Unit 17 · Coordinates

STUDY NOTES

WHAT THE BLE ASKS

- **CDC's grid:** Geometry (Units 13, 14, 15, 16, 17, 18, 19, 20 together): 15 of 50 marks
- **In our 10 model papers:** 1-mark ×8 · 2-mark ×1 · 3-mark ×1
- **Model paper:** no question on distance; the grid wants every topic of an area in proportion, so one can come
- the Grade 7 model paper shows one shape: the coordinates of two points on a grid and the length of the line between them (2 marks, understanding)
- to name a shape: find **all** its sides first, then compare them

Key terms

Origin O: where the axes cross.

x-coordinate: how far across: right +, left −.

y-coordinate: how far up: up +, down −.

Quadrants: the four quarters the axes cut the plane into.

Hypotenuse h: the side opposite the right angle, always the longest; **perpendicular** p, **base** b: the other two.

Pythagorean triples: whole numbers that fit $a^2 + b^2 = c^2$: 3, 4, 5; multiples too: 6, 8, 10 and 9, 12, 15.

Formulas

$h^2 = p^2 + b^2$	right-angled triangle; h longest **Use:** Pythagoras' theorem
$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	$A(x_1, y_1)$, $B(x_2, y_2)$ **Use:** distance between two points

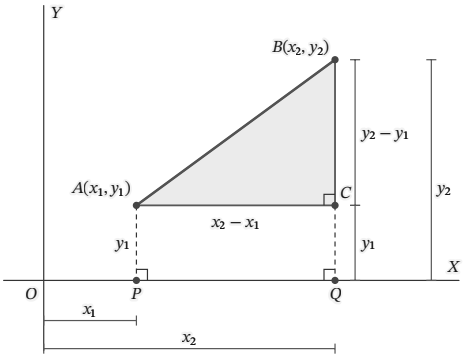
- in words: **square the difference across, square the difference up, add, take the square root**
- level points: just subtract: (2, 3) to (7, 3): $7 - 2 = 5$ units

Points

Quadrant	Where	Signs
First	right, up	(+, +)
Second	left, up	(−, +)
Third	left, down	(−, −)
Fourth	right, down	(+, −)

- (x, y): across first, then up or down; (2, 5) and (5, 2) are different points
- on the **X-axis** $y = 0$: (3, 0), (−8, 0)
- on the **Y-axis** $x = 0$: (0, 6), (0, −2)
- the origin is on both
- "5 units **from** the X-axis": $y = 5$ or -5, anywhere along that line; **on** the X-axis at 5: (5, 0)

Why the formula works



The slanting line is the longest side of a right-angled triangle: AC the difference of the x-coordinates, BC of the y-coordinates.

- it is Pythagoras' theorem with the two short sides found by subtracting
- swap A, B: each difference changes sign, but $(-3)^2 = 3^2 = 9$: either point first

- a distance is never negative
- negative coordinates: write the brackets: $3 - (-2) = 5$
- $\sqrt{a^2 + b^2}$ is not $a + b$: 3 across, 4 up: $\sqrt{25} = 5$, not 7
- 7 is the taxi's distance: along the streets, the two short sides added

Pythagoras both ways

- **forwards:** a missing side: $h^2 = p^2 + b^2$
- a shorter side: subtract: $x^2 = 13^2 - 12^2 = 25$, $x = 5$ cm
- **backwards:** squares of the two shorter sides add up to the longest side's square → right-angled; if not, it isn't
- tests a corner with no protractor

Using the formula

- **circle:** every point at one distance from its center; radius = center to a point on it
- is a point on the circle? compare its distance with the radius
- **isosceles triangle:** two equal sides
- **rhombus:** four equal sides
- **rectangle:** opposite sides equal, diagonals equal
- **right-angled:** test the three sides with Pythagoras
- **on a map:** units × the scale: 5 units, 1 unit = 55 km → 275 km, in a straight line
- "meets the X-axis at −8": (−8, 0); "the Y-axis at 6": (0, 6)
- **a missing coordinate:** put the distance and the known numbers in; square both sides; solve

Back to the map

- Durbar Square (0, 0), Nyatapola (12.0, −3.6), in km:

$$d = \sqrt{12.0^2 + (-3.6)^2} = \sqrt{156.96} \approx 12.5 \text{ km}$$

- the road is longer: it isn't straight
- points one above the other need only a subtraction: Nyatapola, Changu Narayan both at 12.0 km east
- a flat grid is excellent for a valley or a district; across continents the Earth's curve matters

Where it is used

- "as the crow flies"; map apps
- video games: two circles touch when their centers are no further apart than their two radii added
- a knight's move in chess: always $\sqrt{5}$ squares
- GPS: the same formula with a third difference inside the root

COMMON MISTAKES

✗ coordinates or axes swapped
✓ $x = 0$ is the Y-axis.

✗ a sign lost: $3 - (-1) = 2$
✓ 4.

✗ a side that isn't the longest taken as h
✓ h is opposite the right angle.

✗ the square root forgotten at the end
✓ take it.

✗ differences added before squaring
✓ square each, then add.

✗ only some sides found before naming a shape
✓ find every side.