

MATHEMATICS
WORKSHEET_060323

CHAPTER 09 STRAIGHT LINES (ANSWERS)

SUBJECT: MATHEMATICS

MAX. MARKS : 40

CLASS : XI

DURATION : 1½ hrs

General Instructions:

- (i). All questions are compulsory.
- (ii). This question paper contains 20 questions divided into five Sections A, B, C, D and E.
- (iii). **Section A** comprises of 10 MCQs of 1 mark each. **Section B** comprises of 4 questions of 2 marks each. **Section C** comprises of 3 questions of 3 marks each. **Section D** comprises of 1 question of 5 marks each and **Section E** comprises of 2 Case Study Based Questions of 4 marks each.
- (iv). There is no overall choice.
- (v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. The value of y will be, so that the line through (3, y) and (2, 7) is parallel to the line through (-1, 4) and (0, 6).

(a) 7 (b) 8 (c) 9 (d) 10

Ans: Let A(3, y), B(2, 7), C(-1, 4) and D(0, 6) be the given points.

$$\text{Then, } m_1 = \text{Slope of the line AB} = \frac{7-y}{2-3} = y-7$$

$$\text{and } m_2 = \text{Slope of the line CD} = \frac{6-4}{0-(-1)} = 2$$

Since, AB and CD are parallel.

$$\therefore m_1 = m_2 \Rightarrow y-7 = 2 \Rightarrow y = 9$$

2. The equation of the line passing through the point (1, 2) and perpendicular to the line $x + y + 1 = 0$ is

(a) $y - x + 1 = 0$ (b) $y - x - 1 = 0$ (c) $y - x + 2 = 0$ (d) $y - x - 2 = 0$

Ans: Given point is (1, 2) and slope of the required line is 1.

$$\therefore x + y + 1 = 0 \Rightarrow y = -x - 1 \Rightarrow m_1 = -1$$

$$\therefore \text{Slope of the line} = -1/-1 = 1$$

$$\therefore \text{Equation of required line is } y - 2 = 1(x - 1)$$

$$\Rightarrow y - 2 = x - 1 \Rightarrow y - x - 1 = 0$$

3. The equation of line, which passes through point (4, 3) and parallel to the line $2x - 3y = 7$ is

(a) $2x - 3y + 1 = 0$ (b) $2x - 3y - 1 = 0$ (c) $2x + 3y + 1 = 0$ (d) $2x + 3y - 1 = 0$

Ans: (a) $2x - 3y + 1 = 0$

Let the equation of line parallel to the given line is

$$2x - 3y = \lambda \dots (i) [\because \text{In two parallel lines, } m_1 = m_2]$$

Since, the line (i), passes through the point (4, 3).

So, this point will satisfy the equation of line.

$$\therefore 2 \times 4 - 3 \times 3 = \lambda$$

$$\Rightarrow 8 - 9 = \lambda \Rightarrow \lambda = -1$$

Put the value of λ in Eq. (i), we get $2x - 3y = -1$

$$\Rightarrow 2x - 3y + 1 = 0$$

which is the required equation of line.

4. The distance of the point (3, -5) from the line $3x - 4y - 26 = 0$ is

(a) 3/7 (b) 2/5 (c) 7/5 (d) 3/5

Ans: (d) 3/5

Given line is $3x - 4y - 26 = 0 \dots(i)$

On comparing Eq. (i) with general equation of line $Ax + By + C = 0$, we get

$A = 3$, $B = -4$ and $C = -26$

Given point is $(x_1, y_1) = (3, -5)$.

The distance of the given point from given line is

$$d = \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right| \Rightarrow d = \left| \frac{3 \times 3 + (-4) \times (-5) - 26}{\sqrt{3^2 + (-4)^2}} \right| = \frac{3}{5}$$

5. The distance between the parallel lines $3x - 4y + 7 = 0$ and $3x - 4y + 5 = 0$, is

(a) $3/7$ (b) $2/5$ (c) $7/5$ (d) $3/5$

Ans: (b) $2/5$

Here, $A = 3$, $B = -4$, $C_1 = 7$, and $C_2 = 5$.

Therefore, the required distance is $d = \left| \frac{7-5}{\sqrt{3^2 + (-4)^2}} \right| = \frac{2}{5}$

6. The equation of line whose intercepts on the axes of x and y are -2 and 3 respectively is

(a) $3x - 2y = 6$ (b) $3x - 2y + 6 = 0$ (c) $3x + 2y = 6$ (d) $3x + 2y = -6$

Ans: (b) $3x - 2y + 6 = 0$

a = intercepts on x -axis = -2

b = intercepts on y -axis = 3

$\therefore$ equation of line is $\frac{x}{a} + \frac{y}{b} = 1 \Rightarrow \frac{x}{-2} + \frac{y}{3} = 1$

$\Rightarrow 3x - 2y = -6$

7. The new coordinates of point $(3, -5)$, if origin is shifted to the point $(-3, -2)$ are

(a) $(6, 3)$ (b) $(6, -3)$ (c) $(-6, 3)$ (d) $(-6, -3)$

Ans: (b) $(6, -3)$

coordinates of new origin are $h = -3$ and $k = -2$ whereas $x = 3$ and $y = -5$

New coordinates of point be $X = x - h$

$= 3 - (-3) = 6$

$Y = y - k$

$= -5 - (-2) = -5 + 2 = -3$

new coordinates of point are $(6, -3)$

8. The angle between the X -axis and the line joining the points $(3, -1)$ and $(4, -2)$ is

(a) 45° (b) 135° (c) 90° (d) 180°

Ans: (b) 135°

Slope of line $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 + 1}{4 - 3}$

$\tan \theta = \frac{-1}{1} \Rightarrow \tan \theta = -1$

$\Rightarrow \tan \theta = -\tan 45^\circ \quad (\because 1 = \tan 45^\circ)$

$\Rightarrow \tan \theta = \tan (180^\circ - 45^\circ) \quad [\because \tan (180^\circ - \theta) = -\tan \theta]$

$\Rightarrow \tan \theta = \tan 135^\circ \Rightarrow \theta = 135^\circ$

For Q9 and Q10, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

9. **Assertion (A):** The slope of the line $x + 7y = 0$ is $1/7$ and y-intercept is 0.

Reason (R): The slope of the line $6x + 3y - 5 = 0$ is -2 and y-intercept is $5/3$.

Ans: (d) A is false but R is true.

Assertion: Given equation is $x + 7y = 0$

$$\Rightarrow y = -\frac{x}{7} + 0$$

On comparing with $y = mx + c$, we get

Slope (m) = $-1/7$, y-intercept = 0

Reason: Given equation is $6x + 3y - 5 = 0$

$$\Rightarrow y = -2x + \frac{5}{3}$$

On comparing with $y = mx + c$, we get

Slope (m) = -2 , y-intercept = $5/3$

Hence, Assertion is false and Reason is true.

10. **Assertion (A):** Slope of line $3x - 4y + 10 = 0$ is $3/4$.

Reason (R): x-intercept and y-intercept of $3x - 4y + 10 = 0$ respectively are $-10/3$ and $5/2$.

Ans: (b) Both A and R are true but R is not the correct explanation of A.

Assertion: Given equation $3x - 4y + 10 = 0$

can be written as $y = \frac{3}{4}x + \frac{5}{2}$... (i)

Comparing Eq. (i) with $y = mx + c$, we have

slope of the given line as $m = 3/4$.

Reason: Equation $3x - 4y + 10 = 0$ can be written as

$$3x - 4y = -10 \Rightarrow \frac{x}{-\frac{10}{3}} + \frac{y}{\frac{5}{2}} = 1 \text{ ... (ii)}$$

Comparing Eq. (ii) with $\frac{x}{a} + \frac{y}{b} = 1$, we have

x-intercept as $a = -10/3$

and y-intercept as $b = 5/2$.

Hence, Assertion and Reason both are true and Reason is not the correct explanation of Assertion.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. If the lines $2x + y - 3 = 0$, $5x + ky - 3 = 0$ and $3x - y - 2 = 0$ are concurrent, find the value of k .

Ans: Here given lines are

$$2x + y - 3 = 0 \quad \text{... (i)}$$

$$5x + ky - 3 = 0 \quad \text{... (ii)}$$

$$3x - y - 2 = 0 \quad \text{... (iii)}$$

Solving (i) and (iii), we get, $x = 1$, $y = 1$

Therefore, the point of intersection of two (i) and (iii) lines is (1, 1). Since above three lines are concurrent, the point (1, 1) will satisfy equation (ii)

i.e., $5.1 + k.1 - 3 = 0$ or $k = -2$.

12. Find the equation of lines passing through (1, 2) and making angle 30° with y-axis.

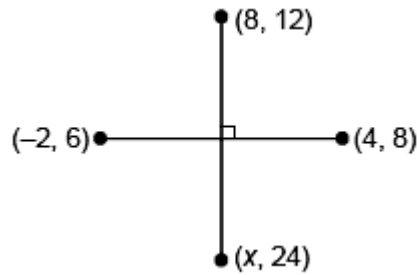
Ans: Slope of line = $\tan (90^\circ - 30^\circ) = \sqrt{3}$

$\therefore$ Equation of line is $y - 2 = \sqrt{3} (x - 1)$

$$\Rightarrow \sqrt{3}x - y + (2 - \sqrt{3}) = 0.$$

13. Line through the points $(-2, 6)$ and $(4, 8)$ is perpendicular to the line through the points $(8, 12)$ and $(x, 24)$, find the value of x .

Ans:



As two lines are perpendicular

$\therefore$ product of the slopes of two lines is -1

$$\Rightarrow \frac{8-6}{4+2} \times \frac{24-12}{x-8} = -1$$

$$\Rightarrow \frac{2}{6} \times \frac{12}{x-8} = -1 \Rightarrow 4 = 8 - x \Rightarrow x = 4$$

14. Find the equation of the straight line passing through the point $(6, 2)$ and having slope -3 .

Ans: Given, A straight line passing through the point $(6, 2)$ and the slope is -3

By using the formula, the equation of line is $[y - y_1 = m(x - x_1)]$

Here, the line passes through $(6, 2)$. It is given that the slope of the line, $m = -3$

Now, substitute the values, and we get $y - 2 = -3(x - 6)$

$$\Rightarrow y - 2 = -3x + 18 \Rightarrow y + 3x - 20 = 0$$

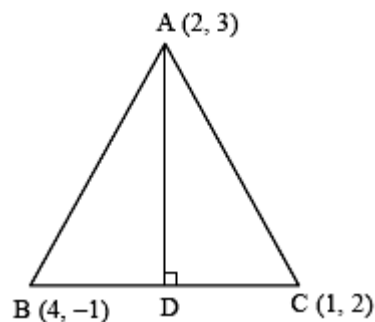
$\therefore$ The equation of line is $3x + y - 20 = 0$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. The vertices of the triangle are $A(2, 3)$, $B(4, -1)$ and $C(1, 2)$. Find the length and equation of the perpendicular drawn from the point A on side BC .

Ans: Vertices of a triangle are $A(2, 3)$, $B(4, -1)$ and $C(1, 2)$.



Equation of BC is

$$y + 1 = \frac{2+1}{1-4} (x - 4) \Rightarrow x + y - 3 = 0 \quad \dots(i)$$

$$\text{Length of } AD = \left| \frac{2+3-3}{\sqrt{1+1}} \right| = \left| \frac{2}{\sqrt{2}} \right| = \sqrt{2}$$

Slope of $BC = -1$ [From (i)]

As AD is perpendicular to BC

$\therefore$ Slope of $AD = 1$

$\therefore$ Equation of AD is, $y - 3 = 1(x - 2)$

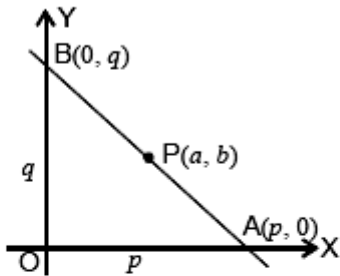
$$\Rightarrow y - 3 = x - 2 \Rightarrow x - y + 1 = 0$$

16. If P (a, b) is the mid-point of a line segment between axes. Show that equation of the line is $\frac{x}{a} + \frac{y}{b} = 2$.

2.

Ans:

Let line be $\frac{x}{p} + \frac{y}{q} = 1$... (i)



Then coordinates of A and B are (p, 0) and (0, q)

$$\therefore \frac{p+0}{2} = a \text{ and } \frac{0+q}{2} = b$$

$$\Rightarrow p = 2a \text{ and } q = 2b$$

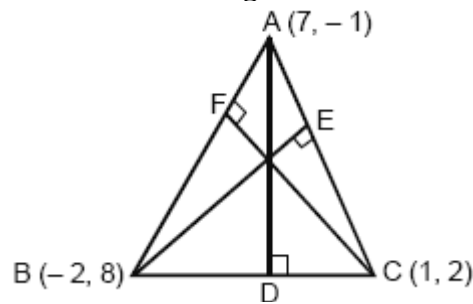
Substituting in (i), we get

$$\frac{x}{2a} + \frac{y}{2b} = 1$$

$$\Rightarrow \frac{x}{a} + \frac{y}{b} = 2 \text{ is the required equation.}$$

17. Find the equations of the altitudes of the triangle whose vertices are A(7, -1), B(-2, 8) and C (1, 2).

Ans: Let AD, BE and CF be three altitudes of triangle ABC.



Let m_1 , m_2 and m_3 be the slopes of AD, BE and CF respectively. Then

$AD \perp BC \Rightarrow \text{Slope of AD} \times \text{Slope of BC} = -1$

$$\Rightarrow m_1 \times \left(\frac{2-8}{1+2} \right) = -1 \Rightarrow m_1 = \frac{1}{2}$$

$BE \perp AC \Rightarrow \text{Slope of BE} \times \text{Slope of AC} = -1$

$$\Rightarrow m_2 \times \left(\frac{-1-2}{7-1} \right) = -1 \Rightarrow m_2 = 2$$

and $CF \perp AB \Rightarrow \text{Slope of CF} \times \text{Slope of AB} = -1$

$$\Rightarrow m_3 \times \left(\frac{-1-8}{7+2} \right) = -1 \Rightarrow m_3 = 1$$

Since AD passes through A(7, -1) and has slope $m_1 = \frac{1}{2}$. So its equation is

$$y + 1 = \frac{1}{2} (x - 7) \Rightarrow x - 2y - 9 = 0$$

Similarly equation of BE is $(y - 8) = 2(x + 2) \Rightarrow 2x - y + 12 = 0$

Equation of CF is $y - 2 = 1 (x - 1) \Rightarrow x - y + 1 = 0$

SECTION – D

Questions 18 carry 5 marks.

- 18.** Find the equations of the lines which pass through the point (4, 5) and make equal angles with the lines $5x - 12y + 6 = 0$ and $3x = 4y + 7$.

Ans: Equations of a line through (4, 5) is

$$y - 5 = m (x - 4) \quad \dots (i)$$

Line (i) makes equal angles with the lines

$$5x - 12y + 6 = 0 \text{ and } 3x - 4y - 7 = 0$$

$$\left| \frac{m - \frac{5}{12}}{1 + \frac{5}{12}m} \right| = \left| \frac{m - \frac{3}{4}}{1 + \frac{3}{4}m} \right| \Rightarrow \frac{12m - 5}{12 + 5m} = \pm \frac{4m - 3}{4 + 3m} \quad \dots(ii)$$

Consider + sign from (ii), we get

$$48m - 20 + 36m^2 - 15m = 48m - 36 + 20m^2 - 15m$$

$$\Rightarrow 16m^2 = -16 \Rightarrow m^2 = -1, \text{ not possible.}$$

Consider – sign from (ii), we get

$$48m - 20 + 36m^2 - 15m = -48m + 36 - 20m^2 + 15m$$

$$\Rightarrow 56m^2 + 66m - 56 = 0 \Rightarrow 28m^2 + 33m - 28 = 0 \Rightarrow 28m^2 + 49m - 16m - 28 = 0$$

$$\Rightarrow 7m(4m + 7) - 4(4m + 7) = 0 \Rightarrow (7m - 4)(4m + 7) = 0$$

$$\Rightarrow 7m - 4 = 0; 4m + 7 = 0 \Rightarrow m = \frac{4}{7}, \frac{-7}{4}$$

–Substituting in (i), we get For $m = \frac{4}{7}$ and For $m = \frac{-7}{4}$

$$y - 5 = \frac{4}{7} (x - 4) \text{ and } y - 5 = \frac{-7}{4} (x - 4)$$

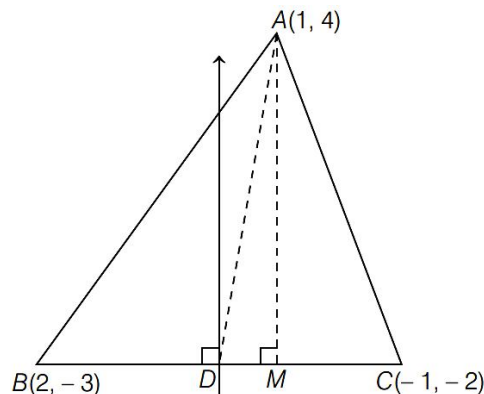
$$\text{i.e. } 7y - 35 = 4x - 16 \text{ and } 4y - 20 = -7x + 28$$

$$\text{i.e. } 4x - 7y + 19 = 0 \text{ and } 7x + 4y - 48 = 0$$

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

- 19.** One day the mathematics teacher drew a triangle $\triangle ABC$ while revising straight lines. He marked vertices $A(1, 4)$, $B(2, -3)$ and $C(-1, -2)$ as shown in the given below figure. AD is the median and AM is the altitude through A.



Based on the above information answer the following questions.

- (i) Find the slope of BC. (1)
- (ii) Find the equation of median through A. (1)
- (iii) Find the equation of the altitude through A. (1)
- (iv) Find the equation of right bisector of side BC. (1)

Ans:

$$(i) \text{ Slope of BC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-3)}{-1 - 2} = \frac{-2 + 3}{-3} = -\frac{1}{3}$$

(ii) Since D is the mid-point of BC.

$$\therefore \text{Coordinates of D are } \left(\frac{2-1}{2}, \frac{-3-2}{2} \right) = \left(\frac{1}{2}, -\frac{5}{2} \right)$$

$$\therefore \text{Slope of AD} = \frac{-\frac{5}{2} - 4}{\frac{1}{2} - 1} = \frac{-\frac{13}{2}}{-\frac{1}{2}} = 13$$

$\therefore$ Equation of the median AD is $y - 4 = 13(x - 1)$

$$\Rightarrow 13x - y - 9 = 0$$

(iii) Since AM is the altitude through A.

$\therefore$ Slope of AM = $-1/\text{slope of BC} = 3$

$\therefore$ Equation of the altitude through A is given by $y - 4 = 3(x - 1)$

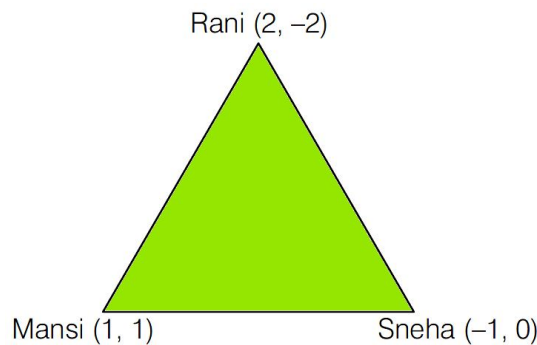
$$\Rightarrow y - 4 = 3x - 3 \Rightarrow 3x - y + 1 = 0$$

(iv) Equation of the right bisector of BC is a line which passes through D and having slope is 3.

$$\therefore y - \left(-\frac{5}{2} \right) = 3 \left(x - \frac{1}{2} \right) \Rightarrow y + \frac{5}{2} = 3x - \frac{3}{2}$$

$$\Rightarrow 3x - y - 4 = 0$$

- 20.** One triangular shaped pond is there in a park. Three friends Rani, Mansi, Sneha are sitting at the corners of the triangular park. They are studying in Class XI in an International. Rani marked her position as (2, -2), Mansi marked as (1, 1) and Sneha marked her position as (-1, 0) as shown in figure given below.



Based on the above information answer the following questions.

- (i) Find the equation of lines formed by Rani and Mansi. (1)
- (ii) Find the Slope of equation of line formed by Rani and Sneha. (1)
- (iii) Find the equation of median of lines through Rani. (1)
- (iv) Find the equation of altitude through Mansi. (1)

$$\text{Ans: (i) The equation of line AB is } y - 1 = \frac{-2 - 1}{2 - 1}(x - 1) \left[\because y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) \right]$$

$$\Rightarrow y - 1 = -3x + 3 \Rightarrow 3x + y = 4$$

(ii) Slope of equation of line AC is

(iii) Let D be the mid-point of BC.

$$\text{Coordinates of D are } \left(\frac{1-1}{2}, \frac{0+1}{2} \right) = \left(0, \frac{1}{2} \right)$$

$$\therefore \text{Equation of AD is } y + 2 = \frac{\frac{1}{2} + 2}{0 - 2}(x - 2) \Rightarrow y + 2 = \frac{-5}{4}(x - 2)$$

$$\Rightarrow 4y + 8 = -5x + 10$$

$$\Rightarrow 5x + 4y = 2$$

$$\text{(iv) Slope of AC} = -2/3$$

$$\therefore \text{Slope of BE} = 3/2 [\because \text{BE} \perp \text{AC}]$$

$$\text{Equation of altitude through B is } y - 1 = \frac{3}{2}(x - 1) \Rightarrow 3x - 2y = 1$$

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