Second semester Mathematics work sheet for Grade nine students

Unit -4 Relations and function

Short Note:-

- ✓ A relation is a set whose elements are ordered pairs. Example:- $R = \{(a, b), (c, d)\}$
- ✓ If A and B are sets a relation R from A to B is any subset of A×B if and only if $R \subset A \times B$
- ✓ If R is a relation from A to A then R is relation on A. that is $R \subset A \times A$
- ✓ The set of all first coordinates of elements of R.That is domain of$R = \{x: (x, y) \in R \text{ for some } y\}$.
- ✓ Range:-The set of all 2nd coordinates of elements of R.That is range of $R = \{y: (x, y) \in R \text{ for some } x\}$

I. **Answer the following Exercises accordingly**

1. For each of the following relations determine the relating phrase?
   A. R={(X,Y): X is taller than Y}
   B. R={(X,Y): Y is the square root of X}
   C. R={(X,Y): Y= 2X}
2. Let A={2,4,6} and B={1,3,5}
   A. R={(2,2),(4,4),(6,6) is a relation on A.Express the relation using set builder method.
   B. R={(X,Y): Y=2X+1} is a relation on A.Where A={1,2,3,4} then list the elements of R.
   C. write some ordered pairs that belong to the relation given by R={(X,Y):Y< 2X , Xϵ Z and YϵZ}
3. Find the domain and range of each of the following relations?
   A. R={(X,Y):Y=$\sqrt{X}$ } B. R={(X,Y):Y=X^2 }

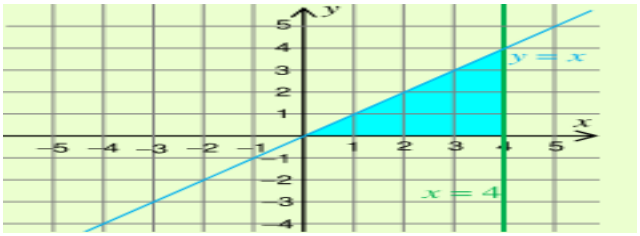
Short Note: - Graphs of Relation - is the graph of its ordered pairs.To sketch the graph of in equalities you should understand the following steps.

A. R= { (x , y) : Ax + By < C B. R = { (x , y) : Ax + By > C }

- ✓ Step-1 Draw the graph of a boundary line Ax + By = C, make a line solid , if the inequality involves (≥ or ≤) and Make a line broken (---), if the inequality involves (< or >)
- ✓ Step-2 choose a test point (a , b) that is not on the line Ax + By = c
- ✓ Step-3 shades the appropriate region. Shade the region if the test point (a , b) satisfies the original inequality ; otherwise shade the other side of Ax + By = c.

II. **Answer the following Exercises accordingly**

4. Sketch the graph of R={(x,y):x≥0 and y≥0; x, y ϵ R}
5. Sketch the graph ofR={(x,y):y≥3x – 2} and determine the domain and range.
6. From the graph of a relation represented by the shaded region specify the relation and determine the domain and the range.



Short Note: - Functions are a relation such that no two ordered pairs have the same first coordinates and different second coordinates.

7. Determine whether each of the following relations is a function. If it is not give a reason.
   A. R={(a,1),(b,2),(c,3)}
   B. R={(1,3),(2,3),(3,3),(4,3),(5,3)}
   C. R={(1,4),(1,5),(1,6),(5,4),(5,5)}
8. If A={2,5,7} and B={2,3,4,6} then is A×B a function ?Explain your answer?
9. Find the domain and range of each of the following functions?
   A. $f(x)$=3 B. $f(x) = 1 - 3x$ C. $f(x) = \sqrt{x+4}$ D. $f(x) = |x| - 1$ E. $f(x) = {}^{1}/_{2x}$
10. Match each of the functions in column A with its corresponding domain in column B.

A	B
1. $f(x) = \sqrt{2-x}$	A. { x : x ≥ 3}
2. $f(x) = 2x - 1$	B. {x: x ≤ 2}
3. $f(x) = \sqrt{x-3}$	C. { x: x∈R}

11. Match each of the functions in column A with its corresponding range in column B.

A	B
1. $f(x) = \sqrt{2-x}$	A. {y:y≥0}
2. $f(x) = 2x - 1$	B. {y:y∈R}
3. $f(x) = \sqrt{x-3}$	C. {y:y≥10}

Short Note: - The sum, difference, product and quotient of two functions, all known as combinations of functions.

12. Let $f(x) = \frac{x}{x-2}$ and $g(x) = \frac{2x-2}{3x+3}$ find:- A. f + g B. f g C. Domain of (f + g) and f g
13. Let $f(x) = 3x - 3$ and $g(x) = \frac{2}{x-1}$ evaluate
    A. $2fg(2)$ B. $\left(\frac{f}{g} - 2f\right)(3)$ C. $(f-g)(4)$

Short Note: - A function is a linear function if and only if its domain is the set of all real numbers denoted by $f(x) = ax + b$. Where ais the slope of linear function.The graph of $f(x) = ax + b$ is straight line a is the slope of a line.For $a > 0$, the graph of $f(x) = ax + b$ is increasing.

- For $a < 0$, the graph of $f(x) = ax + b$ is decreasing.
- For $a = 0$, the graph of will be $f(x) = b$ is horizontal line. It is called constant linear function.
- If x = 0, then $f(0) = b$, b is y-intercept where the graph crosses the y-axis i.e (0,b) crosses y-axis.
- If$f(x) = 0$, then$ax + b = 0 \rightarrow \frac{-b}{a}$, $\frac{-b}{a}$ is x-intercept. i.e ($\frac{-b}{a}$, 0) crosses the x-axis.

14. Sketch the graph of each of the following? A. $f(x) = 3x + 2$ $B. f(x) = 2 - 7x$
15. What is the slope of x-2y=1function?

Short Note: -A quadratic function is a function of the form $f(x) = ax^2 + bx + c$ with $a \neq 0$.

- The domain of quadratic function is the set of all real numbers.
- The graph of all quadratic function is called parabolas.
- The lowest or the highest point of a parabola is called the vertex.
- The vertical lines passing through the vertex in each parabola is called the axis of symmetry.
- To $f(x) = ax^2 + bx + c$ is expressed as $f(x) = a(x - h)^2 + k$ by using completing the square method. Then vertex = (h ,k).

16. Sketch the graph of each of the following functions.
    A. $f(x) = 4x^2 - 2x$ B. $f(x) = (x - 2)^2 + 13$
17. Find the vertex and axis of symmetry of the following functions?
    A. $f(x) = (x - 4)^2 - 3$ b, $f(x) = x^2 - 5x + 8$
18. Determine the minimum or the maximum value the following functions.
    A, $f(x) = (x - 4)^2 - 5$ B, $f(x) = 3x^2 - 5x + 8$
19. Is function $f(x) = 3x^2 - 5x + 7$ downward or upward parabola.
20. The domain of $f(x) = x^2 - 8x + 3$ is all real numbers?

Unit -5 Geometry and measurement

Short Note:-The sum s of all the interior angles of an n-sided polygon is given by the formula S = (n – 2) × 180°. The sum of all the exterior angles of an n-sided polygon is given by S=360°. For any regular n-sided polygon

- Measure of each interior angle = $\frac{(n-2)\,180^\circ}{n}$
- Measure of each central angle =$\frac{360^\circ}{n}$.
- Measure of each exterior angle =.$\frac{360^\circ}{n}$.

21. ABCD is a quadrilateral such that the measure of three of its interior angles are given as m(<D)= $112°$, m(<C)=$75°$, $m(< B) = 51°$,find m(<A).
22. Find the measure of an interior angle of 12 sided regular polygon?
23. Find the number of sides of a regular polygon,if the measure of each of its interior angles is $150°$?
24. If the measure of a central angle of a regular polygon is $18°$, find the measure of each of its interior angles.
25. A regular polygon with 20 sides,find the measure of each exterior angles.

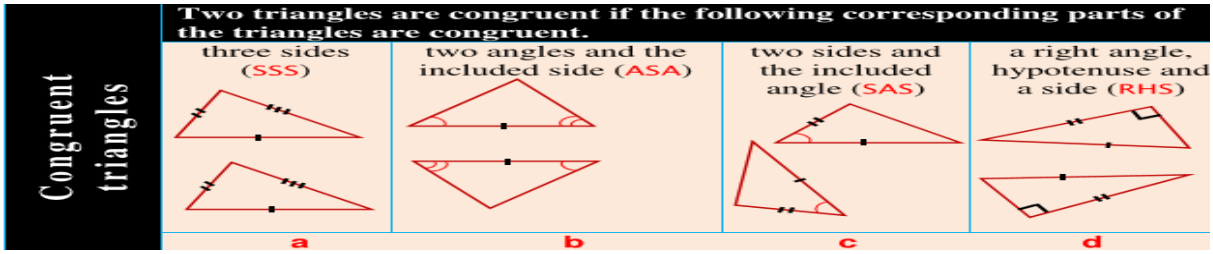
Short Note:- Formula for the length of a side S, apothem a , perimeter p and area A of a regular polygon withn sides and radius r are given by

I. $s = 2r \sin\frac{180°}{n}$

II. $p = 2nr \sin\frac{180°}{n}$

26. Which of the following statements are true and which are false?
    a) Parallelogram which has a line of symmetry is rectangle.
    b) Arhombus which has a line of symmetry must be a square.
    c) An isosceles triangle with more than one line of symmetry is an equilateral triangle.
    d) A pentagon that has more than one line of symmetry must be regular.
    e) A circle can always be in scribed in or circumscribed about any given regular polygon.
    f) The apothem is the distance from the center of regular polygon to a side of the polygon.
27. Find the length of a side a regular twelve –sided polygon with radius 3cm?
28. The radius of a circle is 12 units .find the perimeter of a regular inscribed heptagon?
29. Show that the area A of a square inscribed in a circle with radius r is A= $2r^2$?
30. Find the apothem of regular hexagon with perimeter of 24 units?

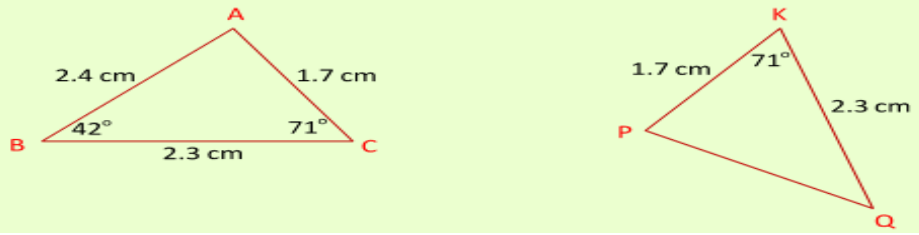
Short Note:-Two triangles are congruent if the following corresponding parts of the triangle are congruent.



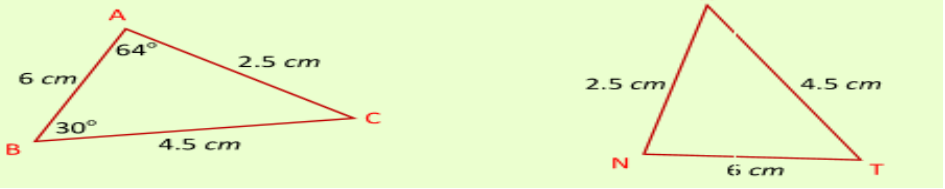
31. Which of the following pairs of triangles are congruent? For those that are congruent state whether the reason is SSS, ASA, SAS Or RHS?

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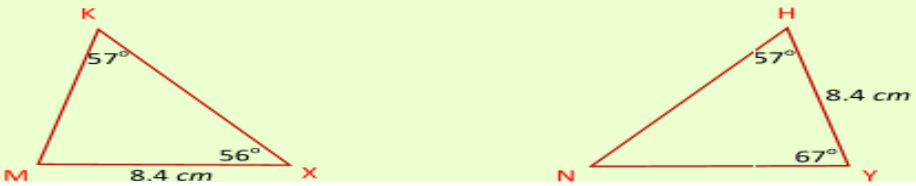
a



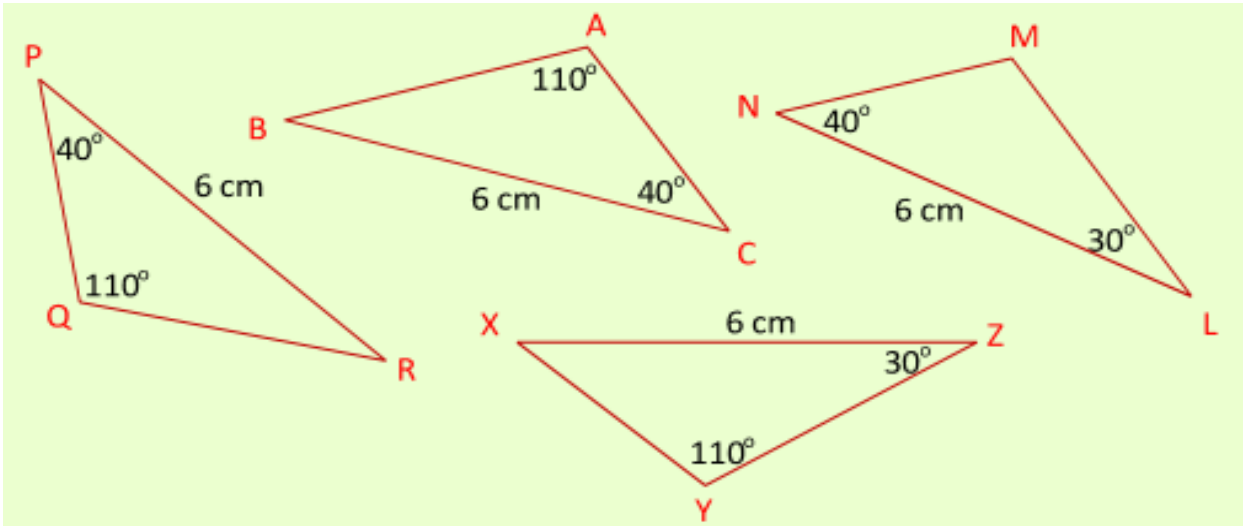
b



c



32. Check whether the following four triangles are congruent:

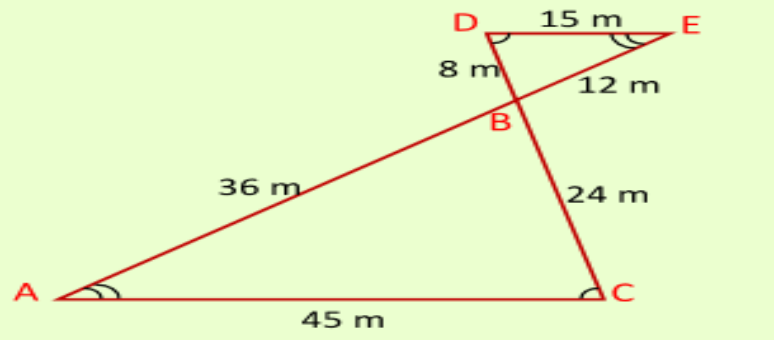


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Similar figures

Short note;-Two polygons of the same number of sides are similar if their corresponding angles are congruent and their corresponding sides have the same ratio.

33. Decide whether or not each pair of polygons is similar, explain your reasoning?



Short note:-Two triangles are similar, if two pairs of corresponding sides of the two triangles are proportional and if the included angles between these sides are congruent.

34. State whether each of the following statements is true or false?

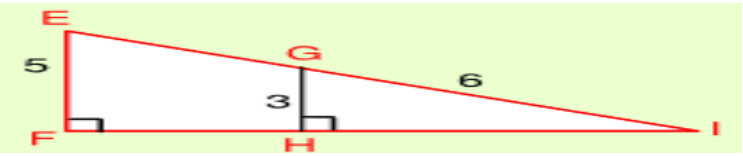
a) If two triangles are similar, then they are congruent.

b) If two triangles are congruent, then they are similar.

c) All equilateral triangles are congruent.

d) All equilateral triangles are similar.

35. Two pair of triangles given below is similar, find the measure of the blank sides?



Short note:-If the ratio of the lengths of the corresponding side of two similar triangles is K, then the ratio of their perimeters is K and the ratio of their areas is k^2.

36. Two triangles are similar; the sides of one are three times as long as the side of the other what is the ratio of the areas of the smaller to the larger?

37. Thearea of two similar triangles is 144 $unit^2$ and 81$unit^2$.

a) What is the ratio of their Perimeter?

b) If a side of the first is 6 units long, what is the length of the corresponding side of the second?

Short note:-

I. A minute which is denoted by (') , is $\frac{1}{60}$ of degrees

II. A second which is denoted (“), is $\frac{1}{60}$ of a minute.

III. 1 radian $= \left(\frac{180°}{\pi}\right) \approx 57.3°$

IV. $1° = \frac{\pi}{180}\ radian\ \approx 0.0175\ radian$

38. Express $\frac{\pi}{6}$ radian measures in degree.

39. Express $270°$ in radian measure.

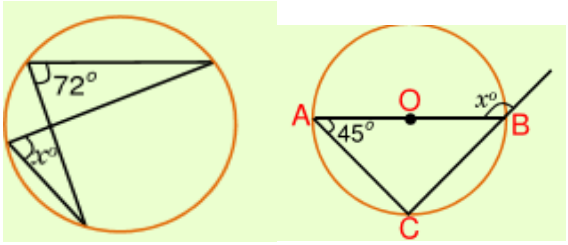
Short note:-The measure of a central angle subtended by an arc is twice the measure of an inscribed angles in the circle subtended by the same arc.

I. The angle inscribed the same arc are congruent.

II. The angle inscribed in a semi-circle is a right angle

40. Find the angle measurement of x in the following figures

41. If the statement is correct say true if not say false.



a) A circle is symmetrical

b) About every diameter.

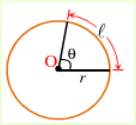
c) A diameter perpendicular to a chord bisects the chord.

d) In the same circle equal chords are equal distant from the center.

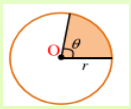
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Short note:-The length L of an arc of a circle of radius r that subtends an angle of θ at thecenter is

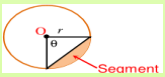
L= $\frac{\theta}{360°} \times 2\pi r = \frac{\pi r\theta}{180°}$.



- The area A of a sector of radius r and central angle θ is A = $\frac{\theta}{360°} \times \pi r^2 = \frac{\pi r^2\theta}{360°}$.
- The perimeter P of the sector is the sum of the radii and the arc that bound it. p= $2r + \frac{\pi r\theta}{180°}$



- The area A and perimeter P of a segment of a circle of radius r cut off by a chord subtending an angle θ at the center of a circle are given by $A = \frac{\pi\theta r^2}{360°} - \frac{1}{2}r^2 \sin\theta$ (sector area- triangle area).



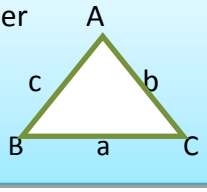
42. Find the perimeter and area of a circle of radius 8cm cut off by a chord that subtend a central angle of$120°$?

A chord of a circle of radius 6 cm is 8cm long. Find the distance of the chord form the center.

43. Find the perimeter of a sector with radius 8cm and central angle is 60°?
44. What is the area of a segment with radius 5 units and the central angle is 90°?

Heron's formula

Short note:-The area A of a triangle with sides a , b and c unit long and semi-perimeter S = $\frac{1}{2}$(a+b+c) is given by A =$\sqrt{S(s-a)(s-b)(s-c)}$



45. Find the area of a triangle whose sides are 6 cm, 8cm and 10cm?
46. The length of three sides of a triangle are 6x , 4x and 3x inches and the perimeter the triangle is 26 inches find

a) The lengths of the sides of the triangle b) The area of the triangle.

Short note:-The area A of a parallelogram with base b and perpendicular height h is A = bh

The area of a rhombus is the half of the product of its diagonals .

47. PQRS is a parallelogram of area 18cm. if PQ = 5cm and QR =4cm. calculate the lengths of the corresponding heights.

48. Find the area of a rhombus whose diagonals are 5 inches and 6 inches long.

Short note:-If we denote the lateral surface area of a prism by A_L, the total surface area by A_T, the area of the base by A_B and its volume by V, then

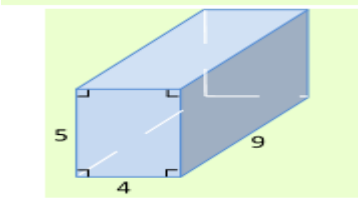
I. $A_L = Ph$ where P is the perimeter of the base and h the altitude or height of the prism.

II. $A_T = 2A_B + A_L$

III. $V = A_B h$.

49. Using the measurements indicated in each of the following figures, find:

A. The total surface area of a figure. B. The volume of figure.



Cylinder Surface area and volume of circular cylinders

Short note:-A *circular cylinder* is a simple closed surface bounded on two ends by circularbases.

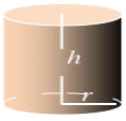
- The lateral surface area (i.e., area of the curved surface) of a right circular cylinder denoted by A_L is the product of its height h and the circumference C of its base. i.e.

  $A_L = hC$ or $A_L = 2\pi rh$

- The total surface area (or simply surface area) of a right circular cylinder denoted by A_T is two times the area of the circular base plus he area of the curved surface (lateral surface area). So, if the height of the cylinder is h and the radius of the base circle is r, we have

  $A_T = 2\pi rh + 2\pi r^2 = 2\pi r(h + r)$

- The volume V of the right circular cylinder is equal to the product of its base areaand height.So, if the height of the cylinder is h and its base radius is r then $V = \pi r^2 h$



50. Find the lateral surface area and total surface area of a right circular cylinder in which
    a) $r = 4$ ft, $h = 12$ ft
    b) $r = 6.5$ cm, $h = 10$ cm
51. A manufacturer makes a closed right cylindrical container whose base has radius 7 inches and whose height measures 14 inches. He also makes another cylindrical container whose base has radius 14 inches and whose height measures 7 in inches.
    a) Which container requires more metal?
    b) How much more metal does it require? Give your answer in terms of π.
52. Find the lateral surface area and volume of aright circular cylinder in which :

A, r = 4 ft and h =12 ft B, r = 6.5cm and h=10 cm

Short note:- Statistics is the science of collecting , organizing, presenting, analyzing and interpreting data (quantitative information) in order to draw conclusions.

- A small part (or a subset) of a population is called a sample.
- If x , x , x , … x are the n observations of a variable then the mean (X) given by $\bar{x} = \frac{x1+x2+x3=---xn}{n}$.
- The median of a variable is the value that i. e in the middle of the date when arranged in ascending or descending order.
- The mode of a variable is the most frequent observation of the variable that occurs in the dataset.

53. Given the numbers 10, 12, 9, 15, 8, what number could be included so that the median is 11? (Explain)
54. Given 3, 4, x, 5, y, 12.Find the values of x and y,if the mode of the data is 3 and the mean is 6
55. If the mean of a, b, c, d is k, then what is the mean of
    a) a+ b, 2b, c+ b, d+ b?
    b) ab,cb,db?

- Variance (σ^2) :- the mean of the squared deviations of each value from the arithmetic mean.
- Standard deviation (σ) the positive square root of the mean of the squared deviations of each value from the arithmetic mean.

56. What is the value of y,if the standard deviation of 8, 8, 8, 8, y, 8 is 0?

57. If the variance of a, b, c, d is k, then what is

a) The variance of a+c , b+c , 2c , d+ c?

b) The standard deviation of a+c, b+c, 2c, d+ c?

c) The variance of ac , bc , c^2, dc ?

d) The standard deviation of ac, bc, c^2,dc?

Short note:-The possibility set (or sample space) for an experiment is the set of all possible outcomes of the experiment.

- An event is a subset of the possibility set (sample space)
- If an experiment has n equally likely outcomes and if m of these represents particular events, then the probability of this event occurring is $\frac{m}{n}$.
- Let s be the possibility set of an experiment and each element of s be equally likely to occur, then

58. Two dice are simultaneously thrown once. List the ways in which the following events can occur.

a) A= the same number is shown on each die

b) B = the sum of the numbers is 13.

c) C = the product of the two numbers is 1.

59. Three coins are tossed at the same time. Sketch a tree diagram for the out comes of this experiment. What is the possibility set?

60. A bag contains four red balls and three black balls. What is the possibility set for color, if 2 balls are chosen at random?

Unit -7 Vector in two dimensions

Short note:-

- Scalar quantities are those quantities of measures that have only magnitude and no direction.
- Vector quantities are those quantities of measure that have both magnitude and direction.
- If two vectors have the opposite directions are called opposite vectors

- 61. Write down some example of scalar and vector quantities.
-

62. When two vectors are parallel?

63. When two vectors are opposite

The diagonal of a parallelogram is the sum of the side vectors. This is called the parallelogram low.

- Subtraction of vectors $\underset{AE}{\rightarrow} and \underset{AC}{\rightarrow}$ Given as $\underset{AE-AC}{\rightarrow} = \underset{CE}{\rightarrow}$ is the same as $\underset{AC+CE}{\rightarrow} = \underset{AE}{\rightarrow}$
- Multiplying a vector by a scalar K either enlarges or shortens the vector. If $|k| > 1$ it enlarges the vector and if 0 <$|k| > 0$, the dirction of the vector is unchanged, multiplying a vector by k < 0 changes the direction of the vector in to the opposite direction.

64. Show by a diagram, that the sum of two vector $\underset{AB}{\rightarrow} and \underset{BC}{\rightarrow} is \underset{AC}{\rightarrow}$.

65. If the magnitude of $\underset{AC}{\rightarrow}$ is 4 cm, find the magnitude of

A. $3\underset{AC}{\rightarrow}$ B. $\frac{1}{4}\underset{AC}{\rightarrow}$ C. $-\underset{AC}{\rightarrow}$

66. ABCD is parallelogram .find a single vector of the following ?

A . $\overrightarrow{CB} - \overrightarrow{CA}$B ,$\overrightarrow{AC} + \overrightarrow{CB}$

67. Find the magnitude of the vector $\overrightarrow{AB}$?

A. A(-3,-5) and B(5,1)

B. A (7,4) and B(1,3)

68. Express the following vectors pair of them are parallel or opposite .

A. $\overrightarrow{\mu}$ and $8\vec{\mu}$

B. B. $3\vec{v}$ and - $6\vec{v}$

C. $2\overrightarrow{C}$ and $-\frac{1}{2}\vec{C}$