

Straight Lines — Assignment 2

Class 11 Mathematics · Higher-difficulty challenge set + integrated problems + figure-based NCERT (5 questions) · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Slope of a Line

2 Mark Questions

- Find the slope of the line which makes an angle of 30° with the positive direction of the y-axis measured anticlockwise.

3 Mark Questions

- Find the value of x for which the points $(x, -1)$, $(2, 1)$ and $(4, 5)$ are collinear.

Parallel and Perpendicular Lines

2 Mark Questions

- Find the equation of the line parallel to the line $3x - 4y + 2 = 0$ and passing through the point $(-2, 3)$.

3 Mark Questions

- Find the equation of the right bisector (perpendicular bisector) of the line segment joining the points $(3, 4)$ and $(-1, 2)$.

Forms of the Equation of a Line

2 Mark Questions

- Find the equation of the line passing through $(2, 2\sqrt{3})$ and inclined with the x-axis at an angle of 75° .

3 Mark Questions

- Find the equation of the line passing through the point $(2, 2)$ and cutting off intercepts on the axes whose sum is 9.

General Equation and Converting Between Forms

2 Mark Questions

- Reduce $6x + 3y - 5 = 0$ into slope-intercept form and find its slope and y-intercept.

3 Mark Questions

- Reduce $4x - 3y = 6$ into intercept form and find its intercepts on the axes; then write its slope-intercept form.

Angle Between Two Lines

2 Mark Questions

1. Find the acute angle between the lines $\sqrt{3}x + y = 1$ and $x + \sqrt{3}y = 1$.

3 Mark Questions

1. Find the equations of the lines passing through the point (3, 2) which make an angle of 45° with the line $x - 2y = 3$.

Distance Formulas**2 Mark Questions**

1. Find the distance of the point $(-1, 1)$ from the line $12(x + 6) = 5(y - 2)$.

3 Mark Questions

1. Find the coordinates of the foot of the perpendicular from the point $(-1, 3)$ to the line $3x - 4y - 16 = 0$.

Area of a Triangle**2 Mark Questions**

1. Find the area of the triangle formed by the lines $y - x = 0$, $x + y = 0$ and $x - k = 0$.

3 Mark Questions

1. The hypotenuse of a right angled triangle has its ends at the points (1, 3) and $(-4, 1)$. Find the equations of the legs (perpendicular sides) of the triangle which are parallel to the axes, and hence the area of the triangle.

Part B — Integrated problems (multi-topic)

- The vertices of a triangle are $A(2, 3)$, $B(4, -1)$ and $C(1, 2)$. Find (i) the equation of the median from A to the side BC, (ii) the equation of the altitude from A to BC, and (iii) the area of the triangle.
- A line L is given by $3x - 4y + 12 = 0$. Find (i) the perpendicular distance of the point $P(1, -2)$ from L, (ii) the equation of the line through P parallel to L, and (iii) the perpendicular distance between these two parallel lines.
- A line cuts off intercepts a and b on the x- and y-axes with $a + b = 9$ and passes through the point (2, 2). Find the two possible equations of the line and the slope of each.
- The foot of the perpendicular from the origin to a line is the point $(-1, 2)$. Find (i) the equation of the line and (ii) the perpendicular distance of the point (4, 6) from this line.
- Find the area of the triangle formed by the lines $2x + y = 4$, $x + 2y = 5$ and the x-axis.
- Show that the points $A(2, 3)$, $B(5, 7)$ and $C(0, 2)$ are not collinear; find (i) the area of triangle ABC, (ii) the perpendicular distance of C from the line AB, and verify the area formula $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$.

Part C — Figure-based NCERT questions (answers at the end)

1. 9.1.1) Draw a quadrilateral in the Cartesian plane, whose vertices are $(-4, 5)$, $(0, 7)$, $(5, -5)$ and $(-4, -2)$. Also, find its area.



2. 9.1.2) The base of an equilateral triangle with side $2a$ lies along the y-axis such that the mid-point of the base is at the origin. Find the vertices of the triangle.



3. 9.2.8) The vertices of ΔPQR are $P(2, 1)$, $Q(-2, 3)$ and $R(4, 5)$. Find the equation of the median through the vertex R.



4. 9.3.16) In the triangle ABC with vertices A(2, 3), B(4, -1) and C(1, 2), find the equation and length of the altitude from the vertex A.



5. 9.M21) 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.



Answer Key

Slope of a Line

2M: slope = $\tan 30^\circ$... (angle with y-axis 30° $\Rightarrow$ angle with x-axis 60° $\Rightarrow m = \sqrt{3}$). 3M: collinear $\Rightarrow$ slopes equal: $(1+1)/(2-x) = (5-1)/(4-2) \Rightarrow (2)/(2-x) = 2 \Rightarrow x = 1$.

Parallel and Perpendicular Lines

2M: parallel line $3x - 4y + c = 0$; at $(-2, 3)$: $c = 18 \Rightarrow 3x - 4y + 18 = 0$. 3M: right bisector of $(3,4), (-1,2)$: mid-point $(1,3)$, slope of segment $1/2 \Rightarrow$ perpendicular slope $-2 \Rightarrow x + y - 5 = 0$.

Forms of the Equation of a Line

2M: $\tan 75^\circ = 2 + \sqrt{3} \Rightarrow 2 + \sqrt{3} = (2 + \sqrt{3})(x - 2)$. 3M: $a + b = 9$ and $2/a + 2/b = 1 \Rightarrow b = 18 \Rightarrow b = 3, 6 \Rightarrow x/3 + y/6 = 1$ or $x/6 + y/3 = 1$.

General Equation and Converting Between Forms

2M: $6x + 3y - 5 = 0 \Rightarrow -2x + 5/3$: slope -2 , y-intercept $5/3$. 3M: $4x - 3y = 6 \Rightarrow (3/2) + y/(-2) = 1$: intercepts $3/2, -2$; slope-intercept $y = (4/3)x - 2$.

Angle Between Two Lines

2M: slopes $-\sqrt{3}$ and $-1/\sqrt{3} \Rightarrow \tan \theta = |2/\sqrt{3}/2| = 1/\sqrt{3} \Rightarrow \theta = 30^\circ$. 3M: $x - 2y = 3$ has slope $1/2$; lines at 45° have slopes $m = (1/2 \pm 1)/(1 - 1/2) = 3$ or $-1/3$; through $(3,2)$: $y - 2 = 3(x - 3)$ and $y - 2 = -(x - 3)/3$.

Distance Formulas

2M: $12(x+6) = 5(y-2) \Rightarrow 2x - 5y + 82 = 0$; $d = |12(-1) - 5(1) + 82|/13 = 65/13 = 5$. 3M: foot of perpendicular from $(-1, 3)$ to $3x - 4y - 16 = 0$: $L = -31, a^2 + b^2 = 25 \Rightarrow \text{foot} = (-1 - 3(-31)/25, 3 + 4(-31)/25) = (68/25, -49/25)$.

Area of a Triangle

2M: triangle of $y - x = 0, x + y = 0, x - k = 0$: base on $x = k$ from (k,k) to $(k,-k)$, length $2k$, altitude $k \Rightarrow \text{area} = k^2$. 3M: hypotenuse ends $(1,3), (-4,1)$: legs $x = 1$ and $y = 1$ (meeting at the right angle $(1,1)$).

Integrated problems

1: (i) $5x + y - 13 = 0$; (ii) $x - y + 1 = 0$; (iii) 3 sq units. 2: (i) $23/5$; (ii) $3x - 4y - 11 = 0$; (iii) $23/5$. 3: $x/3 + y/6 = 1$ (slope -2) and $x/6 + y/3 = 1$ (slope $-1/2$). 4: (i) $x - 2y + 5 = 0$; (ii) $3/\sqrt{5}$. 5: 3 sq units. 6: area $5/2$ sq units; distance of C from AB = 1 unit (AB: $4x - 3y + 1 = 0, |AB| = 5$).

Part C — figure-based NCERT questions

9.1.1: area = $121/2 = 60.5$ sq units. 9.1.2: vertices $(0, a)$ and $(0, -a)$; third vertex $(\pm\sqrt{3}a, 0)$. 9.2.8: mid-point of PQ = $(0, 2)$; median RM: $3x - 4y + 8 = 0$. 9.3.16: altitude AD: $x - y + 1 = 0$; length = $\sqrt{2}$ units. 9.M21: A = $(13/5, 0)$.