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	CBSE Class 11 Straight Lines Worksheet ***Class 11th***
Q.1)	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.
Sol.1)	Let m_1 → slope of the line passes through the point (-2, 6) and (4, 8) Then $m_1 = \frac{8-6}{4-(-2)} = \frac{2}{6}$ ……… using $m = \frac{y_2-y_1}{x_2-x_1}$ $\Rightarrow m_1 = \frac{1}{3}$ Let m_2 → slope of the line passes through the point (8, 12) and (x, 24) Then $m_2 = \frac{24-12}{x-8} = \frac{12}{x-8}$ Given that the two lines are perpendicular $\therefore\ m_1 m_2 = -1$ $\Rightarrow \frac{1}{3} \times \frac{12}{x-8} = -1$ $\Rightarrow \frac{12}{3x-24} = -1$ $\Rightarrow 12 = -3x + 24$ $\Rightarrow 3x = 12$ $\Rightarrow x = 4$ ans.
Q.2)	Find the value of x for which the points $(x, -1), (2, 1)$ and $(4, 5)$ are collinear.
Sol.2)	Let points are $A(x, -1), B(2, 1)$ and $C(4, 5)$ Since points are collinear $\therefore$ slope of $AB = slope\ of\ BC$ $\Rightarrow \frac{1-(-1)}{2-x} = \frac{5-1}{4-2}$ ……… using $m = \frac{y_2-y_1}{x_2-x_1}$ $\Rightarrow \frac{2}{2-x} = \frac{4}{2}$ $\Rightarrow 4 = 8 - 4x$ $\Rightarrow 4x = 4$ $\Rightarrow x = 1$ ans.

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Q.3)	Without using Pythagoras theorem, show that $A(4,4), B(3,5)$ and $C(-1,-1)$ are the vertices of a right angled triangle.
Sol.3)	We have $A(4,4), B(3,5)$ and $C(-1,-1)$ Slope of side $AB(m_1) = \frac{5-4}{3-4} = \frac{1}{-1} = -1$ Slope of side $BC(m_2) = \frac{-1-5}{-1-3} = \frac{-6}{-4} = \frac{3}{2}$ Slope of side $AC = \frac{-1-4}{-1-4} = \frac{-5}{-5} = 1$ Clearly, $m_1 \times m_2 = (-1)(1) = -1$ $\Rightarrow AB \perp \mathrm{AC}$ $\therefore A, B, C$ is a right angle triangle at $A = 90^{\circ}$ Ans.
Q.4)	The slope of a line is double of the slope of another line. If tangent of the angle between them is $\frac{1}{3}$.Find the slopes of the lines.
Sol.4)	Given, $\tan\theta = \frac{1}{3}$ Let the slope of 1st line $= m$ Then slope of 2nd line $= 2m$ (given) Now, angle between two lines is $\tan\theta = \left\|\frac{m_1-m_2}{1+m_1m_2}\right\|$ Here $m_1 = m$ and $m_2 = 2m$ and $\tan\theta = \frac{1}{3}$ $\Rightarrow \frac{1}{3} = \left\|\frac{m-2m}{1+2m^2}\right\|$ $\Rightarrow \frac{1}{3} = \left\|\frac{-m}{1+2m^2}\right\| = \left\|\frac{m}{1+2m^2}\right\|$ $\Rightarrow \pm\frac{1}{3} = \frac{m}{1+2m^2}$ .... $\{if\ \|x\| = y\ then\ x = \pm y\}$ $\Rightarrow 1 + 2m^2 = 3m$ | $-1 - 2m^2 = 3m$ $\Rightarrow 2m^2 - 3m + 1 = 0$ | $2m^2 + 3m + 1 = 0$ $\Rightarrow 2m^2 - 2m - m + 1 = 0$ | $2m^2 + 2m + m + 1 = 0$ $\Rightarrow 2m(m-1) - 1(m-1) = 0$ | $2m(m+1) + 1(m+1) = 0$ $\Rightarrow (m-1)(2m-1) = 0$ $(2m+1)(m+1) = 0$

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$\Rightarrow m = 1$ and $m = \frac{1}{2}$ $\quad\quad\quad\quad$ $m = -\frac{1}{2}$ And $m = -1$

$\therefore$ slope of 1st line are $1, \frac{1}{2}, -\frac{1}{2}$ And -1

$\therefore$ slope of 2nd line are $2, 1, -1$ and -2 ans.

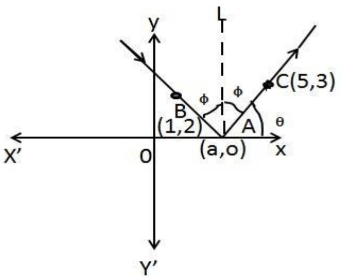
Q.5) A ray of light passing through the point (1, 2) reflects on the $X-axis$ at point A and the reflected ray passes through the point (5, 3). Find the coordinates of A.

Sol.5) Let the coordinates of point A is $(x, 0)$

Slope of $AC = \frac{3-0}{5-x} = \frac{3}{5-x}$ ……… using $m = \frac{y_2-y_1}{x_2-x_1}$

Also slope of $AC = \text{Tan}\,\theta$ ……… $m = \tan\theta$

$\Rightarrow \tan\theta = \frac{3}{5-x}$ ………(i)



Now the slope of $AB = \frac{2-0}{1-x} = \frac{2}{1-x}$

Also slope of $AB = \tan(180-\theta) = -\text{Tan}\,\theta$

$\Rightarrow -\tan\theta = \frac{2}{1-x}$

$\Rightarrow \tan\theta = \frac{-2}{1-x}$ ………..(ii)

From equation (i) & (ii)

$\Rightarrow \frac{3}{5-x} = \frac{-2}{1-x}$

$\Rightarrow 3 - 3x = -10 + 2x$

$\Rightarrow 13 = 5x$

$\Rightarrow x = \frac{13}{5}$

$\therefore$ the required point is $A\left(\frac{13}{5}, 0\right)$ Ans.

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Q.6) Find the equation of a line passing through the point (2, 2) and cutting of intercepts on the axis whose sum is 9.

Sol.6) Let the equation of line is $\frac{x}{a} + \frac{y}{b} = 1$

We have $a + b = 9 \Rightarrow b = 9 - a$

$\Rightarrow \frac{x}{a} + \frac{y}{9-a} = 1$

This line passes through the point

$\therefore$ (2,2) will satisfy the equation of line

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	$\Rightarrow \frac{2}{a}+\frac{2}{9-a}=1$ $\Rightarrow \frac{18-2a+2a}{a(9-a)}=1$ $\Rightarrow 18=9a-a^2$ $\Rightarrow a^2-9a+18=$ $\Rightarrow (a-6)(a-3)=0$ $\Rightarrow a=6$ and $a=3$ When $a=6$ then $b=3$ And $a=3$ then $b=6$ ∴ equations of line are $\frac{x}{6}+\frac{y}{3}=1$ $\qquad$ $\frac{x}{3}+\frac{y}{6}=1$ $\Rightarrow x+2y=6$ ans. $\qquad$ $\Rightarrow 2x+y=6$ ans.
Q.7)	Find the equation of the line passing through the point of intersection of the lines $4x+7y=3$ and $2x-3y=1$ that has equal intercepts with axes.
Sol.7)	Given equations of line:- $4x+7y=3$ ………(i) $2x-3y=-1$ ………(ii) Solving (i) & (ii), we get $x=\frac{1}{13}$ And $y=\frac{5}{13}$ ∴ the intersection point is $\left(\frac{1}{13},\frac{5}{13}\right)$ Let the equation of required line is $\frac{x}{a}+\frac{y}{a}=1$ Now this line passes through the point $\left(\frac{1}{13},\frac{5}{13}\right)$ $\Rightarrow \frac{\frac{1}{13}}{a}+\frac{\frac{5}{13}}{a}=1$ $\Rightarrow \frac{1}{11a}+\frac{5}{13a}=1$ $\Rightarrow 6=13a$ $\Rightarrow a=\frac{6}{13}$ ∴ equation of line becomes

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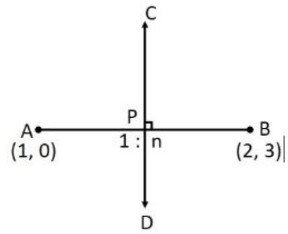
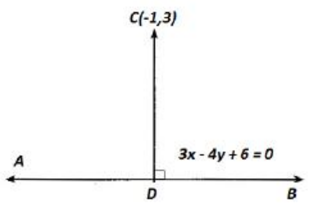
	$\frac{x}{\frac{6}{13}}+\frac{y}{\frac{6}{13}}=1$ $\Rightarrow \frac{13x}{6}+\frac{13y}{6}=1$ $\Rightarrow 13x+13y=6$ ans.
Q.8)	A line perpendicular to the line segment joining the points (1,0) and (2,3) divide it in the ratio $1:n$. Find the equation of the line
Sol.8)	Slope of $AB=\frac{3-0}{2-1}=3$ ……… $m=\frac{y_2-y_1}{x_2-x_1}$ Since $CD\perp \text{AB}$ $\therefore$ Slope of $CD=-\frac{1}{3}$ ……… $-ve\ respectively$ Now, point D divide AB in the ratio $1:n$ By section formula, Coordinate of D is $=\left(\frac{2+n}{1+n},\frac{3}{1+n}\right)$  Equation of required line CD (using point slope form) $y-\frac{3}{1+n}=-\frac{1}{3}\left(x-\frac{2+n}{1+n}\right)$ $\frac{(1+n)y-3}{1+n}=-\frac{1}{3}\left[\frac{x(1+n)-2-n}{1+n}\right]$ $\Rightarrow 3(1+n)y-9=-(1+n)x+2+n$ $\Rightarrow x(1+n)+y(3n+3)=11+n$ ans.
Q.9)	Find the coordinates of the foot of perpendicular from the point (-1, 3) to the line $3x-4y-16=0$.
Sol.9)	Given equation of AB: $3x-4y=16$ ………….(i) Slope of $AB=\frac{-3}{-4}=\frac{3}{4}$ ………..$\left\{m=\frac{-\,coefficient\ of\ x}{coefficient\ of\ y}\right\}$ Since $CD\perp \text{AB}$ $\therefore$ Slope of $CD=-\frac{4}{3}$ ……… $-ve\ respectively$ Equation of line CD (use point slope form), (point (-1, 3) & $m=-\frac{4}{3}$) $y-3=-\frac{4}{3}(x+1)$



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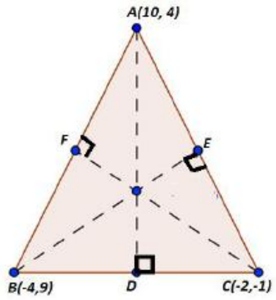
	$\Rightarrow 3y-9=-4x-4$ $\Rightarrow 4x+3y=5$ ……….. (ii) Solving (i) & (ii) We get $x=\frac{68}{25}$ And $y=-\frac{49}{25}$ $\therefore$ foot of perpendicular id $D\left(\frac{68}{25},-\frac{49}{25}\right)$ ……… $\{CD\ and\ AB\ intersects\ at\ point\ D\}$
Q.10)	The vertices of a triangle are $A(10,4), B(-4,9)$ and $C(-2,-1)$. Find the equations of its altitudes. Also find its ORTHOCENTRE.
Sol.10)	Orthocenter is the point of intersects of altitudes of a triangle. Altitude AD: Slope of $BC=\frac{-1-9}{-2+4}=-5$ Since $AD\perp \mathrm{CB}$ $\therefore$ Slope of $AD=\frac{1}{5}$ ……… $-ve\ respectively$ Now equation of AD (using point slope from point A(10, 4), slope $=\frac{1}{5}$) $y-4=\frac{1}{5}(x-10)$ $\Rightarrow 5y-20=x-10$ $\Rightarrow x-5y=-10$ ……….. (i) Altitude BE: Slope of $AC=\frac{-1-4}{-2-10}=\frac{5}{12}$ Since $BF\perp \mathrm{AC}$ $\therefore$ Slope of $BE=-\frac{12}{5}$ ……… $-ve\ respectively$ Now equation of BE (using point slope from point B(-4,9), slope $=\frac{-12}{5}$) $y-9=-\frac{12}{5}(x+4)$ $\Rightarrow 5y-45=-12x-48$ $\Rightarrow 12x+5y=-3$ …………..(ii) Similarly equation of CF is $14x-5y=-23$ ……(iii) $\therefore$ equation of altitudes are $AD=x-5y=-10$ $BF=12x+5y=-3$ $CF=14x-5y=-23$ 

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	To find ORTHOCENTRE, solve any two equations of altitudes. By solving (i) & (ii) we get $x = -1$ and $y = \frac{9}{5}$ $\therefore$ orthocenter is $(-1, \frac{9}{5})$ ans.

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