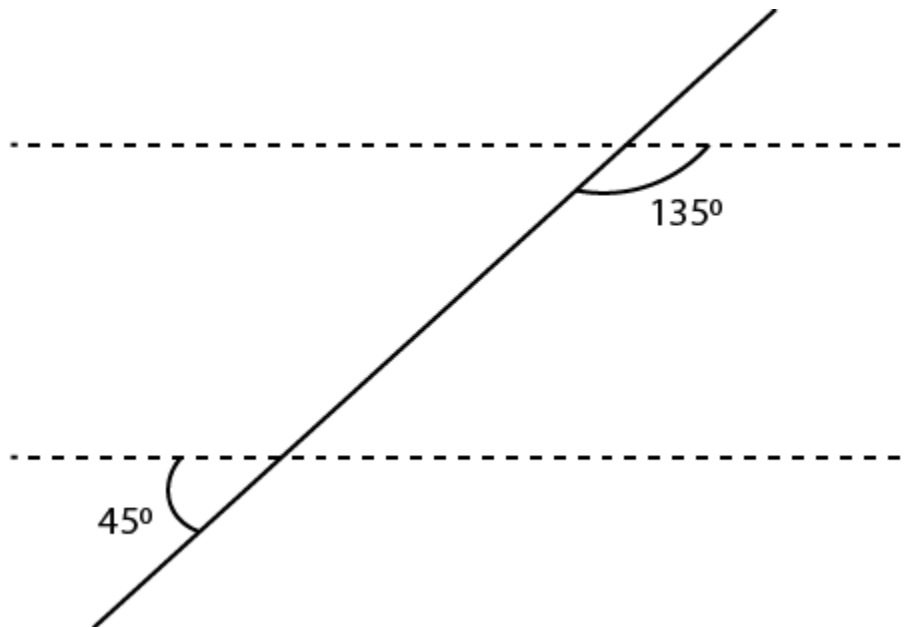
5. Which pair of the dotted line, segments, in the following figures, are parallel. Give reason:

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i)

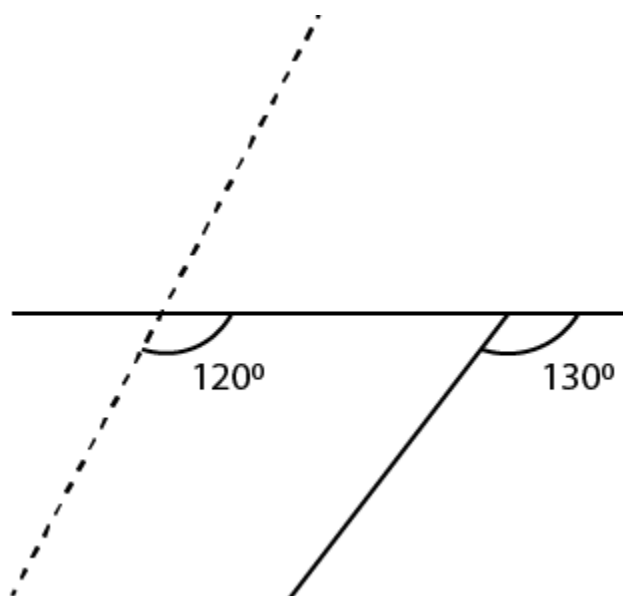


ii)

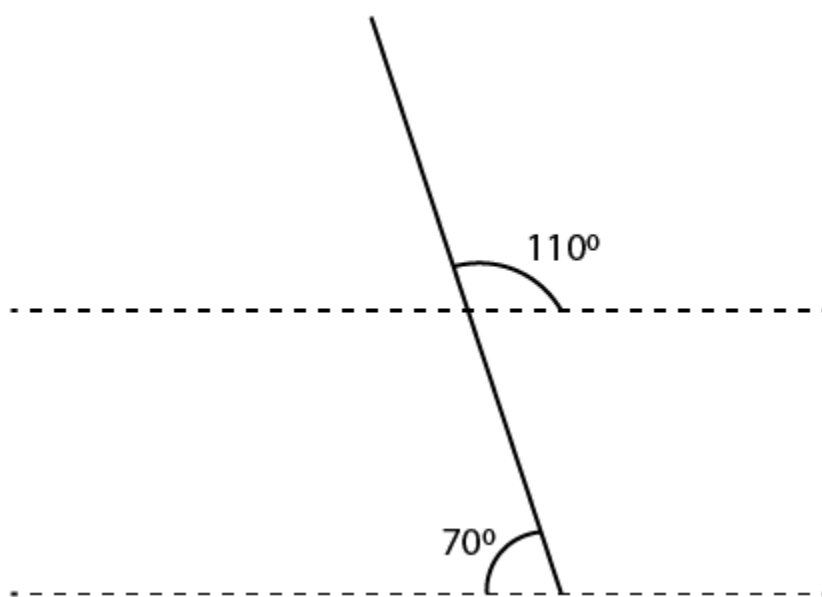


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iii)

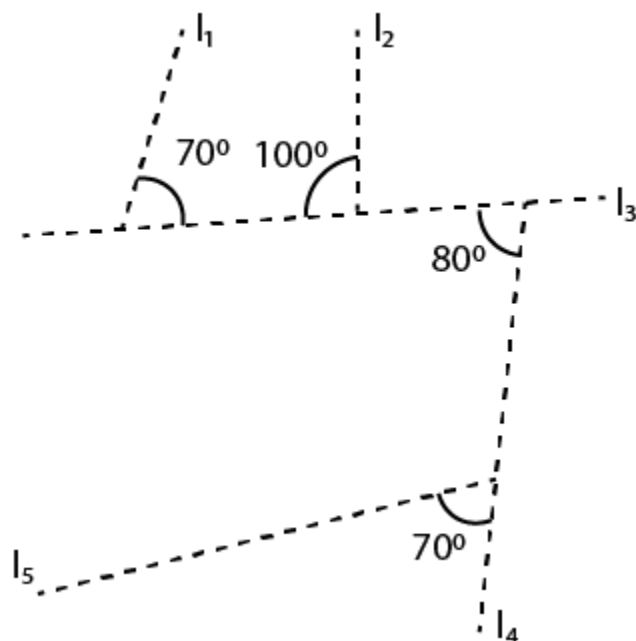


iv)

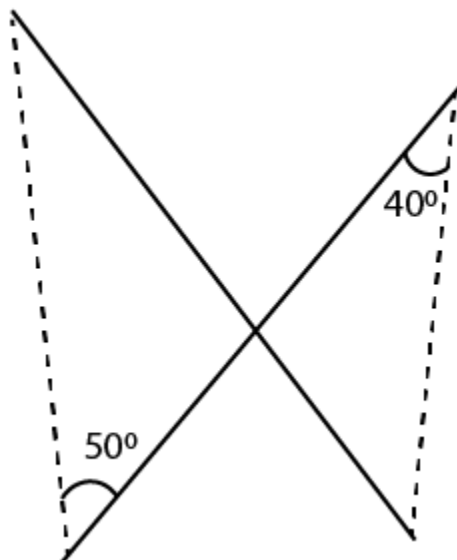


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v)



vi)



Solution:

(i) From the figure (i)

If the lines are parallel we get $120^\circ + 50^\circ = 180^\circ$

There are co-interior angles where $170^\circ \neq 180^\circ$

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Therefore, they are not parallel lines.

(ii) From the figure (ii)

$\angle 1 = 45^\circ$ are vertically opposite angles

We know that the lines are parallel if

$\angle 1 + 135^\circ = 180^\circ$ are co-interior angles

Substituting the values

$$45^\circ + 135^\circ = 180^\circ$$

$$180^\circ = 180^\circ \text{ which is true}$$

Therefore, the lines are parallel.

(iii) From the figure (iii)

The lines are parallel if corresponding angles are equal

$$\text{Here } 120^\circ \neq 130^\circ$$

Hence, lines are not parallel.

(iv) $\angle 1 = 110^\circ$ are vertically opposite angles

We know that if lines are parallel

$\angle 1 + 70^\circ = 180^\circ$ are co-interior angles

Substituting the values

$$110^\circ + 70^\circ = 180^\circ$$

$$180^\circ = 180^\circ \text{ which is correct}$$

Therefore, the lines are parallel.

(v) $\angle 1 + 100^\circ = 180^\circ$

So we get

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$\angle 1 = 180^\circ - 100^\circ = 80^\circ$ which is a linear pair

Here the lines l_1 and l_2 are parallel if $\angle 1 = 70^\circ$

But here $\angle 1 = 80^\circ$ which is not equal to 70°

So the lines l_1 and l_2 are not parallel

Now, l_3 and l_5 will be parallel if corresponding angles are equal

But here, the corresponding angles $80^\circ \neq 70^\circ$

Hence, l_3 and l_5 are not parallel.

We know that, in l_2 and l_4

$\angle 1 = 80^\circ$ are alternate angles

$80^\circ = 80^\circ$ which is true

Hence, l_2 and l_4 are parallel.

(vi) Two lines are parallel if alternate angles are equal

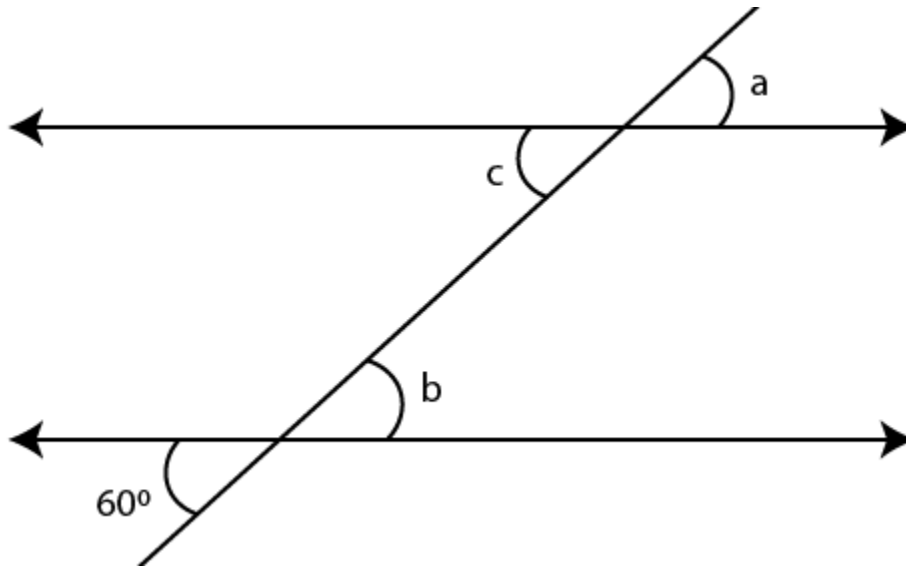
Here, $50^\circ \neq 40^\circ$ which is not true

Hence, the lines are not parallel.

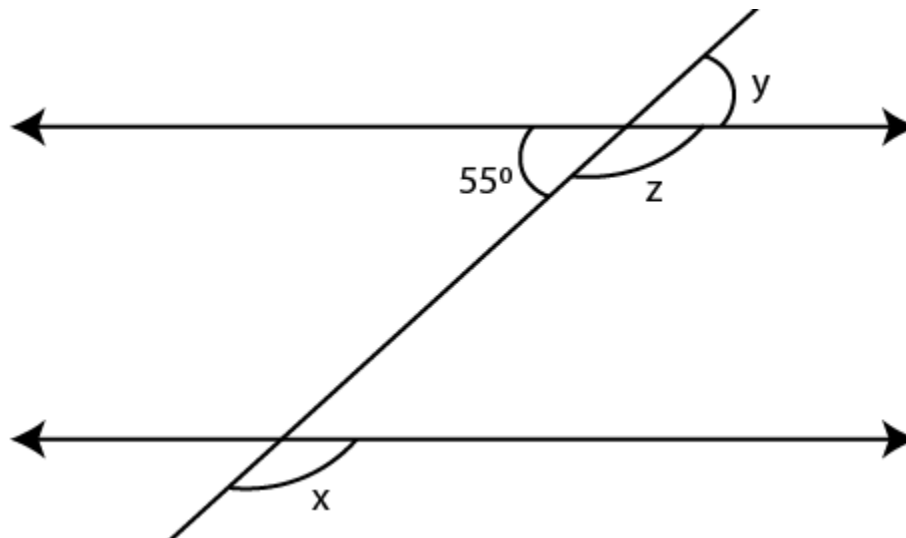
6. In the given figures, the directed lines are parallel to each other. Find the unknown angles.

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i)

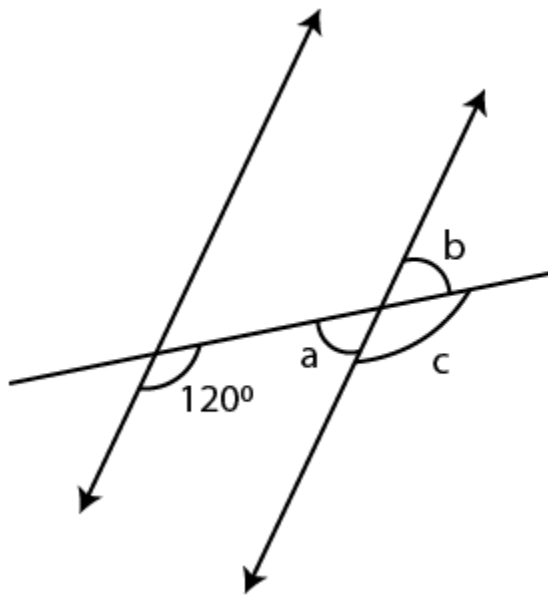


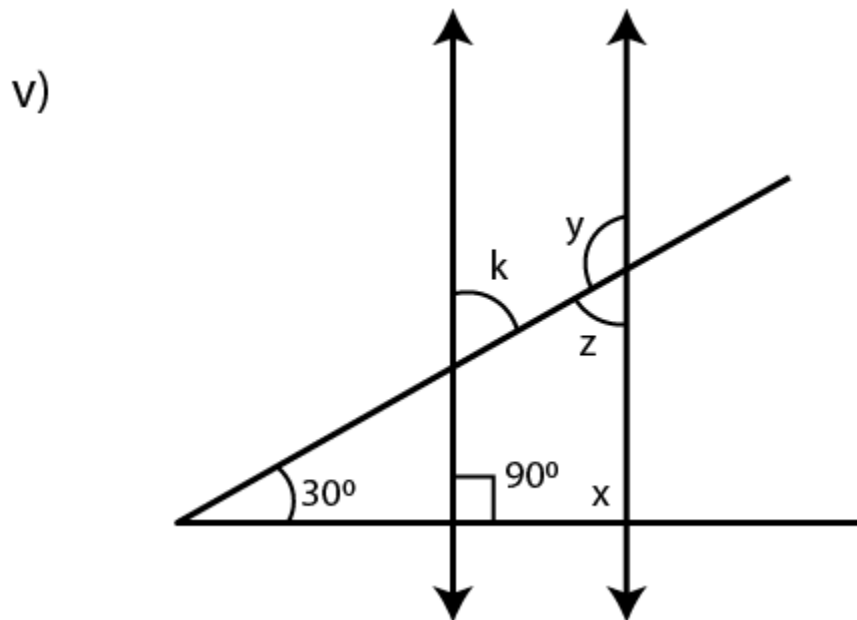
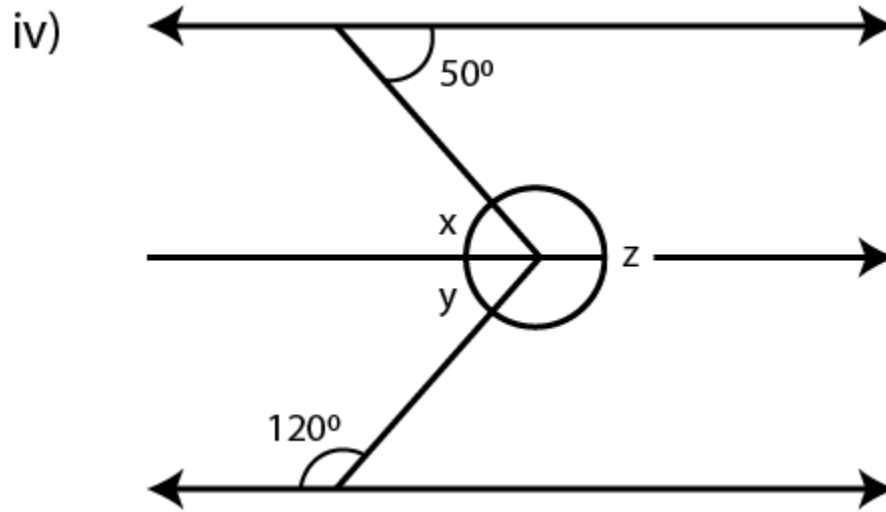
ii)



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iii)





Solution:

(i) If the lines are parallel

$a = b$ are corresponding angles

$a = c$ are vertically opposite angles

$a = b = c$

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Here $b = 60^\circ$ are vertically opposite angles

Therefore, $a = b = c = 60^\circ$

(ii) If the lines are parallel

$x = z$ are corresponding angles

$z + y = 180^\circ$ is a linear pair

$y = 55^\circ$ are vertically opposite angles

Substituting the values

$$z + 55^\circ = 180^\circ$$

$$z = 180 - 55 = 125^\circ$$

If $x = z$ we get $x = 125^\circ$

Therefore, $x = 125^\circ$, $y = 55^\circ$ and $z = 125^\circ$.

(iii) If the lines are parallel

$c = 120^\circ$ (corresponding angles)

$a + 120^\circ = 180^\circ$ are co-interior angles

$$a = 180 - 120 = 60^\circ$$

We know that $a = b$ are vertically opposite angles

So $b = 60^\circ$

Therefore, $a = b = 60^\circ$ and $c = 120^\circ$.

(iv) If the lines are parallel

$x = 50^\circ$ are alternate angles

$y + 120^\circ = 180^\circ$ are co-interior angles

$$y = 180 - 120 = 60^\circ$$

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We know that

$x + y + z = 360^\circ$ are angles at a point

Substituting the values

$$50 + 60 + z = 360$$

By further calculation

$$110 + z = 360$$

$$z = 360 - 110 = 250^\circ$$

Therefore, $x = 50^\circ$, $y = 60^\circ$ and $z = 250^\circ$.

(v) If the lines are parallel

$x + 90^\circ = 180^\circ$ are co-interior angles

$$x = 180^\circ - 90^\circ = 90^\circ$$

$$\angle 2 = x$$

$$\angle 2 = 90^\circ$$

We know that the sum of angles of a triangle

$$\angle 1 + \angle 2 + 30^\circ = 180^\circ$$

Substituting the values

$$\angle 1 + 90^\circ + 30^\circ = 180^\circ$$

By further calculation

$$\angle 1 + 120^\circ = 180^\circ$$

$$\angle 1 = 180 - 120 = 60^\circ$$

Here $\angle 1 = k$ are vertically opposite angles

$$k = 60^\circ$$

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Here $\angle 1 = z$ are corresponding angles

$$z = 60^\circ$$

Here $k + y = 180^\circ$ are co-interior angles

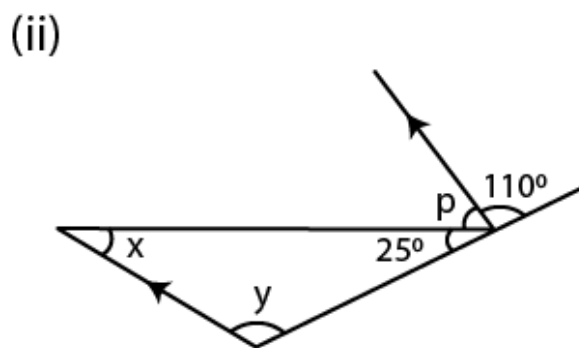
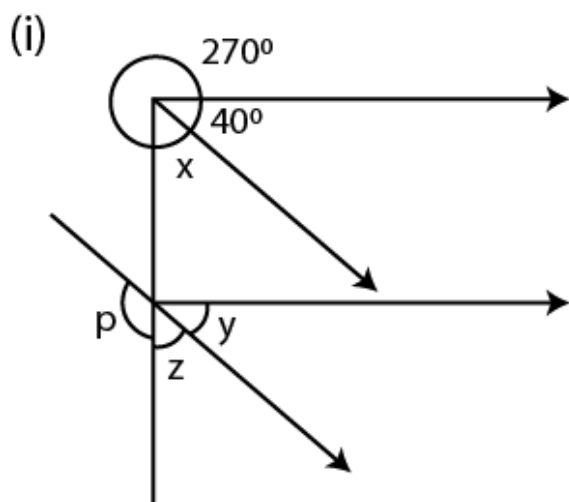
Substituting the values

$$60^\circ + y = 180^\circ$$

$$y = 180 - 60 = 120^\circ$$

Therefore, $x = 90^\circ$, $y = 120^\circ$, $z = 60^\circ$, $k = 60^\circ$.

7. Find x , y and p in the given figures:



Solution:

(i) From the figure (i)

The lines are parallel

$x = z$ are corresponding angles

$y = 40^\circ$ are corresponding angles

We know that

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$x + 40^\circ + 270^\circ = 360^\circ$ are the angles at a point

So we get

$$x + 310^\circ = 360^\circ$$

$$x = 360 - 310 = 50^\circ$$

$$\text{So } z = x = 50^\circ$$

Here $p + z = 180^\circ$ is a linear pair

By substituting the values

$$p + 50^\circ = 180^\circ$$

$$p = 180 - 50 = 130^\circ$$

Therefore, $x = 50^\circ$, $y = 40^\circ$, $z = 50^\circ$ and $p = 130^\circ$.

(ii) From the figure (ii)

The lines are parallel

$y = 110^\circ$ are corresponding angles

We know that

$25^\circ + p + 110^\circ = 180^\circ$ are angles on a line

$$p + 135^\circ = 180^\circ$$

$$p = 180 - 135 = 45^\circ$$

We know that the sum of angles of a triangle

$$x + y + 25^\circ = 180^\circ$$

$$x + 110^\circ + 25^\circ = 180^\circ$$

By further calculation

$$x + 135^\circ = 180^\circ$$

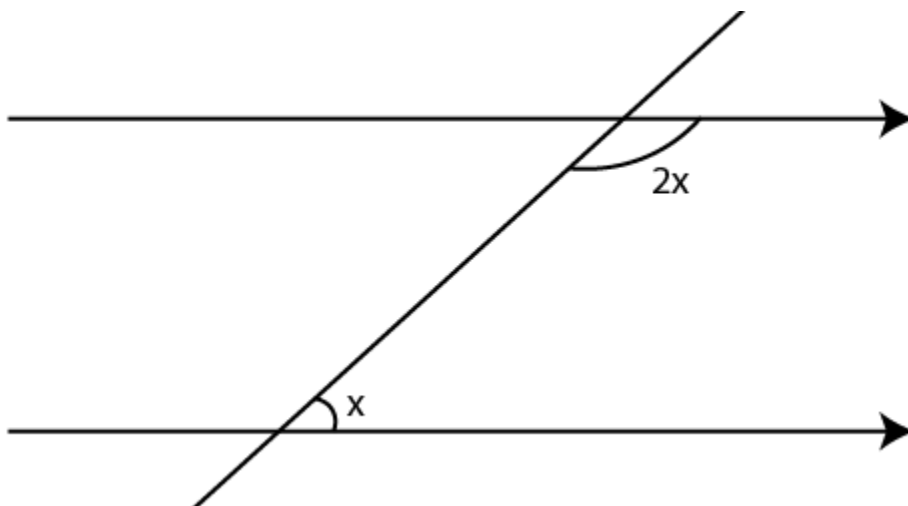
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$$x = 180 - 135 = 45^\circ$$

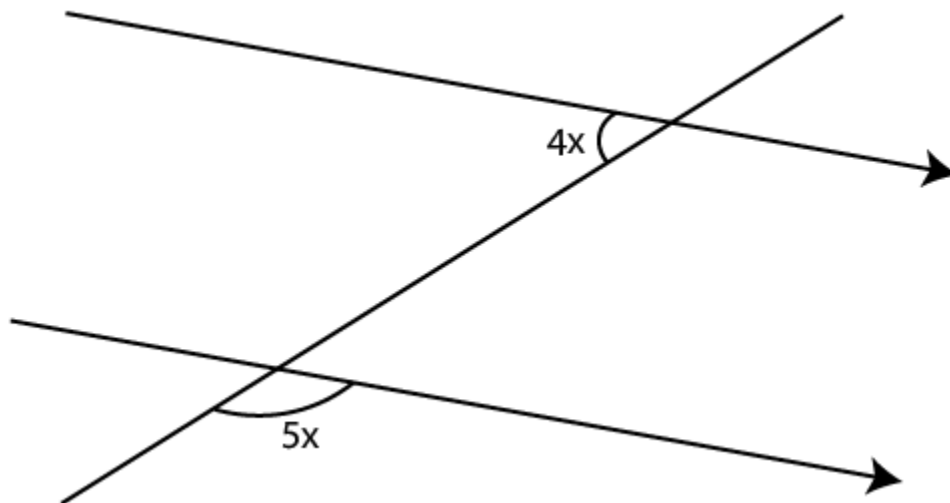
Therefore, $x = 45^\circ$, $y = 110^\circ$ and $p = 45^\circ$.

8. Find x in the following cases:

(i)

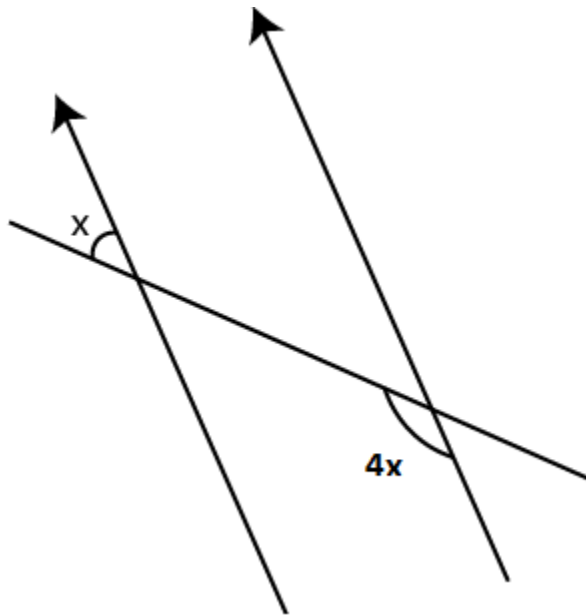


(ii)



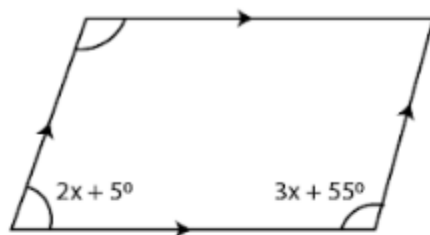
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(iii)

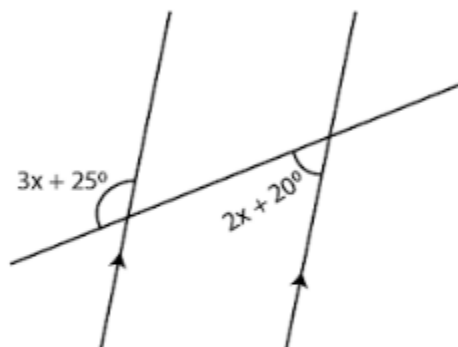


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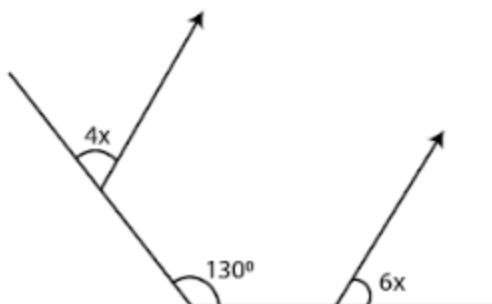
(iv)



(v)



(vi)



Solution:

(i) From the figure (i)

The lines are parallel

$2x + x = 180^\circ$ are co-interior angles

$$3x = 180^\circ$$

$$x = 180/3 = 60^\circ$$

(ii) From the figure (ii)

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The lines are parallel

$4x + \angle 1 = 180^\circ$ are co-interior angles

$\angle 1 = 5x$ are vertically opposite angles

Substituting the values

$$4x + 5x = 180^\circ$$

So we get

$$9x = 180^\circ$$

$$x = 180/9 = 20^\circ$$

(iii) From the figure (iii)

The lines are parallel

$\angle 1 + 4x = 180^\circ$ are co-interior angles

$\angle 1 = x$ are vertically opposite angles

Substituting the values

$$x + 4x = 180^\circ$$

$$5x = 180^\circ$$

So we get

$$x = 180/5 = 36^\circ$$

(iv) From the figure (iv)

The lines are parallel

$2x + 5 + 3x + 55 = 180^\circ$ are co-interior angles

$$5x + 60^\circ = 180^\circ$$

By further calculation

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$$5x = 180 - 60 = 120^\circ$$

So we get

$$x = 120/5 = 24^\circ$$

(v) From the figure (v)

The lines are parallel

$\angle 1 = 2x + 20^\circ$ are alternate angles

$\angle 1 + 3x + 25^\circ = 180^\circ$ is a linear pair

Substituting the values

$$2x + 20^\circ + 3x + 25^\circ = 180^\circ$$

$$5x + 45^\circ = 180^\circ$$

So we get

$$5x = 180 - 45 = 135^\circ$$

$$x = 135/5 = 27^\circ$$

(vi) From the figure (vi)

Construct a line parallel to the given parallel lines

$\angle 1 = 4x$ and $\angle 2 = 6x$ are corresponding angles

$$\angle 1 + \angle 2 = 130^\circ$$

Substituting the values

$$4x + 6x = 130^\circ$$

$$10x = 130^\circ$$

So we get

$$x = 130/10 = 13^\circ$$

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Exercise 14C PAGE: 172

1. Using ruler and compasses, construct the following angles:

(i) 30°

(ii) 15°

(iii) 75°

(iv) 180°

(v) 165°

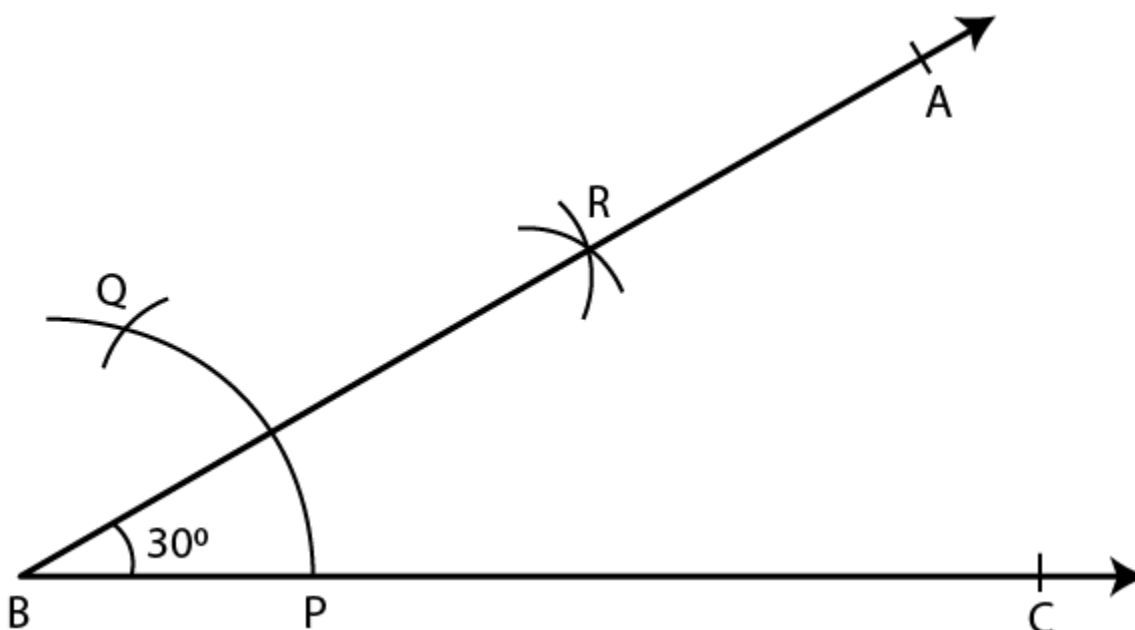
Solution:

(i) 30°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and a suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and same radius cut off the arc at the point Q.
4. Consider P and Q as centre construct two arcs which intersect each other at the point R.
5. Now join BR and produce it to point A forming $\angle ABC = 30^\circ$

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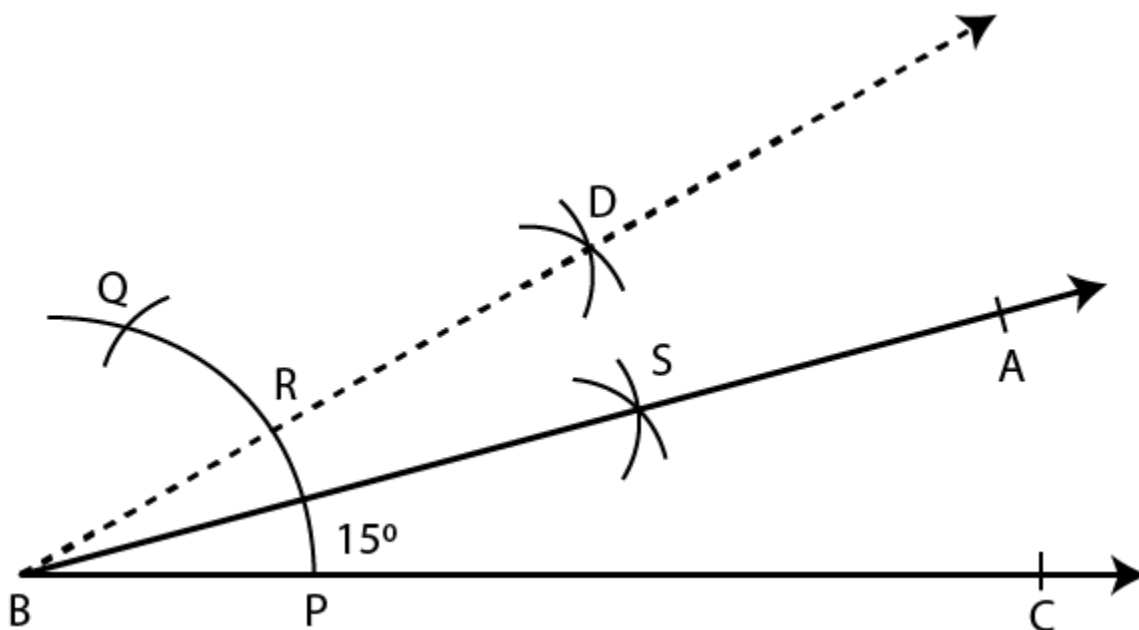
(ii) 15°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and a suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and same radius cut off the arc at the point Q.
4. Consider P and Q as centres, construct two arcs which intersect each other at the point D and join BD.
5. Taking P and R as centre construct two more arcs which intersect each other at the point S.
6. Now join BS and produce it to point A.

$$\angle ABC = 15^\circ$$

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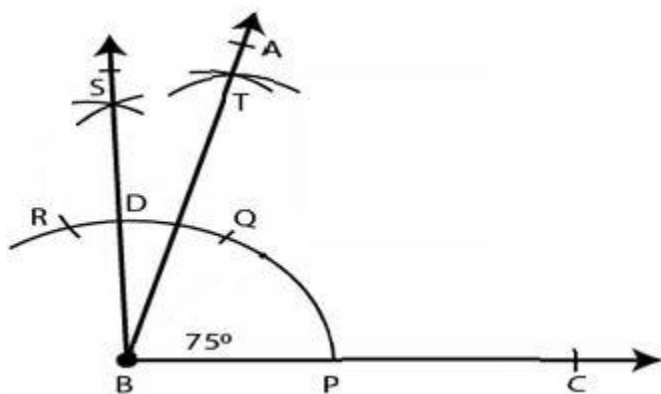
(iii) 75°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and suitable radius construct an arc and cut off PQ then QR of the same radius.
3. Taking Q and R as centre, construct two arcs which intersect each other at the point S.
4. Now join SB.
5. Taking Q and D as centre construct two arcs which intersect each other at the point T.
6. Now join BT and produce it to point A.

$\angle ABC = 75^\circ$

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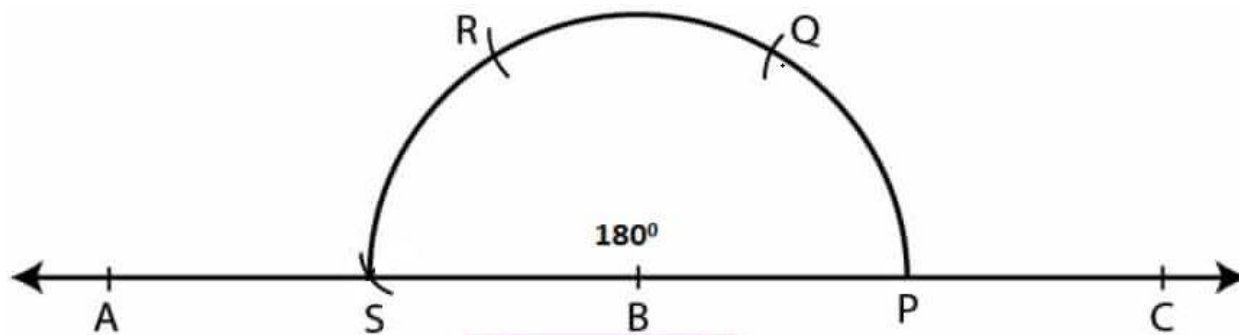


(iv) 180°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and some suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and with same radius cut off the arcs PQ, QR and RS.
4. Now join BS and produce it to point A.

$\angle ABC = 180^\circ$



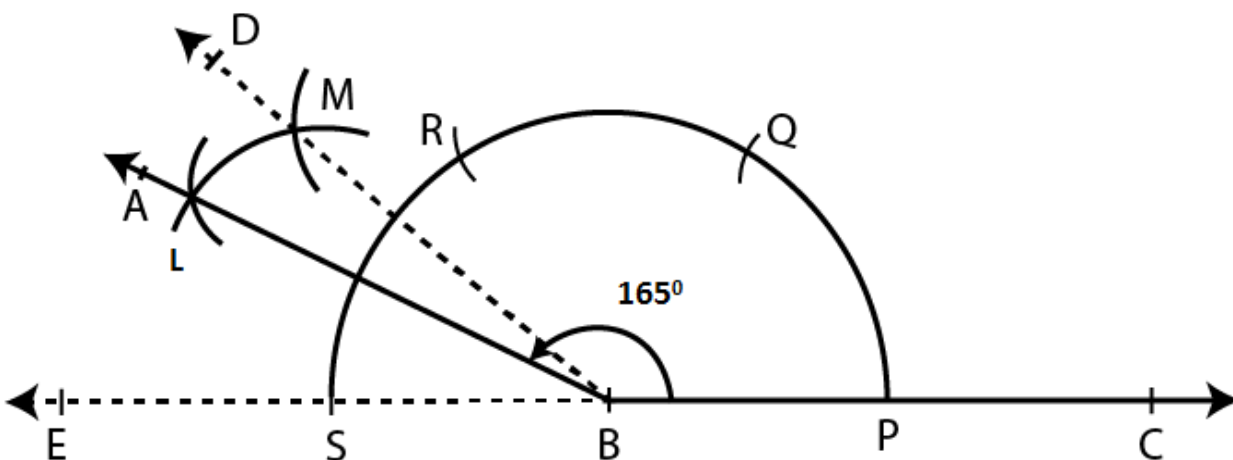
(v) 165°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and some suitable radius construct an arc which meets BC at the point P.
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3. Taking P as centre and same radius cut off arcs at PQ, QR and then RS.
4. Now join SB and produce it to point E.
5. Taking R and S as centres construct two arcs which intersect each other at the point M.
6. Taking T and S as centres construct two arcs which intersect each other at the point L.
7. Now join BL and produce it to point A.

$$\angle ABC = 165^\circ$$



2. Draw $\angle ABC = 120^\circ$. Bisect the angle using ruler and compasses only. Measure each angle so obtained and check whether the angles obtained on bisecting $\angle ABC$ are equal or not.

Solution:

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and some suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and with same radius cut off the arcs PQ and QR.
4. Now join BR and produce it to point A

$$\angle ABC = 120^\circ$$

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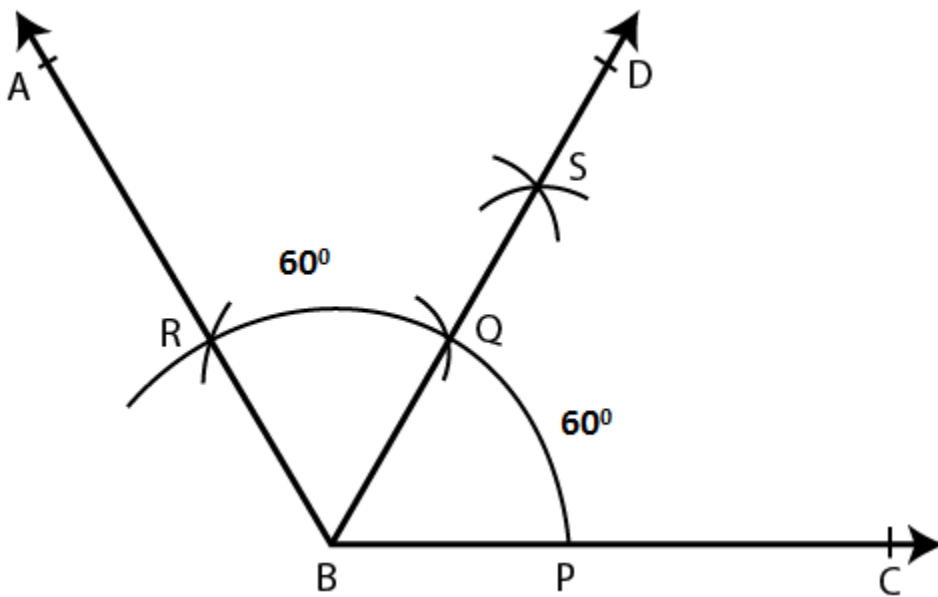
5. Taking P and R as centres construct two arcs which intersect each other at the point S.

6. Now join BS and produce it to point D.

Here BD is the bisector of $\angle ABC$

By measuring each angle we get to know that it is 60°

Yes, both the angles are of equal measure.



3. Draw a line segment $PQ = 6$ cm. Mark a point A in PQ so that $AP = 2$ cm. At point A, construct angle $QAR = 60^\circ$.

Solution:

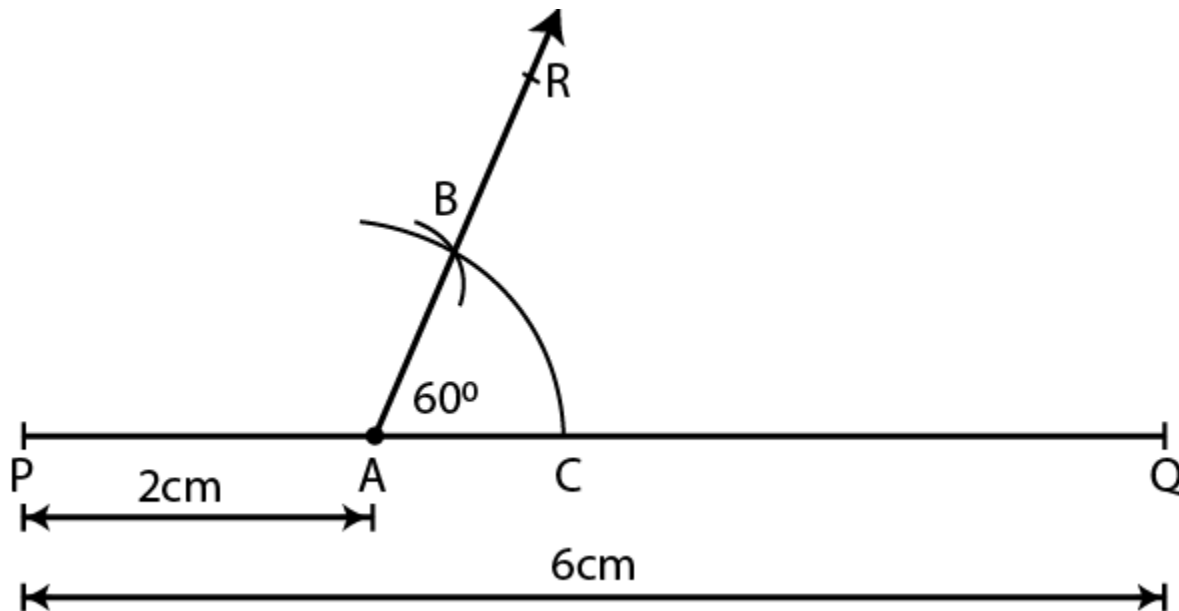
Steps of Construction:

1. Construct a line segment $PQ = 6$ cm.
2. Now mark point A on PQ so that $AP = 2$ cm.
3. Taking A as centre and some suitable radius construct an arc which meets AQ at the point C.
4. Taking C as centre and with same radius cut the arc CB.

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5. Now join AB and produce it to point R.

$$\angle QAR = 60^\circ.$$



4. Draw a line segment $AB = 8$ cm. Mark a point P in AB so that $AP = 5$ cm. At P , construct angle $APQ = 30^\circ$.

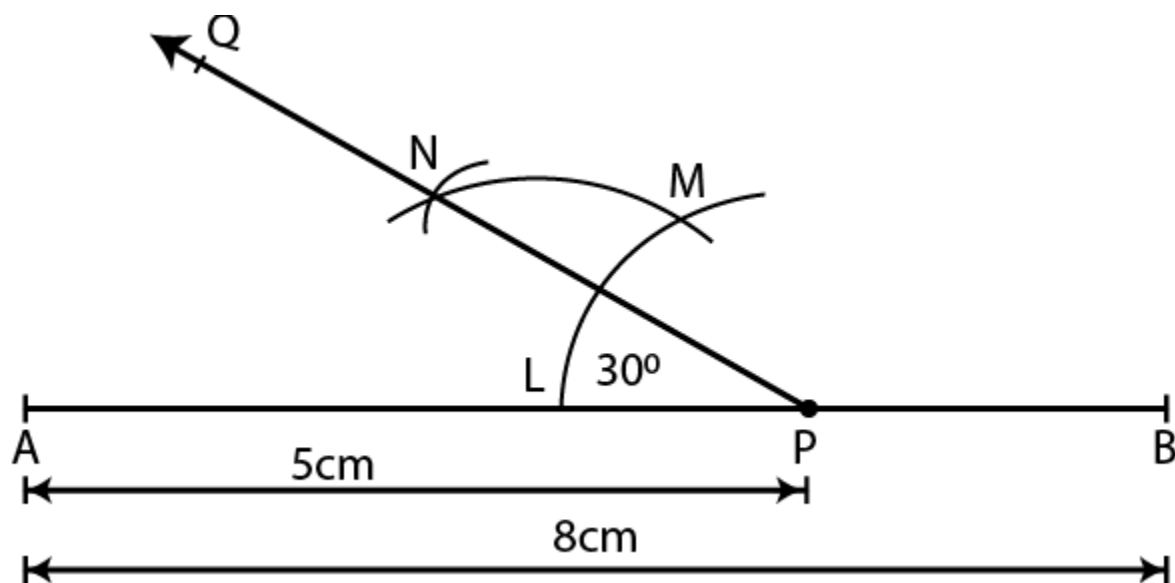
Solution:

Steps of Construction:

1. Construct a line segment $AB = 8$ cm.
2. Now mark the point P on AB such that $AP = 5$ cm.
3. Taking P as centre and some suitable radius construct an arc which meets AB at L .
4. Taking L as centre and same radius cut the arc LM .
5. Now bisect the arc LM at the point N .
6. Join PN and produce it to point Q .

$$\angle APQ = 30^\circ$$

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5. Construct an angle of 75° and then bisect it.

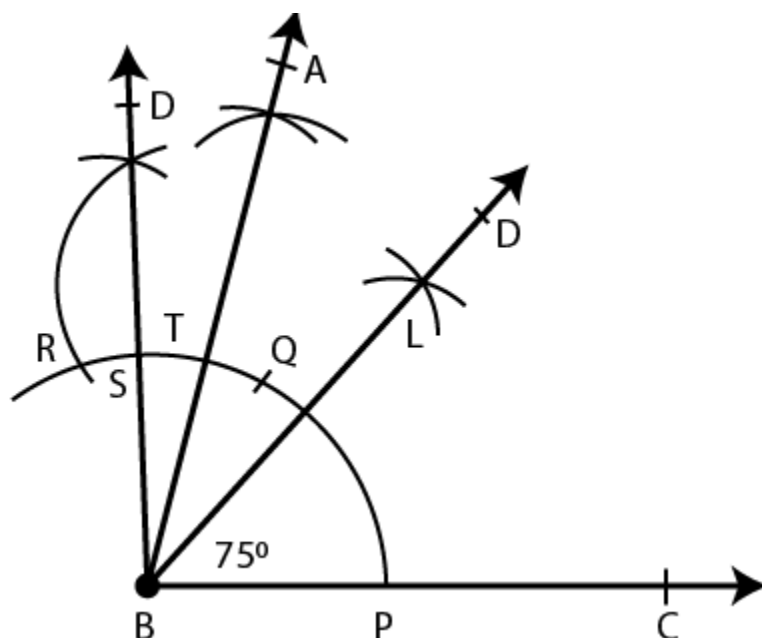
Solution:

Steps of Construction:

1. Construct a line segment BC.
2. At the point B construct an angle ABC which is equal to 75° .
3. Taking P and T as centres construct arcs which intersect each other at the point L.
4. Now join BL and produce it to point D.

Here BD bisects $\angle ABC$.

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6. Draw a line segment of length 6.4 cm. Draw its perpendicular bisector.

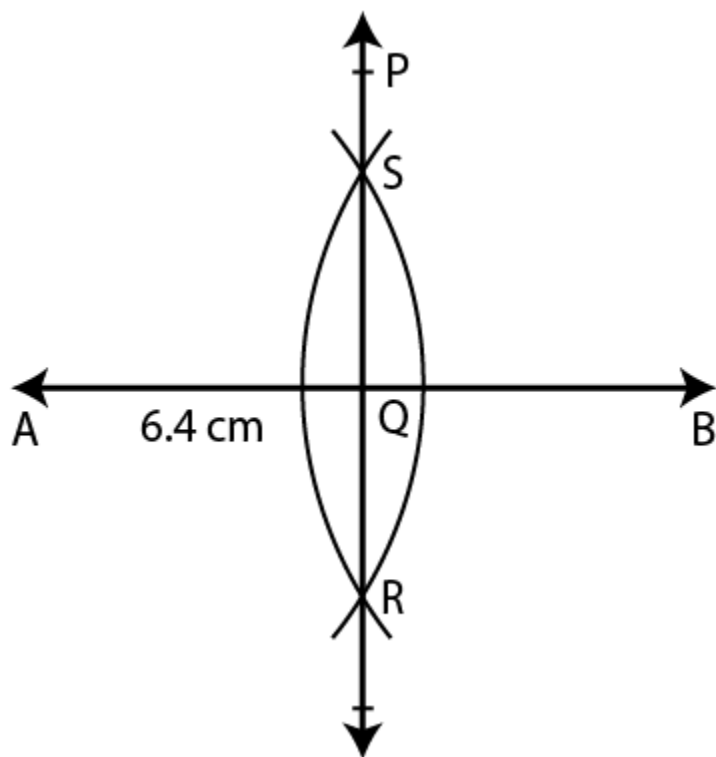
Solution:

Steps of Construction:

1. Construct a line segment $AB = 6.4$ cm.
2. Taking A and B as centres and with some suitable radius construct arcs which intersect each other at the points S and R.
3. Now join SR which intersects AB at the point Q.

Here PQR is the perpendicular bisector of the line segment AB.

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7. Draw a line segment $AB = 5.8$ cm. Mark a point P in AB such that $PB = 3.6$ cm. At P , draw perpendicular to AB .

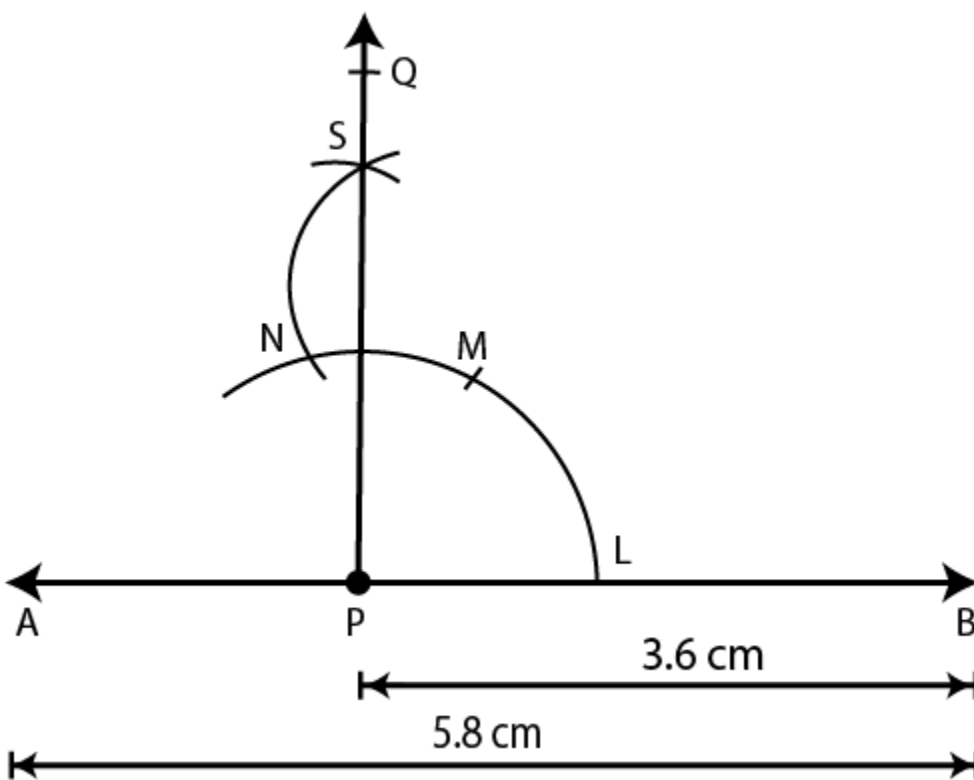
Solution:

Steps of Construction:

1. Construct a line segment $AB = 5.8$ cm.
2. Now mark a point P on the line segment AB such that $PB = 3.6$ cm.
3. Taking P as centre and some suitable radius construct an arc which meets AB at the point L .
4. Taking L as centre and same radius cut off the arcs LM and MN .
5. Now bisect the arc MN at the point S .
6. Join PS and produce it to point Q .

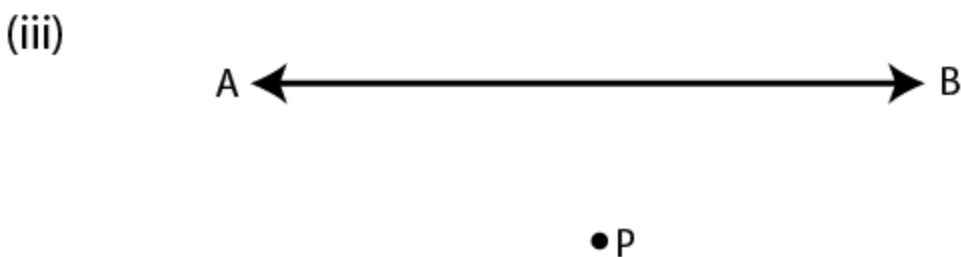
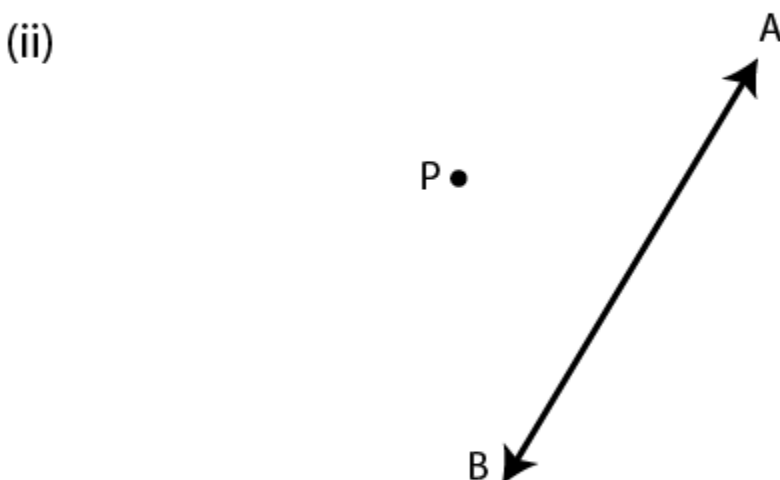
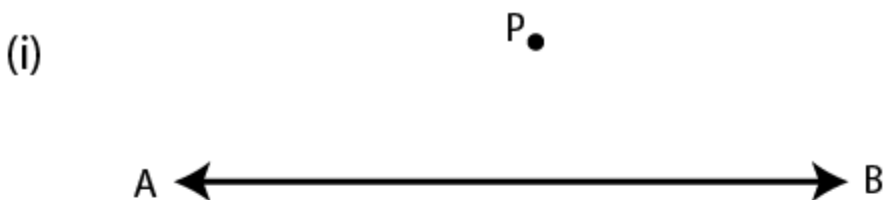
Here PQ is perpendicular to the line segment AB at point P .

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8. In each case, given below, draw a line through point P and parallel to AB:

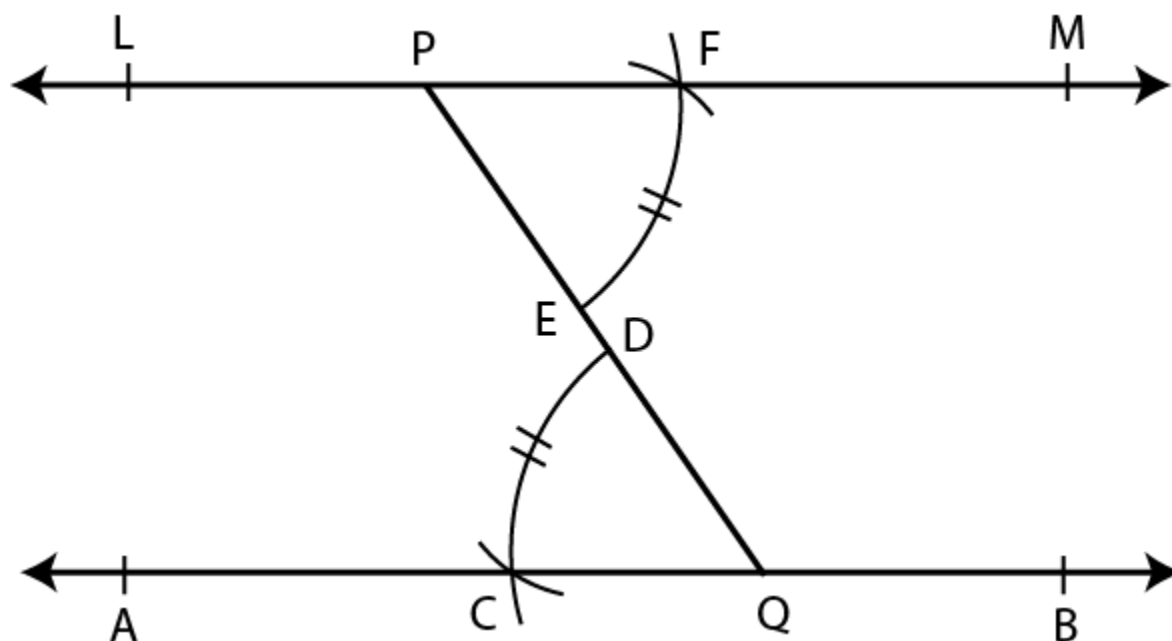
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**Solution:**

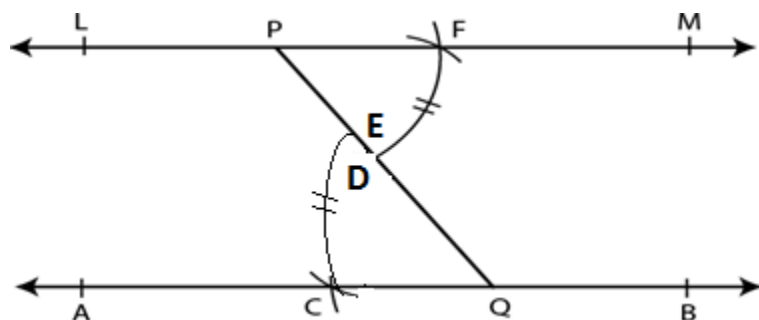
Steps of Construction:

1. From the point P construct a line segment meeting AB
2. Taking Q as centre and some suitable radius construct an arc CD.
3. Taking P as centre and same radius construct another arc which meets PQ at the point E.

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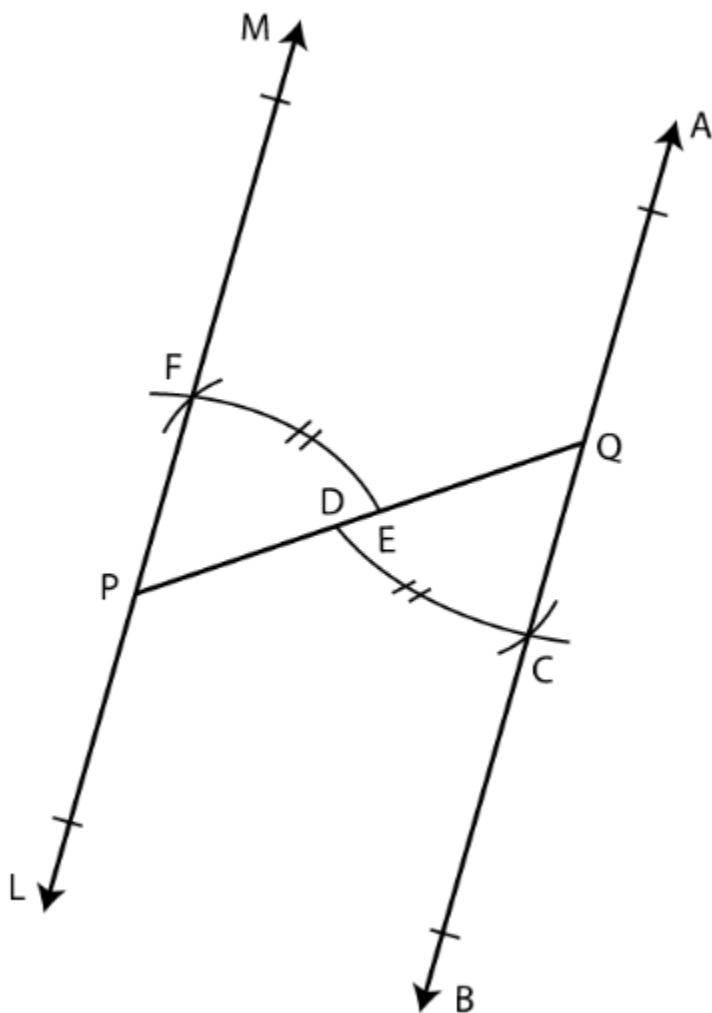
4. Taking E as centre and radius equal to CD cut this arc at the point F.



5. Now join PF and produce it to both sides to L and M.

Here the line LM is parallel to the given line AB.

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Exercise 14B page: 166

1. In questions 1 and 2, given below, identify the given pairs of angles as corresponding angles, interior alternate angles, exterior alternate angles, adjacent angles, vertically opposite angles or allied angles:

- (i) $\angle 3$ and $\angle 6$
- (ii) $\angle 2$ and $\angle 4$
- (iii) $\angle 3$ and $\angle 7$
- (iv) $\angle 2$ and $\angle 7$

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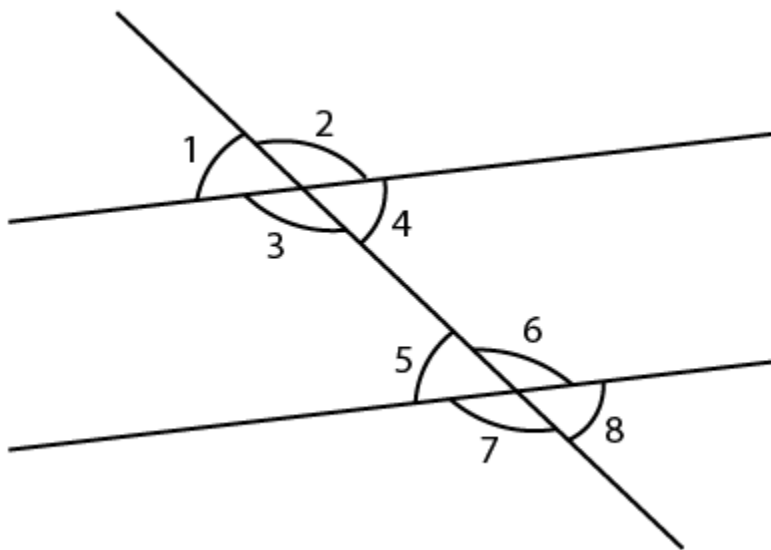
(v) $\angle 4$ and $\angle 6$

(vi) $\angle 1$ and $\angle 8$

(vii) $\angle 1$ and $\angle 5$

(viii) $\angle 1$ and $\angle 4$

(ix) $\angle 5$ and $\angle 7$



Solution:

(i) $\angle 3$ and $\angle 6$ are interior alternate angles.

(ii) $\angle 2$ and $\angle 4$ are adjacent angles.

(iii) $\angle 3$ and $\angle 7$ are corresponding angles.

(iv) $\angle 2$ and $\angle 7$ are exterior alternate angles.

(v) $\angle 4$ and $\angle 6$ are allied or co-interior angles.

(vi) $\angle 1$ and $\angle 8$ are exterior alternate angles.

(vii) $\angle 1$ and $\angle 5$ are corresponding angles.

(viii) $\angle 1$ and $\angle 4$ are vertically opposite angles.

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(ix) $\angle 5$ and $\angle 7$ are adjacent angles.

2. (i) $\angle 1$ and $\angle 4$

(ii) $\angle 4$ and $\angle 7$

(iii) $\angle 10$ and $\angle 12$

(iv) $\angle 7$ and $\angle 13$

(v) $\angle 6$ and $\angle 8$

(vi) $\angle 11$ and $\angle 8$

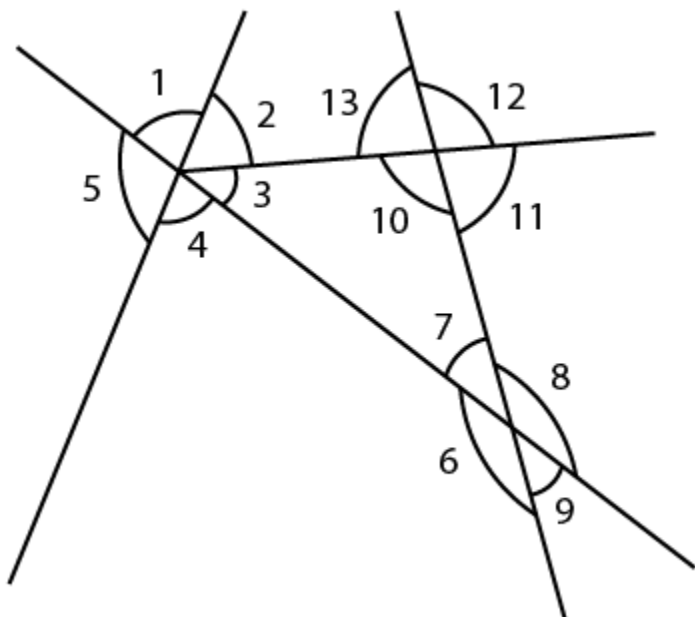
(vii) $\angle 7$ and $\angle 9$

(viii) $\angle 4$ and $\angle 5$

(ix) $\angle 4$ and $\angle 6$

(x) $\angle 6$ and $\angle 7$

(xi) $\angle 2$ and $\angle 13$



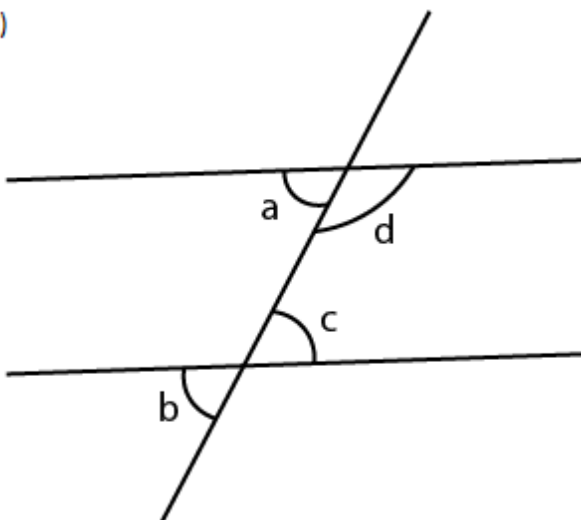
Solution:

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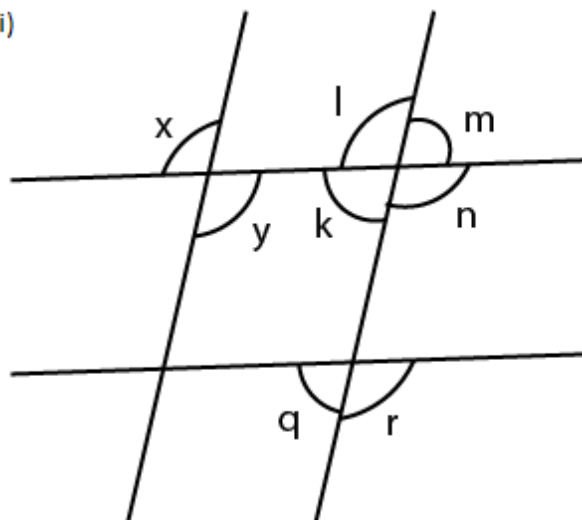
- (i) $\angle 1$ and $\angle 4$ are vertically opposite angles.
- (ii) $\angle 4$ and $\angle 7$ are interior alternate angles.
- (iii) $\angle 10$ and $\angle 12$ are vertically opposite angles.
- (iv) $\angle 7$ and $\angle 13$ are corresponding angles.
- (v) $\angle 6$ and $\angle 8$ are vertically opposite angles.
- (vi) $\angle 11$ and $\angle 8$ are allied or co-interior angles.
- (vii) $\angle 7$ and $\angle 9$ are vertically opposite angles.
- (viii) $\angle 4$ and $\angle 5$ are adjacent angles.
- (ix) $\angle 4$ and $\angle 6$ are allied or co-interior angles.
- (x) $\angle 6$ and $\angle 7$ are adjacent angles.
- (xi) $\angle 2$ and $\angle 13$ are allied or co-interior angles.

3. In the following figures, the arrows indicate parallel lines. State which angles are equal. Give reasons.

(i)



(ii)



Solution:

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(i) From the figure (i)

$a = b$ are corresponding angles

$b = c$ are vertically opposite angles

$a = c$ are alternate angles

So we get

$$a = b = c$$

(ii) From the figure (ii)

$x = y$ are vertically opposite angles

$y = l$ are alternate angles

$x = l$ are corresponding angles

$l = n$ are vertically opposite angles

$n = r$ are corresponding angles

So we get

$$x = y = l = n = r$$

Similarly

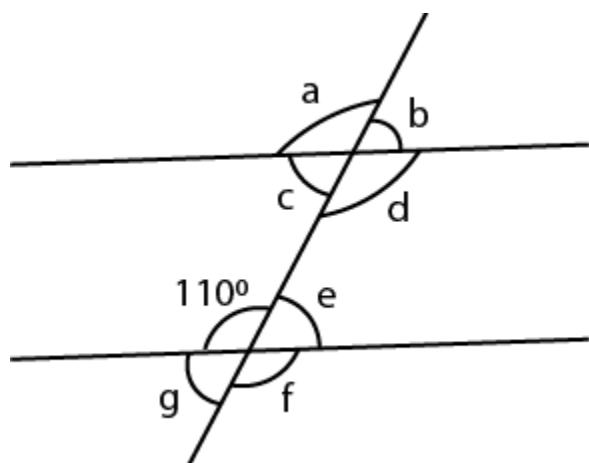
$m = k$ are vertically opposite angles

$k = q$ are corresponding angles

Hence, $m = k = q$.

4. In the given figure, find the measure of the unknown angles:

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**Solution:**

From the figure

$a = d$ are vertically opposite angles

$d = f$ are corresponding angles

$f = 110^\circ$ are vertically opposite angles

So we get

$$a = d = f = 110^\circ$$

We know that

$e + 110^\circ = 180^\circ$ are linear pair of angles

$$e = 180 - 110 = 70^\circ$$

$b = c$ are vertically opposite angles

$b = e$ are corresponding angles

$e = g$ are vertically opposite angles

So we get

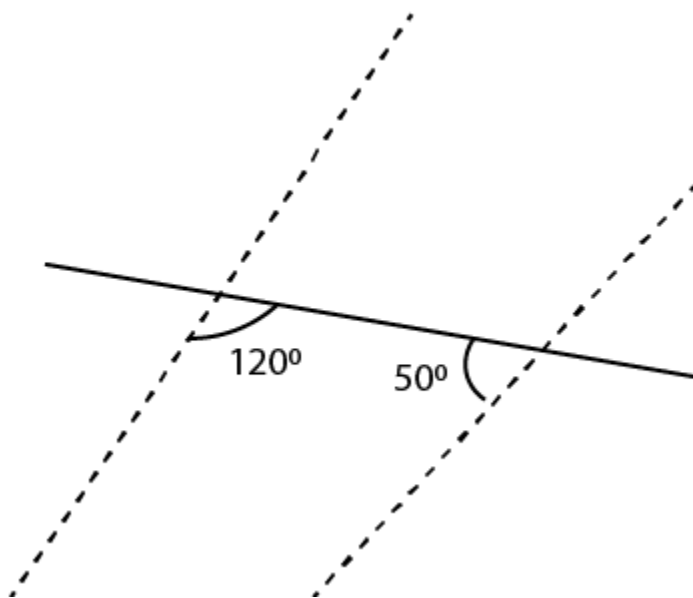
$$b = c = e = g = 70^\circ$$

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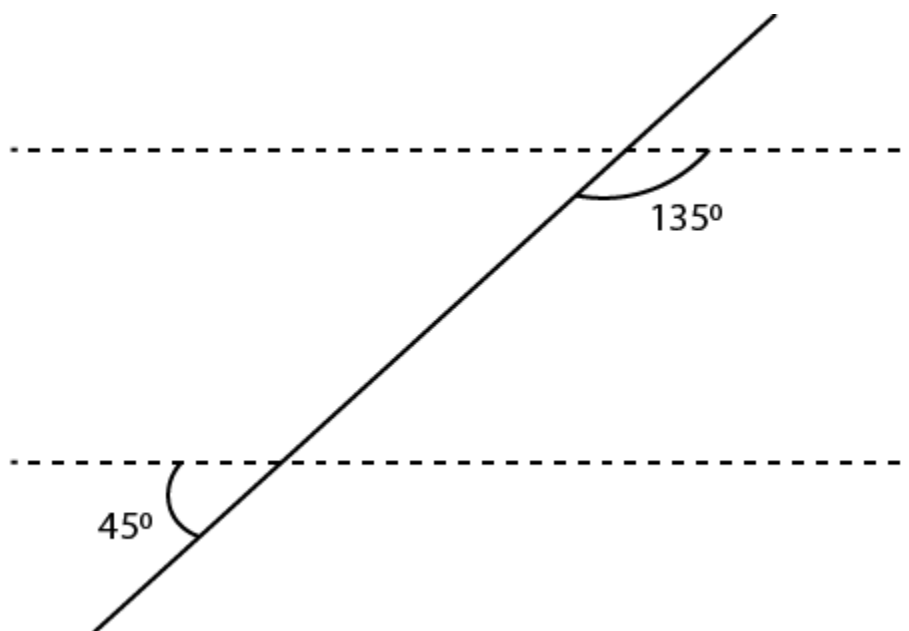
Therefore, $a = 110^\circ$, $b = 70^\circ$, $c = 70^\circ$, $d = 110^\circ$, $e = 70^\circ$, $f = 110^\circ$ and $g = 70^\circ$.

5. Which pair of the dotted line, segments, in the following figures, are parallel. Give reason:

i)

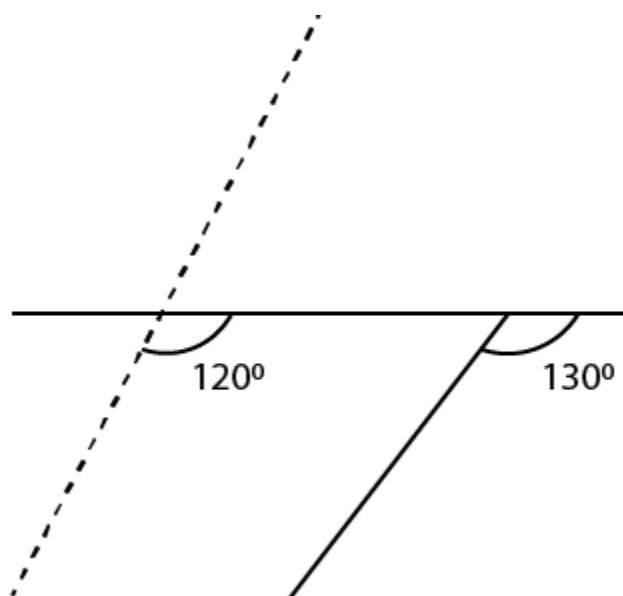


ii)

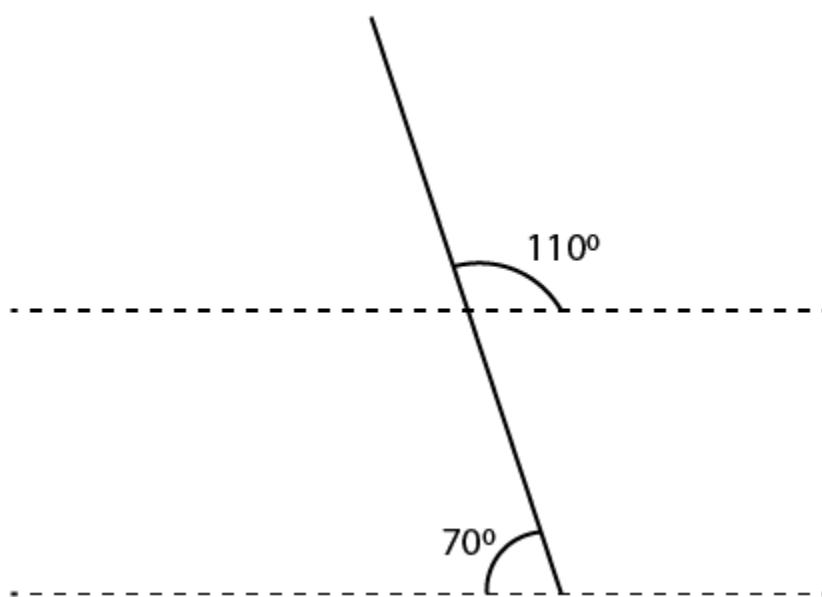


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iii)

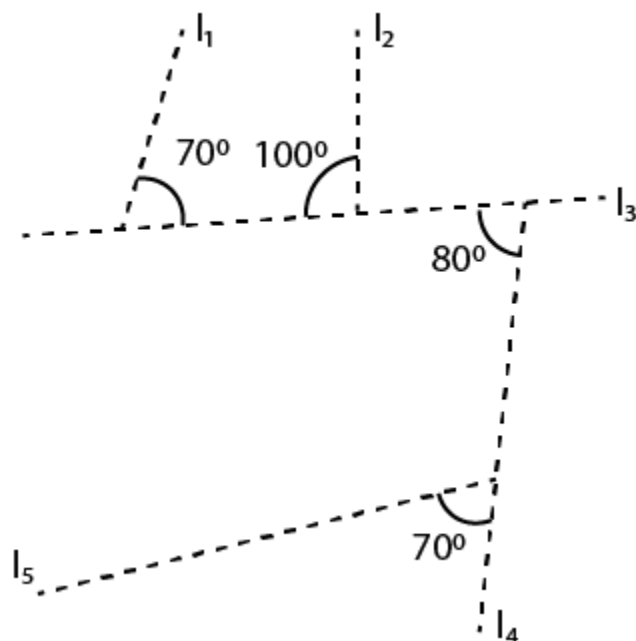


iv)

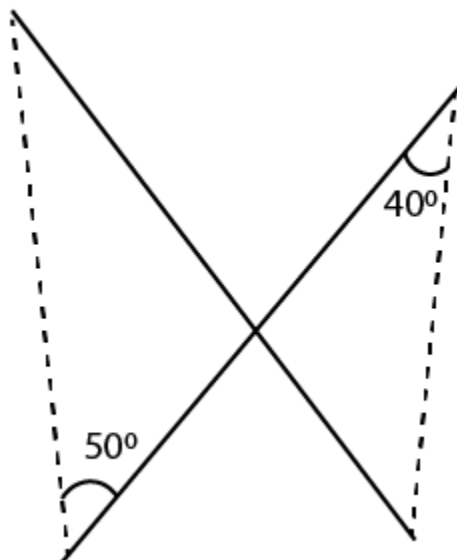


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v)



vi)



Solution:

(i) From the figure (i)

If the lines are parallel we get $120^\circ + 50^\circ = 180^\circ$

There are co-interior angles where $170^\circ \neq 180^\circ$

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Therefore, they are not parallel lines.

(ii) From the figure (ii)

$\angle 1 = 45^\circ$ are vertically opposite angles

We know that the lines are parallel if

$\angle 1 + 135^\circ = 180^\circ$ are co-interior angles

Substituting the values

$$45^\circ + 135^\circ = 180^\circ$$

$$180^\circ = 180^\circ \text{ which is true}$$

Therefore, the lines are parallel.

(iii) From the figure (iii)

The lines are parallel if corresponding angles are equal

$$\text{Here } 120^\circ \neq 130^\circ$$

Hence, lines are not parallel.

(iv) $\angle 1 = 110^\circ$ are vertically opposite angles

We know that if lines are parallel

$\angle 1 + 70^\circ = 180^\circ$ are co-interior angles

Substituting the values

$$110^\circ + 70^\circ = 180^\circ$$

$$180^\circ = 180^\circ \text{ which is correct}$$

Therefore, the lines are parallel.

(v) $\angle 1 + 100^\circ = 180^\circ$

So we get

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$\angle 1 = 180^\circ - 100^\circ = 80^\circ$ which is a linear pair

Here the lines l_1 and l_2 are parallel if $\angle 1 = 70^\circ$

But here $\angle 1 = 80^\circ$ which is not equal to 70°

So the lines l_1 and l_2 are not parallel

Now, l_3 and l_5 will be parallel if corresponding angles are equal

But here, the corresponding angles $80^\circ \neq 70^\circ$

Hence, l_3 and l_5 are not parallel.

We know that, in l_2 and l_4

$\angle 1 = 80^\circ$ are alternate angles

$80^\circ = 80^\circ$ which is true

Hence, l_2 and l_4 are parallel.

(vi) Two lines are parallel if alternate angles are equal

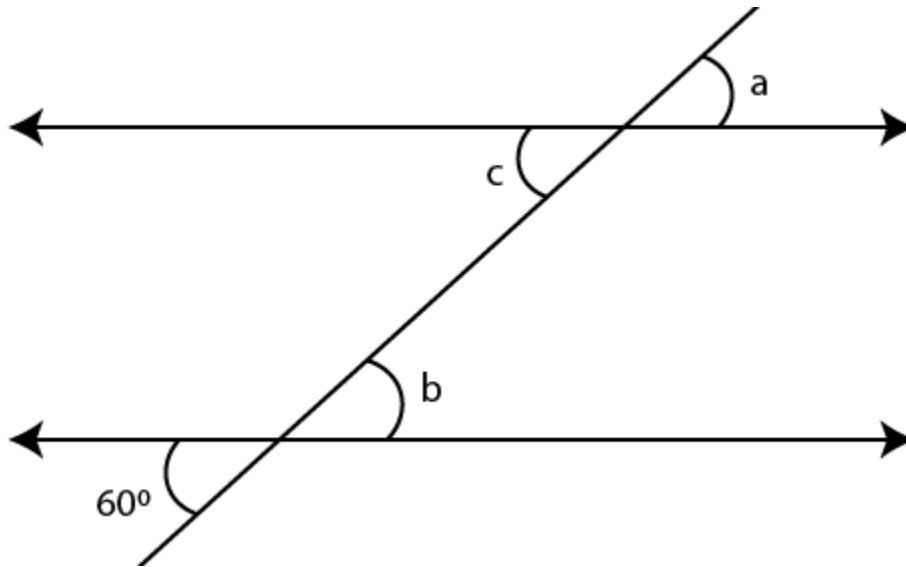
Here, $50^\circ \neq 40^\circ$ which is not true

Hence, the lines are not parallel.

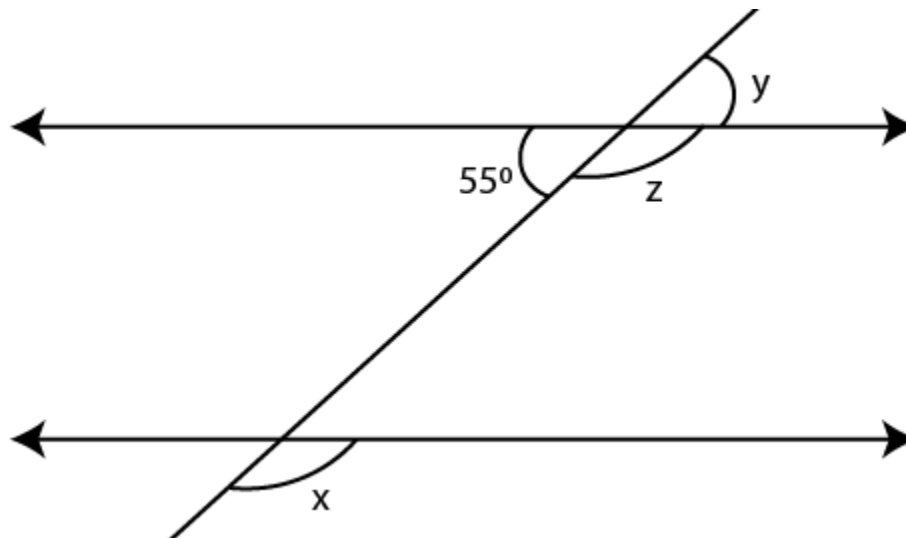
6. In the given figures, the directed lines are parallel to each other. Find the unknown angles.

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i)

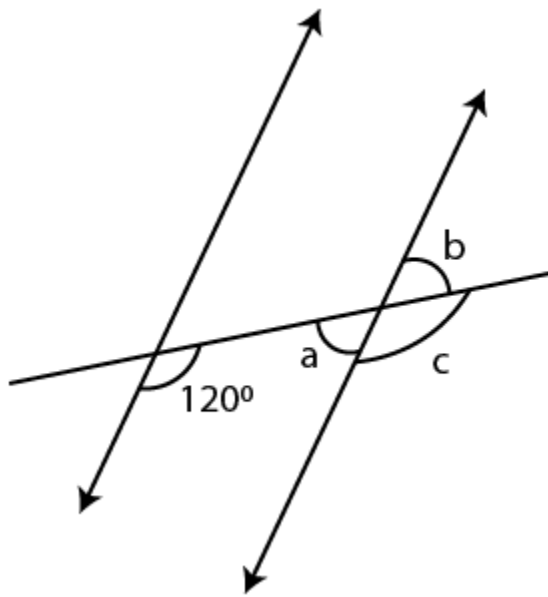


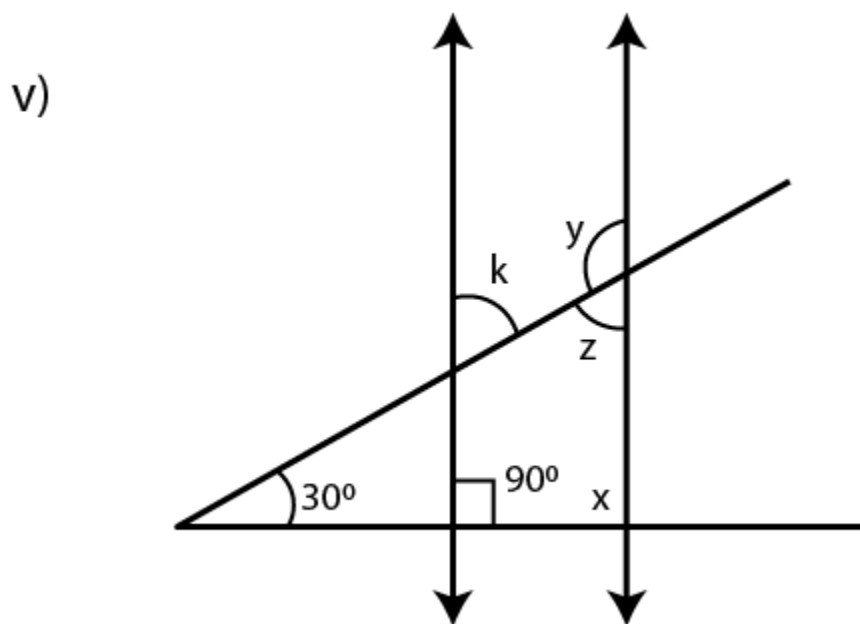
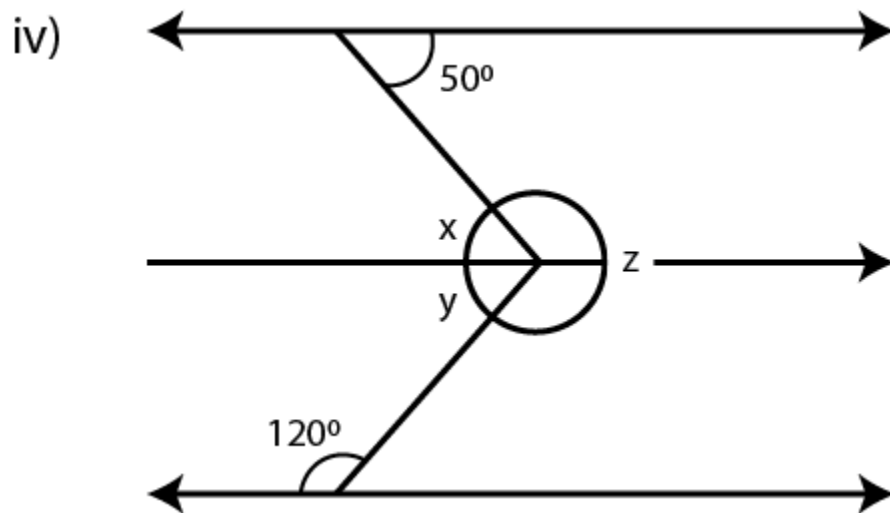
ii)



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iii)





Solution:

(i) If the lines are parallel

$a = b$ are corresponding angles

$a = c$ are vertically opposite angles

$a = b = c$

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Here $b = 60^\circ$ are vertically opposite angles

Therefore, $a = b = c = 60^\circ$

(ii) If the lines are parallel

$x = z$ are corresponding angles

$z + y = 180^\circ$ is a linear pair

$y = 55^\circ$ are vertically opposite angles

Substituting the values

$$z + 55^\circ = 180^\circ$$

$$z = 180 - 55 = 125^\circ$$

If $x = z$ we get $x = 125^\circ$

Therefore, $x = 125^\circ$, $y = 55^\circ$ and $z = 125^\circ$.

(iii) If the lines are parallel

$c = 120^\circ$ (corresponding angles)

$a + 120^\circ = 180^\circ$ are co-interior angles

$$a = 180 - 120 = 60^\circ$$

We know that $a = b$ are vertically opposite angles

So $b = 60^\circ$

Therefore, $a = b = 60^\circ$ and $c = 120^\circ$.

(iv) If the lines are parallel

$x = 50^\circ$ are alternate angles

$y + 120^\circ = 180^\circ$ are co-interior angles

$$y = 180 - 120 = 60^\circ$$

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We know that

$x + y + z = 360^\circ$ are angles at a point

Substituting the values

$$50 + 60 + z = 360$$

By further calculation

$$110 + z = 360$$

$$z = 360 - 110 = 250^\circ$$

Therefore, $x = 50^\circ$, $y = 60^\circ$ and $z = 250^\circ$.

(v) If the lines are parallel

$x + 90^\circ = 180^\circ$ are co-interior angles

$$x = 180^\circ - 90^\circ = 90^\circ$$

$$\angle 2 = x$$

$$\angle 2 = 90^\circ$$

We know that the sum of angles of a triangle

$$\angle 1 + \angle 2 + 30^\circ = 180^\circ$$

Substituting the values

$$\angle 1 + 90^\circ + 30^\circ = 180^\circ$$

By further calculation

$$\angle 1 + 120^\circ = 180^\circ$$

$$\angle 1 = 180 - 120 = 60^\circ$$

Here $\angle 1 = k$ are vertically opposite angles

$$k = 60^\circ$$

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Here $\angle 1 = z$ are corresponding angles

$$z = 60^\circ$$

Here $k + y = 180^\circ$ are co-interior angles

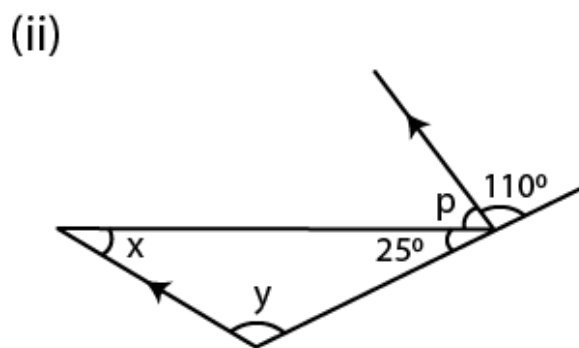
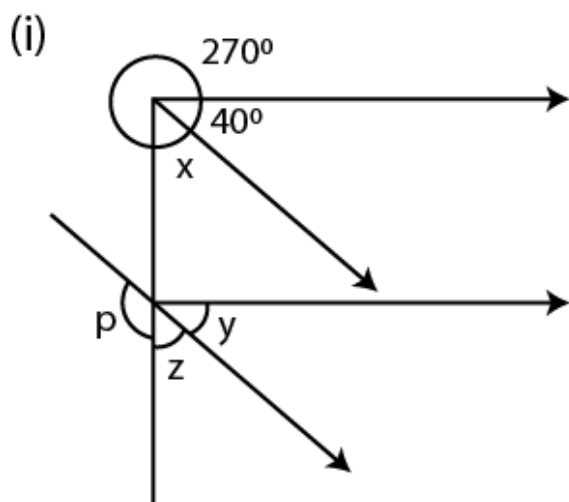
Substituting the values

$$60^\circ + y = 180^\circ$$

$$y = 180 - 60 = 120^\circ$$

Therefore, $x = 90^\circ$, $y = 120^\circ$, $z = 60^\circ$, $k = 60^\circ$.

7. Find x , y and p in the given figures:



Solution:

(i) From the figure (i)

The lines are parallel

$x = z$ are corresponding angles

$y = 40^\circ$ are corresponding angles

We know that

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$x + 40^\circ + 270^\circ = 360^\circ$ are the angles at a point

So we get

$$x + 310^\circ = 360^\circ$$

$$x = 360 - 310 = 50^\circ$$

$$\text{So } z = x = 50^\circ$$

Here $p + z = 180^\circ$ is a linear pair

By substituting the values

$$p + 50^\circ = 180^\circ$$

$$p = 180 - 50 = 130^\circ$$

Therefore, $x = 50^\circ$, $y = 40^\circ$, $z = 50^\circ$ and $p = 130^\circ$.

(ii) From the figure (ii)

The lines are parallel

$y = 110^\circ$ are corresponding angles

We know that

$25^\circ + p + 110^\circ = 180^\circ$ are angles on a line

$$p + 135^\circ = 180^\circ$$

$$p = 180 - 135 = 45^\circ$$

We know that the sum of angles of a triangle

$$x + y + 25^\circ = 180^\circ$$

$$x + 110^\circ + 25^\circ = 180^\circ$$

By further calculation

$$x + 135^\circ = 180^\circ$$

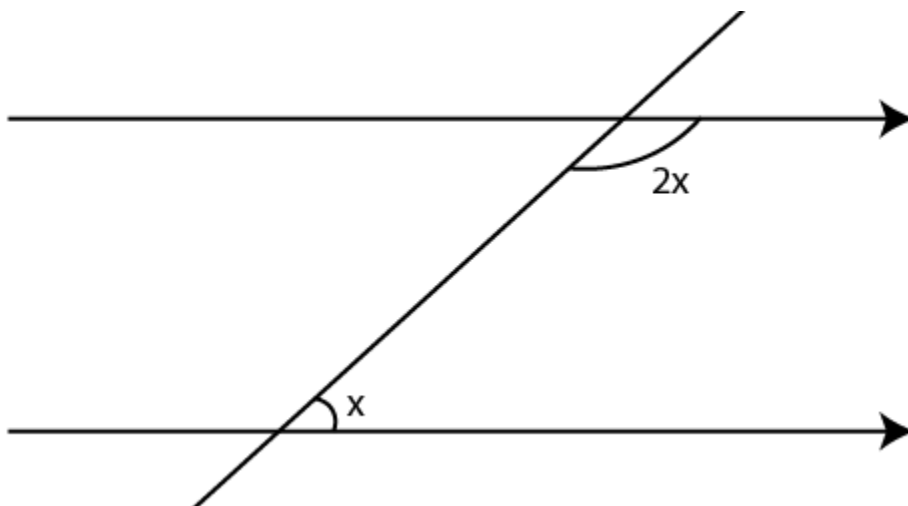
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$$x = 180 - 135 = 45^\circ$$

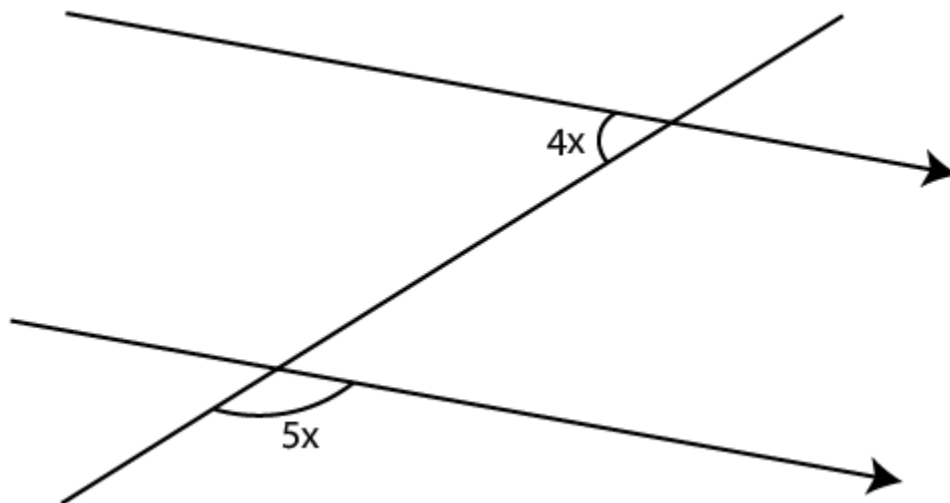
Therefore, $x = 45^\circ$, $y = 110^\circ$ and $p = 45^\circ$.

8. Find x in the following cases:

(i)

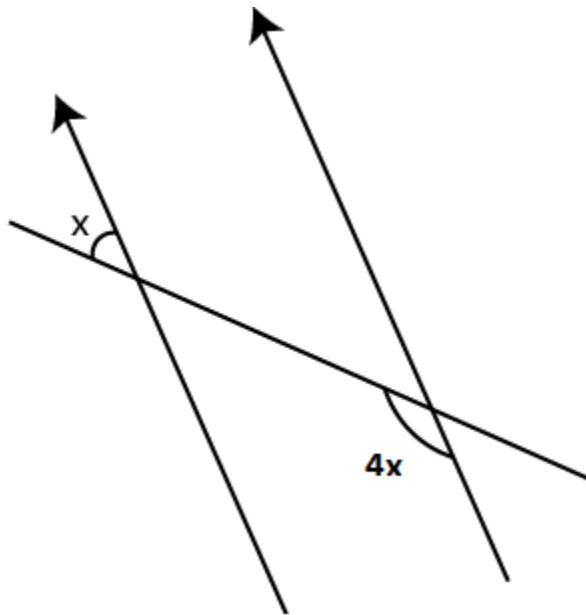


(ii)



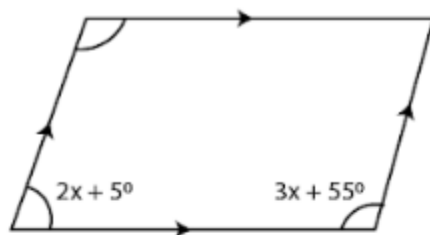
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(iii)

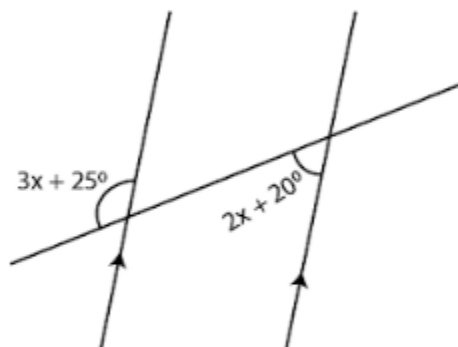


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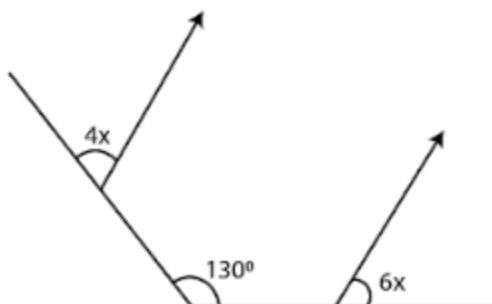
(iv)



(v)



(vi)



Solution:

(i) From the figure (i)

The lines are parallel

$2x + x = 180^\circ$ are co-interior angles

$$3x = 180^\circ$$

$$x = 180/3 = 60^\circ$$

(ii) From the figure (ii)

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The lines are parallel

$4x + \angle 1 = 180^\circ$ are co-interior angles

$\angle 1 = 5x$ are vertically opposite angles

Substituting the values

$$4x + 5x = 180^\circ$$

So we get

$$9x = 180^\circ$$

$$x = 180/9 = 20^\circ$$

(iii) From the figure (iii)

The lines are parallel

$\angle 1 + 4x = 180^\circ$ are co-interior angles

$\angle 1 = x$ are vertically opposite angles

Substituting the values

$$x + 4x = 180^\circ$$

$$5x = 180^\circ$$

So we get

$$x = 180/5 = 36^\circ$$

(iv) From the figure (iv)

The lines are parallel

$2x + 5 + 3x + 55 = 180^\circ$ are co-interior angles

$$5x + 60^\circ = 180^\circ$$

By further calculation

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$$5x = 180 - 60 = 120^\circ$$

So we get

$$x = 120/5 = 24^\circ$$

(v) From the figure (v)

The lines are parallel

$\angle 1 = 2x + 20^\circ$ are alternate angles

$\angle 1 + 3x + 25^\circ = 180^\circ$ is a linear pair

Substituting the values

$$2x + 20^\circ + 3x + 25^\circ = 180^\circ$$

$$5x + 45^\circ = 180^\circ$$

So we get

$$5x = 180 - 45 = 135^\circ$$

$$x = 135/5 = 27^\circ$$

(vi) From the figure (vi)

Construct a line parallel to the given parallel lines

$\angle 1 = 4x$ and $\angle 2 = 6x$ are corresponding angles

$$\angle 1 + \angle 2 = 130^\circ$$

Substituting the values

$$4x + 6x = 130^\circ$$

$$10x = 130^\circ$$

So we get

$$x = 130/10 = 13^\circ$$

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Exercise 14C

Exercise 14C PAGE: 172

1. Using ruler and compasses, construct the following angles:

(i) 30°

(ii) 15°

(iii) 75°

(iv) 180°

(v) 165°

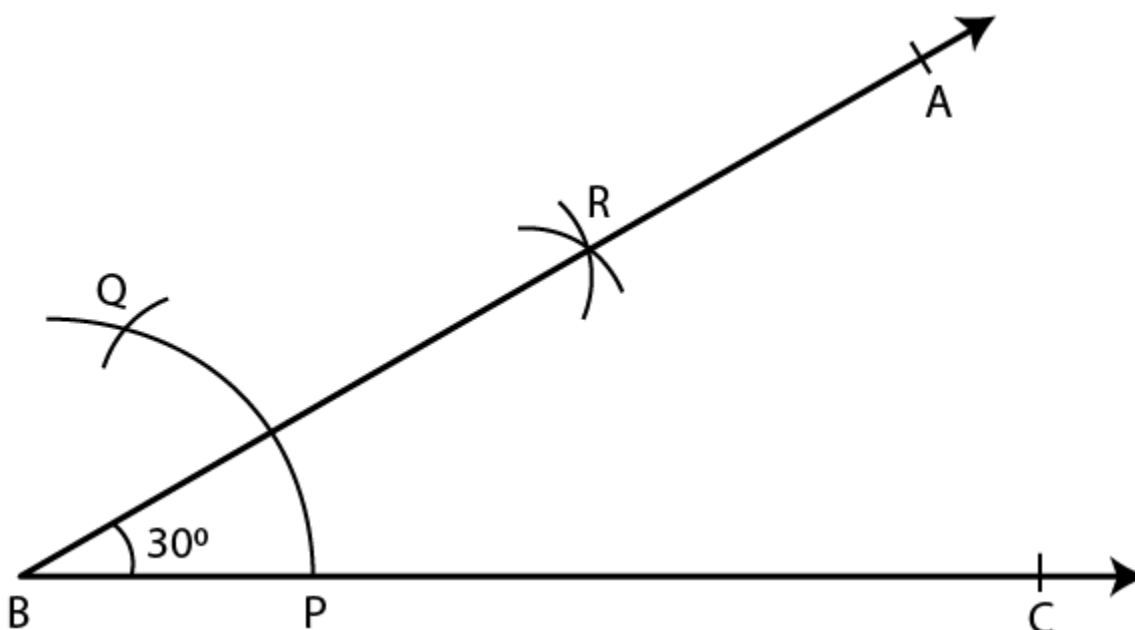
Solution:

(i) 30°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and a suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and same radius cut off the arc at the point Q.
4. Consider P and Q as centre construct two arcs which intersect each other at the point R.
5. Now join BR and produce it to point A forming $\angle ABC = 30^\circ$

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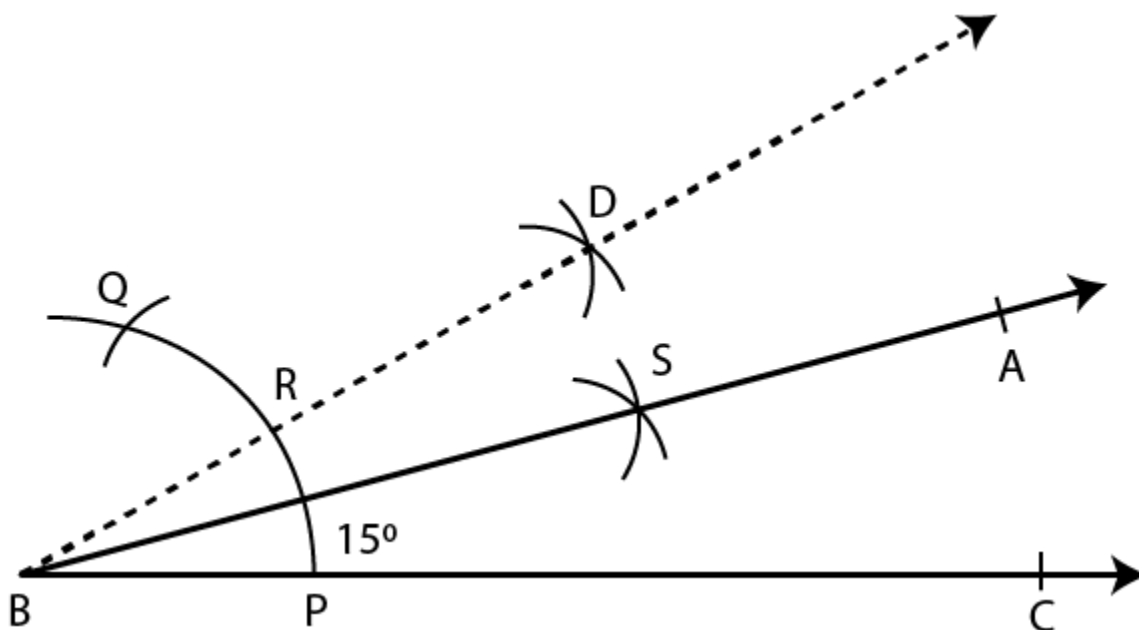
(ii) 15°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and a suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and same radius cut off the arc at the point Q.
4. Consider P and Q as centres, construct two arcs which intersect each other at the point D and join BD.
5. Taking P and R as centre construct two more arcs which intersect each other at the point S.
6. Now join BS and produce it to point A.

$$\angle ABC = 15^\circ$$

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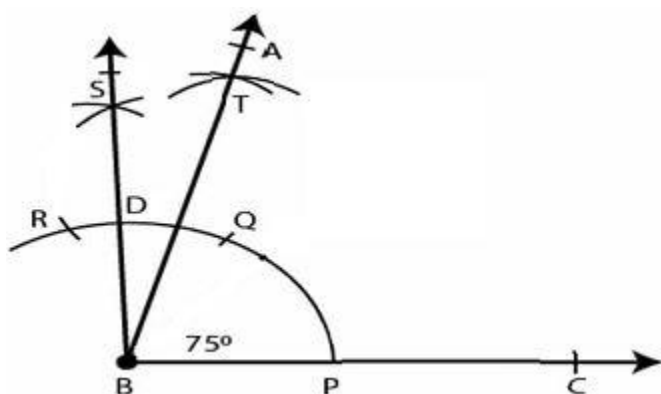
(iii) 75°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and suitable radius construct an arc and cut off PQ then QR of the same radius.
3. Taking Q and R as centre, construct two arcs which intersect each other at the point S.
4. Now join SB.
5. Taking Q and D as centre construct two arcs which intersect each other at the point T.
6. Now join BT and produce it to point A.

$\angle ABC = 75^\circ$

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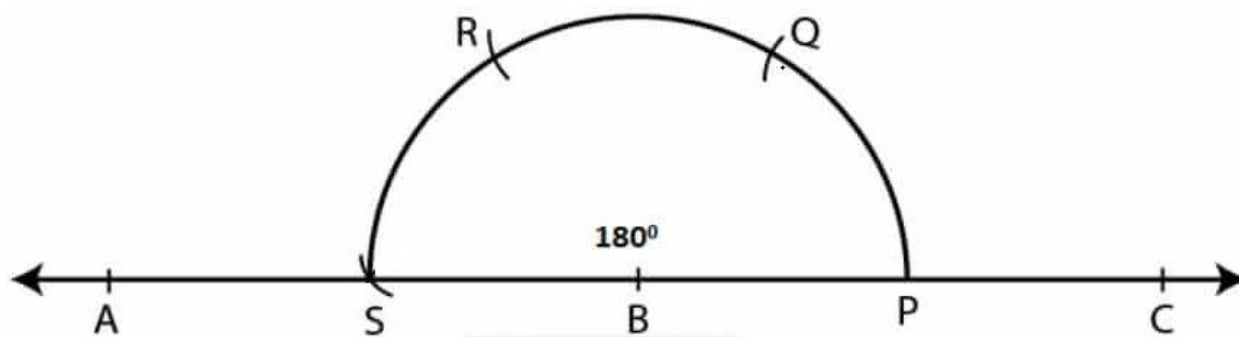


(iv) 180°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and some suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and with same radius cut off the arcs PQ, QR and RS.
4. Now join BS and produce it to point A.

$\angle ABC = 180^\circ$



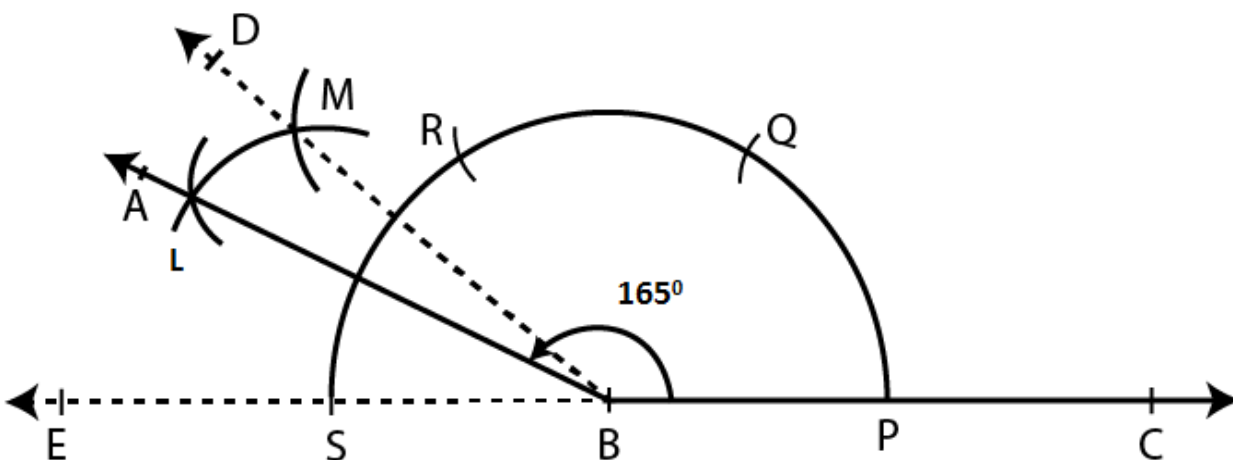
(v) 165°

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and some suitable radius construct an arc which meets BC at the point P.
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3. Taking P as centre and same radius cut off arcs at PQ, QR and then RS.
4. Now join SB and produce it to point E.
5. Taking R and S as centres construct two arcs which intersect each other at the point M.
6. Taking T and S as centres construct two arcs which intersect each other at the point L.
7. Now join BL and produce it to point A.

$$\angle ABC = 165^\circ$$



2. Draw $\angle ABC = 120^\circ$. Bisect the angle using ruler and compasses only. Measure each angle so obtained and check whether the angles obtained on bisecting $\angle ABC$ are equal or not.

Solution:

Steps of Construction:

1. Construct a line segment BC.
2. Taking B as centre and some suitable radius construct an arc which meets BC at the point P.
3. Taking P as centre and with same radius cut off the arcs PQ and QR.
4. Now join BR and produce it to point A

$$\angle ABC = 120^\circ$$

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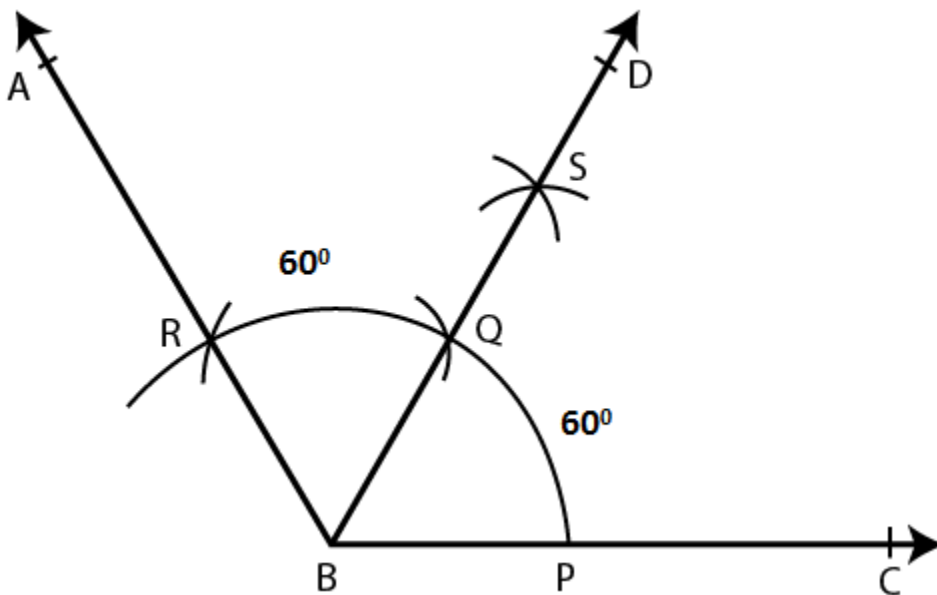
5. Taking P and R as centres construct two arcs which intersect each other at the point S.

6. Now join BS and produce it to point D.

Here BD is the bisector of $\angle ABC$

By measuring each angle we get to know that it is 60°

Yes, both the angles are of equal measure.



3. Draw a line segment $PQ = 6$ cm. Mark a point A in PQ so that $AP = 2$ cm. At point A, construct angle $QAR = 60^\circ$.

Solution:

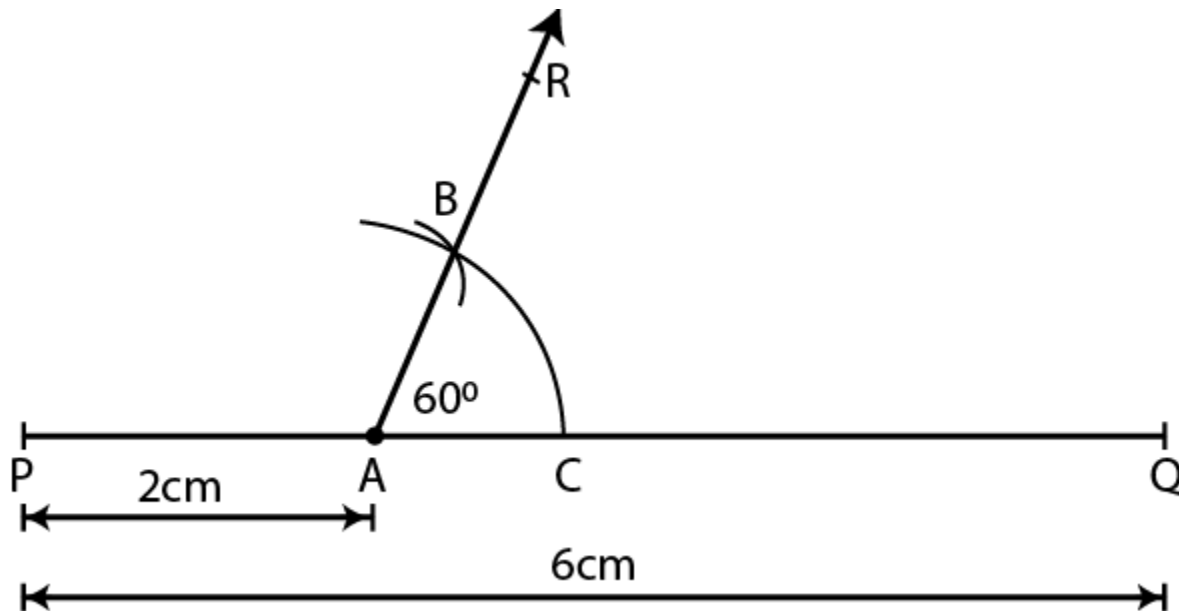
Steps of Construction:

1. Construct a line segment $PQ = 6$ cm.
2. Now mark point A on PQ so that $AP = 2$ cm.
3. Taking A as centre and some suitable radius construct an arc which meets AQ at the point C.
4. Taking C as centre and with same radius cut the arc CB.

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5. Now join AB and produce it to point R.

$$\angle QAR = 60^\circ.$$



4. Draw a line segment $AB = 8$ cm. Mark a point P in AB so that $AP = 5$ cm. At P , construct angle $APQ = 30^\circ$.

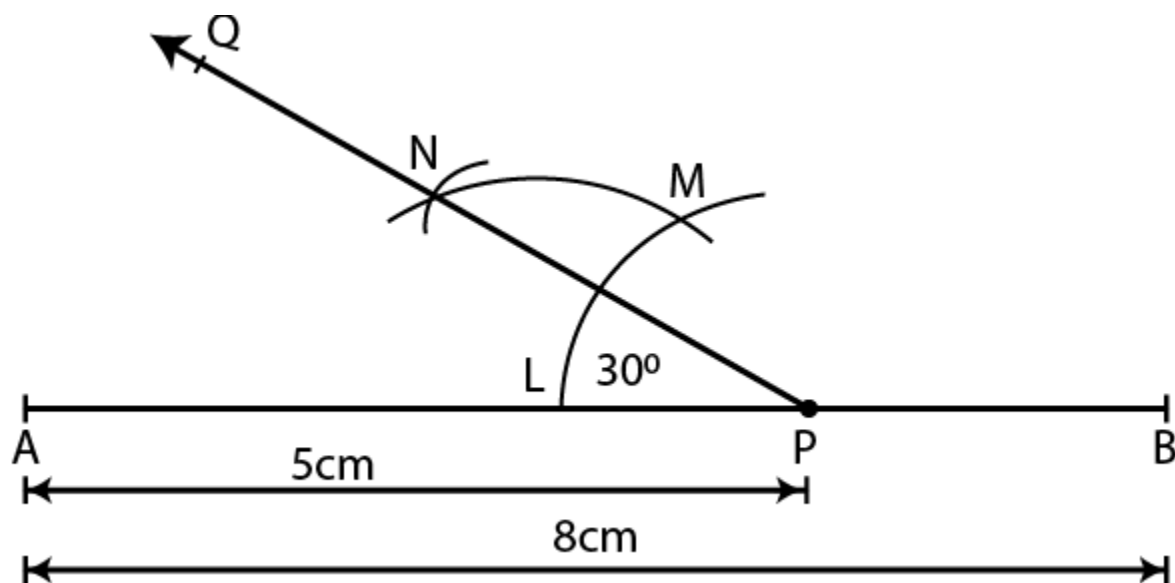
Solution:

Steps of Construction:

1. Construct a line segment $AB = 8$ cm.
2. Now mark the point P on AB such that $AP = 5$ cm.
3. Taking P as centre and some suitable radius construct an arc which meets AB at L .
4. Taking L as centre and same radius cut the arc LM .
5. Now bisect the arc LM at the point N .
6. Join PN and produce it to point Q .

$$\angle APQ = 30^\circ$$

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5. Construct an angle of 75° and then bisect it.

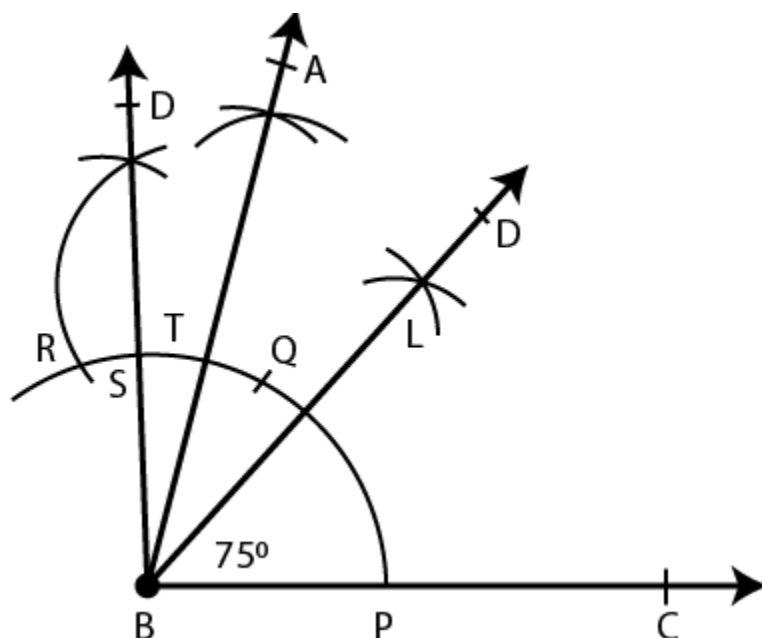
Solution:

Steps of Construction:

1. Construct a line segment BC.
2. At the point B construct an angle ABC which is equal to 75° .
3. Taking P and T as centres construct arcs which intersect each other at the point L.
4. Now join BL and produce it to point D.

Here BD bisects $\angle ABC$.

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6. Draw a line segment of length 6.4 cm. Draw its perpendicular bisector.

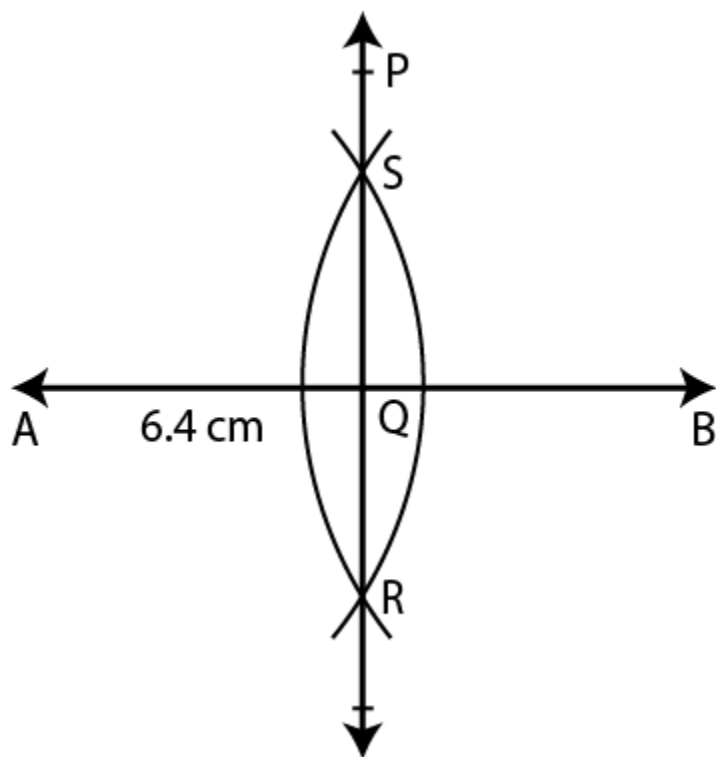
Solution:

Steps of Construction:

1. Construct a line segment $AB = 6.4$ cm.
2. Taking A and B as centres and with some suitable radius construct arcs which intersect each other at the points S and R.
3. Now join SR which intersects AB at the point Q.

Here PQR is the perpendicular bisector of the line segment AB.

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7. Draw a line segment $AB = 5.8$ cm. Mark a point P in AB such that $PB = 3.6$ cm. At P , draw perpendicular to AB .

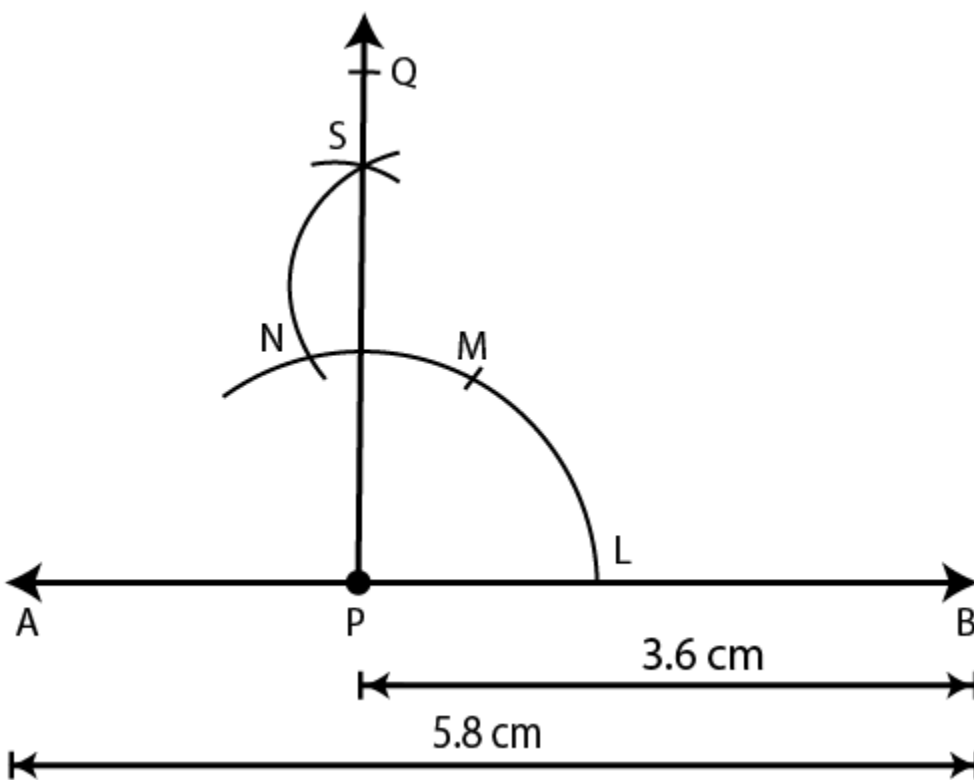
Solution:

Steps of Construction:

1. Construct a line segment $AB = 5.8$ cm.
2. Now mark a point P on the line segment AB such that $PB = 3.6$ cm.
3. Taking P as centre and some suitable radius construct an arc which meets AB at the point L .
4. Taking L as centre and same radius cut off the arcs LM and MN .
5. Now bisect the arc MN at the point S .
6. Join PS and produce it to point Q .

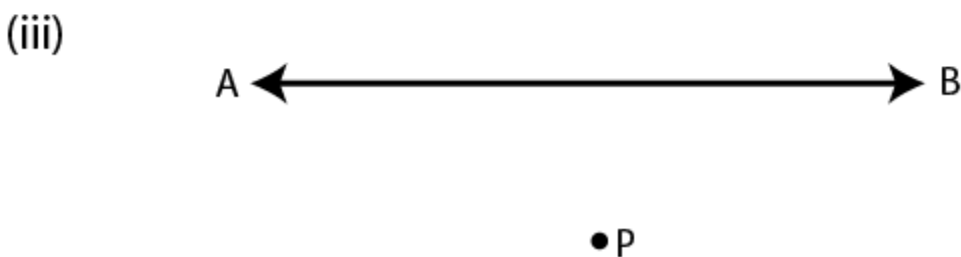
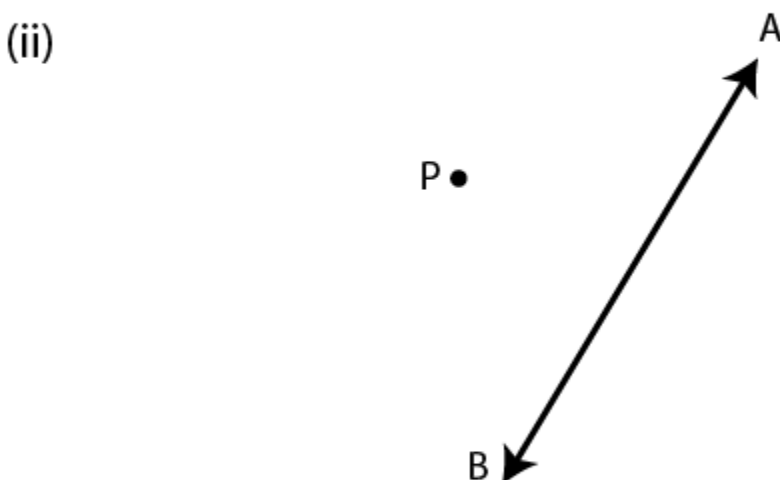
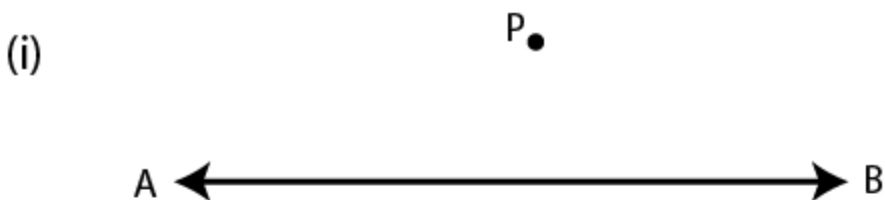
Here PQ is perpendicular to the line segment AB at point P .

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8. In each case, given below, draw a line through point P and parallel to AB:

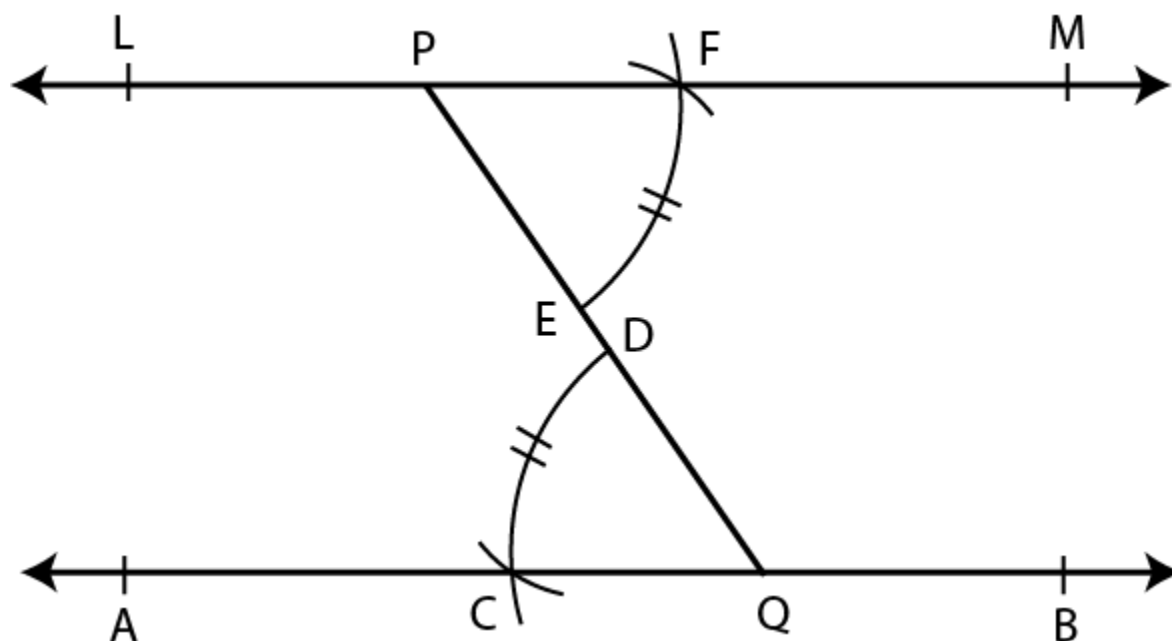
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**Solution:**

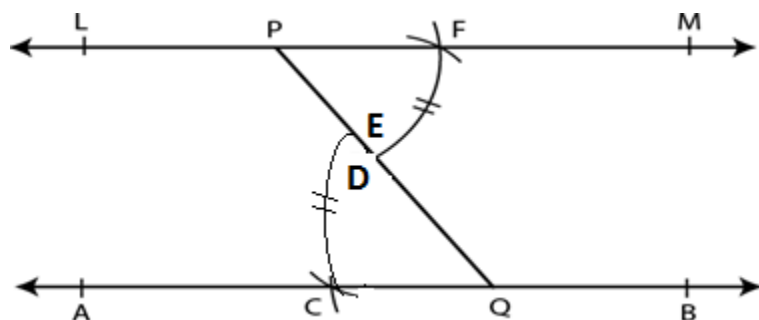
Steps of Construction:

1. From the point P construct a line segment meeting AB
2. Taking Q as centre and some suitable radius construct an arc CD.
3. Taking P as centre and same radius construct another arc which meets PQ at the point E.

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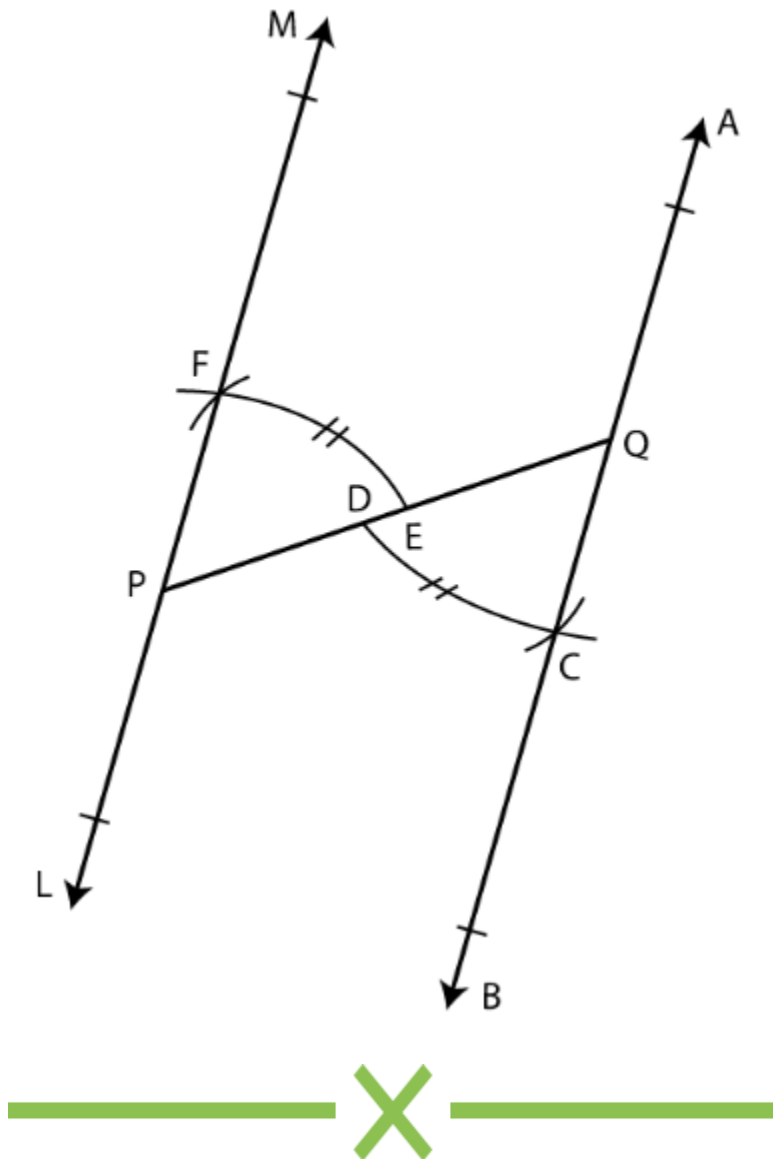
4. Taking E as centre and radius equal to CD cut this arc at the point F.



5. Now join PF and produce it to both sides to L and M.

Here the line LM is parallel to the given line AB.

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