

* Answer The Following Questions In One Sentence.[1 Marks Each]

[2]

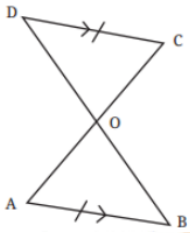
1. Circle the pairs that appear congruent.



Ans. : (a) and (d) are congruent. As they can be superimposed exactly.

2. Given that CD and AB are parallel, and $AB = CD$, what are the other equal parts in this figure?

(Hint: When the lines are parallel, the alternate angles are equal. Are the two resulting triangles congruent? If so, express the congruence.)



Ans. : Given that $DC \parallel AB$; $AB = CD$
 $\angle OCD = \angle OAB$; $\angle OBA = \angle ODC$ (\because Alternate Angles)
 $\angle DOC = \angle BOA$
 $OA = OC$; $OB = OD$

* Questions With Calculation.[2 Marks Each]

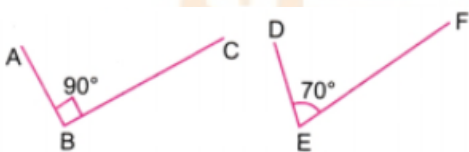
[16]

3. Check if the two figures are congruent.



Ans. : Let's measure the angles above with a protractor.

We found as follows:



Here, $\angle ABC$ does not coincide with $\angle DEF$.
 Hence, the given figures are not congruent.

4. How would we check if two figures like the one below are congruent?



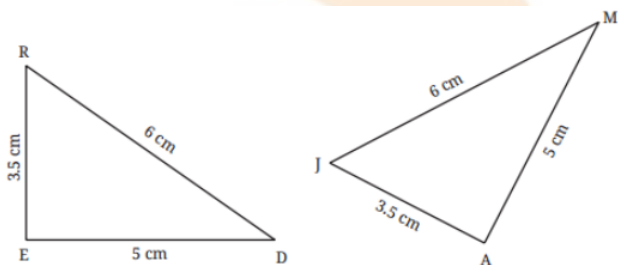
Use this to identify whether each of the following pairs is congruent.



Ans. : To check if the two figures are congruent, one would need to measure the lengths of the corresponding line segments and the angle between them.

Yes, each of the given figures is congruent. Length of line segments in each figure is 3.3 cm (Horizontal line) and 2.3 cm (Vertical line), and the angle between them is 82° .

5. Determine whether the triangles are congruent. If yes, express the congruence.



Ans. : Given the side lengths of the two triangles

$RE = 3.5 \text{ cm}$, $ED = 5 \text{ cm}$, $RD = 6 \text{ cm}$

and $JA = 3.5 \text{ cm}$, $AM = 5 \text{ cm}$, $JM = 6 \text{ cm}$

Clearly $RE = JA = 3.5 \text{ cm}$

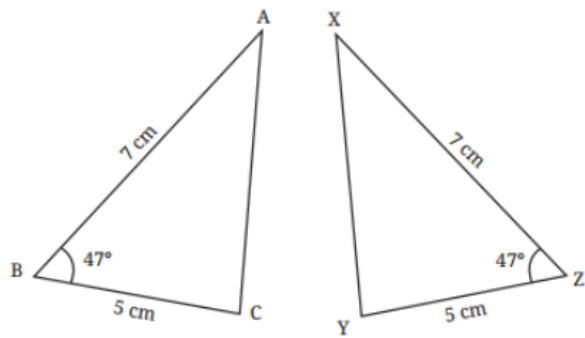
$ED = AM = 5 \text{ cm}$

$RD = JM = 6 \text{ cm}$

Hence $\triangle RED \cong \triangle JAM$.

6. Identify whether the triangles below are congruent. What conditions did you use to establish their congruence? Express the congruence.





Ans. : Here, $BC = ZY = 5 \text{ cm}$

$BA = ZX = 7 \text{ cm}$

$\angle ABC = \angle XZY = 47^\circ$

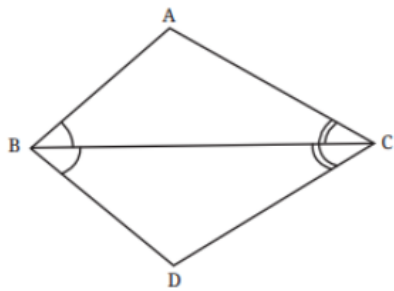
$\triangle ABC \cong \triangle XZY$

Since the two sides and the included angle of triangle ABC are equal to the two sides and the included angle of triangle XZY.

The triangles are congruent by the side-angle-side condition.

It can be expressed as $\triangle ABC \cong \triangle XZY$.

7. Given that $\angle ABC = \angle DBC$ and $\angle ACB = \angle DCB$, show that $\angle BAC = \angle BDC$. Are the two triangles congruent?



Ans. : Let $\angle ABC = a = \angle DBC$

and let $\angle ACB = b = \angle DCB$

BC is a common side of the two triangles, then $\triangle ABC \cong \triangle DBC$

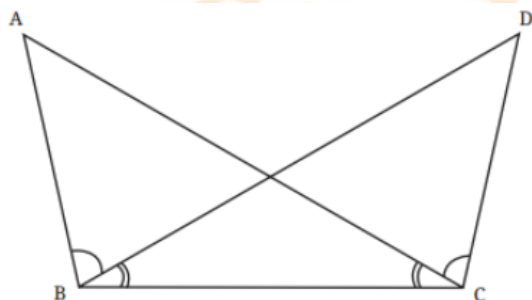
Angle Side Angle Congruence:

When two triangles are congruent, their corresponding parts are equal [CPCT]

Since $\triangle ABC \cong \triangle DBC$, their corresponding angles are equal.

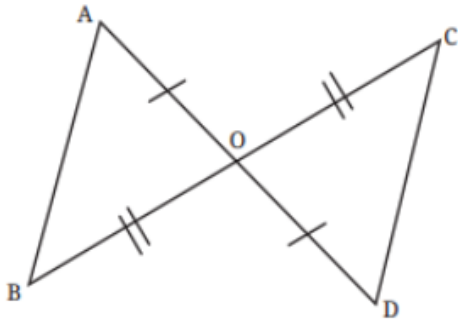
Hence $\angle BAC = \angle BDC$

8. Identify the equal parts in the following figure, given that $\angle ABD = \angle DCA$ and $\angle ACB = \angle DBC$.



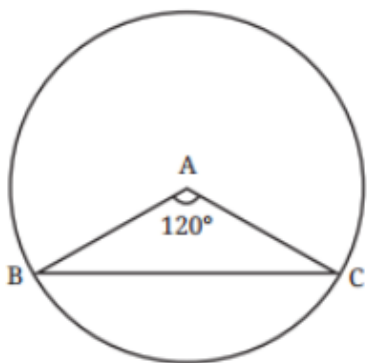
Ans. : Given $\angle ABD = \angle DCA$; $\angle ACB = \angle DBC$
 $\angle AOB = \angle DOC$ (\because They are vertically opposite angles)
 $AO = DO$; $CO = BO$
 $\triangle COD \cong \triangle BOA$
 Angle-side-angle condition

9. It is given that $OB = OC$, and $OA = OD$. Show that AB is parallel to CD .
 [Hint: AD is a transversal for these two lines. Are there any equal alternate angles?]



Ans. : Given $OB = OC$
 $OA = OD$
 Then $\angle AOB = \angle COD$
 $\triangle AOB \cong \triangle COD$ (\because Side angle side condition)
 So, these two triangles can be superimposed exactly.
 Therefore, $\angle A = \angle D$
 $\angle B = \angle C$
 Hence, AB is parallel to CD .

10. Find $\angle B$ and $\angle C$, if A is the centre of the circle.



Ans. : In $\triangle BAC$
 $AB = AC =$ Radius of the circle.
 Let $\angle ABC = \angle ACB = x$ (angles opposite to equal sides are equal)
 Then, $x + x + 120^\circ = 180^\circ$ (\because Sum of all the angles in a triangle is 180°)
 $\Rightarrow 2x = 180^\circ - 120^\circ$
 $\Rightarrow 2x = 60^\circ$
 $\Rightarrow x = 30^\circ$
 Hence $\angle B = \angle C = 30^\circ$



11. What measurements would you take to create a figure congruent to a given:

- (a) Circle
- (b) Rectangle

Using this, state how you would check if two

- (a) Are circles congruent?
- (b) Rectangles are congruent?

Ans. : (a) I will measure the radius or diameter of the given circle.

(b) I will measure the length and breadth of the given rectangle.

(a) I will place one circle over another circle.

If they exactly superimpose, they are congruent.

In this case, both will have the same radius.

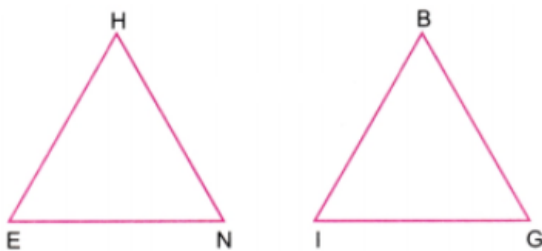
(b) I will place one rectangle over another rectangle.

If they exactly superimpose, they are congruent.

In such a case, both will have the same length and breadth.

12. Suppose $\triangle HEN$ is congruent to $\triangle BIG$. List all the other correct ways of expressing this congruence.

Ans. : Given



$\triangle HEN = \triangle BIG$ means that the vertices H, E, and N correspond to B, I, and G, respectively.

There are six ways to write a congruence statement for two congruent triangles.

The other five ways are

(i) $\triangle HNE \cong \triangle BGI$

(ii) $\triangle EHN \cong \triangle IBG$

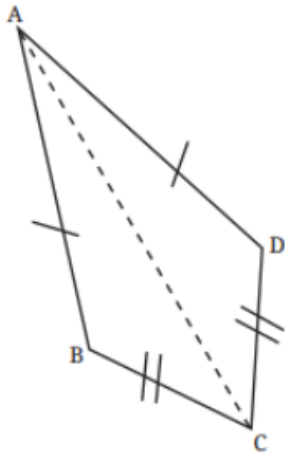
(iii) $\triangle ENH \cong \triangle IGB$

(iv) $\triangle NHE \cong \triangle GBI$

(v) $\triangle NEH \cong \triangle GIB$

13. In the figure below, $AB = AD$, $CB = CD$. Can you identify any pair of congruent triangles? If yes, explain why they are congruent. Does AC divide $\angle BAD$ and $\angle BCD$

into two equal parts? Give reasons.



Ans. : Given $AD = AB$

$CB = CD$

$AC = AC$ (Common side)

Since all three sides of $\triangle ABC$ are equal to the corresponding three sides $\triangle ADC$, the triangles are congruent by the side-side-side (SSS) congruence criterion.

Hence $\triangle ABC \cong \triangle ADC$

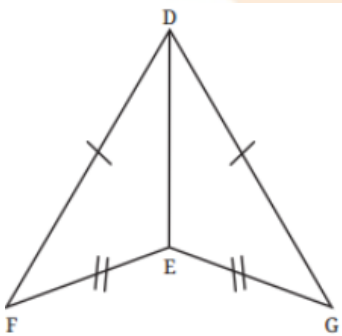
Yes, AC divides $\angle BAD$ and $\angle BCD$ into equal parts.

Since $\triangle ABC \cong \triangle ADC$

Then, $\angle BAC = \angle DAC$ and $\angle BCA = \angle DCA$

This means that AC bisects both $\angle BAD$ and $\angle BCD$.

14. In the figure below, are $\triangle DFE$ and $\triangle GED$ congruent to each other? It is given that $DF = DG$ and $FE = GE$.



Ans. : Given $DF = DG$ and $FE = GE$

The side DE is common to both triangles $\triangle DFE$ and $\triangle DGE$

Hence, by the SSS congruence criterion

$\triangle DFE \cong \triangle DGE$

The order of the vertices matters in congruence statements.

The vertices must correspond correctly.

In $\triangle DFE$ and $\triangle DGE$

DF corresponds to DG

FE corresponds to EG

ED is common.



Given statements $DF = DG$ and $FE = GE$ do not support the congruence of $\triangle DFE$ and $\triangle GED$ because the corresponding sides are not equal.

15. $\triangle AIR \cong \triangle FLY$. Identify the corresponding vertices, sides, and angles.

Ans. : Here $\triangle AIR \cong \triangle FLY$.

The corresponding parts are as follows:

Corresponding Vertices

A corresponds to F

I corresponds to L

R corresponds to Y

Corresponding Sides

AI corresponds to FL

IR corresponds to LY

AR corresponds to FY

Corresponding Angles

$\angle A$ corresponds to $\angle F$

$\angle I$ corresponds to $\angle L$

$\angle R$ corresponds to $\angle Y$

* Questions With Calculation.[5 Marks Each]

[15]

16. Each of the following cases contains certain measurements taken from two triangles. Identify the pairs in which the triangles are congruent to each other, with reason. Express the congruence whenever they are congruent.

(a) $AB = DE$

$BC = EF$

$CA = DF$

(b) $AB = EF$

$\angle A = \angle E$

$AC = ED$

(c) $AB = DF$

$\angle B = \angle D = 90^\circ$

$AC = FE$

(d) $\angle A = \angle D$

$\angle B = \angle E$

$AC = DF$

(e) $AB = DF$

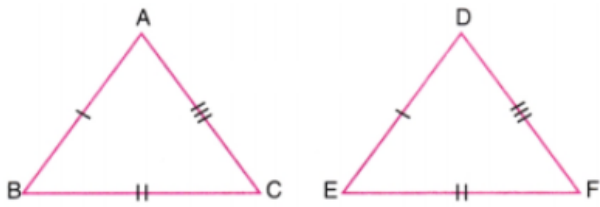
$\angle B = \angle F$

$AC = DE$

Ans. : (a) Here, $AB = DE$

$BC = EF$

$CA = FD$



All three corresponding sides are equal.

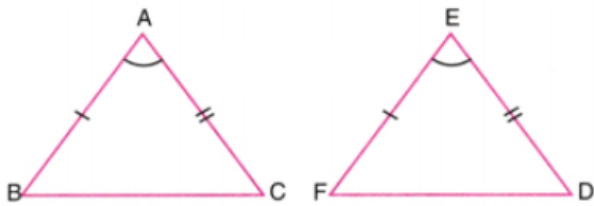
Thus, triangles are congruent by the side-side-side congruence.

Hence, $\triangle ABC \cong \triangle DEF$.

(b) Given $AB = EF$

$\angle A = \angle E$

$AC = ED$



Two corresponding sides and the included angle are equal.

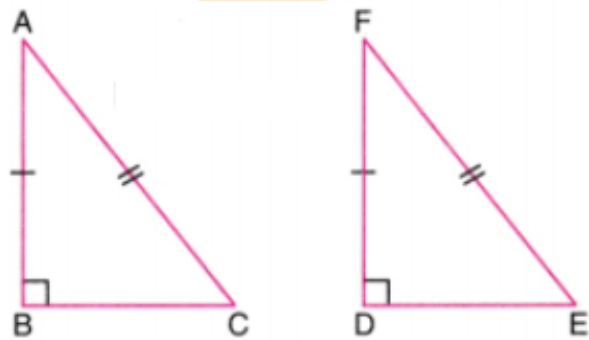
Thus, triangles satisfy the SAS condition.

Hence, $\triangle ABC \cong \triangle FED$

(c) Here, $AB = FD$

$\angle B = \angle D = 90^\circ$

$AC = FE$



The triangles have equal right angles, equal hypotenuses, and one equal corresponding side.

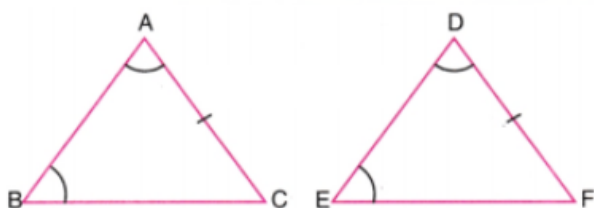
Thus, triangles satisfy the RHS conditions.

Hence, $\triangle ABC \cong \triangle FDE$.

(d) Here, $\angle A = \angle D$

$\angle B = \angle E$

$AC = DF$



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Clearly, two corresponding angles and one corresponding side are equal.

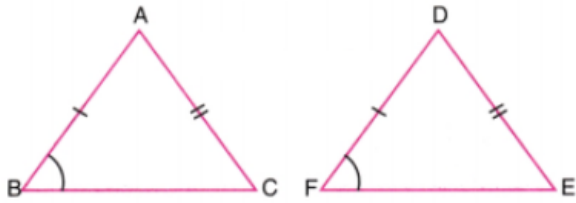
Thus, triangles satisfy the AAS conditions.

Hence, $\triangle ABC \cong \triangle DEF$.

(e) Here, $AB = DF$

$\angle B = \angle F$

$AC = DE$

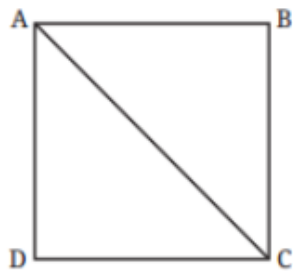


Here, two corresponding sides and a non-included angle are equal.

Thus, the triangles satisfy the SSA condition, which is not a valid congruence rule.

Hence, $\triangle ABC$ need not be congruent to $\triangle DFE$.

17. ABCD is a square. Show that $\triangle ABC \cong \triangle ADC$. Is $\triangle ABC$ also congruent to $\triangle CDA$?



Give more examples of two triangles where one triangle is congruent to the other in two different ways, as in the case above. Can you give an example of two triangles where one is congruent to the other in six different ways?

Ans. : To show $\triangle ABC \cong \triangle ADC$ (\because ABCD is a square)

Now, $AD = AB$

$CD = CB$

$AC = AC$ (Common side)

So, $\triangle ABC \cong \triangle ADC$ (Using SSS criterion)

For $\triangle ABC$ to be congruent to $\triangle CDA$

$AB = CD$

$BC = DA$

$AC = CA$

Since ABCD is a square

Hence, $\triangle ABC$ is congruent to $\triangle CDA$ by side side-side-side condition.

Now, let us take two congruent triangles $\triangle HEN$ and $\triangle BIG$.



$$\Rightarrow 2a = 112^\circ$$

$$\Rightarrow a = 56^\circ$$

$$\angle VRN = \angle VNR = 56^\circ$$

In $\triangle AUP$

$$\angle UAP = \angle UPA (\because \text{they are equal})$$

$$\angle UPA = 56^\circ$$

The sum of the angles of a triangle is 180° .

$$\text{So, } 56^\circ + 56^\circ + \angle AUP = 180^\circ$$

$$\Rightarrow 112^\circ + \angle AUP = 180^\circ$$

$$\Rightarrow \angle AUP = 180^\circ - 112^\circ$$

$$\Rightarrow \angle AUP = 68^\circ$$

$\triangle BOF$ is an equilateral triangle as all sides are equal.

So, $OB = OF = BF$

$$\angle FOB = \angle FBO = \angle OFB = 60^\circ$$

$$\angle RVN + \angle DVN = 180^\circ$$

$$\Rightarrow 68^\circ + \angle DVN = 180^\circ$$

$$\Rightarrow \angle DVN = 180^\circ - 68^\circ$$

$$\Rightarrow \angle DVN = 112^\circ$$

$$\angle VND + \angle VDN + \angle NVD = 180^\circ$$

$$\because VN = VD$$

$$\therefore \angle VND = \angle VDN = c$$

$$\therefore c + c + 112^\circ = 180^\circ$$

$$\Rightarrow 2c = 180^\circ - 112^\circ$$

$$\Rightarrow 2c = 68^\circ$$

$$\Rightarrow c = 34^\circ$$

$$\angle VND = \angle VDN = 34^\circ$$

In $\triangle OLB$

$$\angle OBL = 90^\circ - 60^\circ = 30^\circ$$

$$\angle LOB = 60^\circ [\because LO \parallel BF \text{ and } BO \text{ is transversal}]$$

In $\triangle OPN$

$$\angle OPN + \angle PON + \angle PNO = 180^\circ$$

$$\Rightarrow \angle OPN + 56^\circ + 90^\circ = 180^\circ$$

$$\Rightarrow \angle OPN + 146^\circ = 180^\circ$$

$$\Rightarrow \angle OPN = 180^\circ - 146^\circ$$

$$\Rightarrow \angle OPN = 34^\circ$$

Now, $\angle APK + \angle KPO + \angle OPN = 180^\circ$ [\because Straight angle is 180°]

$$\Rightarrow 44^\circ + \angle KPO + 34^\circ = 180^\circ$$

$$\Rightarrow \angle KPO = 180^\circ - 78^\circ$$

$$\Rightarrow \angle KPO = 102^\circ \text{ In } \triangle KPO$$

$$\angle KPO + \angle POK + \angle PKO = 180^\circ$$

$$\Rightarrow 102^\circ + 30^\circ + \angle PKO = 180^\circ$$



$$\Rightarrow 132^\circ + \angle PKO = 180^\circ$$

$$\Rightarrow \angle PKO = 180^\circ - 132^\circ = 48^\circ$$

$$\angle KAP + \angle KPA + \angle AKP = 180^\circ [\because \text{Sum of angles of a triangle is } 180^\circ]$$

$$\Rightarrow 34^\circ + 44^\circ + \angle AKP = 180^\circ$$

$$\Rightarrow 78^\circ + \angle AKP = 180^\circ$$

$$\Rightarrow \angle AKP = 180^\circ - 78^\circ$$

$$\Rightarrow \angle AKP = 102^\circ \text{ and } \angle PKO = 48^\circ$$

$$\text{So, } \angle AKP + \angle PKO + \angle OKL = 180^\circ$$

$$\Rightarrow 102^\circ + 48^\circ + \angle OKL = 180^\circ$$

$$\Rightarrow 150^\circ + \angle OKL = 180^\circ$$

$$\Rightarrow \angle OKL = 180^\circ - 150^\circ$$

$$\Rightarrow \angle OKL = 30^\circ$$

In $\triangle KOL$

$$\angle OKL + \angle OLK + \angle KOL = 180^\circ$$

$$\Rightarrow 30^\circ + 90^\circ + \angle KOL = 180^\circ$$

$$\Rightarrow \angle KOL = 180^\circ - 120^\circ$$

$$\Rightarrow \angle KOL = 60^\circ$$

Also, $\triangle OKL \cong \triangle OBL$

$$KL = LB$$

$$\angle OLK \cong \angle OLB = 90^\circ$$

Side angle side condition.

