Unit 20 · Bearing and Scale Drawing

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 35

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

1 Spot the errors

ANSWER U · 4

i. **315°.** A bearing is turned **clockwise** from north. North-west is 45° the other way, so the clockwise turn is 360° − 45° = 315°. 045° is north-east.

ii. **1 : 200.** A ratio compares two lengths in the **same unit**: 2 m = 200 cm, so 1 cm to 200 cm.

iii. **2 km.** 4 × 50 000 = 200 000 cm, and 200 000 ÷ 100 = 2000 m = 2 km. She divided by 1000, but 100 cm make a meter.

iv. **Smaller.** At 1 cm = 5 m each centimeter stands for more of the ground, so fewer centimeters are needed: a 30 m side is 6 cm at 1 cm = 5 m, but 15 cm at 1 cm = 2 m.

MARKING SCHEME

- ✓ i. 315°: clockwise from north.
- ✓ ii. 1 : 200, both in centimeters.
- ✓ iii. 2 km.
- ✓ iv. Smaller.

2 Turning on a ridge

ANSWER A · 4

i. 070° + 125° = **195°**.

ii. 300° + 90° = 390°, more than a full turn: 390° − 360° = **030°**.

iii. 040° − 100° goes 60° past north the other way: 360° − 60° = **300°**.

iv. From 310° clockwise to north is 360° − 310° = 50°, and on from north to 050° is 50° more: **100°**. (The other way round, 310° − 50° = 260°, is the bigger angle.)

MARKING SCHEME

- ✓ i. 195°.
- ✓ ii. 030°.
- ✓ iii. 300°.
- ✓ iv. 100°.

3 Bearings on squared paper

ANSWER A · 4

i. *A* is as far right as up: north-east, **045°**. *B* is due west, **270°**. *C* is as far right as down: south-east, **135°**. *D* is due south, **180°**.

ii. North-west, as far left as up: for example **(−1, 1)** and **(−3, 3)**.

iii. **Less.** At 045° a point goes up as far as it goes across. *P* goes up 4 but across only 3, so it is nearer the north line than north-east is. (Measured, it is about 037°.)

iv. A right-angled triangle with sides 3 and 4: $OP^2 = 3^2 + 4^2 = 25$, so OP = **5 units**.

MARKING SCHEME

- ✓ i. 045°, 270°, 135°, 180°.
- ✓ ii. Two points $(-a, a)$.
- ✓ iii. Less: it goes up more than across.
- ✓ iv. 5 units.

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

4 One scale, two ways

ANSWER A · 4

i. 5 km = 5000 m = 500 000 cm: **1 : 500 000**.
ii. 25 000 cm = **250 m**. 7.2 × 250 = 1800 m = **1.8 km**.
iii. 3.5 km = 3500 m, and 3500 ÷ 250 = **14 cm**.
iv. 100 m = 10 000 cm, so 4 cm stands for 10 000 cm: 4 : 10 000 = **1 : 2500**.

MARKING SCHEME

✓ i. 1 : 500 000.
✓ ii. 250 m; 1.8 km.
✓ iii. 14 cm.
✓ iv. 1 : 2500.

5 A room on a plan

ANSWER HA · 4

i. 8 × 50 = 400 cm and 6 × 50 = 300 cm: **4 m by 3 m**.
ii. On the plan, 8 × 6 = **48 cm²**. Real: 400 × 300 = **120 000 cm²**, or 4 × 3 = **12 m²**.
iii. **No.** 120 000 ÷ 48 = 2500: the floor is **2500 times** the area on the plan. Both the length and the breadth are 50 times as long, so the area is 50 × 50 = 2500 times.
iv. On the plan, $8^2 + 6^2 = 100$, so the diagonal is **10 cm**; real, $4^2 + 3^2 = 25$, so **5 m** = 500 cm. **Yes**: 10 × 50 = 500. Every length is 50 times, sides and diagonals alike; only areas are 2500 times.

MARKING SCHEME

✓ i. 4 m by 3 m.
✓ ii. 48 cm²; 120 000 cm² = 12 m².
✓ iii. No: 2500 times, 50 × 50.
✓ iv. 10 cm and 5 m; yes, 50 times.

6 Back on Poon Hill

ANSWER A · 4

i. Divide each distance by 4: Dhaulagiri **9.5 cm**, Annapurna I **6.25 cm**, Annapurna South **4.25 cm**, Machhapuchhre **7 cm**.
ii. Dhaulagiri is 30° short of north (360° − 330°) and Annapurna I is 30° past it: **60°**.
iii. 067° − 041° = **26°**.
iv. Measure 360° − 330° = 30° from the north line **counter-clockwise**, towards the west. Her turn: 30° up to north, then 67° on to Machhapuchhre, 30° + 67° = **97°**.

(Source: the bearings and distances are the unit's, in Back to Poon Hill, worked out from the peaks' coordinates on Wikipedia.)

MARKING SCHEME

✓ i. 9.5 cm, 6.25 cm, 4.25 cm, 7 cm.
✓ ii. 60°.
✓ iii. 26°.
✓ iv. 30° counter-clockwise from north; a turn of 97°.

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

7 Choose the scale

ANSWER A · 4

i. 1 cm = 4 m: 20 cm by 15 cm, **too big**. 1 cm = 8 m: **10 cm by 7.5 cm**, fits. 1 cm = 10 m: 8 cm by 6 cm, fits but smaller. So **1 cm = 8 m**.

ii. 8 m = 800 cm: **1 : 800**.

iii. $10^2 + 7.5^2 = 100 + 56.25 = 156.25 = 12.5^2$: **12.5 cm** on the drawing (measure it to check), and $12.5 \times 8 =$ **100 m**. (Check: $80^2 + 60^2 = 10\,000 = 100^2$.)

iv. Along two sides, 80 + 60 = 140 m; across, 100 m: **40 m shorter**.

MARKING SCHEME

- ✓ i. 1 cm = 8 m, 10 cm by 7.5 cm, with the other two sizes.
- ✓ ii. 1 : 800.
- ✓ iii. 12.5 cm (12.3 to 12.7 measured), 100 m.
- ✓ iv. 40 m.

8 Think: a clock as a compass

ANSWER HA · 4

i. The minute hand turns 360° ÷ 60 = 6° a minute: 20 × 6° = **120**°, and 45 × 6° = **270**°.

ii. The hour hand turns 360° ÷ 12 = 30° an hour: 4 × 30° = **120**°, and 9 × 30° = **270**°.

iii. Hour hand: 120° + 30° ÷ 2 = **135**°. Minute hand: 30 × 6° = **180**°. The angle between them is 180° − 135° = **45**°.

iv. **No.** The minute hand is on **090**°, but in a quarter of an hour the hour hand has moved a quarter of the way from 3 to 4: 90° + 30° ÷ 4 = **097.5**°. The angle between them is **7.5**°.

MARKING SCHEME

- ✓ i. 120° and 270°.
- ✓ ii. 120° and 270°.
- ✓ iii. 135° and 180°; 45° between them.
- ✓ iv. No: the hour hand is on 097.5°, 7.5° from the minute hand.

9 Make your own

ANSWER A · 3

For example:

i. 200°: between south (180°) and south-west (225°), nearer south.

ii. 1 cm = 3 m, or 1 : 300; 7 cm stands for 21 m.

iii. 300° and 030°: from 300° to north is 60°, and on to 030° is 30° more, 90° in all.

Any correct answers are right.

MARKING SCHEME

- ✓ i. A bearing from 181° to 269° and its place in words.
- ✓ ii. A scale both ways and the real length for 7 cm.
- ✓ iii. Two bearings 90° apart, one over 270°.

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.

- **The Compass Rose** (exhibit): Its eight points split a full turn into eight 45° parts. Face N and turn clockwise: SE is at a bearing of 135°, W at 270° and NW at 315°.
- **3D Map of Nepal** (exhibit): Use the scale bar on the small flat map in its corner to find Nepal's length in kilometers. The raised map stretches its heights far more than its distances.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	4	23	8	**35**

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