FIRST: ALGEBRA

Choose the correct answer :

1. The irrational number lies between 3 and 4 is .....
(a) 3.5 (b) $3\frac{1}{8}$ (c) $\sqrt{13}$ (d) $\sqrt{20}$

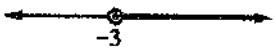
2. $]-2,1] \cap \{-2,0,1\}$ = ...
(a) $\{-2,0,1\}$ (b) $\{1\}$ (c) $\{0,1\}$ (d) $[-2,1]$

3. If $x = \sqrt{3}+2$ and $y = \sqrt{3}-2$, then $(xy, x+y)$ = ...
(a) $(5, 2\sqrt{3})$ (b) $(5, 9)$ (c) $(1, 2\sqrt{3})$ (d) $(-1, 2\sqrt{3})$

4. The line represented the relation : $3x + 8y = 24$ intersects the y-axis at the point .....
(a) (0 , 8) (b) (8 , 0) (c) (0 , 3) (d) (3 , 0)

5. If the arithmetic mean of the set of the values $m, m+5, m+4, m+3$ is 9 , then m = ...
(a) 2 (b) 6 (c) 9 (d) 10

6. If the volume of a cube is 64 cm^3 , then its edge length is .....
(a) 32 cm. (b) 16 cm. (c) 8 cm. (d) 4 cm.

7. The figure  represents the solution of the inequality ..... in $\mathbb{R}$
(a) $x > -3$ (b) $x \geq -3$ (c) $x < -3$ (d) $x \leq -3$

8. $\sqrt{3}(\sqrt{11}+\sqrt{3})$ = ...
(a) $3\sqrt{11}+2$ (b) $\sqrt{33}+3$ (c) $11\sqrt{3}+2$ (d) $2\sqrt{11}+3$

9. (3 , 2) does not satisfy the relation .....
(a) $y + x = 5$ (b) $3y - x = 3$ (c) $y + x = 7$ (d) $x - y = 1$

10. The arithmetic mean of the values : 5 , 12 , 17 , 6 is .....
(a) 10 (b) 12 (c) 4 (d) 17

11. If $x = \sqrt{3} + 2$ and $y = \sqrt{3} - 2$, then $x\,y =$ .....
(a) 1 (b) –1 (c) – 4 (d) 3

12. $]-1\ ,3[\cap [-3\ ,-1] =$ .....
(a) $\varnothing$ (b) $\{-3\}$ (c) $\{-1\}$ (d) $\{3\}$

13. If the lower limit of a set is 6 and the upper limit is 10 , then its centre is .....
(a) 4 (b) 6 (c) 10 (d) 8

14. The multiplicative inverse of $\frac{\sqrt{5}}{10}$ is .....
(a) $\sqrt{10}$ (b) $\sqrt{5}$ (c) $2\sqrt{5}$ (d) $-2\sqrt{5}$

15. The S.S. of $x + 2 \geq 1$ in $\mathbb{R}$ is .....
(a) $[-1\ ,\infty[$ (b) $]-1\ ,\infty[$ (c) $[1\ ,2]$ (d) $[1\ ,2[$

16. The mean of the set of numbers : 5 , 12 , 17 , 6 is .....
(a) 40 (b) 20 (c) 5 (d) 10

17. The S.S. of the equation : $x^2 - 1 = 8$ in $\mathbb{R}$ is .....
(a) $\varnothing$ (b) $\{3\}$ (c) $\{-3\}$ (d) $\{-3\ ,3\}$

18. The conjugate of $\frac{1}{\sqrt{3}-\sqrt{2}}$ is .....
(a) $\sqrt{3}-\sqrt{2}$ (b) $3-\sqrt{2}$ (c) $3+\sqrt{2}$ (d) $\sqrt{3}+\sqrt{2}$

19. The value of b that makes $(-2\ ,3)$ satisfies the relation : $3x + by = 3$ is .....
(a) 3 (b) 2 (c) 1 (d) –3

20. If the mode of the values : $5\ ,x+3\ ,9\ ,4$ is 9 , then $x =$ .....
(a) 5 (b) 4 (c) 6 (d) 3

21. $\left(\sqrt{2}+\sqrt{8}\right)^2 =$ .....
(a) 18 (b) $\sqrt{10}$ (c) 4 (d) 10

22. The sum of the real numbers of the interval $[-150, 150]$ is .....
(a) 300 (b) -300 (c) zero (d) 150

23. The volume of a cuboid whose dimensions $\sqrt{2}$ cm., $\sqrt{3}$ cm., $\sqrt{6}$ cm. is .....
(a) 6 cm.^{3} (b) 36 cm.^{3} (c) $6\sqrt{6}$ cm.^{3} (d) $18\sqrt{2}$ cm.^{3}

24. If $|a| = 5$, then a = ...
(a) 5 (b) -5 (c) ± 5 (d) $\sqrt{5}$

25. $\{8, 9, 10\} -]8, 10[$ = ...
(a) $\varnothing$ (b) $\{9\}$ (c) $\mathbb{N}$ (d) $\{8, 10\}$

26. $\mathbb{Q} \cap \grave{\mathbb{Q}}$ = ...
(a) $\mathbb{R}$ (b) $\mathbb{R}_+$ (c) $\mathbb{R}_-$ (d) $\varnothing$

27. $\{x : x \in \mathbb{R}, x < 1\}$ = ...
(a) $\{0, -1, -2\}$ (b) $]-\infty, 1]$ (c) $]-\infty, 1[$ (d) $]1, \infty[$

28. The additive inverse of $\sqrt{5} - \sqrt{3}$ is .....
(a) $\sqrt{5} - \sqrt{3}$ (b) $\sqrt{3} + \sqrt{5}$ (c) $-\sqrt{5} - \sqrt{3}$ (d) $\sqrt{3} - \sqrt{5}$

29. $\left(\sqrt{5} + \sqrt{3}\right)^2 \left(\sqrt{5} - \sqrt{3}\right)^2$ = ...
(a) 4 (b) 2 (c) 8 (d) 3

Complete each of the following :

1. The slope of a straight line which passes through $(-3, 1)$ and $(-2, 5)$ is .....

2. If the mode of the set of the values 17, 8, k + 5, 8, 17 is 8, then k = ...

3. The multiplicative inverse of $\frac{\sqrt{13} - \sqrt{10}}{3}$ is ..... (In the simplest form)

4. The radius length of a sphere whose volume is $\frac{9}{2}\pi$ cm.^{3} is ..... cm.

5. If the order of the median of the set of values is fifth, then the number of these values equals .....

6.	$\sqrt[3]{-64}+\sqrt{16}=$ .....
7.	The multiplicative inverse of the number $\frac{3}{\sqrt{3}}$ is $\frac{\cdots\cdots}{\sqrt{3}}$
8.	If the volume of a sphere $=\frac{9}{16}\pi$ cm^3 , then its radius length = ... cm.
9.	The S.S. of the equation : $x^3-27=0$ in $\mathbb{R}$ is .....
10.	$[1,5]-\{1,5\}=$ .....
11.	A cube whose volume is 8 cm^3 , the length of its edge = ... cm.
12.	The slope of the straight line which passes through the two points $(2,-2)$ and $(4,2)$ is .....
13.	The arithmetic mean of 10 , 6 , 5 , 14 , 15 is .....
14.	The S.S. of the equation $x^2+9=0$ in $\mathbb{R}$ is .....
15.	$\sqrt{16}=\sqrt[3]{\cdots\cdots}$
16.	The multiplicative inverse of the number $2\sqrt{3}$ is .....
17.	$\{8,9,10\}\cap]8,10[=$ .....
18.	The length of the edge of a cube of volume $15\frac{5}{8}$ cm^3 is .....
19.	If $a=\sqrt{5}-2$, $b=\sqrt{5}+2$, then $a^2b^2=$ .....
20.	The S.S. of the equation $x^2+5=0$ in $\mathbb{R}$ is .....
21.	If $a^2+b^2=25$ and $ab=5$, then $\frac{a}{b}+\frac{b}{a}=$ .....
22.	$]5,7[\cup\{5,7\}=$ .....
23.	The slope of any line parallel to x-axis = ...
24.	$\sqrt{5}+\sqrt{2}$ its conjugate is ..... and their product is .....

25. The conjugate of the number $\frac{4}{\sqrt{7}-\sqrt{3}}$ is .....

26. The total area of a cube of edge length 4 cm. is ..... cm^2

27. If the point (6 , a) lies on the straight line whose equation is $x + y = 3$, then a = ...

28. $[2 , 7[\cup \{2 , 7\}$ = ...

29. If $a = \sqrt{5} + 1$ and $b = \sqrt{5} - 1$, then $a - b$ = ...

Essay problems:

1. If $A =]-1 , 3]$ and $B = [0 , 5[$, **then find :**
   (1) $A \cap B$ (2) $B - A$ (3) $\mathbb{R}_+ \cap B$

2. **Simplify :** $2\sqrt{27} + \frac{1}{3}\sqrt[3]{54} - \sqrt{75} + \sqrt[3]{16}$

3. **Find in $\mathbb{R}$ the S.S. of each of the following :**
   (1) $\frac{(2x-1)^3}{3} = 9$ (2) $-1 < 3 - 2x \leq 5$

4. If $x = 2\sqrt{3} - \sqrt{2}$ and $y = \sqrt{12} + \sqrt{2}$ **Find the value of :** $\frac{x+y}{xy+2}$

5. If (a , 3) and (3 , b) satisfies the relation $2x - y = 1$
   (1) Find the value of a and b
   (2) Find the slope of the straight line which represented the relation : $2x - y = 1$

6. **Find the mean of the following frequency distribution :**

Sets	5 –	15 –	25 –	35 –	45 –	Total
Frequency	3	10	12	10	5	40

7. If $x = \sqrt{3} - 2$ and $y = \sqrt{3} + 2$, **find the value of :** $\left(\frac{x-y}{x+y}\right)^2$

8. **Simplify the following to the simplest form :** $\sqrt{98} - \sqrt{128} - \sqrt{18} + 4\sqrt{2}$

9.	If $X =]-\infty , 2[$ and $Y = [-1 , 5]$, **find using the number line :** (1) $X \cap Y$ (2) $X - Y$
10.	Find the slope of the straight line passing through the two points : A (1 , 3) and B (2 , 3)
11.	**Find the solution set for the following equation in $\mathbb{R}$, then represent the solution on the number line :** $-8 \leq 3x + 1 \leq 4$
12.	If $X = [-2 , 1]$ and $Y = [0 , \infty[$ **Find :** (1) $X \cap Y$ (2) $X \cup Y$ (3) $Y - X$
13.	**Represent graphically the relation :** $2y - x = 2$
14.	**Represent graphically the relation :** $y = 2x - 3$
15.	If (3 , 2) satisfies the relation $x + 2y = m$, then find the value of m
16.	**Find in the simplest form :** $2\sqrt{18} + \sqrt{50} + \frac{1}{3}\sqrt{162}$
17.	Find the lateral area for right circular cylinder of volume 924 cm^3 , and its height 6 cm. $\left(\pi = \frac{22}{7}\right)$
18.	**Find the S.S. of the inequality :** $7 \geq 2x + 1 > 3$
19.	If $X = [-1 , 2]$ and $Y = [1 , \infty[$ **Find :** (1) $X \cap Y$ (2) $X \cup Y$
20.	The radius length of the base of a right cylinder is $4\sqrt{2}$ cm. and its height is 9 cm. Find its volume in terms of π
21.	If $x = \frac{4}{3+\sqrt{5}}$ and $y = 3 + \sqrt{5}$ **Prove that :** x and y are conjugate numbers , **then find the value of :** $(x + y)^2$
22.	If $A =]-2 , 6]$ and $B = [4 , \infty[$, **use the number line to find :** (1) $A \cup B$ (2) $A \cap B$
23.	If the volume of a sphere is 36π cm^3 Find the length of its radius , then calculate its total area ($\pi = 3.14$)

24. **Solve in $\mathbb{R}$ the inequality :** $x + 2 \leq 3x + 2 < x + 16$

25. If $x = \sqrt{7} + \sqrt{6}$ and $y = \dfrac{1}{\sqrt{7} + \sqrt{6}}$

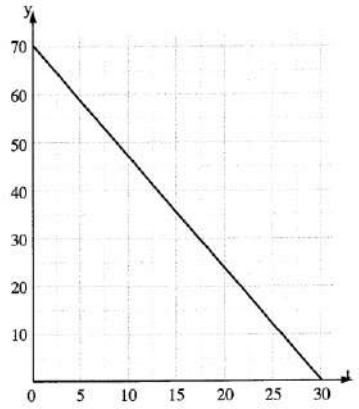
(1) **Prove that :** x and y are conjugate. (2) **Find :** the numerical value of $x^2 - y^2$

26. **Find in $\mathbb{R}$ the S.S. of the inequality :** $-9 \leq -3x + 2 < 17$

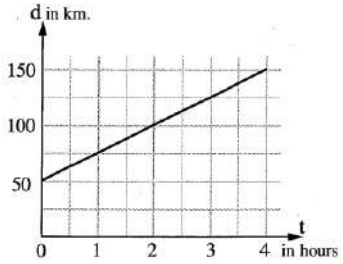
27. **If the volume of a sphere is 288 π cm^3 find its area.**

28. **Magdi filled the tank of his car by fuel. The opposite figure represents the relation between the time (t) in hours and the amount of remained fuel in the tank (y) in litres :**

(1) What is the greatest capacity of the tank ?
(2) When will the tank become empty ?
(3) What is the amount of remained fuel after 15 hours ?
(4) What is the range of consumption of fuel in each hour ? « 70 L , 30 hr. , 35 L , $2\frac{1}{3}$ L /hr. »



29. The opposite graph represents the motion of a car moving with uniform velocity.
Determine the velocity of the car.



SECOND: GEOMETRY

Choose the correct answer :

1. In ΔABC : If $m(\angle B) = 90°$, then .....
(a) AC > CB (b) AB > AC (c) BC > AC (d) AB = AC

2. If the lengths of two sides of an isosceles triangle are 3 cm. and 7 cm. , then the length of the third side is .....
(a) 3 (b) 4 (c) 7 (d) 10

3. In ΔABC : If $AB = AC$ and $m(\angle A) = 60°$, then the number of axes of symmetry of the triangle ABC is .....
(a) 0 (b) 1 (c) 2 (d) 3

4. Any triangle has ..... medians.
(a) 0 (b) 1 (c) 2 (d) 3

5. If ABCD is a square , then the axes of symmetry of $\overline{AC}$ is .....
(a) $\overleftrightarrow{AD}$ (b) $\overleftrightarrow{BC}$ (c) $\overleftrightarrow{BD}$ (d) $\overleftrightarrow{AB}$

6. The measure of the exterior angle of equilateral triangle = ...
(a) 90° (b) 120° (c) 45° (d) 60°

7. If $\overline{AD}$ is a median in ΔABC and M is the point of intersection of the medians , then AM = ... AD
(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{3}{2}$ (d) $\frac{1}{2}$

8. In ΔXYZ , if $m(\angle Z) = 70°$ and $m(\angle Y) = 60°$, then YZ ..... XY
(a) < (b) = (c) > (d) is twice

9. The numbers 4 , 8 , ... can be lengths of sides of an isosceles triangle.
(a) 4 (b) 8 (c) 12 (d) 3

10. In ΔABC , if $m(\angle B) = 90°$ and $m(\angle C) = 30°$, then AB ..... AC
(a) $\frac{1}{3}$ (b) 2 (c) equals (d) $\frac{1}{2}$

11. The number of axes of symmetry of an equilateral triangle is .....
(a) 0 (b) 1 (c) 2 (d) 3

12. An isosceles triangle , one of its base angles has measure 50° , then the measure of the vertex angle = ...
(a) 50° (b) 60° (c) 70° (d) 80°

13. $\overline{AD}$ is a median of triangle ABC , and M is the point of intersection of the medians , then AM = ... AD
(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

14. If the lengths of two sides of a triangle are 4 cm. and 8 cm. , then the length of the third side = ... cm.

(a) 3 (b) 4 (c) 8 (d) 12

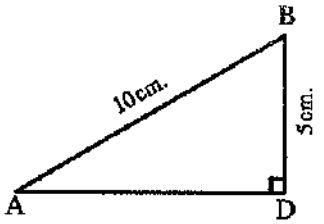
15. In a triangle ABC , if m (∠ A) = 80° and m (∠ C) = 60° , then AB ..... BC

(a) < (b) > (c) = (d) ≥

16. **In the opposite figure :**

Δ ADB , m (∠ ADB) = 90° , BD = 5 cm.

and AB = 10 cm. , then m (∠ A) = ...°



(a) 30 (b) 50 (c) 70 (d) 90

17. The point of concurrency of medians divides each median in the ratio ..... from the base.

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

18. The number of axes of symmetry in the scalene triangle is .....

(a) 1 (b) 2 (c) 3 (d) zero

19. In Δ ABC , AB = AC and m (∠ B) = 70° , then m (∠ A) = ...

(a) 140° (b) 70° (c) 40° (d) 110°

20. Δ ABC in which : m (∠ B) > m (∠ C) , then AC ..... AB

(a) > (b) < (c) = (d) ≤

Complete each of the following :

1. The intersection point of the three medians of the triangle divide the median in the ratio ..... from the vertex.

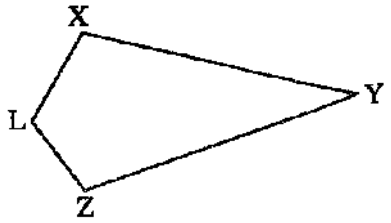
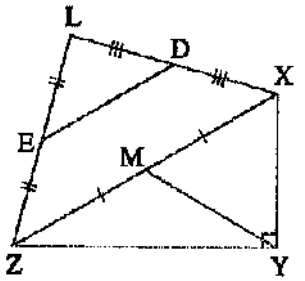
2. In Δ ABC : If CA = CB and m (∠ C) = m (∠ A) , then m (∠ B) = ...°

3. The bisector of the vertex angle of the isosceles triangle is ..... and .....

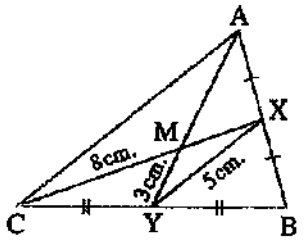
4. If the measure of an angle in the isosceles triangle is 100° , then the number of axes of symmetry of Δ ABC is .....

5.	The longest side in the right-angled triangle is .....
6.	In ΔXYZ , $m(\angle X) = 90°$, then the longest side is .....
7.	The base angles of the isosceles triangle are .....
8.	ABC is a triangle in which AB = 4 cm. , CB = 7 cm. , then AC $\in$]..... , ...[
9.	If A $\in$ the axis of symmetry of $\overline{XY}$, then ..... = ...
10.	If the measure of an angle in the isosceles triangle equals 60° , then the triangle has ..... axes of symmetry.
11.	The sum of measures of any two consecutive angles in the parallelogram = ... °
12.	The straight line perpendicular to the midpoint of a line segment is called .....
13.	The length of the median from the vertex of the right angle in the right-angled triangle = ...
14.	If AB = AC in ΔABC and $m(\angle B) = 40°$, then $m(\angle C)$ = ...°
15.	In ΔXYZ , if XY < YZ < ZX , then the greatest angle in measure is $\angle$ .....

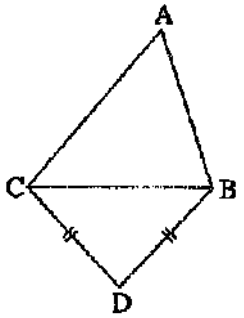
Essay problems:

1.	In ΔABC , if AB = 5 cm. , BC = 7 cm. and AC = 9 cm. Arrange the measures of its angles in a descending order.
2.	**In the opposite figure :** XY > XL and YZ > ZL **Prove that :** $m(\angle XLZ) > m(\angle XYZ)$ 
3.	**In the opposite figure :** $m(\angle XYZ) = 90°$, D is midpoint of $\overline{XL}$, E is midpoint of $\overline{ZL}$ and M is the midpoint of $\overline{XZ}$ **Prove that :** DE = YM 

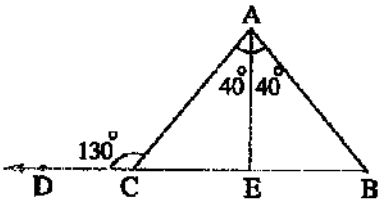
4. **In the opposite figure :**
ABC is a triangle , X is the midpoint of $\overline{AB}$
, Y is midpoint of $\overline{BC}$, XY = 5 cm. and $\overline{XC} \cap \overline{AY} = \{M\}$
where CM = 8 cm. , YM = 3 cm.
Find : (1) The perimeter of Δ MXY
(2) The perimeter of Δ MAC



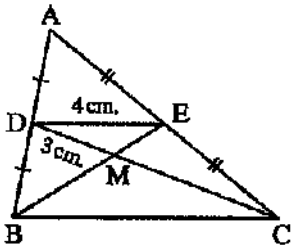
5. **In the opposite figure :**
AC > AB and DB = DC
Prove that : m (∠ ABD) > m (∠ ACD)



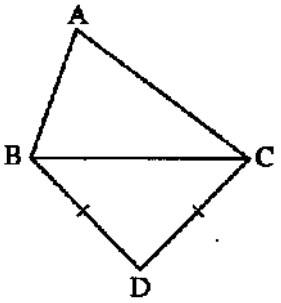
6. **In the opposite figure :**
$C \in \overrightarrow{BD}$, m (∠ ACD) = 130°
and m (∠ BAE) = m (∠ CAE) = 40°
Prove that : (1) $\overline{AE} \perp \overline{BC}$
(2) E bisects $\overline{BC}$



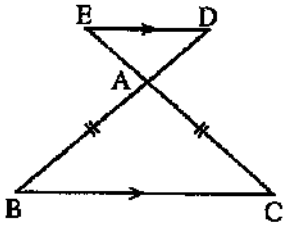
7. **In the opposite figure :**
D is the midpoint of $\overline{AB}$, E is the midpoint of $\overline{AC}$
, $\overline{CD} \cap \overline{BE} = \{M\}$
If DE = 4 cm. , DM = 3 cm. , BE = 6 cm.
Find : The perimeter of Δ BMC



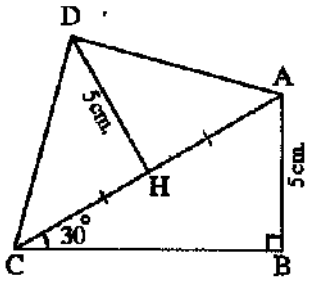
8. **In the opposite figure :**
If AC > AB and DC = DB
Prove that : m (∠ ABD) > m (∠ ACD)



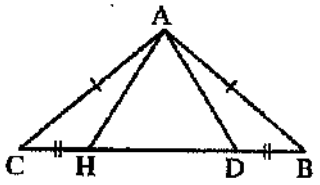
9. **In the opposite figure :**
If AB = AC
Prove that : AD = AE



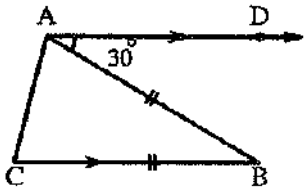
10. **In the opposite figure :**
ABC is a right angled triangle at B
, m (∠ ACB) = 30° , AB = 5 cm.
, DH = 5 cm. and H is the midpoint of $\overline{AC}$
Prove that : m (∠ ADC) = 90°



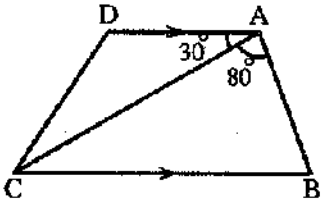
11. **In the opposite figure :**
ABC is a triangle in which :
AB = AC , BD = CH
Prove that : ① Δ ADH is an isosceles triangle.
② ∠ AHD ≡ ∠ ADH



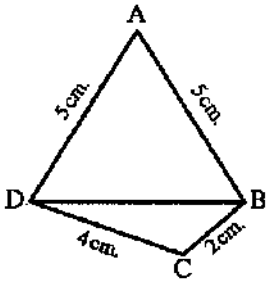
12. **In the opposite figure :**
ABC is a triangle in which : AB = BC , $\overrightarrow{AD}$ // $\overline{BC}$
, m (∠ DAB) = 30°
Find : The measures of the angles of Δ ABC



13. **In the opposite figure :**
$\overrightarrow{AD}$ // $\overline{BC}$, m (∠ BAC) = 80°
, m (∠ DAC) = 30°
Prove that : BC > AB



14. **In the opposite figure :**
ABCD is a quadrilateral in which : AB = AD = 5 cm.
, BC = 2 cm. , DC = 4 cm.
Prove that : m (∠ ABC) > m (∠ ADC)



15. **In the opposite figure :**
AB > AC , $\overline{DE}$ // $\overline{BC}$
Prove that : AD > AE