Unit 17 · Coordinates

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 28

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Name the shape

ANSWER A · 4

i. $AB = \sqrt{4^2 + 1^2} = \sqrt{17}$, $BC = \sqrt{1^2 + 4^2} = \sqrt{17}$, $CD = \sqrt{4^2 + 1^2} = \sqrt{17}$, $DA = \sqrt{1^2 + 4^2} = \sqrt{17}$.

ii. $AC = \sqrt{5^2 + 5^2} = \sqrt{50}$ and $BD = \sqrt{3^2 + 3^2} = \sqrt{18}$.

iii. All four sides are equal, so it is a **rhombus**. It isn't a square, because the diagonals of a square are equal, and these aren't.

MARKING SCHEME

- ✓ All four sides $\sqrt{17}$.
- ✓ $AC = \sqrt{50}$ and $BD = \sqrt{18}$.
- ✓ A rhombus.
- ✓ The diagonals aren't equal, so not a square.

2 Right-angled or not?

ANSWER A · 3

$PQ^2 = 4^2 + 2^2 = 20$, $QR^2 = 2^2 + 4^2 = 20$, $PR^2 = 6^2 + 2^2 = 40$.

$PQ = QR$, so it is **isosceles**. $PQ^2 + QR^2 = 40 = PR^2$, so it is **right-angled, at** Q.

Area: $\frac{1}{2} \times PQ \times QR = \frac{1}{2} \times 20 =$ **10 square units**.

MARKING SCHEME

- ✓ $PQ^2 = QR^2 = 20$ and $PR^2 = 40$.
- ✓ Isosceles, and right-angled at Q, by Pythagoras' theorem.
- ✓ Area 10 square units.

3 The same distance from both

ANSWER HA · 3

Let the point be $(x, 0)$. Then $(x - 1)^2 + 3^2 = (x - 5)^2 + 1^2$.

$x^2 - 2x + 10 = x^2 - 10x + 26$, so $8x = 16$ and $x = 2$.

The point is **(2, 0)**, and the distance is $\sqrt{1^2 + 3^2} = \sqrt{\mathbf{10}}$ units.

MARKING SCHEME

- ✓ The two distances set equal, with $(x, 0)$.
- ✓ $x = 2$.
- ✓ $(2, 0)$, at a distance of $\sqrt{10}$.

4 Is it a triangle?

ANSWER HA · 3

$AB = \sqrt{2^2 + 1^2} = \sqrt{5} \approx 2.24$, $BC = \sqrt{4^2 + 2^2} = \sqrt{20} \approx 4.47$, $AC = \sqrt{6^2 + 3^2} = \sqrt{45} \approx 6.71$.

$AB + BC = AC$ $(2.24 + 4.47 = 6.71)$.

She isn't right. In a triangle two sides together are longer than the third. Here they just reach it, so A, B and C lie **on one straight line**.

MARKING SCHEME

- ✓ The three distances.
- ✓ $AB + BC = AC$.
- ✓ They lie on a straight line, so there is no triangle.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

5 Inside, on or outside?

ANSWER A · 3

i. $\sqrt{3^2 + 4^2} = \mathbf{5\ units}$.

ii. Distances from the center: $(-3, 1)$: $\sqrt{16 + 9} = 5$, **on** the circle. $(4, 0)$: $\sqrt{9 + 4} = \sqrt{13} < 5$, **inside**. $(7, -2)$: $\sqrt{36 + 0} = 6 > 5$, **outside**.

MARKING SCHEME

- ✓ Radius 5.
- ✓ The three distances from the center.
- ✓ On, inside and outside.

6 Spot the error

ANSWER U · 3

He dropped the minus sign of -2. The first bracket is $4 - (-2) = 6$, not $4 - 2$. Brackets round negative numbers prevent this.

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

MARKING SCHEME

- ✓ The mistake: $4 - (-2)$ is 6.
- ✓ $\sqrt{36 + 64}$.
- ✓ 10 units.

7 In a real setting

ANSWER A · 4

i. $HP = \sqrt{6^2 + 8^2} = 10$ units = **15 km**. $HQ = \sqrt{8^2 + 6^2} = 10$ units = **15 km**.

ii. $PQ^2 = 2^2 + 14^2 = 200$, and $HP^2 + HQ^2 = 100 + 100 = 200$, so the angle at H is $90°$.

iii. $PQ = \sqrt{200} \approx 14.14$ units ≈ 21.2 km. The trip is about $15 + 21.2 + 15 = \mathbf{51.2\ km}$.

MARKING SCHEME

- ✓ 15 km and 15 km.
- ✓ $PQ^2 = 200 = HP^2 + HQ^2$.
- ✓ $PQ \approx 21.2$ km.
- ✓ About 51.2 km.

8 Think

ANSWER HA · 3

12 points. On the axes: $(5, 0)$, $(-5, 0)$, $(0, 5)$, $(0, -5)$.

Off the axes, from $3^2 + 4^2 = 25$: $(3, 4)$, $(3, -4)$, $(-3, 4)$, $(-3, -4)$, $(4, 3)$, $(4, -3)$, $(-4, 3)$, $(-4, -3)$.

They all lie on a circle of radius 5 around the origin.

MARKING SCHEME

- ✓ The 4 points on the axes.
- ✓ The 8 points from $3^2 + 4^2 = 25$.
- ✓ 12 in all.

9 Make your own

ANSWER HA · 2

For example, $(0, 0)$, $(2, 1)$, $(1, 3)$, $(-1, 2)$. Each side is $\sqrt{5}$, and both diagonals are $\sqrt{10}$.

MARKING SCHEME

- ✓ Four points that make a tilted square.
- ✓ Four equal sides and two equal diagonals shown.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Pythagoras in Beads** (exhibit): Tilt it: the beads in the square on the hypotenuse exactly fill the other two squares, $h^2 = p^2 + b^2$, the theorem behind the distance formula.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	14	11	**28**

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking