

CLASS 10 MATHEMATICS | NCERT EXEMPLAR | CHAPTER 7

COORDINATE GEOMETRY

Distance, Section Formula & Area — Complete Study Guide with Diagrams

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KEY FORMULAS

Distance Formula	$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Distance from Origin	$OP = \sqrt{x^2 + y^2}$
Section Formula	$P = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$
Midpoint Formula	$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$
Area of Triangle	$\Delta = \frac{1}{2} x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) $
Collinearity	3 points are collinear if and only if Area of triangle = 0.
Centroid	$G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$
4th vertex of gram	$D = (x_1 + x_3 - x_2, y_1 + y_3 - y_2)$ [diagonals bisect each other]

MCQ EXERCISE 7.1 — Multiple Choice Questions

Q1 Distance of P(2,3) from x-axis:

(A) 2

(B) [OK] 3

(C) 1

(D) 5

Solution — Q1

Distance from x-axis = |y-coordinate| = |3| = 3.

[OK] Distance = 3

Q2 Distance between A(0,6) and B(0,-2):

(A) 6

(B) [OK] 8

(C) 4

(D) 2

Solution — Q2

Both on y-axis. Distance = $|6 - (-2)| = 8$.

[OK] 8

Q3 Distance of P(-6,8) from origin:

(A) 8

(B) $2\sqrt{7}$

(C) [OK] 10

(D) 6

Solution — Q3

$d = \sqrt{(-6)^2 + 8^2} = \sqrt{36+64} = \sqrt{100} = 10$.

[OK] 10 [Note: 6-8-10 is a Pythagorean triplet]

Q4 Distance between (0,5) and (-5,0):

(A) 5

(B) [OK] $5\sqrt{2}$

(C) $2\sqrt{5}$

(D) 10

Solution — Q4

$d = \sqrt{(-5)^2 + (-5)^2} = \sqrt{50} = 5\sqrt{2}$.

[OK] $5\sqrt{2}$

Q5 AOBC rectangle: A(0,3), O(0,0), B(5,0). Length of diagonal:

(A) 5

(B) 3

(C) [OK] $\sqrt{34}$

(D) 4

Solution — Q5

C = (5,3). Diagonal AC = $\sqrt{25+9} = \sqrt{34}$.

[OK] $\sqrt{34}$

Q6 Perimeter of triangle with vertices (0,4),(0,0),(3,0):

- | | |
|--------|--------------------|
| (A) 5 | (B) [OK] 12 |
| (C) 11 | (D) $7 + \sqrt{5}$ |

Solution — Q6

Sides: 4, 3, $\sqrt{9+16}=5$. Perimeter = $4+3+5 = 12$.

[OK] 12 [3-4-5 right triangle]

Q7 Area of triangle A(3,0),B(7,0),C(8,4):

- | | |
|-------------------|--------|
| (A) 14 | (B) 28 |
| (C) [OK] 8 | (D) 6 |

Solution — Q7

Base AB on x-axis = 4. Height = y-coord of C = 4.

Area = $(1/2) \times 4 \times 4 = 8$.

[OK] 8

Q8 Points (-4,0),(4,0),(0,3) form a ____:

- | | |
|--------------------------|------------------------------------|
| (A) Right triangle | (B) [OK] Isosceles triangle |
| (C) Equilateral triangle | (D) Scalene triangle |

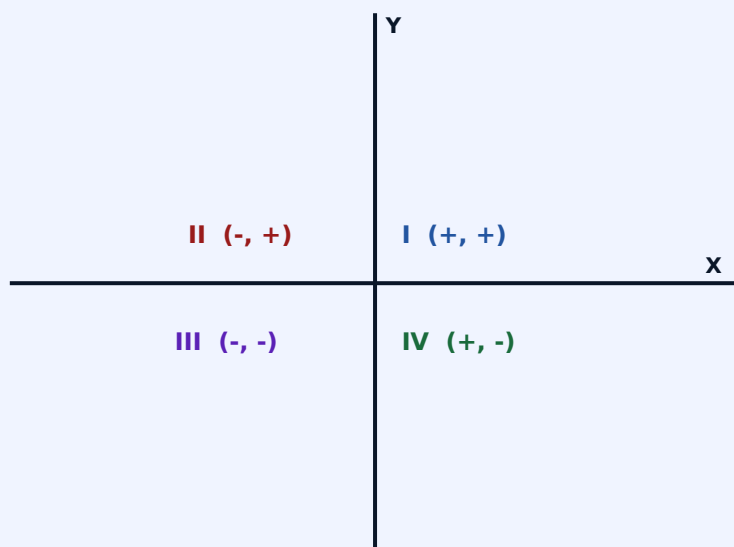
Solution — Q8

$d_1=8$, $d_2=\sqrt{16+9}=5$, $d_3=\sqrt{16+9}=5$. Two sides equal.

[OK] Isosceles triangle

Q9 Point dividing (7,-6) and (3,4) in ratio 1:2 lies in:

DIAGRAM — Q9



(A) I quadrant

(B) II quadrant

(C) III quadrant

(D) [OK] IV quadrant

Solution — Q9

$x = (1 \cdot 3 + 2 \cdot 7) / 3 = 17/3$ (positive), $y = (1 \cdot 4 + 2 \cdot (-6)) / 3 = -8/3$ (negative).

$x > 0, y < 0 \rightarrow$ IV quadrant.

[OK] IV quadrant

Q10 Point on perp. bisector of A(-2,-5) and B(2,5):

(A) [OK] (0,0)

(B) (0,2)

(C) (2,0)

(D) (-2,0)

Solution — Q10

Perp. bisector = locus equidistant from A and B.

Check (0,0): dist to A = dist to B = $\sqrt{29}$. Equal!

[OK] (0,0)

Q11 Fourth vertex D of ||gram ABCD: A(-2,3),B(6,7),C(8,3):

(A) (0,1)	(B) [OK] (0,-1)
(C) (-1,0)	(D) (1,0)

Solution — Q11

Midpoint AC = (3,3) = Midpoint BD. $D = (2 \times 3 - 6, 2 \times 3 - 7) = (0, -1)$.

[OK] D = (0,-1)

Q12 P(2,1) on segment A(4,2) to B(8,4). Then:

(A) $AP = (1/3)AB$	(B) $AP = PB$
(C) $PB = (1/3)AB$	(D) [OK] $AP = (1/2)AB$

Solution — Q12

$AP = \sqrt{4+1} = \sqrt{5}$. $AB = \sqrt{16+4} = 2\sqrt{5}$. $AP/AB = 1/2$.

[OK] $AP = (1/2) AB$

Q13 P(a/3,4) is midpoint of Q(-6,5) and R(-2,3). Find a:

(A) -4	(B) [OK] -12
(C) 12	(D) -6

Solution — Q13

Midpoint QR = (-4, 4). So $a/3 = -4 \Rightarrow a = -12$.

[OK] a = -12

Q14 Perp. bisector of A(1,5) and B(4,6) cuts y-axis at:

(A) [OK] (0,13)	(B) (0,-13)
(C) (0,12)	(D) (13,0)

Solution — Q14

Midpoint M = (5/2, 11/2). Slope AB = 1/3. Perp slope = -3.

Equation: $y - 11/2 = -3(x - 5/2)$. At x=0: y=13.

[OK] (0,13)

Q17 Line meets y-axis at P and x-axis at Q. Midpoint of PQ=(2,-5). Find P and Q:

(A) (0,-5)&(2,0)

(B) (0,10)&(-4,0)

(C) (0,4)&(-10,0)

(D) [OK] (0,-10)&(4,0)

Solution — Q17

$P=(0,p)$, $Q=(q,0)$. $(q/2, p/2)=(2,-5) \Rightarrow q=4, p=-10$.

[OK] $P=(0,-10)$, $Q=(4,0)$

Q18 Area of triangle with vertices $(a,b+c), (b,c+a), (c,a+b)$:

(A) $(a+b+c)^2$

(B) [OK] 0

(C) $a+b+c$

(D) abc

Solution — Q18

Expand area formula: all terms cancel $\rightarrow$ Area = 0.

[OK] 0 (the three points are always collinear!)

Q19 Distance between $(4,p)$ and $(1,0)$ is 5. Find p:

(A) 4 only

(B) [OK] ± 4

(C) -4 only

(D) 0

Solution — Q19

$\sqrt{9+p^2}=5 \Rightarrow p^2=16 \Rightarrow p=\pm 4$.

[OK] $p = \pm 4$

Q20 $A(1,2), O(0,0), C(a,b)$ are collinear. Then:

(A) $a=b$

(B) $a=2b$

(C) [OK] $2a=b$

(D) $a=-b$

Solution — Q20

Area=0: $(1/2)|1*(0-b)+0*(b-2)+a*(2-0)|=0 \Rightarrow |2a-b|=0 \Rightarrow 2a=b$.

[OK] $2a = b$

T/F EXERCISE 7.2 — True or False

Q1 tri ABC: A(-2,0),B(2,0),C(0,2) similar to tri DEF: D(-4,0),E(4,0),F(0,4)?

ANSWER: TRUE

All sides of DEF = 2x sides of ABC. Ratio 1:2 throughout -> SSS similarity.

Q2 P(-4,2) lies on segment joining A(-4,6) and B(-4,-6)?

ANSWER: TRUE

All three points have x=-4. P's y=2 is between -6 and 6.

Q3 Points (0,5),(0,-9),(3,6) are collinear?

ANSWER: FALSE

Area = $(1/2)|0(-9-6)+0(6-5)+3(5+9)| = (1/2)|42| = 21$ which is not 0.

Q4 P(0,2) is on perp. bisector of A(-1,1) and B(3,3)?

ANSWER: FALSE

PA = $\sqrt{1+1}=\sqrt{2}$. PB = $\sqrt{9+1}=\sqrt{10}$. PA not equal to PB.

Q5 A(3,1),B(12,-2),C(0,2) cannot be vertices of a triangle?

ANSWER: TRUE

Area = $(1/2)|3(-2-2)+12(2-1)+0(1+2)| = (1/2)|-12+12| = 0$. Points are collinear.

Q6 A(4,3),B(6,4),C(5,-6),D(-3,5) form a parallelogram?

ANSWER: FALSE

Midpoint AC=(4.5,-1.5). Midpoint BD=(1.5,4.5). Different -> not a parallelogram.

Q7 Circle at origin, P(5,0) on it. Q(6,8) lies outside?

ANSWER: TRUE

Radius=5. OQ= $\sqrt{36+64}=10>5$. Q is outside.

Q8 A(2,7) lies on perp. bisector of P(6,5) and Q(0,-4)?

ANSWER: FALSE

AP= $\sqrt{16+4}=\sqrt{20}$. AQ= $\sqrt{4+121}=\sqrt{125}$. Not equal.

Q9 P(5,-3) is a trisection point of A(7,-2) to B(1,-5)?

ANSWER: TRUE

At ratio 1:2: $x=(1+14)/3=5$, $y=(-5-4)/3=-3$. Yes, $P=(5,-3)$.

Q10 A(-6,10), B(-4,6), C(3,-8) are collinear and $AB=(2/9)AC$?

ANSWER: TRUE

Area=0 (verified). $AB=\sqrt{20}$, $AC=\sqrt{405}=9\sqrt{5}$. $AB/AC=2/9$.

Q11 P(-2,4) lies on circle of radius 6, centre C(3,5)?

ANSWER: FALSE

$CP=\sqrt{25+1}=\sqrt{26}$ approx 5.1 < 6. P is INSIDE, not ON the circle.

Q12 A(-1,-2), B(4,3), C(2,5), D(-3,0) form a rectangle?

ANSWER: TRUE

Midpoints of both diagonals are equal, and diagonals are equal in length.

SA EXERCISE 7.3 — Short Answer Questions

Q1 Name the type of triangle: A(-5,6), B(-4,-2), C(7,5).

Solution — Q1

$AB=\sqrt{1+64}=\sqrt{65}$. $BC=\sqrt{121+49}=\sqrt{170}$. $CA=\sqrt{144+1}=\sqrt{145}$.

All sides different.

[OK] Scalene triangle

Q2 Find points on x-axis at distance $2\sqrt{5}$ from (7,-4). How many?

Solution — Q2

Point on x-axis: (x,0). $\sqrt{(x-7)^2+16} = 2\sqrt{5}$.

$(x-7)^2 = 4 \Rightarrow x=9$ or $x=5$.

[OK] Points: (9,0) and (5,0). There are 2 such points.

Q3 What type of quadrilateral: A(2,-2),B(7,3),C(11,-1),D(6,-6)?

Solution — Q3

$AB=CD=5\sqrt{2}$, $BC=DA=4\sqrt{2}$ (opposite sides equal $\rightarrow$ parallelogram).

Diagonal AC = Diagonal BD = $\sqrt{82}$ (equal diagonals $\rightarrow$ rectangle).

[OK] Rectangle

Q4 Find a if distance between A(-3,-14) and B(a,-5) is 9.

Solution — Q4

$\sqrt{(a+3)^2 + 81} = 9 \Rightarrow (a+3)^2 = 0 \Rightarrow a = -3$.

[OK] a = -3

Q5 Find a point equidistant from A(-5,4) and B(-1,6). How many?

Solution — Q5

Midpoint of AB = (-3,5) is one such point.

All points on the perpendicular bisector of AB are equidistant from A and B.

[OK] Infinitely many points (all on perpendicular bisector of AB)

Q7 Find m if (5,1),(-2,-3),(8,2m) are collinear.

Solution — Q7

Area = 0: $(1/2)|5(-3-2m)+(-2)(2m-1)+8(1+3)| = 0$.

$|-15-10m-4m+2+32| = 0 \Rightarrow 19-14m = 0 \Rightarrow m = 19/14$.

[OK] m = 19/14

Q9 Find area of triangle: (-8,4),(-6,6),(-3,9).

Solution — Q9

Area = $(1/2)|-8(6-9)+(-6)(9-4)+(-3)(4-6)| = (1/2)|24-30+6| = 0$.

[OK] Area = 0 (the 3 points are COLLINEAR!)

Q10 x-axis divides (-4,-6) to (-1,7). Find ratio and point.

Solution — Q10

Let ratio = k:1. $y=0$: $(7k-6)/(k+1)=0 \Rightarrow k=6/7$. Ratio = 6:7.

$x = (6*(-1)+7*(-4))/13 = -34/13$.

[OK] Ratio = 6:7, Point = (-34/13, 0)

Q11 Point $P(3/4, 5/12)$ divides $A(1/2, 3/2)$ to $B(2, -5)$. Find ratio.

Solution — Q11

Let ratio = $m:1$. $x = (2m + 1/2)/(m + 1) = 3/4 \Rightarrow 8m + 2 = 3m + 3 \Rightarrow m = 1/5$.

[OK] Ratio = 1:5

Q13 (a, b) is midpoint of $A(10, -6)$ and $B(k, 4)$, $a - 2b = 18$. Find k and AB .

Solution — Q13

$b = (4 - 6)/2 = -1$. $a - 2(-1) = 18 \Rightarrow a = 16$.

$16 = (10 + k)/2 \Rightarrow k = 22$. $AB = \sqrt{144 + 100} = 2\sqrt{61}$.

[OK] $k = 22$, $AB = 2\sqrt{61}$

Q17 $A(2, 9), B(a, 5), C(5, 5)$ — right-angled at B . Find a and area.

Solution — Q17

$BA \cdot BC = 0$: $(2 - a)(5 - a) = 0 \Rightarrow a = 2$ or $a = 5$. $a = 5$ makes $B = C$ (invalid) $\Rightarrow a = 2$.

$AB = 4$, $BC = 3$. Area = $(1/2) \cdot 4 \cdot 3 = 6$.

[OK] $a = 2$, Area = 6 sq units

Q19 Find k if $A(k + 1, 2k), B(3k, 2k + 3), C(5k - 1, 5k)$ are collinear.

Solution — Q19

Area = 0 $\Rightarrow 6k^2 - 15k + 6 = 0 \Rightarrow 2k^2 - 5k + 2 = 0 \Rightarrow (2k - 1)(k - 2) = 0$.

[OK] $k = 1/2$ or $k = 2$

Q20 Line $2x + 3y - 5 = 0$ divides $(8, -9)$ to $(2, 1)$. Find ratio and point.

Solution — Q20

Division point: $((2k + 8)/(k + 1), (k - 9)/(k + 1))$. Substitute into line equation.

$2(2k + 8) + 3(k - 9) - 5(k + 1) = 0 \Rightarrow 2k = 16 \Rightarrow k = 8$.

Point: $x = 8/3$, $y = -1/9$.

[OK] Ratio = 8:1, Point = $(8/3, -1/9)$

LA EXERCISE 7.4 — Long Answer Questions

Q1 $(-4,3)$ and $(4,3)$ are two vertices of equilateral triangle, origin inside. Find third vertex.

Solution — Q1

Base is horizontal at $y=3$. Midpoint $= (0,3)$. Third vertex lies on $x=0$ (axis of symmetry).

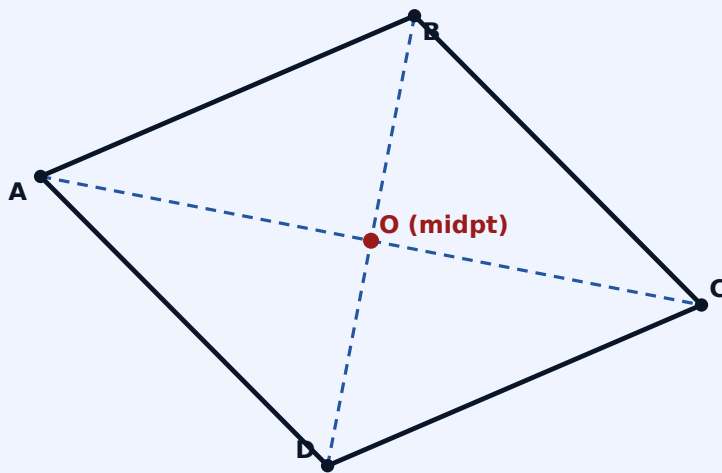
Height of equilateral triangle $= (\sqrt{3}/2) \times 8 = 4\sqrt{3}$.

For origin to be inside: third vertex must be below ($y < 3$).

$\Rightarrow$ Third vertex $= (0, 3 - 4\sqrt{3})$

Q2 $A(6,1), B(8,2), C(9,4)$ are 3 vertices of ||gram ABCD. E is midpoint of DC. Find area of tri ADE.

DIAGRAM — Q2



Diagonals bisect each other $\rightarrow$ midpoints equal

Solution — Q2

D: midpoint of AC = midpoint of BD. Midpoint AC $= (7.5, 2.5)$. $D = (2 \times 7.5 - 8, 2 \times 2.5 - 2) = (7, 3)$.

E = midpoint DC $= ((7+9)/2, (3+4)/2) = (8, 3.5)$.

Area tri ADE $= (1/2)|6(3-3.5)+7(3.5-1)+8(1-3)| = (1/2)|(-3+17.5-16)| = (1/2) \times 1.5$.

$\Rightarrow$ Area $= 3/4$ sq units

Q3 Vertices $A(x_1, y_1), B(x_2, y_2), C(x_3, y_3)$. Find median foot D, centroid P, and verify all medians meet.

Solution — Q3

(i) D = midpoint of BC $= ((x_2+x_3)/2, (y_2+y_3)/2)$.

(ii) P on AD with AP:PD $= 2:1 \Rightarrow P = ((x_1+x_2+x_3)/3, (y_1+y_2+y_3)/3)$.

(iii) Points Q and R on other medians also give the same point P.

$\Rightarrow$ Centroid G $= ((x_1+x_2+x_3)/3, (y_1+y_2+y_3)/3)$

Q4 A(1,-2),B(2,3),C(a,2),D(-4,-3) form a ||gram. Find a and height (base AB).

Solution — Q4

Midpoint AC = Midpoint BD $\Rightarrow (1+a)/2 = (2-4)/2 \Rightarrow a = -3$.

AB = $\sqrt{1+25} = \sqrt{26}$.

Area (shoelace) = 24. Height = Area/base = $24/\sqrt{26} = 12\sqrt{26}/13$.

$\Rightarrow a = -3$, Height = $12\sqrt{26}/13$

Q5 Students A(3,5),B(7,9),C(11,5),D(7,1). Can Jaspal be equidistant from all 4?

Solution — Q5

Midpoint AC=(7,5) and Midpoint BD=(7,5). Both diagonals have same midpoint!

Point equidistant from all 4 = intersection of perpendicular bisectors = (7,5).

Verify: distance from (7,5) to each student = 4 units. All equal!

$\Rightarrow$ Yes, Jaspal should stand at position (7, 5)

Q6 House(2,4)->Bank(5,8)->School(13,14)->Office(13,26). Find extra distance.

Solution — Q6

House->Bank = $\sqrt{9+16} = 5$ km.

Bank->School = $\sqrt{64+36} = 10$ km.

School->Office = $\sqrt{0+144} = 12$ km. Total detour = 27 km.

Direct House->Office = $\sqrt{121+484} = \sqrt{605}$ approx 24.6 km.

$\Rightarrow$ Extra distance = $27 - 24.6$ approx 2.4 km

REVISION QUICK REVISION — ANSWER KEY

Ex 7.1 MCQ	Q1->B, Q2->B, Q3->C, Q4->B, Q5->C, Q6->B, Q7->C, Q8->B, Q9->D, Q10->A
Ex 7.1 MCQ	Q11->B, Q12->D, Q13->B, Q14->A, Q17->D, Q18->B, Q19->B, Q20->C
Ex 7.2 T/F	Q1:T,Q2:T,Q3:F,Q4:F,Q5:T,Q6:F,Q7:T,Q8:F,Q9:T,Q10:T,Q11:F,Q12:T
Ex 7.3	Q1:Scalene Q2:(9,0)&(5,0) Q3:Rectangle Q4:a=-3 Q7:m=19/14
Ex 7.3	Q9:Area=0 (collinear) Q10:6:7,(-34/13,0) Q11:1:5 Q13:k=22
Ex 7.4	Q1:(0,3-4sqrt(3)) Q2:3/4 sq.units Q5:(7,5) Q6:2.4km extra

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