Unit 17 · Coordinates

STUDY NOTES

Key terms

X-axis XX': the line across; **Y-axis** YY': the line up and down; they cross at right angles.

Origin: where the axes cross, $O(0, 0)$.

Ordered pair (x, y): the **x-coordinate** first (across), then the **y-coordinate** (up or down).

Abscissa: another name for the x-coordinate; **ordinate**: for the y-coordinate.

Quadrants: the four parts the axes cut the plane into, numbered from the top right, against a clock's hands.

Plot: mark a point in its place on graph paper.

Reading coordinates

- x: units **right** (+) or **left** (−) of O; y: units **up** (+) or **down** (−)
- each axis is a number line of integers: left of 0 and below 0 negative

Quadrant	Where	Signs	Example
1st	top right	(+, +)	$A(4, 3)$
2nd	top left	(−, +)	$B(-2, 2)$
3rd	bottom left	(−, −)	$(-5, -3)$
4th	bottom right	(+, −)	$C(3, -3)$

- a **0** puts the point **on an axis**, in no quadrant: $(-4, 0)$ on the X-axis, $(0, -3)$ on the Y-axis
- 6 left of the Y-axis, 1 below the X-axis: $(-6, -1)$, not $(-1, -6)$
- $(2, -5)$ and $(-5, 2)$ are different points: across first

Plotting

1. draw the axes, number them
2. from O, go across by x (right if +, left if −)
3. then up or down by y; mark the point, write its name

- $(3, -2)$: 3 right, then 2 down
- join plotted points in order → name the shape: $A(4, 0)$, $B(4, 4)$, $C(-2, 4)$, $D(-2, 0)$: a **rectangle**, 6 by 4

Distance along a grid line

- **same y** (one line across): distance = **bigger x − smaller x**
- **same x** (one line up and down): distance = **bigger y − smaller y**
- $A(6, 5)$, $B(-3, 5)$: $6 - (-3) = 6 + 3 =$ **9 units** (3 squares to the axis + 6)
- $D(4, -4)$ to $(4, 5)$: $5 - (-4) = 9$ units
- both on one side: $P(-7, 2)$, $Q(-1, 2)$: $-1 - (-7) = 6$
- a distance is never negative; opposite sides of an axis: the sizes **add**
- points sharing neither number: a **slanting** line; counting squares doesn't measure it (Grade 8)

Fourth corner of a rectangle

- sides along grid lines: the fourth corner takes **one corner's x** and **another's y**
- $K(3, 4)$, $L(-3, 4)$, $M(3, -5)$: M is below K, so N is below L, level with M: $N(-3, -5)$
- $KL = 3 - (-3) = 6$; $KM = 4 - (-5) = 9$: not a square
- $A(-2, -2)$, $B(3, -2)$, $C(3, 3)$: $D(-2, 3)$; all sides 5: a square

Back to the plot

- tap at the origin, east right, north up, 1 unit = 1 m
- pegs $A(7, 3)$, $B(-5, 3)$, $C(-5, -6)$ → D below A, level with C: D**(7, −6)**
- $AB = 7 - (-5) =$ **12 m**; $BC = 3 - (-6) =$ **9 m**: a house 12 m by 9 m

Where it is used

- maps: latitude and longitude; south and west stored as negative (Sydney ≈ (−33.87, 151.21)); Bhaktapur ≈ 27.67° N, 85.43° E
- screens: origin at the **top left**, y grows **downward**: (100, 50) is 100 pixels from the left, 50 down

COMMON MISTAKES

✗ (2, −5) plotted 5 right, 2 down
✓ across by the first number: 2 right, then 5 down.

✗ distance from (−5, 2) to (3, 2) = 3 − 5 = −2
✓ $3 - (-5) = 8$; never negative.

✗ (0, −4) is in the 3rd quadrant
✓ a 0 puts it on an axis: no quadrant.

✗ 6 left and 1 below = (−1, −6)
✓ (−6, −1).